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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.

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Abstract

An overview of survey results for Greenland Halibut from Canadian spring and fall surveys through 2016 is provided, including a new series constructed from the autumn Div 3LNO series to 730m. The biomass index from the Canadian fall survey of Divs. 2J3K declined substantially in 2015 and declined again in 2016. The abundance index from the fall survey has been below the series average since 2012. Abundance and biomass indices from the Canadian spring surveys in Div. 3LNO have been relatively low in most years since the late 1990s. In 2013, 2014, and 2016, both abundance and biomass were below the time-series average. The survey in 2006 and 2015 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 declined from relatively high values in the late 1990s and has been relatively low in most years thereafter. 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. In 2015 and 2016, both abundance and biomass were lower than all other years in the time series. The survey in 2014 is not presented as it is not considered representative of the stock due to missed strata. In 2012-2016, index values for ages 1 through 4 are all below the Campelen time-series average in the Div. 2J3K series. The total abundance over ages 1-4 in the spring Div. 3LNO survey has been low since the good year classes of the mid 1990s. Age compositions for the Div. 3LNO combined autumn series show since 2005 the number of fish 1-4 has been below the average of the time series in all years but 2011. These results indicate that there has been no good recruitment 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



is based on 3 survey indices, two of which are Canadian and are updated here. The harvest control rule was abandoned for the setting of the TAC that was set for 2017.

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 2016. The main focuses are the Canadian indices used in the last accepted assessment of this stock and used in the harvest control rule. In addition, a reworking of the Canadian fall survey in Div. 3LNO is presented.

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

Survey coverage details by NAFO division and depth zone for the *Campelen 1800* surveys (spring and fall) over 1996-2011 are detailed elsewhere (Healey *et al.*, 2012; Healey and Brodie, 2009). Some of the coverage deficiencies of the Canadian surveys in recent years are of particular significance in assessing the status of this stock: sporadic coverage of Division 2H during fall surveys, irregular coverage of both Div. 3M and the deep-water strata of Divisions 3NO. Further, various additional strata have been missed in some surveys. The impact of these deficiencies on the assessment, has been considered elsewhere (Healey and Mahé, 2009; Healey and Dwyer, 2005). The history and recent performance of these Canadian research vessel (RV) surveys are reviewed in Power *et al.* (2015). These authors provide an overview of the Canadian spring and autumn RV multi-species surveys, with details on coverage and timing of each survey conducted over 1995-2015. Healey *et al.* (2012) also provide illustrations of the current survey stratification scheme used in Canadian surveys.

During the fall of 2013, gaps in survey coverage of relevance to the assessment of Greenland Halibut include no coverage in the deep-water strata of Divs. 3LNO, and a portion of Div. 2H was not completed (strata 937, 942, 949, 950). The remainder of the offshore survey area, as well as the inshore strata in Div. 3K, was completed. In 2014, major mechanical issues with one vessel caused it to be out of service for the entire fall survey. In

advance of the survey, it was decided that that Division 2H would not be surveyed beyond 750m. 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. However, all strata were covered (Power et al, 2014). In spring of 2015, important strata for Greenland halibut were missed in Division 3L and the spring 3LNO survey in spring 2015 is not considered to be representative of the population. Survey coverage in fall 2015 in Div. 2J3K is considered to be sufficient to serve as an index of stock size. In addition, poor coverage of div. 3LNO in autumn 2014 mean that this is considered to provide insufficient coverage to be representative of the stock.

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 incorrect (obviously, the lower bound should always be greater than or equal to zero) and 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.

A new survey series was produced from the Canadian Div. 3LNO fall survey. The coverage of depths beyond 730 m has been variable in Div. 3LNO in the autumn. To produce one consistent survey indices of biomass and abundance were produced for depths extending only to 730 m. Standard stratified random analyses were used.

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 were used.

Results and Discussion

Trends in Stock Size

Figure 1 shows the area covered by 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 declined substantially in 2015 and declined again in 2016 (Figure 2). The abundance index from the fall survey has been below the series average since 2012.

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 relatively low in most years thereafter. In 2013, 2014, and 2016, both abundance and biomass were below the time-series average. The survey in 2006 and 2015 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 and has been relatively low in most years thereafter. 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. In 2015 and 2016, both abundance and biomass were lower than all other years in the time series.

Age and Size Composition

It should be noted that ageing of this species is problematic and has been considered in several workshops (e.g. Treble and Dwyer, 2006). 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 2012-2016, index values for ages 1 through 4 are all below the Campelen time-series average. Indices for ages 6-9, were mostly above average in 2012-2015, and near the 1995-2016 average in the last year.

Age compositions for the Div 3LNO combined spring series (Table 4) demonstrate that in most years, younger age groups (ages 1-6) are typically most abundant in this survey. Larger, older fish are generally 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 and 2015 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. 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 \geq 70 cm over 1996-2014. 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 -2016, with the 3 lowest values in the time series. 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 was at about the same level in 2014 as 2013, but declined in 2015. 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 so that the 2012-2016 values are the highest in the 1996-2015 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. 3O 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 fall surveys in Sub-Areas 2+3 in 2014. Depth range is given in meters, number of sets for the trip in parantheses. All sets conducted in the survey are included.

Fall 2016

Division	Ship		Total
	<i>Teleost</i>	<i>A.Needler</i>	
2G	Not surveyed		
2H	90-489(53)		53
2J	116-1418		114
	(114)		
3K	134 - 1408		151
	(151)		
3L	165-335(19)	61-703(123)	142
3N		39-72(69)	69
3O		64-694(75)	75
			604

Table 2. Summary of successful sets in spring surveys in Divs. 3LNO in 2014. Depth range is given in meters, number of sets for the trip in parantheses. All sets conducted in the survey are included.

Spring 2015

Division	Ship		Total
	<i>Teleost</i>	<i>A.Needler</i>	
3L		65 - 685 (56)	56
3N		39-674(72)	72
3O		63-628(74)	74
			202

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 1995-2016. Only otoliths collected in Div. 2J or 3K are used in the analysis.

Age (yrs)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
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
Age (yrs)	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0	3.75	2.21	9.38	5.49	19.54	4.81	5.16	0.1	3.10	0.50	10.58
1	32.34	32.61	16.32	50.62	50.94	44.14	12.28	24.32	22.08	17.17	29.65
2	17.98	14.51	11.77	19.15	39.25	42.06	9.61	12.92	30.41	13.98	19.47
3	8.50	12.81	7.92	11.40	14.81	20.97	11.27	6.74	11.39	15.14	10.81
4	17.60	18.77	8.90	8.42	9.45	18.79	11.86	7.4	4.54	7.77	8.15
5	13.03	9.57	7.19	9.89	6.74	10.32	10.96	10.91	7.96	6.82	4.83
6	9.11	10.35	5.72	5.40	3.77	5.50	9.03	9.09	7.38	4.18	4.89
7	4.18	6.17	3.38	3.59	2.20	3.15	4.31	7.76	8.92	3.91	3.01
8	1.15	2.14	1.70	1.39	1.02	1.26	1.69	3.96	6.62	3.92	2.09
9	0.18	0.34	0.21	0.25	0.18	0.33	0.29	0.5	0.97	0.65	0.51
10	0.03	0.08	0.03	0.08	0.07	0.13	0.11	0.15	0.20	0.14	0.10
11	0.02	0.04	0.02	0.02	0.04	0.06	0.05	0.04	0.04	0.06	0.06
12	0.01	0.02	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.02
13	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.02	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	0.00	0.01	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	72.55	115.73	148.03	151.55	76.67	83.94	103.67	74.27	94.20
Ages 1-4	76.42	78.70	44.92	89.59	114.45	125.96	45.02	51.38	68.42	54.06	68.08
Ages 5+	27.72	28.73	18.25	20.65	14.04	20.78	26.49	32.46	32.15	19.72	15.54
Ages 6-9	14.62	19.00	11.01	10.63	7.16	10.24	15.31	21.31	23.89	12.66	10.50



Table 4. Greenland halibut stratified mean number per set at age from Canadian spring surveys conducted in Div. 3LNO combined during 1996-2016. 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	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00		0.08
1	1.62	1.16	0.23	0.29	0.79	0.57	0.64	0.93	0.66	0.35		1.60	0.44	0.27	0.77	1.96	0.32	1.28	1.62		0.42
2	4.24	3.92	0.84	0.55	1.07	0.71	0.57	2.14	0.57	0.31		0.52	0.77	0.22	0.66	1.40	0.80	0.68	1.19		0.56
3	4.60	5.16	3.89	1.15	1.07	0.74	0.60	1.66	1.18	1.09		0.80	0.96	0.19	0.52	0.92	2.48	0.05	0.32		0.37
4	2.18	3.23	6.21	1.98	1.51	0.68	0.58	1.57	1.18	0.95		0.40	0.71	0.39	0.40	0.65	1.40	0.38	0.20		0.46
5	0.83	1.46	4.96	3.39	1.95	0.80	0.61	1.06	1.16	1.37		1.41	1.25	0.45	0.84	0.62	1.16	0.61	0.24		0.30
6	0.28	0.51	1.24	1.09	2.04	0.72	0.21	0.21	0.26	0.82		1.49	0.75	0.26	1.08	0.29	0.50	0.23	0.24		0.20
7	0.06	0.10	0.33	0.24	0.56	0.28	0.05	0.05	0.04	0.21		1.12	0.64	0.13	0.35	0.16	0.18	0.11	0.14		0.08
8	0.00	0.01	0.07	0.05	0.03	0.02	0.01	0.01	0.02	0.03		0.18	0.28	0.07	0.14	0.10	0.06	0.04	0.06		0.05
9	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00		0.02	0.02	0.01	0.02	0.01	0.02	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	0.01	0.00	0.01	0.00	0.00	0.00	0.00		0.01
Ages 1-4	12.64	13.47	11.18	3.98	4.44	2.69	2.40	6.30	3.60	2.70		3.31	2.89	1.06	2.34	4.92	5.01	2.40	3.33		1.81
Ages 5+	1.17	2.08	6.61	4.78	4.59	1.81	0.87	1.32	1.48	2.43		4.22	2.96	0.92	2.45	1.18	1.92	1.00	0.68		0.65
Ages 1-10	13.81	15.56	17.79	8.75	9.03	4.51	3.27	7.62	5.08	5.13		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 1996-2016. 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	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0	0.25	0.24	0.06	0.22	0.12	0.49	0.13	0.17	0.06	0.08	0.16	0.09	0.25	0.23	0.44	0.33	0.33	0.08		0.05	0.98
1	5.27	1.22	0.53	0.04	1.76	1.40	1.28	1.79	1.18	0.60	0.85	0.83	0.95	2.15	1.95	1.30	0.62	2.77		0.78	1.30
2	4.92	3.33	1.76	0.62	1.24	0.62	0.90	1.07	1.32	0.89	0.49	0.47	0.28	0.24	0.62	4.13	0.20	1.00		0.60	0.44
3	3.84	4.46	1.86	0.73	0.39	0.68	1.04	1.55	1.56	0.50	0.12	0.27	0.82	0.42	0.86	1.20	0.45	0.37		0.33	0.56
4	1.41	3.63	2.99	1.04	0.78	1.39	1.01	1.87	1.69	1.76	0.68	0.81	1.13	0.47	0.67	2.02	1.18	0.41		0.31	0.50
5	1.00	1.88	4.10	1.97	1.21	0.75	0.91	0.91	1.51	1.58	1.33	0.61	0.90	0.88	0.68	0.93	0.93	1.02		0.25	0.63
6	0.40	0.47	1.50	1.67	1.35	1.15	0.39	0.28	0.39	1.14	1.35	1.24	1.00	0.61	0.67	0.67	0.70	1.06		0.34	0.38
7	0.08	0.11	0.32	0.39	0.47	0.61	0.17	0.05	0.10	0.56	0.59	0.75	0.76	0.30	0.31	0.32	0.27	0.62		0.17	0.21
8	0.00	0.04	0.08	0.04	0.04	0.05	0.04	0.02	0.01	0.06	0.13	0.21	0.44	0.14	0.11	0.06	0.08	0.26		0.10	0.09
9	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.02	0.04	0.03	0.02	0.02	0.01	0.01		0.01	0.03
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01		0.00	0.01
11	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	0.01		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	0.00	0.00	0.00	0.00	0.00	0.00	0.01		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	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	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	2.37	3.17	3.28	4.10	8.66	2.45	4.55		2.02	2.81
Ages 5+	1.49	2.51	6.02	4.08	3.07	2.56	1.51	1.25	2.01	3.36	3.41	2.84	3.13	1.96	1.79	2.00	2.01	2.98		0.87	1.35
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	5.21	6.31	5.24	5.89	10.65	4.46	7.52		2.89	4.16



Table 6. Biomass (tons) by stratum (converted to Campelen units from 1978-94) from Canadian fall surveys in Div. 2J 1978-2016

Depth Range (m)	V1 Area	V4 Area	Stratum	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
101 - 200	1427	633	201	257	91	486	439	1620	524	913	91	206	42	21	171	103	34	0
	1823	1594	205	1753	2385	1007	2591	4878	2748	1521	502	283	113	168	126	87	104	16
	2582	1870	206	3384	2279	3315	9691	5703	2647	3370	1545	1399	250	590	217	335	99	75
	2246	2264	207	6538	2707	2153	4177	2601	1921	1526	627	352	93	58	14	0	0	0
	733	237	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	778	238	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
201 - 300	440	621	202	1007	1437	1673	1778	1915	1307	4167	563	448	867	.	32	246	164	79
	1608	680	209	4481	15830	15100	8547	19662	8897	5183	6062	2398	1491	1997	2003	1488	574	454
	774	1035	210	956	782	960	549	1845	3694	2268	566	374	281	786	654	908	266	373
	1725	1583	213	2686	1921	4701	5070	6550	4853	3547	6427	3754	1918	1146	494	609	84	301
	1171	1341	214	5954	2893	1904	6928	9277	5862	7527	7489	1398	1923	2598	862	883	176	425
	1270	1302	215	3247	1181	2407	1842	5350	1967	5528	2829	2056	1920	1265	896	1445	750	869
	1428	2196	228	528	1406	3057	1289	1643	1817	2615	1119	1392	889	330	1034	1517	475	424
	508	530	234	7009	4357	3916	3492	5306	2665	4868	1143	922	454	1426	853	386	226	141
301 - 400	480	487	203	2311	4188	1296	2925	3502	11077	12390	1400	6043	1586	2104	4732	2108	2424	587
	448	588	208	7045	4799	6542	10304	15563	5125	19043	17885	8229	4397	3640	9245	8660	2572	2006
	330	251	211	3152	1736	2734	1256	1821	4216	1912	5424	3300	1992	3049	1016	6051	922	352
	384	360	216	2832	6574	6969	2551	7456	4258	6788	3213	1460	2197	170	487	447	166	167
	441	450	222	3064	3243	3729	2527	7887	5835	2964	1850	128	1506	1847	407	865	70	154
	567	536	229	1024	1412	1464	2017	1261	2235	681	1021	985	371	208	233	152	545	783
401 - 500	354	288	204	21544	12476	.	9195	11739	9016	8750	728	8930	6466	6227	20968	5584	3045	2276
	268	241	217	4717	1845	3767	1192	1694	1595	.	3480	2589	1325	1349	181	1012	164	100
	180	158	223	1711	1208	2623	1635	1622	1106	1893	1358	2065	462	1134	306	574	72	75
	686	598	227	6618	2186	5935	3056	3822	2768	2565	2912	1652	3068	2352	4044	3232	1101	1937
	420	414	235	5146	4006	5923	2000	4265	10840	3224	3269	7547	4825	2789	6721	8779	661	609
	.	133	240
501 - 750	664	557	212	11338	15580	7520	9579	9423	3113	4609	7201	23242	21891	4953	2937	5488	1658	2331
	420	362	218	11403	.	5223	6388	1767	1695	.	1461	3151	2308	2513	859	2077	1096	174
	270	228	224	2250	3012	1067	2825	1182	1438	1167	847	5782	1554	1661	89	374	248	191
	237	185	230	2124	.	4016	1823	769	2452	629	766	2386	1369	1273	1063	1268	903	1647
	120	239	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
751 -1000	213	283	219	.	.	.	1005	.	2120	.	1664	6187	1872	1104	791	2015	293	253
	182	186	231	2634	.	3261	.	1805	1117	1842	2372	580	791	2975	.	2131	574	730
1001 -1250	122	193	236	.	.	.	640	946	1287	718	1113	2478	1199	182	.	1390	1501	593
	324	303	220	1571	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	177	195	225	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1251 -1500	236	228	232	870	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	286	330	221	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	180	201	226	99	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	180	237	233	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Total Biomass (t)				129254	99533	102747	107311	142873	110193	112208	86927	101716	69422	49917	61433	60215	20968	18121



Table 6 cont'd. Biomass (tons) by stratum (converted to Campelen units from 1978-94) from Canadian fall surveys in Div. 2J 1978-2016

Depth Range (m)	V1 Area	V4 Area	Stratum	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
101 - 200	1427	633	201	6	27		82	26	91	0	65	27	133	11	135	50	27	491	33	79	87	507	154	159	22	15	109
	1823	1594	205	6	14		514	35	502	532	281	863	754	706	1055	990	245	1769	530	469	630	1051	343	4504	860	856	692
	2582	1870	206	28	132	399	1120	404	349	403	357	1367	1586	890	813	1079	404	617	835	384	2870	2184	587	1869	239	230	896
	2246	2264	207	0	33	1	56	51	74	192	16	208	35	192	118	30	15	160	51	5	717	754	3570	207	239	1157	200
	733	237		0	0	0	1	4	19	320	0	5	42	3	0	37	0	280	17	0	111		5	96	0	10	129
	778	238			7		15	0	79	0	53	27	6	54	81	18	8	696	43	8	62	713	1	44	83	2	112
Sub-Total				40	213	400	1789	519	1115	1447	771	2498	2556	1856	2202	2205	697	4012	1508	946	4478	5210	4659	6880	1444	2270	2138
201 - 300	440	621	202	8	307	95	89	157	593	1685	574	2215	491	871	2260	898	797	901	876	164	947	2996	2909	1711	7724	1557	3611
	1608	680	209	384	123	360	1059	424	282	2204	694	291	1061	1475	811	379	2560	1775	250	1204	790	1153	1115	223	3308	717	1186
	774	1035	210	589	121	2708	3904	893	1047	613	661	1140	3314	1861	626	285	828	981	443	1397	1281	3088	2746	4573	3596	1289	432
	1725	1583	213	302	422	236	1338	1146	1962	1426	893	2332	1336	1950	1163	1325	3620	2343	2776	952	1911	2730	2031	2704	2932	928	932
	1171	1341	214	1064	507	327	4057	1258	1502	1883	1204	1930	485	1337	2500	2520	3241	2087	1904	1631	1690	2633	2154	8797	2875	1302	1281
	1270	1302	215	1349	855	1370	1247	1448	1889	1986	1139	1967	3499	1360	1592	3091	1633	1920	909	2691	4767	1983	7065	2087	5366	2385	806
	1428	2196	228	967	2749	2219	5478	3666	4356	2566	2870	2803	1850	1175	2858	3626	3389	3339	891	2473	1452	1735	1478	762	1589	525	515
	508	530	234	895	129		163	753	352	311	122	349	75	1237	54	1367	327	671	337	304	363	16749	1449	2987	583	463	2062
Sub-Total				5557	5214	7315	17335	9744	11982	12675	8157	13026	12111	11267	11864	13491	16394	14017	8387	10816	13200	33066	20945	23846	27973	9166	10825
301 - 400	480	487	203	1856	1404	387	946	2233	3303	2553	2200	4090	1134	2846	6523	1792	2581	2064	1548	4950	6055	13207	3089	12619	5620	5720	1818
	448	588	208	1025	4820	4799	3707	12593	6479	11101	9423	5230	7812	2894	8453	5500	20207	3983	2086	4542	10744	11136	8229	31005	22176	7541	516
	330	251	211	1628	871	1400	1343	1875	870	3541	640	2964	2336	2016	2414	5397	3626	1353	615	1388	1752	3960	4575	2129	10983	6655	237
	384	360	216	331	392	64	506	1090	1631	881	1103	1076	397	957	697	641	1457	348	1274	1192	1376	890	2534	1222	1781	416	569
	441	450	222	170	535	122	1672	930	382	751	995	1151	1086	322	371	164	593	289	637	404	86	155	1252	2319	1317	230	390
	567	536	229	246	1202	1799	3900	1940	2514	1206	1639	1591	1123	2336	439	728	508	625	1607	1041	1552	360	188	1277	700	475	147
Sub-Total				5255	9223	8571	12074	20660	15179	20032	16001	16101	13888	11371	18897	14222	31873	8662	7766	13516	21566	29708	19866	50571	42577	21039	3677
401 - 500	354	288	204	2512	3442	1437	3823	7941	6171	3707	4652	5240	1762	7283	8250	8979	5950	2949	4064	4711	5412	3633	8443	3548	6119	6035	5559
	268	241	217	270	226	131	932	676	621	704	628	1983	458	395	433	1027	444	190	234	716	210	307	676	264	924	567	505
	180	158	223	130	168	162	438	425	598	505		346	419	179	699	424	475	224	161	116	135	91	367	212	323	333	888
	686	598	227	1648	2009	909	5850	9244	1793	13071	3628	4226	1316	6852	1325	6381	31416	4173	1936	1043	4561	915	2293	1446	1875	912	865
	420	414	235	810	1042	3895	4373	8365	3256	4183	3929	4170	4733	5739	1990	2852	3286	3384	477	1387	2354	1218	3053	2694	10860	5100	6733
	133	240		85	118	632	537	501	251	643	204	413	552	178	194	186	629	190	136	334	325	283	132	121	33	338	129
Sub-Total				5455	7004	7167	15953	27152	12692	22813	13041	16379	9240	20626	12891	19849	42200	11110	7008	8305	12997	6447	14964	8286	20134	13285	14679
501 - 750	664	557	212	5048	1485	5499	4940	10735	4375	14447	4366	3802	7126	4898	3595	4086	4733	6766	6429	12166	7310	3818	4583	3677	3574	992	14686
	420	362	218	248	136	693	1783	1207	1319	1019	690	1413	732	456	844	661	731	237	100	1489	407	455	491	687	694	1686	574
	270	228	224	85	309	214	702	625	401	293	701	360	130	205	356	538	372	190	248	764	612	206	193	873	900	435	815
	237	185	230	135	379	652	1350	1589	547	2230	786	569	560	383	356	242	629	502	442	1405	458	552	348	786	580	847	300
	120	239		1917	1411	1676	2586	2725	4867	4064	1959	1945	867	3470	3389	1776	3456	2219	2746	2165	2337	1460	4572	2766	2086	3001	5500
Sub-Total				7434	3720	8734	11360	16880	11508	22052	8501	8088	9415	9413	8540	7302	9922	9914	9965	17989	11124	6491	10188	8789	7835	6961	21874
751 - 1000	213	283	219	639	1579	2021	405	1727	2249	1402	1731	1297	621	1248	1156	374	761	1083		1703	687	1081	132	866	426	1678	1201
	182	186	231	613	604	376	1013	651	1635	1744	2828	2820	1603	432	720	612	1561	1865	1384	1284	433	924	468	625	667	273	491
	122	193	236	886	230	1007	698	381	725	1107	592	937	881	533	344	468	642	925		749	221	697	230	805	375	322	561
Sub-Total				2138	2413	3405	2116	2758	4609	4252	5151	5054	3105	2213	2220	1454	2963	3873	1384	3737	1341	2702	830	2296	1469	2272	2252
1001 - 1250	324	303	220				1296	503	1196		568	786	749	1480	1116	871	472	3420		353	374	480	306	154	495	805	1466
	177	195	225				835	693	655	478	175	1219	65	171	112	481	186	408	319	563	111	446	51	126	0	340	338
	236	228	232				717	935	627	1787	1063	1146	626	56	714	502	300	1001	666	1276	440	374	32	267	367	28	

Table 7 Biomass (tons) by stratum (converted to Campelen units from 1978-94) from Canadian fall surveys in Div. 3K 1978-2016

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	1672	1931
	850	888	625	1915	1387	1530	3242	822	5794	3856	4936	3449	5773	3204	847	3881	2176	484	3229	2385
	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	622	16724	8517	3448	10766	7914	14953	8922	4742	36448	12755	17950	13695	30531	6256	4326	6993	3921
		1184	1255	11452	5878	9820	24040	16903	27637	38222	18219	33516	21372	21502	37862	18637	10870	4355	31882	7308
		1202	1321	8523	3909	4910	8787	5115	8693	12698	9456	8334	15010	11317	17190	4993	16791	3570	9779	9453
		198	69	835		1177	756	531		344	398	204	417	163	225	367	310	130	77	111
		204	216	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	641	776	1647	2245	1521	1622	3609	3924	1384		1367		2661	651	440	411	109	
		333	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	642	2417		3824	1134	3305		8496	3279		2722		4475	4484	9225	1541	2336	
		409	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	643	1254	1364															
		232	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	644	1890	783															
		263	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
	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
		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
751 - 1000	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
Sub-Total				5193	5094	6636	10317	8518	7190	12067	3560	5567	3794	12868	5044	6232	2438	7907	4951
1001 - 1250	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
Sub-Total				3071	6068	9590	10800	8959	5207	10064	4055	2298	2910	3197	6839	6181	937	6872	3581
1251 - 1500	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	
101 - 200		798	608							
		445	612			1				
		250	616							
		1455	1347	618	481	35	50	20	27	134
		1588	1753	619	1855	98	40	22	28	125
	Sub-Total			2337	134	90	42	54	259	
201 - 300		342	609							
		573	611							
		251	615			323				
		2709	2545	620	13352	1187	3393	1874	1942	1620
		2859	2537	621	14581	5218	4733	3353	3613	3192
		668	1105	624	2185	375	394	899	515	193
		447	632							
		1618	1555	634	912	1117	581	1438	633	695
		1274	1274	635	658	962	1732	1053	657	520
		1455	1455	636	429	299	1987	1031	602	175
		1132	1132	637	1879	1186	740	1379	521	1115
	Sub-Total			33996	10344	13883	11026	8481	7511	
301 - 400		256	610							
		263	614			2322				
		593	617		8302	6474	7237	3067	6994	504
		1027	494	623	4008	8985	8145	1929	6448	4455
		850	888	625	4128	3821	1648	9312	4417	836
		919	1113	626	5429	6165	19534	28639	3940	11326
		1085	1085	628	2593	922	6370	2596	2489	2829
		499	495	629	1628	4396	774	8859	3757	4471
		544	332	630	2660	4137	6418	5286	2037	2309
		2179	2067	633	2335	3688	856	881	981	1997
		2059	2059	638	3479	1513	5616	6950	2708	576
		1463	1463	639	405	111	1024	864	650	469
		Sub-Total			34967	40213	59945	68383	34420	29772
	401 - 500		30	613			195			
		632	691	622	5238	23531	13563	17532	28859	6211
		1184	1255	627	28132	16741	29604	42129	22689	14161
		1202	1321	631	15341	20091	18444	17316	19111	18571
		198	69	640	38	45	17	34	112	64
		204	216	645	372	137	78	80	208	206
		134	650		132	36	38	53	56	
	Sub-Total			49252	60580	61938	77144	71033	39213	
501 - 750		584	230	641	112	37	216	414	583	188
		333	325	646	251	129	331	298	712	632
		359	651		1118	474	1239	872	1213	667
	Sub-Total			1481	639	1787	1584	2508	1487	
751 - 1000		931	418	642	448	585	492	873	860	1178
		409	360	647	1360	1312	1065	770	343	1415
		516	652		1049	1293	674	1885	1369	1533
	Sub-Total			2856	3190	2232	3527	2573	4127	
1001 - 1250		1266	733	643	288	1096	1060	2844	1294	2398
		232	228	648	601	761	1105	258	632	1737
		531	653		703	84	557	1622	459	1305
	Sub-Total			1592	1941	2723	4725	2385	5440	
1251 - 1500		954	474	644	1021	646	94	635	1046	1111
		263	212	649	430	22	140	324	426	1065
		479	654		1251	1261	881	653	612	
	Sub-Total			2702	1930	1115	1612	2085	2175	
Total biomass (t)				129183	118971	143712	168044	123539	89984	



Table 8 Biomass (tons) by stratum from Canadian spring surveys in Div. 3L 1996-2016

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
30 - 56		268	784			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
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	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
	1121	1121	371	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
	1120	1120	384	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	0	0	0	0	0	0	0	0	0	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
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	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	0	46		4
	525	525	343	0	0	2	0	0	0	0	0	0	30	0	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	0	5	1	0	6	6		3
	2114	2114	349	1	0	11	0	14	2	0	0	5	0	0	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	0	0	7		0
	1041	1041	365	1	0	0	14	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	43	0	1	0	1	0	1	1			0
	2356	2356	385	0	0	0	0	0	0	0	12	0	0	0	4	0	0	0	0	2	5			0
	1481	1481	390	0	24	0	0	6	0	0	0	9	0	0	0	0	0	0	0	1	0			0
	84	786				0	0												0					
	613	787				0	0												0					
	261	788					0																	
	89	790					10																	
	72	793					3																	
	216	794					0				0													
	98	797					0				0													
	72	799					0				0													
Sub-Total				5	39	32	26	64	4	0	2	13	103	42	49	6	3	13	19	50	32	303	0	55
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	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					0												
Sub-Total				58	758	267	1268	1099	150	67	702	440	2214	4249	5381	866	217	559	644	1392	313	249	0	90
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	####	5549	2932	1686	3766	11458	2793	2224	0	2227
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				148													
Sub-Total				5019	7601	####	####	9958	5447	2410	6115	3566	4580	2614	4334	5279	843	4062	1008	3821	1925	1698	0	1186
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	####	6297	9001	5370	2449	2632	1466	2865	1434	6659	6461	1604	8629	3086	1463	1293	1269	0	2215
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 1996-2016

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
<=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
	Sub-Total			12	0	0	0	0	1	0	1	0	70	0	1	0	0	0	0	0	0	0	0	0
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	0
	2520	2520	362	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	2520	2520	373	0	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	0
	674	674	383	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Total			53	349	131	471	183	29	73	3	71	202	0	2	0	0	0	5	0	3	2	0	0	
93 - 183	421	421	359	145	133	31	165	96	19	0	2	4	133	.	0	30	0	58	17	17	0	5	0	1
	100	100	377	6	4	0	321	0	0	0	0	0	25	.	51	12	1	0	4	3	0	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	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	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	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	.	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	0	907



Table 10 Biomass (tons) by stratum from Canadian spring surveys in Div. 30 1996-2016

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
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	0
	456	456	331	0	0	16	0	0	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	0
	1716	1716	340	0	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	0
	2580	2580	352	114	48	0	0	0	0	3	0	0	0	0	0	0	0	0	0	75	1	0	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	0
Sub-Total				710	234	409	2	25	0	8	0	14	84	66	1	0	1	0	26	75	2	8	0	1
93 - 183	1721	1721	329	1	13	0	0	1	1	0	0	0	14	.	0	0	28	0	0	1	12	44	0	0
	1047	1047	332	148	376	475	0	4	0	1	6	24	62	.	0	0	0	2	47	0	0	17	1	1
	948	948	337	179	139	4	0	3	31	1	91	17	37	.	13	1	0	0	0	15	0	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	0
	474	474	354	807	122	330	3	0	11	22	8	25	43	.	1	6	5	2	29	0	6	0	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
184 - 274	151	147	333	5	62	23	0	9	0	8	0	2	12	.	0	10	1	5	0	0	1	0	0	0
	121	121	336	100	168	11	0	7	3	8	11	6	15	.	0	16	0	7	2	0	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	0	29
Sub-Total				355	398	54	0	18	87	21	57	50	40	0	26	38	12	24	14	0	1	2	0	31
275 - 366	92	96	334	20	39	6	2	1	0	1	0	0	3	.	0	1	2	1	1	0	0	1	0	0
	58	58	335	9	92	15	0	2	0	0	0	1	1	.	1	0	0	4	0	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	0
Sub-Total				190	199	68	3	3	3	3	7	2	7	0	34	17	8	5	1	2	0	2	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	0	.
	76	76	719	9	24	29	1	8	0	21	0	23	18	.	0	14	5	1	45	0	1	1	0	0
	76	76	721	161	59	112	5	30	1	8	2	7	3	.	0	0	28	2	67	20	2	14	0	0
Sub-Total				212	248	196	7	39	3	30	2	36	20	0	0	14	51	4	131	45	3	15	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	0	.
	105	105	720	29	61	111	4	45	23	3	12	63	122	.	36	148	117	27	.	45	0	7	0	0
	93	93	722	57	176	203	23	120	23	43	3	86	51	.	240	187	42	160	368	116	188	126	0	13
Sub-Total				156	353	467	37	191	55	87	74	222	230	0	310	673	204	213	504	195	251	226	0	13
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	0	66

Table 11 Biomass (tons) by stratum from Canadian autumn surveys in Div. 3L 1996-2016

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
30 - 56			268	784	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	1	0	0	2	0	0	0	0	0	0	0	0	0
	1780	1780	363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	1121	1121	371	3	0	0	24	0	0	0	0	0	0	0	0	20	0	1	0	0	0
	2460	2460	372	0	0	0	0	0	0	0	0	1	0	3	0	0	1	0	0	0	0
	1120	1120	384	0	0	0	0	0	0	0	0	1	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
Sub-Total	3	0	0	24	0	0	0	1	0	0	4	0	3	0	0	20	0	1	0	0	1
93 - 183	1519	1519	328	1	6	1	11	18	0	1	0	0	2	0	0	3	4	36	49	11	18
	1574	1574	341	2	249	184	0	6	0	13	0	22	0	20	0	2	4	154	477	34	6
	585	585	342	1	84	16	0	6	0	0	0	4	28	0	0	0	0	0	0	19	26
	525	525	343	0	34	45	0	1	0	0	0	43	0	17	0	0	0	0	0	0	3
	2120	2120	348	2	129	177	216	22	2	23	0	162	427	336	3	77	0	2	374	87	1640
	2114	2114	349	2	60	252	416	0	0	0	2	47	182	21	0	4	31	195	17	13	2
	2817	2817	364	0	103	414	30	0	1	6	0	56	64	0	2	82	6	14	90	68	171
	1041	1041	365	0	169	140	55	0	0	0	0	444	258	2	41	0	15	574	427	244	0
	1320	1320	370	14	48	871	555	19	1	55	23	0	277	0	141	0	39	168	192	458	0
	2356	2356	385	64	502	334	253	29	47	190	69	348	273	233	554	565	17	107	833	871	262
	1481	1481	390	67	200	625	310	69	497	222	13	193	332	118	350	127	64	264	311	12	52
	84	786	67	2	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	613	787	1	86	0	0	0	0	0	59	0	1	0	0	0	0	0	0	0	0	0
	261	788	0	45	31	0	0	0	0	0	0	4	10	0	0	0	0	0	0	0	0
	89	790	0	6	6	25	0	0	0	29	14	0	0	0	0	25	0	0	0	0	0
	72	793	0	4	4	0	0	5	0	0	53	0	0	0	0	0	0	0	0	0	0
	216	794	0	15	4	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0
	98	797	0	3	14	0	0	0	0	23	0	0	0	0	0	0	0	0	0	0	0
	72	799	0	0	4	0	0	0	0	0	6	0	0	0	0	0	0	0	0	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
184 - 274	1494	1582	344	11	96	885	181	42	0	7	17	918	761	796	661	1783	65	14	678	1270	1716
	983	983	347	0	37	1021	297	160	88	28	0	476	338	1123	281	1903	23	206	1444	1358	1273
	1394	1394	366	338	878	2172	2108	62	265	689	119	0	2545	2185	2261	2365	496	277	1843	659	1605
	961	961	369	108	888	2347	719	85	296	55	278	0	3319	1720	829	2690	195	384	2567	1932	2070
	983	983	386	447	1010	1683	1129	473	337	998	453	0	3490	1741	652	758	1076	835	2223	1704	1719
	821	821	389	900	875	474	673	727	1143	531	563	706	244	644	416	601	662	681	211	979	531
	282	282	391	344	892	257	135	379	89	135	448	144	192	262	68	170	137	77	36	126	267
	791	791	391	193	151	0	201	2	10	12	81	182	0	0	0	0	0	130	0	0	0
	164	795	5	35	6	11	8	0	0	664	58	65	0	0	0	0	0	0	0	0	0
Sub-Total	2153	4904	8997	5242	2140	2227	2453	1890	2989	11129	8537	5168	10269	2653	2604	9002	8028	9182	0	1842	4521
275 - 366	1432	1432	345	3747	1775	4359	1665	2659	1248	2343	2052	3998	2281	2488	2996	5552	2203	5051	5975	1638	7300
	865	865	346	5483	2378	2062	1312	1020	1224	1045	4602	3555	3909	2960	2027	3288	1998	1350	1341	1567	1186
	334	334	368	690	338	2272	860	857	871	1829	1059	0	1106	581	968	2950	982	493	423	435	207
	718	718	387	1765	1613	1609	5284	4896	4503	661	1147	0	586	2336	3862	1246	613	1462	435	607	1909
	361	361	388	711	814	380	270	704	993	309	554	431	317	582	1047	388	542	29	97	186	71
	145	145	392	500	618	215	170	234	116	53	266	165	137	77	93	61	107	59	57	25	35
	72	789	0	14	10	0	12	1	0	1	67	18	2	0	0	0	0	0	0	0	0
	227	791	66	37	355	289	154	96	41	2	318	385	380	0	0	0	0	383	0	0	0
	175	796	76	108	152	0	226	19	50	38	806	1096	0	0	0	0	0	32	0	0	0
	100	798	0	313	517	0	233	191	215	52	636	725	0	0	0	125	286	0	0	0	0
Sub-Total	81	800	#####	8325	#####	9560	#####	9262	6547	9773	9977	10562	9406	10994	13486	6570	9147	8328	4458	11364	0
367 - 549	186	186	729	648	496	242	239	1002	438	100	218	139	13	103	149	81	52	85	38	38	130
	216	216	731	706	713	305	1795	891	407	318	306	262	150	227	145	55	170	52	76	14	27
	468	468	733	1111	938	2093	2465	728	1504	1177	412	0	808	1457	1368	1125	1615	1578	346	389	646
	272	272	735	186	349	608	0	316	69	31	200	1021	602	0	0	0	0	254	0	0	0
Sub-Total	2651	3247	5783	6011	4258	3324	1938	2085	1785	2790	4035	2149	1433	2153	2085	312	734	1128	0	916	873
550 - 731	170	170	730	37	330	44	224	125	627	200	183	74	32	196	294	30	151	40	0	125	116
	231	231	732	463	590	705	519	858	319	152	430	130	226	123	377	152	244	437	86	60	95
	228	228	734	642	604	515	184	554	671	214	124	0	34	136	131	205	928	126	407	126	41
	175	175	736	1117	951	1285	498	4028	1038	910	214	0	195	445	1862	864	721	593	186	851	450
Sub-Total	2259	2476	2549	1425	5566	2655	1476	951	204	487	900	2664	1251	2044	1196	679	1162	702	0	975	916
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	0	7586	12249

Table 12 Biomass (tons) by stratum from Canadian autumn surveys in Div. 3N 1996-2016

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
<=56	1593	1593	375	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1
	1499	1499	376	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sub-Total			0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	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	0	37
	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	0
	2520	2520	373	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0
	931	931	374	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
674	674	383	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	48	0	0	
	Sub-Total			744	1245	808	144	165	0	2	33	12	260	0	3	12	105	0	290	35	50	0	0	40
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	0
	100	100	377	4	166	30	21	30	1	0	10	7	58	0	11	0	43	52	26	9	0	0	0	0
	647	647	382	0	24	111	0	0	0	96	0	1	42	0	297	5	105	39	73	52	0	0	0	1
	Sub-Total			4	350	865	88	57	83	96	10	10	102	22	366	34	208	209	104	61	2	0	0	1
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	0
	139	139	378	112	262	2198	257	5	237	206	20	135	1	274	36	0	20	.	1	1	7	209	1	
	182	182	381	802	615	1622	590	253	138	73	67	114	146	170	109	47	94	195	246	357	1	213	203	
	Sub-Total			1053	971	3862	860	263	864	280	95	253	151	456	145	53	121	202	249	358	8	423	204	
275 - 366	164	164	357	40	58	7	.	6	8	20	21	8	228	0	29	27	29	9	1	4	0	24	0	
	106	106	379	581	41	31	22	36	404	98	59	629	26	15	21	172	12	51	242	14	2	22	1	
	116	116	380	178	516	794	330	151	141	95	130	362	138	201	56	19	119	74	26	55	49	10	38	
	Sub-Total			800	614	832	352	193	553	214	210	998	391	217	106	218	159	134	270	73	51	57	39	
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	
	105	105	725	165	1646	65	95	171	58	54	42	.	52	16	104	30	251	.	59	42	64	252	33	
	160	160	727	1006	371	509	494	391	570	211	209	342	224	19	167	183	174	200	66	259	38	66	39	
	Sub-Total			1285	2127	910	602	610	699	273	282	354	341	35	324	250	455	389	167	302	136	505	123	
550 - 731	124	124	724	160	589	374	126	67	62	154	.	122	99	193	250	156	194	89	46	12	45	52	30	
	72	72	726	296	448	765	55	30	517	214	136	52	74	104	80	72	510	63	146	58	36	73	496	
	156	156	728	1035	455	675	511	201	299	510	291	1084	38	54	451	359	353	126	55	103	71	86	215	
	Sub-Total			1490	1491	1814	692	299	878	878	428	1257	211	352	781	586	1057	278	247	172	152	212	741	
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



Table 13 Biomass (tons) by stratum from Canadian autumn surveys in Div. 30 1996-2016

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	
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	0	
	456	456	331	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	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	0
	1716	1716	340	0	0	0	17	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	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	0	0
	1282	1282	353	472	769	544	108	0	0	3	0	180	40	0	88	96	0	102	4	3	8	0	0	19	
Sub-Total				514	985	638	164	0	4	3	26	196	40	0	90	110	2	102	8	3	8	4	19		
93 - 183	1721	1721	329	28	57	11	50	46	3	0	0	0	0	0	0	0	0	0	0	66	0	0	4	1	
	1047	1047	332	25	81	74	0	0	0	0	16	26	0	0	7	0	0	0	0	0	2	2	19	0	
	948	948	337	48	30	21	67	0	0	0	7	0	17	0	6	22	0	2	3	18	0	3	0	0	
	585	585	339	0	103	8	0	46	16	0	1	0	0	0	181	60	0	4	0	0	264	16	6	0	
	474	474	354	5	59	15	1094	95	71	24	84	39	6	77	5	0	6	0	0	0	0	0	0	0	0
	Sub-Total				106	329	130	1210	187	90	24	109	66	22	77	198	82	6	7	3	84	266	25	27	
184 - 274	151	147	333	0	10	0	0	3	0	0	0	5	0	0	0	5	0	0	0	0	0	0	0	0	
	121	121	336	3	7	5	0	0	0	0	12	5	0	0	0	33	0	1	0	0	0	0	0	0	
	103	103	355	39	22	3	1	0	1	5	3	25	2	9	2	29	0	0	0	0	1	0	0	0	
Sub-Total				42	39	7	1	3	1	5	14	35	3	9	2	66	0	1	0	0	1	0	0		
275 - 366	92	96	334	0	6	6	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	1	0	
	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		
367 - 549	93	166	717	0	42	27	6	0	72	0	27	1	3	0	51	25	0	6	0	54	0	0	0	1	
	76	76	719	11	4	14	36	18	10	1	0	31	0	0	0	0	46	8	0	17	23	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	
550 - 731	111	134	718	0	131	158	186	20	26	107	355	35	82	0	265	432	77	76	193	87	19	13	11		
	105	105	720	82	0	92	105	181	141	152	131	17	79	34	101	60	35	108	145	64	174	66	1		
	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		
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		



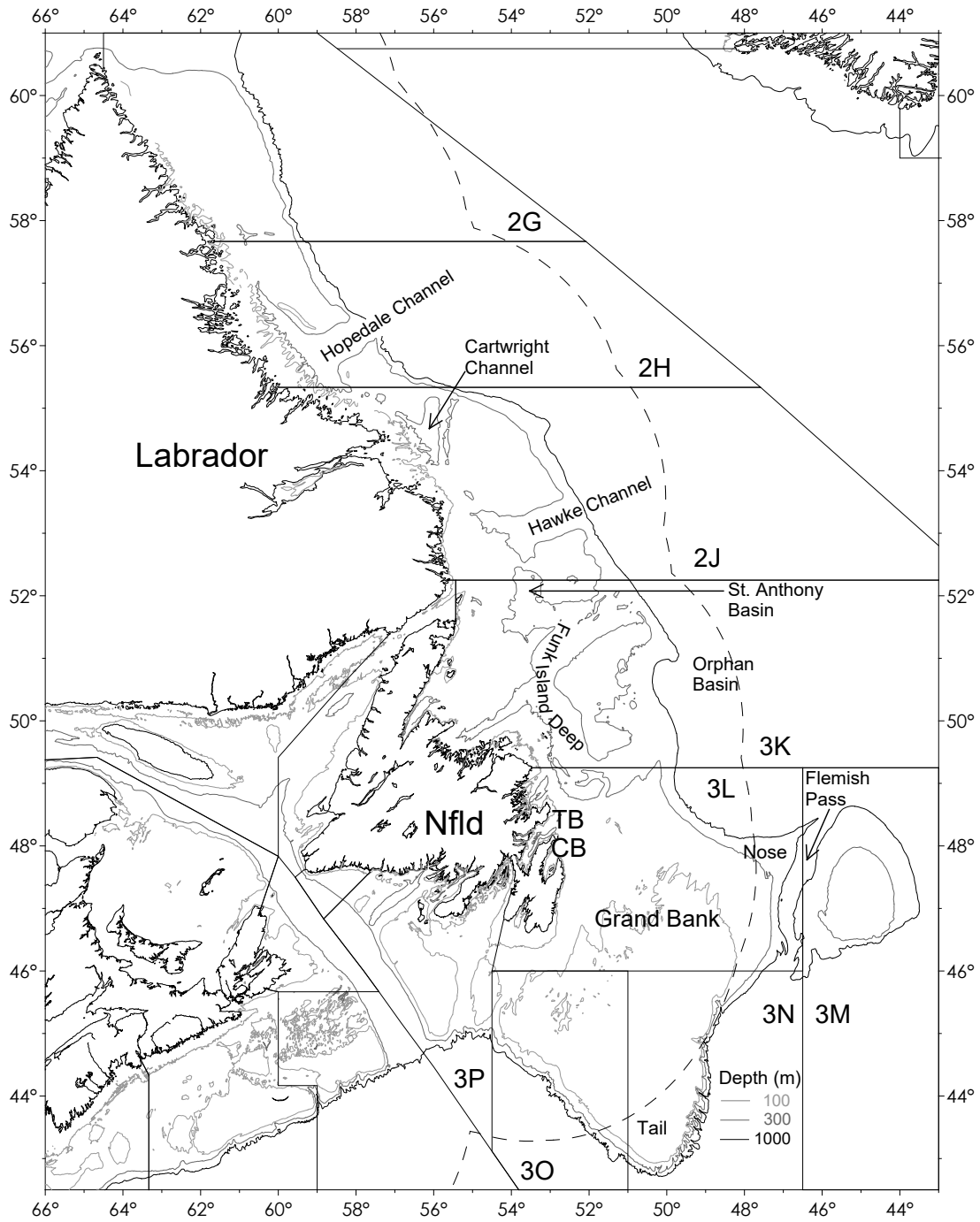


Fig. 1. Map of stock area, with NAFO dividing lines, select isobaths, and names referred to in the text. TB and CB refer to Trinity and Conception Bays, respectively.

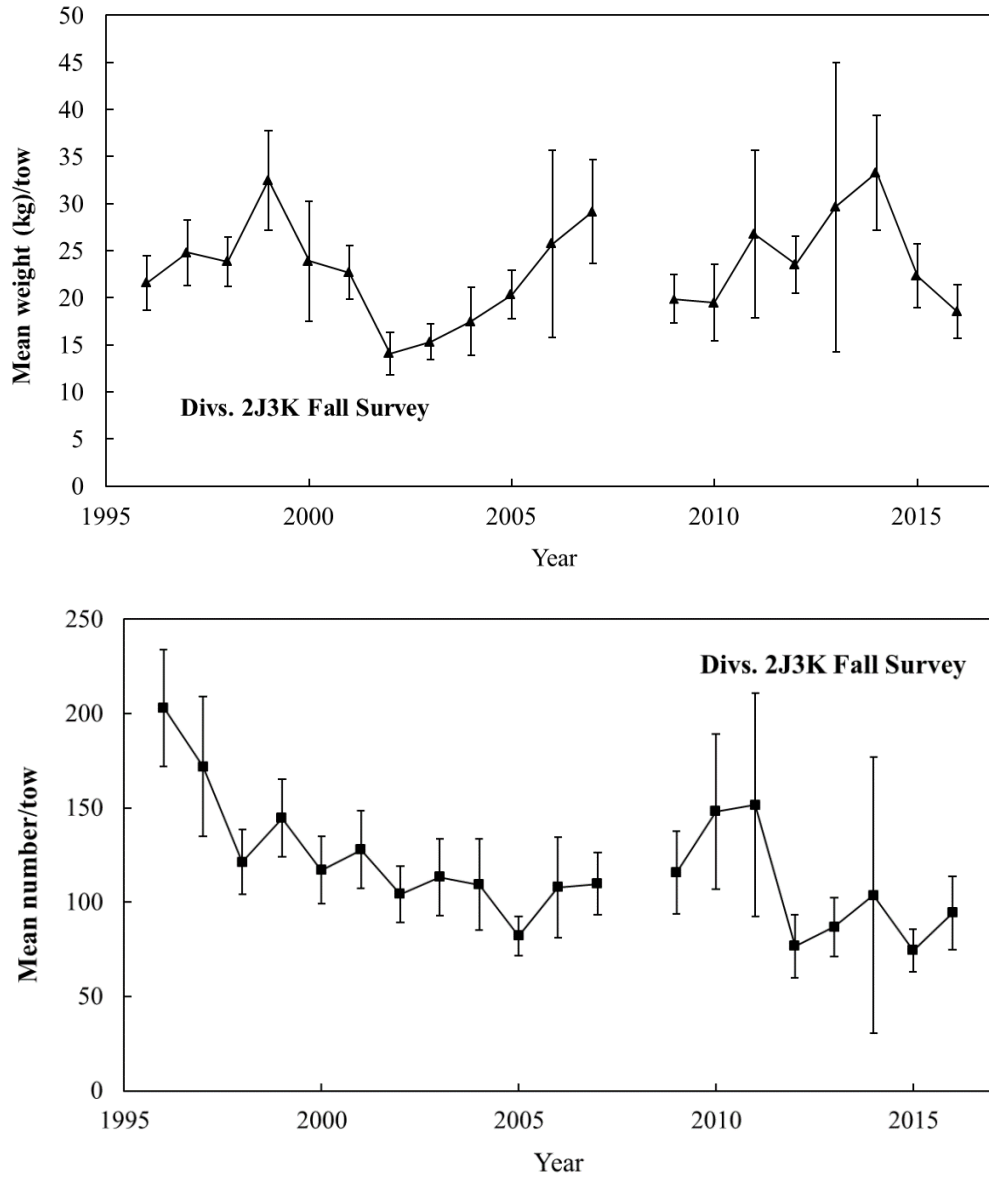


Fig. 2. Mean weight (Kg) and mean number per tow from Canadian autumn surveys of Div. 2J3K from 1996-2016.

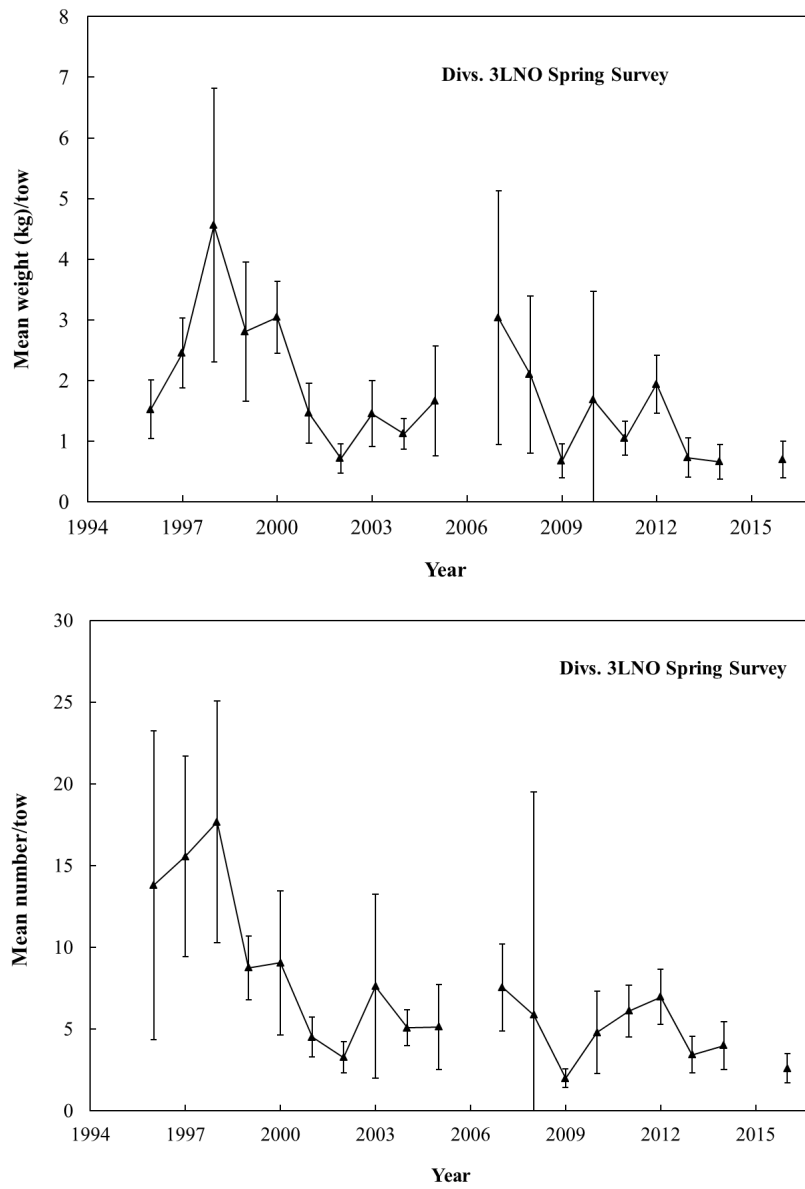


Fig.3. Mean weight (Kg) and mean number per tow from Canadian spring surveys of Div. 3LNO from 1996-2016.

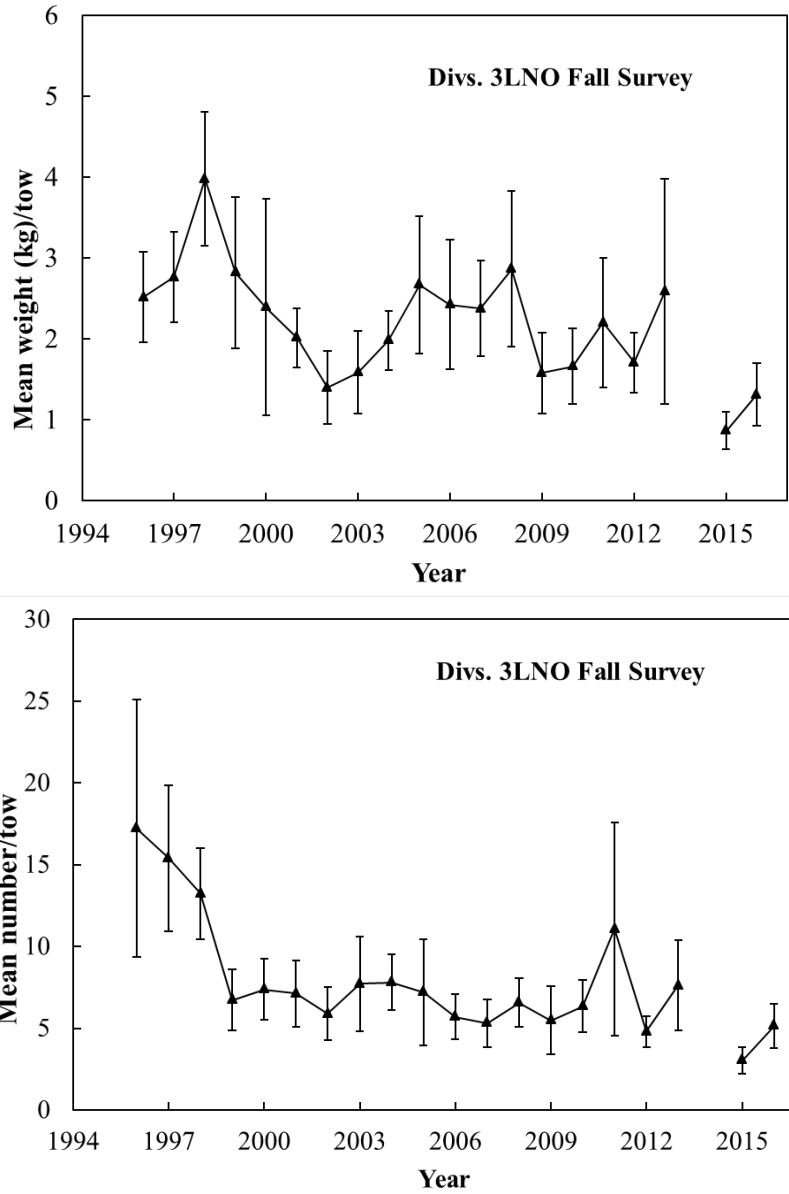


Fig. 4. Mean weight (Kg) and mean number per tow from Canadian autumn surveys of Div. 3LNO from 1996-2016.

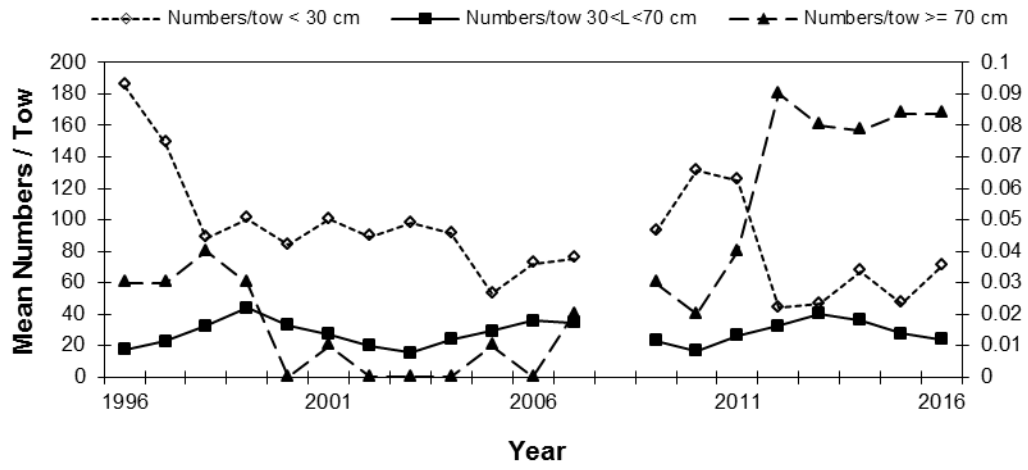


Fig. 5. Mean number per tow by size class from Canadian autumn surveys of Div. 2J3K from 1996-2016. Mean number per tow for the >= 70cm category is given on the right y-axis.