Northwest Atlantic Fisheries Organization

Serial No. N6335 **NAFO SCR Doc. 14/039**

SCIENTIFIC COUNCIL MEETING – JUNE 2014

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

Greenland halibut are a deep-water species with wide distribution throughout NAFO Subarea 2 and Divisions 3KLMNO. An overview of survey results for Greenland Halibut from Canadian spring and fall surveys through 2013 is provided, focusing on the indices used in the assessment of the stock. The biomass index from the fall survey of Divs. 2J3K increased from 2010 to 2013 to reach the second highest levels of the time series, however, the uncertainty in the fall 2013 mean weight per tow is high. The abundance index from the fall survey was lower in 2012 and 2013, the lowest and third lowest levels in the series respectively. The biomass index from the spring survey of Divs. 3LNO has been variable without trend since 2009, although generally at a lower level. The values in 2009, 2011 and 2013 are 3 of the 4 lowest of the time series. The abundance index from the Canadian spring survey of Divs. 3LNO has been at a low level since 2011, with the value in 2013 being the third lowest in the series. Recruitment in the most recent years appears to be low with the 2012 and 2013 index values for ages 1 through 4 all below the Campelen time-series average in the fall and the total abundance over ages 1-4 the second lowest in the time series in 2013 in the spring survey.

Introduction

Greenland halibut are widely distributed throughout the waters adjacent to Labrador and eastern Newfoundland. During the late 1970's and most of the 1980's they were found in relatively high abundance along the deep slopes of the continental shelf, particularly in Division 2G. They were likewise plentiful in the deep channels running between the fishing banks especially in Divisions 2H, 2J and 3K. By 1991 distribution in the northern areas was greatly reduced and most of the resource was located in Division 3K. In Divisions 2HJ and 3K where most of the Greenland halibut resource presently resides, the stock biomass was relatively stable until the mid 1980's after which it declined substantially to reach an all time low in the early 1990's largely precipitated by the disappearance of older fish from the

population. From about 1995 the stock began to increase and continued to improve to 1999 based upon several strong, successive year-classes particularly those of 1993-95. Recruitment following the strong 1993-95 year-classes appeared weaker at younger ages. In contrast to these results, many of the cohorts of the late 1990s and early 2000s have been measured as being average or even above average at older (commercially selected) ages in Divisions 2J and 3K, leading to increases in survey estimates of stock biomass until 2007. Subsequent trends have been variable, and the 2012 survey biomass index in Divs. 2J3K is near the time-series average.

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 2013. Stratified mean number and weight per tow are updated for the two Canadian indices used in the assessment, as are age-disaggregated survey indices. Distribution maps of spring and fall survey catches are also provided.

Methods

Canadian Research Vessel Surveys

The current survey design is random-stratified, 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 Healey (2013), Healey et al. (2012), Healey and Brodie (2009) and Brodie and Stansbury (2007). 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 1995-2013. 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. The inshore of Div. 3L was not surveyed. The fall survey of 2013 began on September 19th (Div. 3O) and finished on December 18th (Div. 3K). The spring survey of Divs. 3LNO, was conducted from April 23rd through to June 20th, and the survey was complete. The number of sets conducted during the 2013 spring and fall surveys by division and vessel deployed, along with the depth range covered, is available in Table 1 and Table 2.

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 several 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.

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

Results and Discussion

Geographic Distribution

Figure 1 shows the area covered by Canadian surveys and includes place names referred to in the text. Figure 2 contains distribution plots for autumn surveys from 2010-2013. Stock distribution in 2013 was similar to that observed in other years, with the largest catches in the deepwater channels in the northern half of the stock area. In each year, large catches were obtained within the Hopedale Channel in Division 2H. The Cartwright and Hawke Channels in Division 2J are also areas with relatively large catches in most years. Fish are also abundant in the Funk Island Deep in Div. 3K but catches were less in 2012 and 2013. Survey biomass within both the Flemish Pass and Divisions 3LNO in general remains relatively low, though again the deep water strata in Divs. 3LNO were not completed from 2011- 2013. Many fewer fish are caught during the spring survey in each year. Greenland halibut are captured around the edge of the Grand Bank in the spring survey and there has been no indication of a change in distribution of fish in this survey (Figure 3).

Trends in Stock Size

The biomass index from the Canadian fall survey of Divs. 2J3K increased from 2010 to 2013 to reach the second highest levels of the time series (Figure 4). However, the uncertainty in the fall 2013 mean weight per tow is high, the largest of the series. The abundance index from the fall survey was lower in 2012 and 2013, the lowest and third lowest levels in the series respectively.

The biomass index from the Canadian spring survey of Divs. 3LNO has been variable without trend since 2009, although generally at a lower level. The values in 2009, 2011 and 2013 are 3 of the 4 lowest of the time series (Figure 5). The abundance index from the Canadian spring survey of Divs. 3LNO has been at a low level since 2011, with the value in 2013 being the third lowest in the 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 1978-2013 are presented in Table 3. Survey catches are typically dominated by fish aged 1 to 6 years old. In 2012 and 2013, index values for ages 1 through 4 are all below the Campelen time-series average. Data for age 5 are about average, and for ages 6-11, results are well above average.

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). Abundance at age is lower than the series average in 2013 at all ages. The total abundance over ages 1-4 is the second lowest in the time series in 2013.

Figure 6 shows trends in mean numbers per tow for Greenland halibut <30 cm, between 31-69 cm and >=70 cm over 1996-2013. 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 both 2012 and 2013, with these two years being the lowest in the time series. The MNPT values for the 30-70cm group has increased fairly steadily from 2010 to 2013 as the higher numbers of fish in the <30 cm size class in 2009-2011 grew. 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 and 2013 values are the highest in the 1996-2013 time series.

Conclusions

The biomass index from the fall survey of Divs. 2J3K increased from 2010 to 2013 to reach the second highest levels of the time series (1996-2013), however, the uncertainty in the fall 2013 mean weight per tow is high. The abundance index from the fall survey was lower in 2012 and 2013, the lowest and third lowest levels in the series respectively. The biomass index from the spring survey of Divs. 3LNO (1996-2013) has been variable without trend since 2009, although generally at a lower level. The values in 2009, 2011 and 2013 are 3 of the 4 lowest of the time series. The abundance index from the Canadian spring survey of Divs. 3LNO has been at a low level since 2011, with the value in 2013 being the third lowest in the series. Recruitment in the most recent years appears to be low, with the 2012 and 2013 index values for ages 1 through 4 being below the Campelen time-series average in the fall and the total abundance over ages 1-4 being the second lowest in the time series in 2013 in the spring survey.

Acknowledgements

These data sources would not exist without the extensive efforts of the DFO scientific sampling teams, as well as the crews of the survey vessels CCGS *Teleost*, CCGS *W.Templeman* and CCGS *A. Needler*. Interpretation of age samples by Randy Burry and Brian Greene is gratefully acknowledged. Gus Cossitt (DFO Science, St.John's, NL) prepared Fig.1.

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Table 1. Summary of successful sets in fall surveys in Sub-Areas 2+3 in 2013. Depth range is given in meters, number of sets appear in parentheses. All sets conducted in the survey are included.

Division	Ship		Total
	Teleost	*A.Needler*	
2G	Not surveyed		
2H	91-1378 (83)		83
2J	99-1445 (116)		116
3K	140 - 1407 (87)	155 -488 (60)	147
3L	100-304 (6)	57 - 657 (142)	148
3N		42 - 681 (70)	70
3O		66 - 630 (75)	75
			639

Table 2. Summary of successful sets in spring surveys in Divs. 3LNO in 2013. Depth range is given in meters, number of sets appear in parentheses. All sets conducted in the survey are included.

Division	Ship	Total
	A.Needler	
3L	62 - 632 (134)	134
3N	40 - 684 (79)	79
3O	64- 650 (79)	79
		292

Table 3. Greenland halibut stratified mean number per set at age from Canadian fall surveys conducted in Divisions 2J and 3K combined during 1978-2013. 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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

Age (yrs)	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
0	0.92	1.05	16.90	10.95	4.92	2.18	1.52	6.46	3.09	8.49	8.30	9.94	4.15	5.07
1	5.69	8.08	29.79	49.93	98.68	28.05	23.35	15.99	38.57	43.90	40.67	45.70	32.49	16.06
2	23.78	43.64	21.62	51.10	47.82	58.62	25.07	34.42	21.94	22.72	24.08	26.67	32.93	16.15
3	20.40	64.00	22.61	15.13	32.01	43.61	31.19	24.07	16.43	17.00	12.50	11.69	13.89	8.56
4	13.59	19.28	18.90	6.03	9.54	21.13	21.87	28.28	13.20	14.07	9.68	9.49	12.31	13.84
5	4.84	5.56	7.22	6.63	6.28	10.37	10.86	20.04	13.76	9.77	6.03	6.39	9.21	10.98
6	3.11	1.76	1.32	1.99	2.47	5.01	4.45	10.53	7.21	7.59	1.97	2.27	2.68	6.85
7	1.27	0.74	0.61	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	0.23	0.19	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	0.03	0.03	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	0.00	0.01	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	0.00	0.00	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	0.02	0.00	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	0.00	0.00	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	0.00	0.00	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	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	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	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	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	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
Ages 0-20	73.76	144.39	119.19	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	63.46	135.00	92.92	122.19	188.05	151.41	101.48	102.76	90.14	97.69	86.93	93.55	91.62	54.61
Ages 5+	9.37	8.34	9.37	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	4.52	2.76	2.14	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
0	3.75	2.21	9.15	5.49	19.54	4.81	5.16	0.1
1	32.34	32.61	15.98	50.62	50.94	44.14	12.28	24.32
2	17.98	14.51	11.71	19.15	39.25	42.06	9.61	12.92
3	8.50	12.81	8.20	11.40	14.81	20.97	11.27	6.74
4	17.60	18.77	9.57	8.42	9.45	18.79	11.86	7.4
5	13.03	9.57	7.57	9.89	6.74	10.32	10.96	10.91
6	9.11	10.35	6.25	5.40	3.77	5.50	9.03	9.09
7	4.18	6.17	3.51	3.59	2.20	3.15	4.31	7.76
8	1.15	2.14	1.68	1.39	1.02	1.26	1.69	3.96
9	0.18	0.34	0.20	0.25	0.18	0.33	0.29	0.5
10	0.03	0.08	0.03	0.08	0.07	0.13	0.11	0.15
11	0.02	0.04	0.02	0.02	0.04	0.06	0.05	0.04
12	0.01	0.02	0.00	0.01	0.02	0.02	0.02	0.02
13	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.02
14	0.00	0.01	0.00	0.00	0.00	0.01	0.02	0.01
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
16	0.00	0.00	0.00	0.01	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
18	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
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ages 0-20	107.89	109.64	73.87	115.73	148.03	151.55	76.67	83.94
Ages 1-4	76.42	78.70	45.46	89.59	114.45	125.96	45.02	51.38
Ages 5+	27.72	28.73	19.26	20.65	14.04	20.78	26.49	32.46
Ages 6-9	14.62	19.00	11.64	10.63	7.16	10.24	15.31	21.31

Table 4. Greenland halibut stratified mean number per set at age from Canadian spring surveys conducted in Div. 3LNO combined during 1996-2013. Only otoliths collected in 3L, 3N, or 3O are used in the analysis. Numbers in Campelen 1800 units.

Age (yrs)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
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
1	1.62	1.16	0.22	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	0.29
2	4.24	3.92	0.81	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
3	4.60	5.16	3.85	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
4	2.18	3.23	6.19	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	0.37
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
6	0.28	0.51	1.24	1.09	2.04	0.72	0.21	0.21	0.26	0.82	**No Survey**	1.49	0.75	0.26	1.08	0.29	0.50	0.24
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
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
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
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
Ages 1-4	12.64	13.47	11.07	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	1.39
Ages 5+	1.17	2.08	6.60	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
Ages 1-10	13.81	15.56	17.67	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	2.39

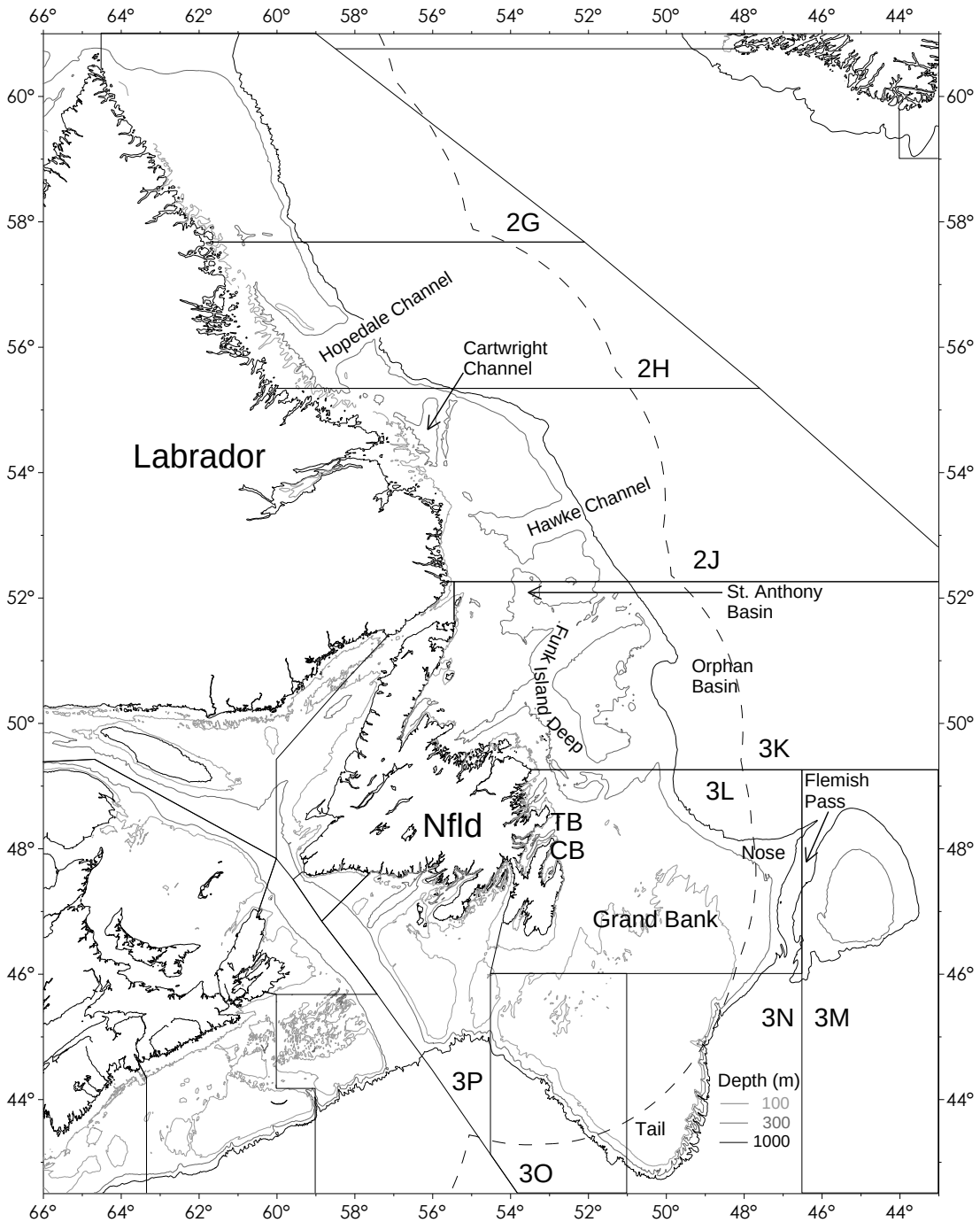

Figure 1. Map of stock area, with NAFO dividing lines, select isobaths, and names referred to in the text. TB and CB refer to Trinity and Conception Bays, respectively.

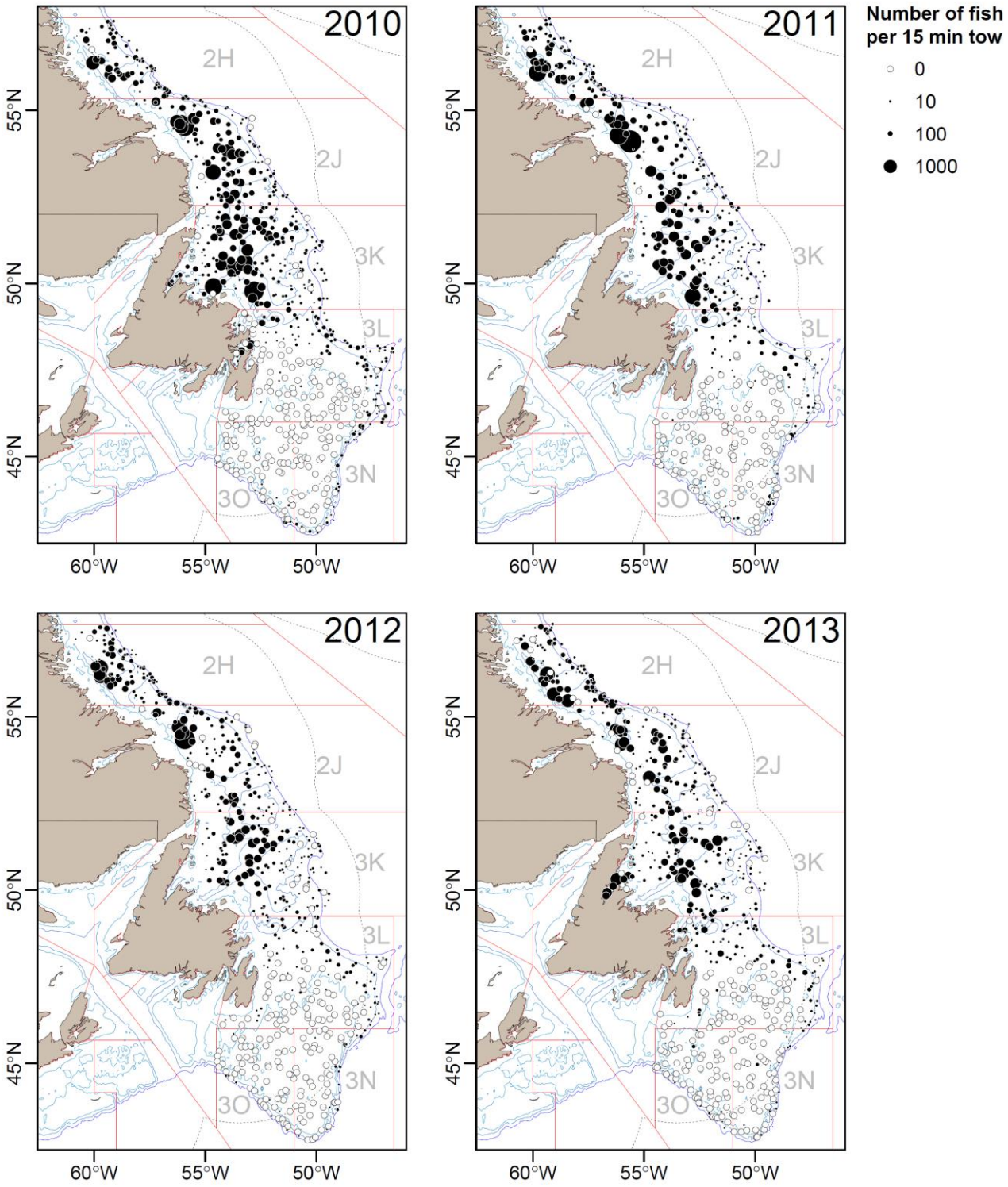

Figure 2 Distribution (number per set) of Greenland halibut from the Canadian autumn survey of Divisions 2H, 2J, 3K, 3L, 3N and 3O from 2010 to 2013.

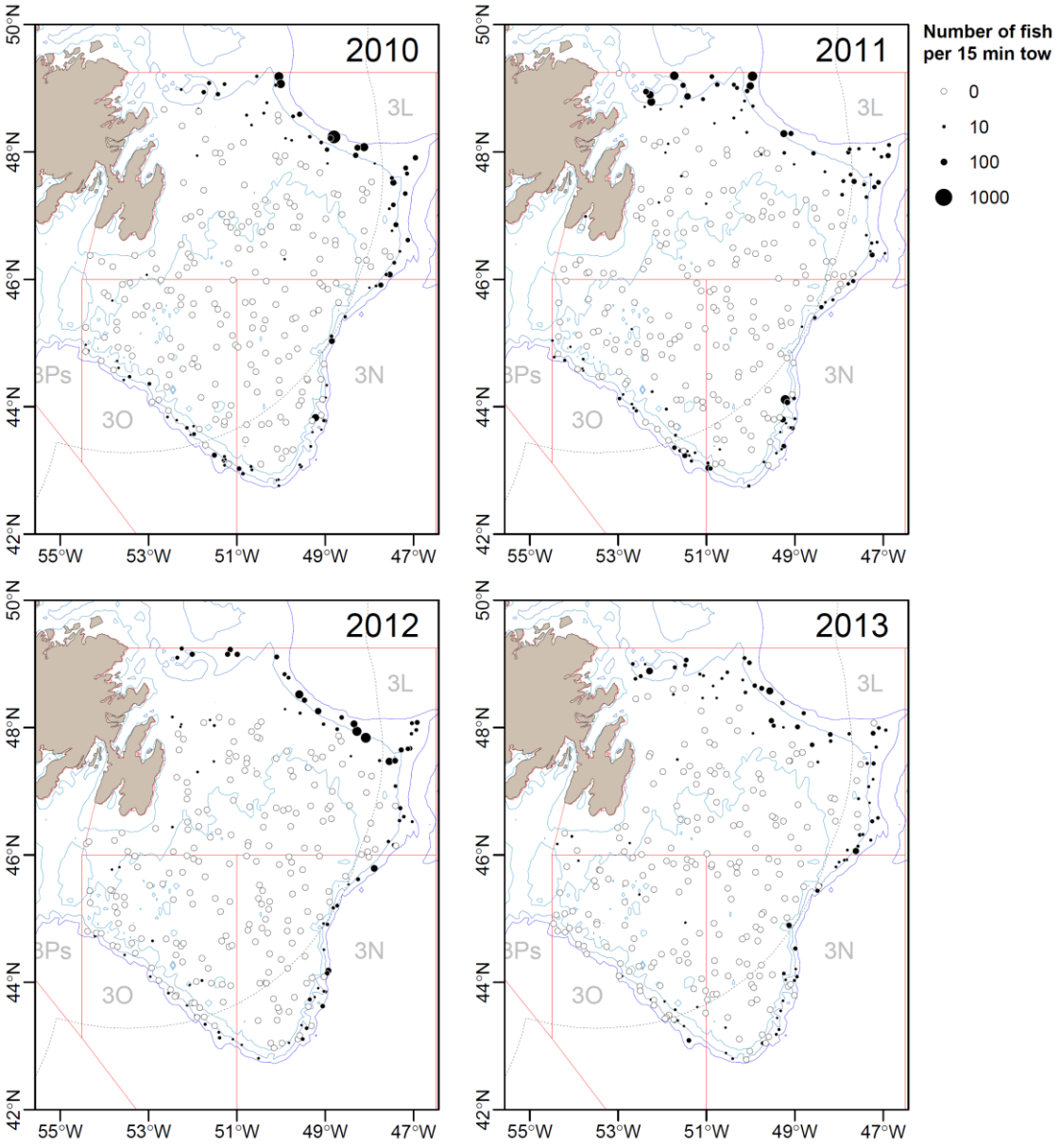

Figure 3. Distribution (number per set) of Greenland halibut from the Canadian autumn survey of Divisions 3L, 3N and 3O from 2010 to 2013.

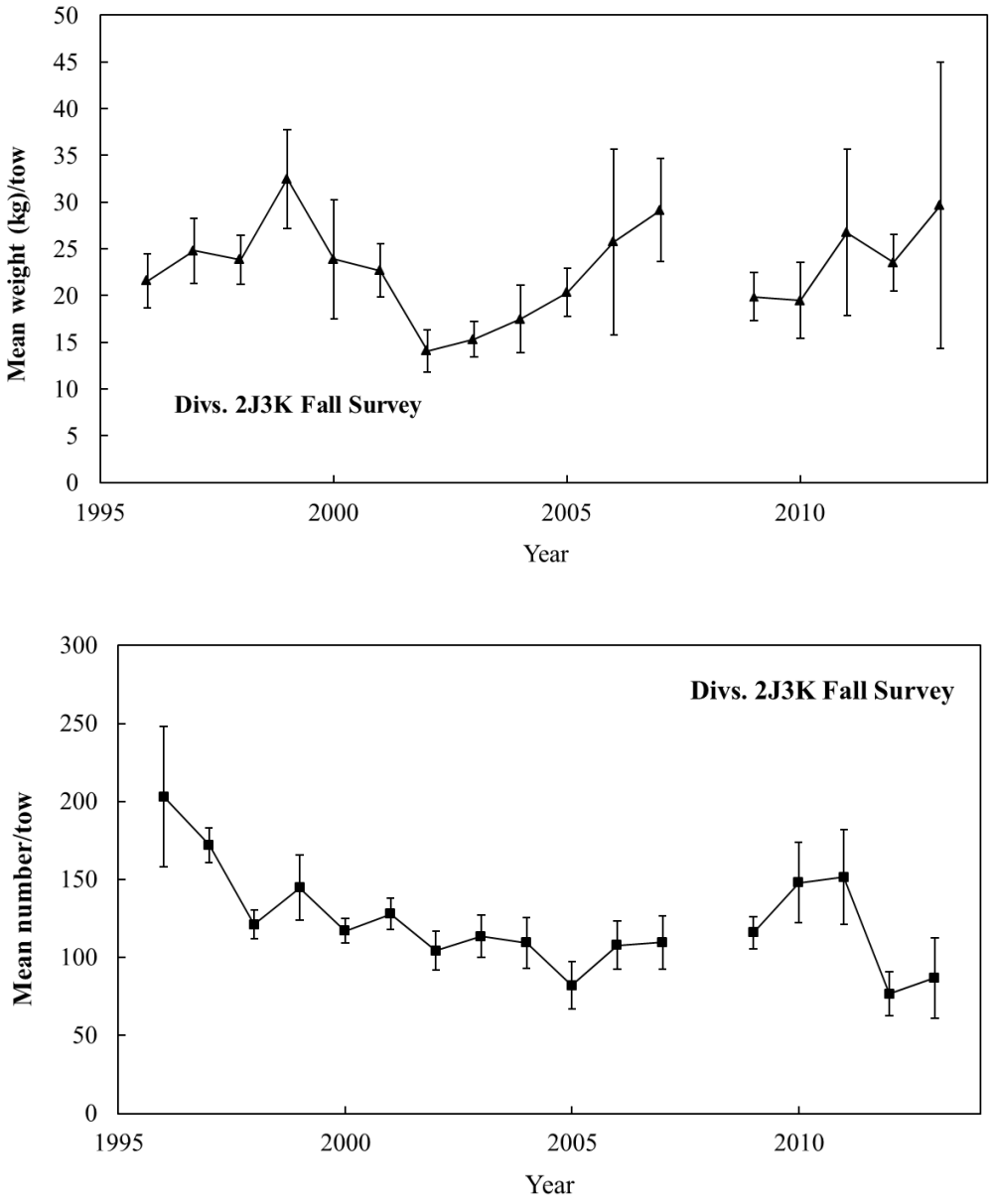

Figure 4. Mean weight (Kg) and mean number per tow from Canadian autumn surveys of Div. 2J3K from 1996-2013.

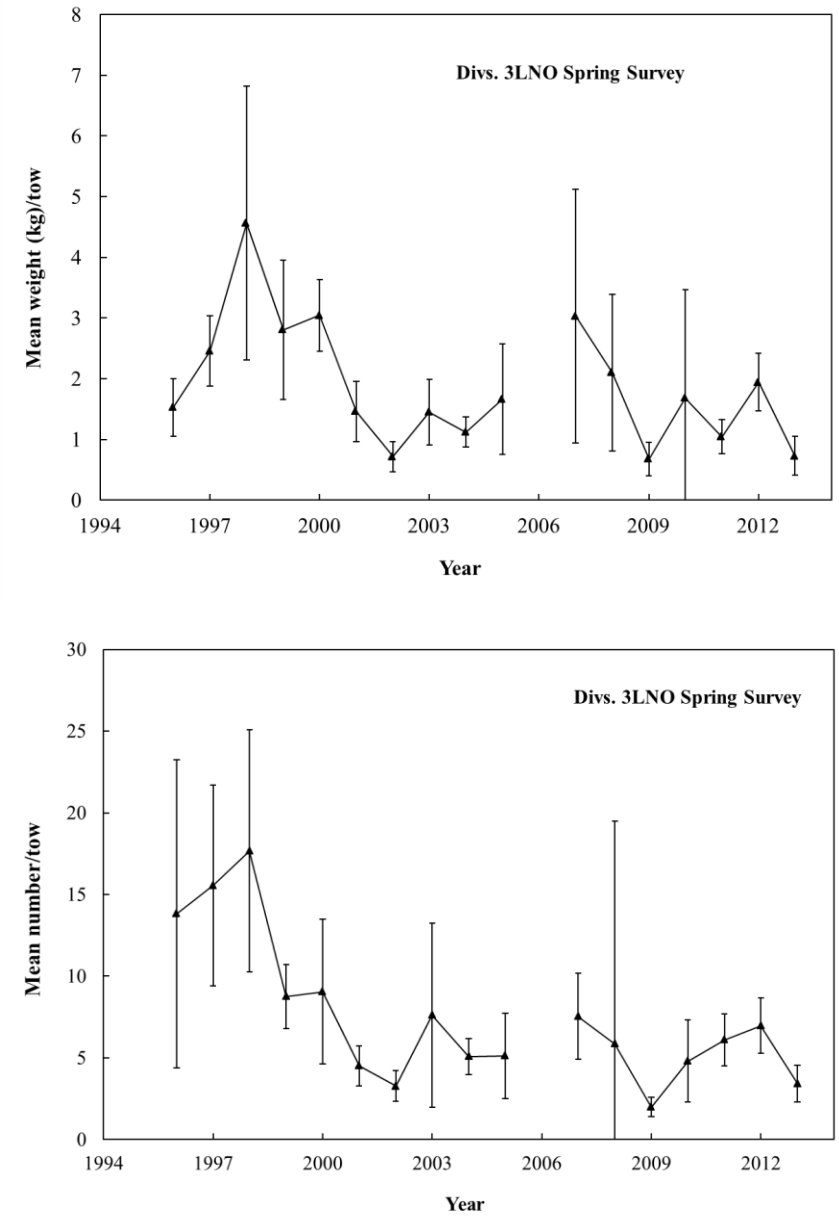

Figure 5. Mean weight (Kg) and mean number per tow from Canadian spring surveys of Div. 3LNO from 1996-2013.

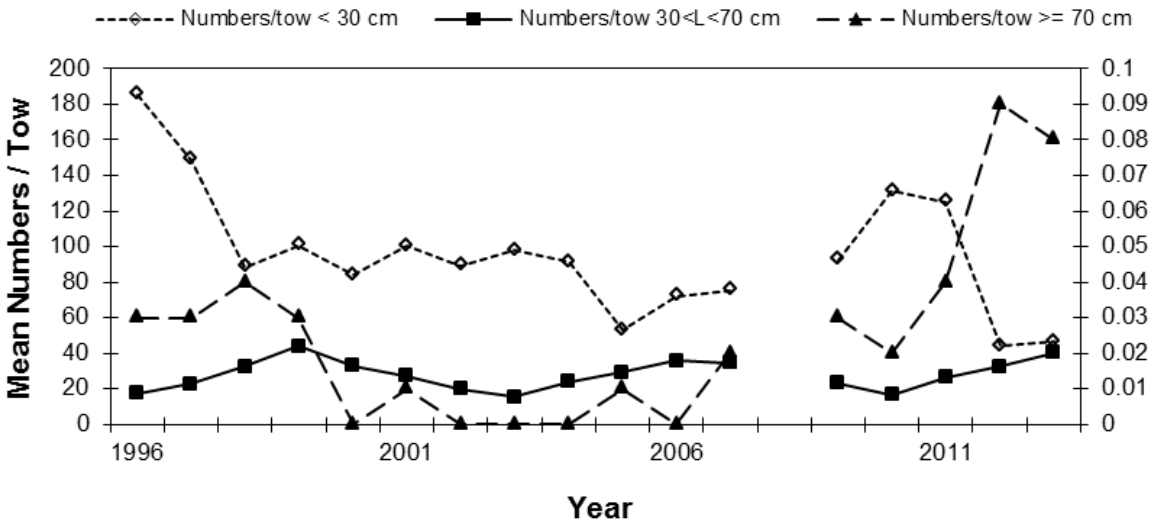

Figure 6. Mean number per tow by size class from Canadian autumn surveys of Div. 2J3K from 1996-2013. Mean number per tow for the >= 70cm category is given on the right y-axis.