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Canadian Research Survey Data Conversions for Redfish in Div. 3LN Based on Comparative Fishing Trials Between an Engel 145 Otter Trawl and a Campelen 1800 Shrimp Trawl

by

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Introduction

Multispecies comparative fishing trials were carried out in 1995 and 1996 for the purpose of deriving conversion factors between an Engel 145 survey trawl and a recently adopted *Campelen 1800* shrimp trawl by the Science Branch of the Department of Fisheries and Oceans (DFO) Newfoundland region. The Engel survey gear with bobbin footgear had been the standard survey gear since on the FRV Gadus Atlantica from 1977-1994 primarily in Div. 2J3K and on the CCGS *Wilfred Templeman* from 1982 to 1995 primarily in Div. 3LNOP. The trials were necessary to provide a means to maintain continuity with the older data time series.

There was also a change in vessel in the Div. 2J3K series with the change in survey gear to the Campelen 1800 with rockhopper footgear. Two sets of trials were conducted, one between the *Wilfred Templeman* using the new survey gear and its sister ship CCGS *Alfred Needler* using the previous survey gear and the second between the *CCGS* Telcost (new vessel, new survey gear) and the Gadus *Atlantica* (previous vessel, previous survey gear. Details of the fishing trials for both sets of trials and a formulation of the experimental design and the length based data modelling are outlined in Warren (1996 and 1997). Six target species were investigated (including redfish) because of their commercial significance and management requirements.

The purpose of this paper is to illustrate the results of the conversion factors and the impact on length distribution as well as trends in stock size using the newly converted data time series. The method of applying the conversion factors was similar to Stansbury (1997).

Materials and Methods

For the applicable surveys in Div. 3LN between 1978 and 1995, redfish length frequencies for each fishing set were first adjusted to a standardized for distance the net was towed and were then converted from Engel trawl catches to Campelen 1800 trawl catch equivalents. Conversion factors as presented in Warren et al. (1996 and 1997) for redfish were applied using weighted least squares as follows:

For the Wilfred Templeman conversion from Engel to Campelen a segmented model was used Warren (1997):

The converted numbers at length $y_x = R_x * n_x$

where R = ratio of Campelen numbers caught to Engels number caught at length X (in 1 cm length classes)
n = number at length in the Engels fishing set

where For X=X(0)=28, R=0.767082
For X<X(0) the Model used was : log R=a +b [X - X(0)log(X)]
For X>X(0) the Model used was: log R=a +bX(0) [1 - log(X(0))]

where a = 27.898086, b = 0.431279

Ratios for X<14 were fixed at X=14 because it was considered that the model was estimating beyond the range of the data.

For the Gadus Atlantica conversion from Engel to Campelen Warren (1996):

The converted numbers at length $y_x = R_x * n_x$

where R = ratio of Campelen numbers caught to Engels number caught at length X (in 1 cm length classes)
n = number at length in the Engels fishing set

where

Model used: log R = 6.7580137 + 0.006839 * X - 1.927210 log (X)

Ratios for X<10 were fixed at X=10 because it was again considered that the model was estimating beyond the range of the data.

Weights were applied in the modeling as the number of fishing sets used to estimate the ratio for a given length class.

After the length frequencies were converted to a Campelen trawl catch equivalent with the appropriate model, a sampling ratio was applied if necessary to each length group and then summed to provide total numbers of redfish caught per standard Campelen set (0.8 nautical mile tow distance in 15 minutes with a wing spread of 16.84 m). These numbers were used to calculate a set weight using the following standard length-weight relationship:

$$\text{WT (males)} = 0.01659\ \text{Forklength}^{2.9548}$$
$$\text{WT (females)} = 0.013272\ \text{Forklength}^{3.0210}$$

This dataset was then used to generate mean number and weight (kg) per set by stratum and year for converted data. For comparative and information purposes the previous Engel data are presented here in Tables 1-2 for Div. 3L and Tables 3-4 for Div. 3N. The Campelen equivalent data are listed in Tables 5-6 for Div. 3L and Tables 7-8 for Div. 3N. No adjustments have been made for differences in revisions to the stratum areas, however, changes are only minimal for this management area.

Results and Discussion

In general the conversion factors derived for each comparative fishing trial reflect the increased catchability for smaller redfish (≤ 20 cm). For the Teleost/Gadus trials, the model estimated a ratio of fish caught by the Campelen to the Engel at about 1.0 for 38 cm fish and increased gradually to about 2 as the length approached 25 cm. This covers most of the range of fish lengths which comprise a good deal of the catches in various surveys in Div. 3LN by the Gadus Atlantica. Ratios increased rapidly for fish length less than 25 cm, and the ratio at lengths less than 10 were fixed because there were few data for the smaller fish.

For the Wilfred Templeman/Alfred Needler trials, the segmented model estimated a ratio of fish caught by the Campelen to the Engel at about 1.0 for 23 cm fish and increased gradually to about a ratio of 7 as the length approached 14 cm. The model estimates of ratios increase rapidly for length less than 14 cm in which there were very few data. For lengths >23 cm the ratios decrease to about 0.77 for fish at length 50 cm. The ratio was fixed at X=14 for lengths less than 14 cm because of the lack of data fitted in this region.

For illustration, a comparison of the stratified mean number and weight per tow between the converted and unconverted data sets in Div. 3L and Div. 3N is presented in Fig. 1. In most years in the early period of each survey

time series the Campelen estimates are higher. Overall trend in was the same except that the relative values estimated for the Campelen trawl are higher. This is also seen in a comparison of stratified mean number per tow at length for a few illustrative years in the surveys (Fig. 2). The catching efficiency of the Campelen for smaller fish (<20 cm) is demonstrated by these plots. Differences between the results of Gadus/Teleost fishing trials and the Wilfred Templeman/Alfred Needler are also evident. The Campelen estimates at length are always as high or higher than its Engel counterpart for Gadus surveys but in some years Campelen estimates are lower at some lengths than the Engel for surveys when it was a Wilfred Templeman survey.

The Campelen equivalent conversions did not distort any trends in the historic series for Div. 3LN redfish but suggest, for Div. 3L, that the rate of decline from the early to mid-1980's was even greater in terms of number per tow than weight per tow. This is a reflection of the increased catchability of the Campelen for size groups less than 20 cm coupled with the fact that the Gadus conducted the surveys in question in the 1978-1981 period and the derived conversion ratios with the Gadus Atlantica Engels were greater than 1 over a larger size range than with the Wilfred Templeman Engels.

Adopting the Campelen has technically enabled a sampling tool that will detect recruitment to the stock at an earlier stage than before, not only for redfish but other species as well.

References

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Table 1. Mean number per standard tow from various Canadian surveys in Div. 3L where strata greater than 366 m (200 fath.) were sampled. Dashes (-) represent unsampled strata. Number of successful sets in brackets. The gear utilized was an Engels 145 otter trawl with a small mesh liner in the codend. G.A. = Gadus Atlantica, W.T. = Wilfred Templeman, A.N. = Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	Aug 16-Aug 29 1978-Q3 (G.A. 12)	Sep 4-Sep 10 1979-Q3 (G.A. 25)	May 8-May 13 1980-Q2 (G.A. 36)	Sep 18-Sep 26 1981-Q3 (G.A. 55)	Jul 26-Sep 3 1984-Q3 (W.T. 16-18)	Jan 10-Feb 11 1985-Q1 (W.T. 22-24)	Apr 17-May 26 1985-Q2 (W.T. 28-30)	Jul 27-Aug 25 1985-Q3 (W.T. 32-34)	Oct 9-Nov 18 1985-Q4 (W.T. 37-39)
347	184-274	983	131.67 (3)	0.00 (2)	0.00 (4)	3.96 (4)	0.00 (6)	0.00 (5)	0.40 (5)	0.00 (3)	0.00 (5)
366	184-274	1394	197.00 (3)	13.50 (2)	9.83 (6)	47.67 (6)	13.91 (11)	0.00 (5)	1.33 (6)	17.40 (5)	17.22 (9)
369	184-274	961	0.00 (3)	1.00 (2)	0.25 (4)	13.75 (4)	0.43 (7)	0.00 (5)	0.20 (5)	0.17 (6)	0.00 (6)
386	184-274	983	115.67 (3)	11.50 (2)	2.00 (4)	11.00 (4)	23.13 (8)	0.00 (5)	0.40 (5)	19.60 (5)	0.60 (5)
389	184-274	821	0.33 (3)	-	29.50 (2)	4.00 (3)	21.67 (6)	4.00 (4)	0.20 (5)	1.75 (4)	7.40 (5)
391	184-274	282	0.00 (2)	19.00 (2)	4.00 (2)	1.50 (2)	0.50 (2)	0.00 (2)	0.00 (2)	0.00 (2)	12.50 (2)
345	275-366	1432	68.50 (2)	96.75 (4)	12.00 (4)	46.60 (5)	37.80 (7)	3.33 (3)	3.20 (5)	62.29 (7)	5.11 (9)
346	275-366	865	206.00 (2)	126.75 (4)	27.00 (2)	70.33 (3)	263.33 (6)	10.00 (4)	20.00 (2)	91.33 (3)	84.40 (5)
368	275-366	334	2,709.00 (2)	140.00 (3)	24.00 (2)	526.50 (2)	4,379.50 (2)	405.00 (2)	14.50 (2)	320.50 (2)	351.50 (2)
387	275-366	718	532.00 (2)	595.40 (5)	23.67 (3)	1,748.67 (3)	4,678.00 (3)	102.00 (4)	11.33 (6)	1,807.33 (3)	628.00 (4)
388	275-366	361	1,240.50 (2)	2,326.33 (3)	4.50 (2)	464.50 (2)	195.00 (2)	16.00 (3)	20.00 (2)	397.00 (2)	78.00 (2)
392	275-366	145	-	818.00 (3)	27.33 (3)	536.50 (2)	2,811.00 (2)	4.00 (2)	10.00 (2)	131.50 (2)	1,398.50 (2)
729	367-549	186	-	488.00 (3)	-	1,050.00 (2)	448.00 (2)	3,406.00 (2)	24.50 (2)	1,231.00 (2)	2,720.50 (2)
731	367-549	216	486.00 (2)	457.00 (3)	325.50 (2)	176.00 (2)	257.00 (2)	80.67 (3)	63.00 (2)	257.00 (2)	502.00 (2)
733	367-549	468	817.00 (2)	1,300.67 (3)	43.67 (3)	1,420.50 (2)	480.00 (4)	1,921.67 (3)	1,147.53 (3)	1,699.50 (2)	727.00 (3)
735	367-549	272	810.50 (2)	452.67 (3)	39.00 (2)	768.00 (2)	723.33 (3)	10.50 (2)	52.50 (2)	282.00 (2)	232.00 (2)
730	550-731	170	1,135.00 (2)	399.33 (3)	295.00 (2)	496.50 (2)	100.50 (2)	816.00 (2)	8,926.00 (2)	347.00 (2)	37.50 (2)
732	550-731	231	85.50 (2)	54.00 (2)	104.00 (2)	53.00 (2)	90.00 (2)	416.00 (2)	141.50 (2)	48.00 (2)	39.00 (2)
734	550-731	228	1,435.50 (2)	535.67 (3)	1,756.00 (2)	760.50 (2)	557.00 (3)	195.50 (2)	366.00 (2)	912.00 (2)	540.00 (2)
736	550-731	175	163.50 (2)	270.33 (3)	-	84.00 (2)		-	532.50 (2)	26.50 (2)	222.00 (2)
737	732-914	227	-	-	-	-	-	-	-	-	-
741	732-914	223	-	-	-	-	-	-	-	-	-
745	732-914	348	-	-	-	-	-	-	-	-	-
748	732-914	159	-	-	-	-	-	-	-	-	-
Upper (95% CI)			653.4	544.2	266.4	680.1	1,078.5	302.2	1,909.1	465.2	290.3
Weighted mean (by area)			349.3	257.3	63.5	293.5	575.5	174.7	208.7	286.8	187.9
Lower (95% CI)			45.2	11.0	-139.6	-93.2	73.9	47.2	-1491.7	108.5	85.5
Abundance of surveyed area (millions)			285.6	216.8	54.3	247.3	478.2	144.9	175.9	241.7	158.3

Table 1. Mean number , Div. 3L (continued)

Stratum	Depth Range (M)	Area (sq. n.) mi	Jan 22-Feb 27 1986-Q1 (W.T.42-44)	Nov13-Nov 30 1986-Q4 (A.N. 72)	Jan 17-Jan 25 1990-Q1 (W.T. 90)	Aug 7-Aug 19 1990-Q3 (W.T. 98)	Oct 18-Nov 18 1990-Q4 (W.T. 101)	May 11- May 2 1991-Q2 (W.T. 106-7)	Aug 4- Aug 11 1991-Q3 (W.T. 109)	Nov 10- Dec 2 1991-Q4 (W.T. 114-5)	May 13-June 7 1992-Q2 (W.T 120-2)
									0.3		
347	184-274	983	1.50 (4)	0.00 (4)	0.50 (4)	1.93 (4)	0.00 (2)	0.25 (2)	0.00 (3)	0.00 (4)	0.00 (4)
366	184-274	1394	1.50 (2)	5.50 (4)	1.00 (5)	9.00 (4)	0.00 (6)	-	0.33 (3)	0.19 (21)	0.33 (6)
369	184-274	961	0.00 (3)	4.24 (3)	0.00 (4)	2.50 (4)	0.00 (4)	0.00 (2)	6.50 (4)	0.56 (9)	0.00 (4)
386	184-274	983	0.86 (7)	4.10 (4)	5.50 (4)	1.29 (7)	2.00 (4)	0.67 (3)	1.00 (3)	0.00 (3)	0.00 (4)
389	184-274	821	1.50 (4)	2.25 (4)	0.00 (3)	5.33 (3)	1.00 (3)	1.67 (3)	0.33 (3)	0.00 (3)	0.00 (3)
391	184-274	282	0.00 (3)	18.00 (2)	0.50 (5)	1.00 (5)	0.00 (2)	0.00 (3)	5.67 (3)	0.00 (3)	2.50 (2)
345	275-366	1432	1.33 (3)	6.68 (4)	0.40 (5)	16.33 (6)	1.00 (5)	0.67 (3)	4.50 (4)	0.25 (4)	0.00 (6)
346	275-366	865	4.25 (4)	22.13 (3)	14.67 (3)	247.66 (7)	67.00 (3)	-	30.00 (4)	6.80 (15)	1.75 (4)
368	275-366	334		24.90 (2)	21.00 (2)	1,728.57 (7)	57.50 (2)	-	409.75 (4)	31.17 (6)	12.00 (2)
387	275-366	718	12.00 (4)	6.00 (2)	135.00 (3)	297.70 (10)	89.67 (3)	45.00 (3)	189.40 (5)	13.00 (5)	8.00 (3)
388	275-366	361	15.67 (3)	-	13.00 (2)	183.86 (7)	16.00 (2)	13.53 (3)	50.33 (3)	12.33 (3)	2.00 (2)
392	275-366	145	9.67 (3)	359.50 (2)	4.00 (2)	146.56 (9)	9.00 (2)	2.50 (2)	350.67 (3)	4.67 (3)	3.50 (2)
729	367-549	186	2,690.00 (2)	1,491.22 (2)	206.50 (2)	328.43 (7)	206.50 (2)	19.00 (2)	190.00 (2)	142.00 (3)	59.50 (2)
731	367-549	216	-	-	68.00 (2)	166.83 (6)	275.50 (2)	27.50 (2)	244.00 (3)	41.00 (3)	26.00 (2)
733	367-549	468	452.07 (2)	-	72.00 (2)	490.87 (9)	216.00 (2)	16.00 (2)	611.00 (4)	340.00 (3)	53.00 (2)
735	367-549	272	-	153.50 (2)	223.00 (2)	603.51 (6)	-	-	106.82 (3)	125.67 (3)	76.50 (2)
730	550-731	170	-	-	109.50 (2)	183.52 (4)	-	178.00 (2)	222.33 (3)	348.50 (2)	113.50 (2)
732	550-731	231	-	-	68.00 (2)	59.44 (9)	193.00 (2)	300.00 (2)	96.67 (3)	39.00 (2)	214.50 (2)
734	550-731	228	451.00 (2)	-	142.93 (2)	271.60 (5)	42.00 (2)	231.60 (2)	59.67 (3)	16.00 (2)	140.00 (2)
736	550-731	175	-	24.74 (2)	208.50 (2)	93.50 (6)	281.00 (2)	-	12.67 (3)	51.00 (2)	60.50 (2)
737	732-914	227	-	-	-	-	-	-	-	-	-
741	732-914	223	-	-	-	-	-	-	-	-	-
745	732-914	348	-	-	-	-	-	-	-	-	-
748	732-914	159	-	-	-	-	-	-	-	-	-
Upper (95% CI)			466.00	66.30	62.50	263.80	63.10	123.20	94.90	58.30	38.60
Weighted mean (by area)			91.90	46.39	33.90	156.20	42.50	25.70	76.90	30.40	16.70
Lower (95% CI)			-294.7	25.80	5.30	48.60	21.30	-71.9	58.80	2.50	-5.2
Abundance of surveyed area (millions)			118.50	36.60	28.60	131.60	38.70	15.80	64.80	25.60	14.10

Table 1. Mean number , Div. 3L (continued)

Stratum	Depth Range (M)	Area (sq. n.) mi	Nov 5-Nov 29 1992-Q4 (W.T 129-30)	May 18-Jun 10 1993-Q2 (W.T 137-8)	Aug 5-Aug 15 1993-Q3 (G.A. 223)	Nov 12- Dec 4 1993-Q4 (W.T. 145-6)	May 22-Jun 10 1994-Q2 (W.T. 153-54)	Nov 8-Dec 7 1994-Q4 (W.T. 161-62)	May 27-Jun 14 1995-Q2 (W.T. 169-70)
347	184-274	983	0.00 (2)	0.00 (4)	0.00 (3)	0.00 (4)	0.00 (4)	0.00 (8)	0.00 (4)
366	184-274	1394	1.00 (24)	0.00 (7)	2.50 (2)	0.21 (14)	0.20 (5)	0.10 (10)	0.00 (5)
369	184-274	961	0.00 (8)	0.00 (5)	0.00 (3)	0.14 (7)	0.33 (3)	0.00 (3)	0.00 (3)
386	184-274	983	0.00 (3)	0.20 (5)	0.00 (3)	0.00 (3)	0.00 (4)	0.00 (3)	0.00 (4)
389	184-274	821	0.67 (3)	0.00 (4)	1.00 (3)	0.00 (3)	0.00 (3)	0.00 (3)	2.25 (4)
391	184-274	282	0.00 (3)	0.00 (2)	0.33 (3)	1.00 (3)	0.00 (2)	1.67 (3)	2.00 (2)
345	275-366	1432	0.25 (4)	0.00 (2)	1.67 (3)	0.00 (3)	0.60 (5)	0.00 (8)	0.00 (5)
346	275-366	865	2.64 (14)	2.25 (6)	5.33 (3)	5.09 (11)	1.83 (3)	0.29 (7)	0.67 (3)
368	275-366	334	18.20 (10)	9.50 (4)	25.00 (3)	5.63 (8)	3.50 (2)	0.50 (12)	2.00 (2)
387	275-366	718	10.00 (3)	6.07 (2)	51.33 (3)	2.33 (3)	1.00 (3)	3.22 (9)	7.33 (3)
388	275-366	361	20.00 (3)	1.50 (3)	11.00 (3)	6.67 (3)	0.00 (2)	2.86 (7)	5.00 (2)
392	275-366	145	3.33 (3)	1.50 (2)	21.00 (3)	4.67 (3)	0.00 (2)	4.67 (3)	27.50 (2)
729	367-549	186	296.50 (3)	31.50 (2)	210.33 (3)	172.67 (3)	18.50 (2)	800.67 (9)	48.00 (2)
731	367-549	216	205.00 (3)	26.00 (3)	170.00 (3)	21.67 (3)	41.00 (2)	35.50 (7)	24.50 (2)
733	367-549	468	210.00 (3)	20.67 (2)	215.67 (3)	18.67 (3)	20.50 (2)	40.89 (9)	7.50 (2)
735	367-549	272	222.33 (3)	14.50 (2)	35.00 (3)	31.00 (3)	34.00 (2)	11.20 (11)	22.00 (2)
730	550-731	170	69.50 (2)	249.00 (2)	50.33 (3)	332.00 (3)	35.00 (2)	114.33 (3)	72.00 (2)
732	550-731	231	198.00 (2)	401.00 (2)	93.67 (3)	18.00 (2)	53.00 (2)	98.67 (3)	54.50 (2)
734	550-731	228	108.00 (2)	19.06 (2)	20.67 (3)	70.50 (2)	43.38 (2)	44.87 (3)	106.50 (2)
736	550-731	175	45.50 (2)	40.50 (2)	11.67 (3)	24.67 (3)	23.00 (2)	25.43 (7)	41.50 (2)
737	732-914	227	-	-	-	-	5.50 (2)	-	-
741	732-914	223	-	-	-	-	1.50 (2)	-	-
745	732-914	348	-	-	-	-	0.50 (2)	-	-
748	732-914	159	-	-	-	-	1.00 (2)	-	-
Upper (95% CI)			49.80	117.90	41.60	24.65	8.80	39.30	10.54
Weighted mean (by area)			33.30	16.20	25.60	13.10	5.90	21.50	8.45
Lower (95% CI)			16.80	-85.5	9.50	1.50	2.80	3.60	6.36
Abundance of surveyed area (millions)			28.10	13.70	21.50	11.00	5.30	18.10	7.10

Table 2. Mean weight (kg) per standard tow from various Canadian surveys in Div. 3L where strata greater than 366 m (200 fath.) were sampled. Dashes (-) represent unsampled strata. Number of successful sets in brackets. The gear utilized was an Engels 145 otter trawl with a small mesh liner in the codend. G.A. = Gadus Atlantica, W.T. = Wilfred Templeman, A.N. = Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	Aug 16-Aug 29 1978-Q3 (G.A. 12)	Sep 4-Sep 10 1979-Q3 (G.A. 25)	May 8-May 13 1980-Q2 (G.A. 36)	Sep 18-Sep 26 1981-Q3 (G.A. 55)	Jul 26-Sep 3 1984-Q3 (W.T. 16-18)	Jan 10-Feb 11 1985-Q1 (W.T. 22-24)	Apr 17-May 26 1985-Q2 (W.T. 28-30)	Jul 27-Aug 25 1985-Q3 (W.T. 32-34)	Oct 9-Nov 18 1985-Q4 (W.T. 37-39)
347	184-274	983	42.52 (3)	0.00 (2)	0.00 (4)	1.32 (4)	0.00 (6)	0.00 (5)	0.00 (5)	0.00 (3)	0.00 (5)
366	184-274	1394	35.42 (3)	1.82 (2)	2.00 (6)	25.01 (6)	1.14 (11)	0.00 (5)	0.05 (6)	4.00 (5)	5.33 (9)
369	184-274	961	0.00 (3)	0.80 (2)	0.25 (4)	2.40 (4)	0.00 (7)	0.00 (5)	0.20 (5)	0.17 (6)	0.00 (6)
386	184-274	983	62.99 (3)	11.32 (2)	1.25 (4)	8.50 (4)	14.18 (8)	0.00 (5)	0.21 (5)	15.30 (5)	0.44 (5)
389	184-274	821	0.03 (3)	-	9.25 (2)	2.33 (3)	8.83 (6)	0.50 (4)	0.01 (5)	0.63 (4)	1.46 (5)
391	184-274	282	0.00 (2)	6.39 (2)	0.75 (2)	0.08 (2)	0.03 (2)	0.00 (2)	0.00 (2)	0.00 (2)	4.00 (2)
345	275-366	1432	51.08 (2)	78.92 (4)	8.50 (4)	35.80 (5)	31.10 (7)	0.83 (3)	3.14 (5)	44.41 (7)	3.32 (9)
346	275-366	865	151.18 (2)	80.88 (4)	14.75 (2)	64.83 (3)	163.33 (6)	5.80 (4)	18.25 (2)	67.50 (3)	61.50 (5)
368	275-366	334	1154.53 (2)	61.72 (3)	7.25 (2)	176.75 (2)	1915.75 (2)	2.00 (2)	5.35 (2)	181.75 (2)	151.50 (2)
387	275-366	718	203.16 (2)	286.77 (5)	6.83 (3)	572.00 (3)	1972.33 (3)	71.50 (4)	4.68 (6)	633.03 (3)	279.17 (4)
388	275-366	361	262.18 (2)	562.10 (3)	1.10 (2)	145.50 (2)	63.00 (2)	14.17. (3)	7.65 (2)	130.50 (2)	30.75 (2)
392	275-366	145	-	304.24 (3)	7.50 (3)	146.75 (2)	1118.44 (2)	1.40 (2)	1.50 (2)	45.75 (2)	451.50 (2)
729	367-549	186	-	199.53 (3)	-	413.50 (2)	203.43 (2)	1249.00 (2)	7.25 (2)	560.00 (2)	1213.50 (2)
731	367-549	216	289.42 (2)	255.57 (3)	112.25 (2)	69.00 (2)	120.00 (2)	29.17 (3)	16.00 (2)	121.50 (2)	275.50 (2)
733	367-549	468	460.96 (2)	647.34 (3)	18.83 (3)	754.00 (2)	280.63 (4)	895.28 (3)	623.43 (3)	1023.50 (2)	353.76 (3)
735	367-549	272	603.98 (2)	252.05 (3)	14.50 (2)	348.00 (2)	442.00 (3)	4.50 (2)	20.50 (2)	186.00 (2)	127.75 (2)
730	550-731	170	509.74 (2)	238.85 (3)	96.75 (2)	263.25 (2)	57.25 (2)	408.00 (2)	4710.00 (2)	195.50 (2)	19.75 (2)
732	550-731	231	47.44 (2)	29.94 (2)	30.25 (2)	30.50 (2)	49.25 (2)	217.50 (2)	56.00 (2)	33.00 (2)	22.00 (2)
734	550-731	228	1084.93 (2)	357.43 (3)	1187.45 (2)	430.64 (2)	350.00 (3)	119.75 (2)	146.75 (2)	598.50 (2)	387.13 (2)
736	550-731	175	61.59 (2)	116.73 (3)		42.25 (2)	-	-	152.00 (2)	17.25 (2)	107.75 (2)
737	732-914	227	-	-	-	-	-	-	-	-	-
741	732-914	223	-	-	-	-	-	-	-	-	-
745	732-914	348	-	-	-	-	-	-	-	-	-
748	732-914	159	-	-	-	-	-	-	-	-	-
Upper (95% CI)			252.90	164.50	185.30	246.60	536.80	111.30	1008.10	264.90	278.70
Weighted mean (by area)			163.50	114.60	34.66	124.40	259.06	78.70	107.30	138.30	88.80
Lower (95% CI)			74.13	82.80	-115.9	3.20	-18.1	46.10	-793.4	11.70	-101.1
Survey biomass index (tons)			133724	96536	29001	104817	215259	65282	90432	116543	74828

Table 2. Mean weight , Div. 3L (continued)

Stratum	Depth Range (M)	Area (sq. n.) mi	Jan 22-Feb 27 1986-Q1 (W.T.42-44)	Nov13-Nov 30 1986-Q4 (A.N. 72)	Jan 17-Jan 25 1990-Q1 (W.T. 90)	Aug 7-Aug 19 1990-Q3 (W.T. 98)	Oct 18-Nov 18 1990-Q4 (W.T. 101)	May 11- May 2 1991-Q2 (W.T. 106-7)	Aug 4- Aug 11 1991-Q3 (W.T. 109)	Nov 10- Dec 2 1991-Q4 (W.T. 114-5)	May 13-June 7 1992-Q2 (W.T 120-2)
347	184-274	983	0.08 (4)	0.00 (4)	0.06 (4)	0.63 (4)	0.00 (2)	0.00 (2)	0.00 (3)	0.00 (4)	0.00 (4)
366	184-274	1394	0.01 (2)	2.13 (4)	0.04 (5)	2.56 (4)	0.00 (6)	-	0.10 (3)	0.03 (21)	0.08 (6)
369	184-274	961	0.00 (3)	0.71 (3)	0.00 (4)	0.79 (4)	0.00 (4)	0.00 (2)	3.27 (4)	0.12 (9)	0.00 (4)
386	184-274	983	0.45 (7)	0.34 (4)	3.21 (4)	0.09 (7)	0.05 (4)	0.02 (3)	0.20 (3)	0.00 (3)	0.00 (4)
389	184-274	821	0.15 (4)	0.84 (4)	0.00 (3)	0.85 (3)	0.54 (3)	0.07 (3)	0.22 (3)	0.00 (3)	0.00 (3)
391	184-274	282	0.00 (3)	3.50 (2)	0.01 (5)	0.26 (5)	0.00 (2)	0.00 (3)	1.40 (3)	0.00 (3)	0.40 (2)
345	275-366	1432	0.04 (3)	5.21 (4)	0.02 (5)	8.66 (6)	0.53 (5)	0.07 (3)	2.13 (4)	0.12 (4)	0.00 (6)
346	275-366	865	1.08 (4)	16.80 (3)	3.22 (3)	172.19 (7)	38.98 (3)	-	11.46 (4)	2.59 (15)	0.50 (4)
368	275-366	334	-	7.25 (2)	5.10 (2)	737.95 (7)	14.25 (2)	-	153.78 (4)	6.80 (6)	4.70 (2)
387	275-366	718	8.00 (4)	3.10 (2)	75.92 (3)	115.68 (10)	35.05 (3)	12.73 (3)	61.37 (5)	6.08 (5)	2.47 (3)
388	275-366	361	5.33 (3)	-	2.85 (2)	47.46 (7)	3.30 (2)	1.56 (3)	8.13 (3)	1.67 (3)	0.30 (2)
392	275-366	145	4.10 (3)	113.25 (2)	2.08 (2)	35.49 (9)	2.32 (2)	0.48 (2)	133.63 (3)	0.56 (3)	1.63 (2)
729	367-549	186	1118.30 (2)	480.88 (2)	121.20 (2)	175.09 (7)	94.00 (2)	4.45 (2)	86.38 (2)	40.88 (3)	13.70 (2)
731	367-549	216	-	-	18.38 (2)	66.18 (6)	116.86 (2)	5.47 (2)	78.32 (3)	9.65 (3)	6.75 (2)
733	367-549	468	238.22 (2)	-	30.00 (2)	314.42 (9)	59.60 (2)	5.83 (2)	282.51 (4)	100.25 (3)	16.83 (2)
735	367-549	272	-	63.50 (2)	51.22 (2)	417.61 (6)	-	-	47.01 (3)	30.17 (3)	20.88 (2)
730	550-731	170	-	-	59.68 (2)	107.15 (4)	-	45.30 (2)	120.32 (3)	247.68 (2)	41.40 (2)
732	550-731	231	-	-	37.75 (2)	31.32 (9)	118.85 (2)	56.35 (2)	44.95 (3)	19.08 (2)	71.70 (2)
734	550-731	228	296.90 (2)	-	80.68 (2)	164.97 (5)	23.00 (2)	43.29 (2)	37.08 (3)	11.00 (2)	51.63 (2)
736	550-731	175	-	14.38 (2)	65.63 (2)	51.32 (6)	156.25 (2)	-	6.43 (3)	22.02 (2)	17.38 (2)
737	732-914	227	-	-	-	-	-	-	-	-	-
741	732-914	223	-	-	-	-	-	-	-	-	-
745	732-914	348	-	-	-	-	-	-	-	-	-
748	732-914	159	-	-	-	-	-	-	-	-	-
Upper (95% CI)			202.70	24.80	31.90	130.00	29.90	11.70	40.80	19.80	12.50
Weighted mean (by area)			44.48	16.71	14.90	80.10	18.43	5.53	31.50	11.40	5.40
Lower (95% CI)			-121.9	8.30	-2.1	30.10	6.60	-0.6	22.10	2.90	-1.7
Survey biomass index (tons)			55514	13568	12525	67453	16563	3399	26510	9576	4528

Table 2. Mean weight , Div. 3L (continued)

Stratum	Depth Range (M)	Area (sq. n.) mi	Nov 5-Nov 29 1992-Q4 (W.T 129-30)	May 18-Jun 10 1993-Q2 (W.T 137-8)	Aug 5-Aug 15 1993-Q3 (G.A. 223)	Nov 12- Dec 4 1993-Q4 (W.T. 145-6)	May 22-Jun 10 1994-Q2 (W.T. 153-54)	Nov 8-Dec 7 1994-Q4 (W.T. 161-62)	May 27-Jun 14 1995-Q2 (W.T. 169-70)
347	184-274	983	0.00 (2)	0.00 (4)	0.00 (3)	0.00 (4)	0.00 (4)	0.00 (8)	0.00 (4)
366	184-274	1394	0.28 (24)	0.00 (7)	0.70 (2)	0.06 (14)	0.08 (5)	0.04 (10)	0.00 (5)
369	184-274	961	0.00 (8)	0.00 (5)	0.00 (3)	0.03 (7)	0.06 (3)	0.00 (3)	0.00 (3)
386	184-274	983	0.00 (3)	0.09 (5)	0.00 (3)	0.00 (3)	0.00 (4)	0.00 (3)	0.00 (4)
389	184-274	821	0.03 (3)	0.00 (4)	0.14 (3)	0.00 (3)	0.00 (3)	0.00 (3)	0.59 (4)
391	184-274	282	0.00 (3)	0.00 (2)	0.22 (3)	0.53 (3)	0.00 (2)	0.78 (3)	0.17 (2)
345	275-366	1432	0.19 (4)	0.00 (2)	0.48 (3)	0.00 (3)	0.23 (5)	0.00 (8)	0.00 (5)
346	275-366	865	0.83 (14)	0.52 (6)	1.43 (3)	1.94 (11)	0.56 (3)	0.09 (7)	0.30 (3)
368	275-366	334	4.60 (10)	3.25 (4)	6.77 (3)	1.04 (8)	0.63 (2)	0.10 (12)	0.16 (2)
387	275-366	718	2.43 (3)	2.36 (2)	14.45 (3)	0.68 (3)	0.17 (3)	0.78 (9)	1.22 (3)
388	275-366	361	3.27 (3)	0.49 (3)	3.28 (3)	2.33 (3)	0.00 (2)	0.81 (7)	0.50 (2)
392	275-366	145	0.55 (3)	0.36 (2)	3.45 (3)	1.56 (3)	0.00 (2)	2.11 (3)	2.40 (2)
729	367-549	186	89.72 (3)	6.75 (2)	60.22 (3)	55.12 (3)	3.82 (2)	235.73 (9)	8.10 (2)
731	367-549	216	46.25 (3)	7.25 (3)	59.72 (3)	5.08 (3)	9.53 (2)	6.88 (7)	4.68 (2)
733	367-549	468	68.35 (3)	6.68 (2)	68.48 (3)	4.92 (3)	5.30 (2)	10.54 (9)	1.23 (2)
735	367-549	272	79.35 (3)	3.90 (2)	7.60 (3)	5.32 (3)	5.95 (2)	2.43 (11)	3.65 (2)
730	550-731	170	36.53 (2)	43.95 (2)	23.32 (3)	168.46 (3)	10.15 (2)	45.77 (3)	23.13 (2)
732	550-731	231	67.80 (2)	90.90 (2)	45.27 (3)	4.57 (2)	13.15 (2)	31.68 (3)	16.55 (2)
734	550-731	228	43.58 (2)	7.93 (2)	11.35 (3)	21.03 (2)	12.29 (2)	16.53 (3)	31.52 (2)
736	550-731	175	13.60 (2)	13.60 (2)	6.43 (3)	6.35 (3)	5.40 (2)	8.25 (7)	12.10 (2)
737	732-914	227	-	-	-	-	1.98 (2)	-	-
741	732-914	223	-	-	-	-	0.65 (2)	-	-
745	732-914	348	-	-	-	-	0.43 (2)	-	-
748	732-914	159	-	-	-	-	0.32 (2)	-	-
Upper (95% CI)			16.20	24.90	14.80	10.70	2.10	12.00	2.58
Weighted mean (by area)			10.70	3.90	8.40	4.90	1.40	6.50	2.08
Lower (95% CI)			5.30	-17.2	1.90	-1.0	0.70	1.00	1.58
Survey biomass index (tons)			9037	3243	7037	4095	1313	5463	1756

Table 3. Mean number per standard tow from various Canadian surveys in Div. 3N where strata greater than 366 m (200 fath.) were sampled. Dashes (-) represent unsampled strata. Number of successful sets in brackets. The gear utilized was an Engels 145 otter trawl with a small mesh liner in the codend. G.A. = Gadus Atlantica, W.T. = Wilfred Templeman, A.N. = Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	May 3-11 1991-Q2 (W.T. 106)	Aug 11-18 1991-Q3 (W.T.109)	Oct 27-Nov 10 1991-Q4 (W.T. 113-4)	May 2-13 1992-Q2 (W.T.119-20)	Oct 26-Nov 5 1992-Q4 (W.T. 128-9)	May 5-18 1993-Q2 (W.T.136-7)	Aug 15-20 1993-Q3 (G.A.233)	Nov 1-12 1993-Q4 (W.T.144-5)	May 14-22 1994-Q2 (W.T.153)	Oct 29-Dec 13 1994-Q4 (W.T.160-61)	May 13-27 1995-Q2 (W.T.168-69)
382	093-183	647	0.50 (2)	0.00 (3)	0.00 (3)	0.00 (3)	0.00 (2)	0.00 (2)	0.00 (3)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)
377	093-183	100	0.00 (2)	0.00 (2)		0.00 (2)	0.00 (2)	0.00 (2)	2.00 (3)	0.50 (2)	0.00 (2)	0.50 (2)	0.00 (2)
359	093-183	421	0.50 (2)	26.25 (4)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.33 (3)	0.00 (2)	0.00 (2)	1.50 (2)	0.00 (2)
381	185-274	182	0.50 (2)	5.00 (3)	1.00 (2)	1.00 (2)	-	0.00 (2)	2.00 (4)	3.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)
378	185-274	139	5.33 (3)	13.00 (3)	177.00 (2)	7.50 (2)	1.50 (2)	1.00 (2)	4.33 (3)	3.00 (2)	0.50 (2)	1.50 (2)	1.69 (2)
358	185-274	225	9.00 (2)	677.00 (3)	1,867.50 (2)	6.00 (2)	18,258.00 (2)	526.00 (2)	6,700.75 (4)	4.50 (2)	12.50 (2)	143.00 (2)	1.50 (2)
380	275-366	116	1.00 (2)	3,856.00 (2)	197.00 (2)	0.00 (2)	-	4.00 (2)	318.00 (2)	2.50 (2)	2.00 (2)	0.00 (2)	11.50 (2)
379	275-366	106	30.00 (2)	6,305.20 (2)		6.50 (2)	94.50 (2)	10.00 (2)	982.00 (3)	156.50 (2)	25.50 (2)	50.00 (2)	22.50 (2)
357	275-366	164	101.50 (2)	2,649.00 (2)	2,380.00 (2)	105.00 (2)	4,188.00 (2)	176.00 (2)	545.33 (3)	113.50 (2)	94.50 (2)	2,253.00 (2)	96.50 (2)
727	367-549	160	15.50 (2)	121.44 (4)	-	9.00 (2)	-	32.00 (2)	1,551.05 (3)	195.50 (2)	36.50 (2)	128.00 (2)	73.50 (2)
725	367-549	105	148.00 (2)	502.67 (3)			2,083.70 (2)	72.00 (2)	746.00 (3)	296.50 (2)	28.50 (2)	418.00 (2)	30.00 (2)
723	367-549	155	158.00 (2)		170.00 (2)	236.50 (2)	-	266.50 (2)	1,517.57 (4)	1,509.00 (2)	78.50 (2)	1,268.00 (2)	72.00 (2)
728	550-731	156	72.50 (2)	66.50 (4)	-	85.00 (2)	-	1,203.73 (2)	100.67 (3)		38.00 (3)	9.29 (2)	123.00 (2)
726	550-731	72	402.00 (2)	91.00 (2)		89.50 (2)	-	93.25 (2)	362.50 (2)	79.50 (2)	34.85 (2)	262.50 (2)	103.50 (2)
724	550-731	124	446.85 (2)		34.76 (2)	80.50 (2)	-	194.50 (2)	783.75 (4)	676.00 (2)	66.00 (2)	1,305.00 (2)	141.50 (2)
760	732-914	154	-	-	-	-	-	-	-	-	3.69 (2)	-	-
756	732-914	106	-	-	-	-	-	-	-	-	5.50 (2)	-	-
752	732-914	134	-	-	-	-	-	-	-	-	1.50 (2)	-	-
Upper (95% CI)			134.6	2,964.8	850.2	55.1	23,024.8	1,090.0	1,969.9	767.7	28.1	1,703.1	55.1
Weighted mean (by area)			56.2	648.9	367.7	38.5	2,634.5	146.8	849.6	149.1	18.5	284.6	31.5
Lower (95% CI)			-22.2	-1572.3	-32.2	8.70	-17755.9	-796.5	-270.7	-456	8.9	-133.8	7.88
Abundance of surveyed area (millions)			12.1	139.9	70.6	6.6	377.1	31.6	182.2	31.8	4.5	61.4	6.8

Table 4. Mean weight (kg) per standard tow from various Canadian surveys in Div. 3N where strata greater than 366 m (200 fath.) were sampled. Dashes (-) represent unsampled strata. Number of successful sets in brackets. The gear utilized was an Engels 145 otter trawl with a small mesh liner in the codend. G.A. = Gadus Atlantica, W.T. = Wilfred Templeman, A.N. = Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	May 3-11 1991-Q2 (W.T. 106)	Aug 11-18 1991-Q3 (W.T.109)	Oct 27-Nov 10 1991-Q4 (W.T. 113-4)	May 2-13 1992-Q2 (W.T.119-20)	Oct 26-Nov 5 1992-Q4 (W.T. 128-9)	May 5-18 1993-Q2 (W.T.136-7)	Aug 15-20 1993-Q3 (G.A.233)	Nov 1-12 1993-Q4 (W.T.144-5)	May 14-22 1994-Q2 (W.T.153)	Oct 29-Dec 13 1994-Q4 (W.T.160-61)	May 13-27 1995-Q2 (W.T.168-69)
382	093-183	647	0.16 (2)	0.00 (3)	0.00 (3)	0.00 (3)	0.00 (2)	0.00 (2)	0.00 (3)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (3)
377	093-183	100	0.00 (2)	0.00 (2)		0.00 (2)	0.00 (2)	0.00 (2)	0.37 (3)	0.25 (2)	0.00 (2)	0.13 (2)	0.00 (2)
359	093-183	421	0.00 (2)	0.60 (4)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.06 (3)	0.00 (2)	0.00 (2)	1.20 (2)	0.00 (2)
381	185-274	182	0.13 (2)	0.97 (3)	0.09 (2)	0.17 (2)	-	0.00 (2)	0.58 (4)	1.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)
378	185-274	139	0.88 (3)	3.68 (3)	57.39 (2)	1.10 (2)	0.38 (2)	0.30 (2)	1.41 (3)	0.80 (2)	0.07 (2)	0.10 (2)	0.20 (2)
358	185-274	225	0.18 (2)	106.19 (3)	132.02 (2)	0.30 (2)	2,176.10 (2)	54.13 (2)	547.29 (4)	0.90 (2)	0.72 (2)	12.23 (2)	0.12 (2)
380	275-366	116	0.03 (2)	1,041.38 (2)	53.54 (2)	0.00 (2)	-	0.68 (2)	62.67 (2)	0.18 (2)	0.12 (2)	0.00 (2)	1.50 (2)
379	275-366	106	3.14 (2)	949.58 (2)		0.73 (2)	13.28 (2)	1.30 (2)	212.93 (3)	23.95 (2)	2.67 (2)	7.58 (2)	2.55 (2)
357	275-366	164	11.13 (2)	576.92 (2)	324.18 (2)	5.95 (2)	674.36 (2)	23.48 (2)	95.47 (3)	14.05 (2)	9.60 (2)	301.35 (2)	10.88 (2)
727	367-549	160	2.85 (2)	40.73 (4)	-	1.20 (2)	-	4.54 (2)	558.06 (3)	43.95 (2)	6.97 (2)	32.20 (2)	13.43 (2)
725	367-549	105	18.78 (2)	177.22 (3)			589.09 (2)	14.52 (2)	246.24 (3)	79.54 (2)	5.22 (2)	112.40 (2)	4.33 (2)
723	367-549	155	19.05 (2)	188.85 (1)	46.42 (2)	31.20 (2)	-	74.20 (2)	605.24 (4)	291.95 (2)	13.45 (2)	375.87 (2)	11.25 (2)
728	550-731	156	22.20 (2)	30.75 (4)	-	23.95 (2)	-	513.79 (2)	40.93 (3)	11.25 (1)	10.37 (3)	3.65 (2)	34.80 (2)
726	550-731	72	97.75 (2)	41.17 (2)		26.80 (2)	-	20.99 (2)	180.50 (2)	30.17 (2)	9.24 (2)	116.92 (2)	16.76 (2)
724	550-731	124	76.18 (2)		26.17 (2)	18.33 (2)	-	82.08 (2)	314.30 (4)	281.02 (2)	23.30 (2)	383.55 (2)	27.75 (2)
760	732-914	154	-	-	-	-	-	-	-	-	1.52 (2)	-	-
756	732-914	106	-	-	-	-	-	-	-	-	2.38 (2)	-	-
752	732-914	134	-	-	-	-	-	-	-	-	0.50 (2)	-	-
Upper (95% CI)			24.4	729.9	160.7	10.3	2,769.5	392.8	250.4	72.1	4.4	136.0	9.2
Weighted mean (by area)			9.7	141.7	48.7	6.0	348.0	42.4	151.9	36.5	3.5	64.5	5.8
Lower (95% CI)			-5.1	-442.0	-61.7	0.0	-2073.6	-308	53.5	3.8	2.6	-7.0	2.4
Survey biomass index (tons)			2085	30552	9350	1071	49807	9148	32752	7735	864	13907	1254

Table 5. Mean number per standard tow from various Canadian surveys in Div. 3L where strata greater than 366 m (200 fath.) were sampled. Dashes (-) represent unsampled strata. Number of successful sets in brackets. The data are Campelen trawl equivalent units based on a comparative fishing experiment with an Engel 145 otter trawl (see text). G.A. = GadusAtlantica, W.T. = Wilfred Templeman, A.N. = Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	Aug 16-Aug 29 1978-Q3 (G.A. 12)	Sep 4-Sep 10 1979-Q3 (G.A. 25)	May 8-May 13 1980-Q2 (G.A. 36)	Sep 18-Sep 26 1981-Q3 (G.A. 55)	Jul 26-Sep 3 1984-Q3 (W.T. 16-18)	Jan 10-Feb 11 1985-Q1 (W.T. 22-24)	Apr 17-May 26 1985-Q2 (W.T. 28-30)	Jul 27-Aug 25 1985-Q3 (W.T. 32-34)	Oct 9-Nov 18 1985-Q4 (W.T. 37-39)
347	184-274	983	303.00 (3)	0.00 (2)	0.00 (4)	15.75 (4)	0.00 (6)	0.00 (5)	3.20 (5)	0.00 (3)	0.00 (5)
366	184-274	1394	885.33 (3)	63.50 (2)	35.83 (6)	81.33 (6)	63.55 (11)	0.00 (5)	9.83 (6)	44.40 (5)	30.89 (9)
369	184-274	961	0.00 (3)	1.00 (2)	0.25 (4)	40.25 (4)	3.43 (7)	0.00 (5)	0.20 (5)	0.17 (6)	0.00 (6)
386	184-274	983	230.67 (3)	12.50 (2)	2.25 (4)	15.75 (4)	27.25 (8)	0.00 (5)	1.80 (5)	17.20 (5)	0.60 (5)
389	184-274	821	1.00 (3)	---	55.50 (2)	7.00 (3)	33.00 (6)	19.50 (4)	1.60 (5)	4.25 (4)	23.40 (5)
391	184-274	282	0.00 (2)	43.00 (2)	11.50 (2)	10.50 (2)	4.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	11.50 (2)
345	275-366	1432	96.50 (2)	133.00 (4)	22.00 (4)	74.00 (5)	36.71 (7)	8.00 (3)	4.60 (5)	52.00 (7)	8.67 (9)
346	275-366	865	330.00 (2)	223.75 (4)	45.00 (2)	85.67 (3)	221.67 (6)	12.50 (4)	18.50 (2)	77.33 (3)	86.40 (5)
368	275-366	334	4307.50 (2)	238.67 (3)	59.50 (2)	1028.00 (2)	3418.50 (2)	8.00 (2)	27.00 (2)	265.50 (2)	286.00 (2)
387	275-366	718	936.50 (2)	942.00 (5)	54.67 (3)	3068.00 (3)	3678.30 (3)	87.50 (4)	18.00 (6)	1524.70 (3)	508.25 (4)
388	275-366	361	2824.50 (2)	5037.00 (3)	18.50 (2)	891.50 (2)	167.00 (2)	28.00 (3)	28.50 (2)	323.50 (2)	75.00 (2)
392	275-366	145	---	1556.00 (3)	63.00 (3)	1129.00 (2)	2321.50 (2)	6.50 (2)	18.00 (2)	121.50 (2)	1164.00 (2)
729	367-549	186	---	816.00 (3)	---	1714.00 (2)	374.00 (2)	2767.00 (2)	26.00 (2)	968.00 (2)	2143.50 (2)
731	367-549	216	626.50 (2)	676.33 (3)	640.00 (2)	309.50 (2)	205.00 (2)	84.33 (3)	77.00 (2)	207.50 (2)	400.00 (2)
733	367-549	468	1070.00 (2)	1884.70 (3)	85.67 (3)	1993.00 (2)	376.75 (4)	1519.70 (3)	916.33 (3)	1313.50 (2)	566.33 (3)
735	367-549	272	935.50 (2)	664.67 (3)	73.00 (2)	1147.00 (2)	567.33 (3)	10.00 (2)	62.50 (2)	221.00 (2)	188.50 (2)
730	550-731	170	1604.00 (2)	511.33 (3)	512.00 (2)	662.00 (2)	83.50 (2)	634.00 (2)	6963.50 (2)	269.50 (2)	31.00 (2)
732	550-731	231	110.50 (2)	74.00 (2)	192.50 (2)	70.00 (2)	72.50 (2)	325.00 (2)	113.50 (2)	40.00 (2)	32.00 (2)
734	550-731	228	1571.00 (2)	669.67 (3)	2065.00 (2)	1009.00 (2)	436.33 (3)	152.00 (2)	291.00 (2)	719.00 (2)	420.50 (2)
736	550-731	175	261.50 (2)	418.67 (3)	---	116.50 (2)	---	---	425.00 (2)	25.50 (2)	173.50 (2)
737	732-914	227	---	---	---	---	---	---	---	---	---
741	732-914	223	---	---	---	---	---	---	---	---	---
745	732-914	348	---	---	---	---	---	---	---	---	---
748	732-914	159	---	---	---	---	---	---	---	---	---
Upper (95% CI)			1086.0	1068.5	336.1	1156.5	860.6	244.5	1496.1	370.1	235.9
Weighted mean (by area)			634.0	479.5	96.4	482.2	465.7	142.9	168.9	237.4	155.9
Lower (95% CI)			182.0	-109.5	-143.4	-192.0	70.8	41.3	-1158.4	104.7	75.9
Abundance of surveyed area (millions)			950.1	686.2	144.0	744.6	707.9	217.2	260.8	366.6	240.7

Table 5. Mean number in Campelen equivalents , Div. 3L (continued)

Stratum	Depth Range (M)	Area (sq. n.) mi	Jan 22-Feb 27 1986-Q1 (W.T.42-44)	Nov13-Nov 30 1986-Q4 (A.N. 72)	Jan 17-Jan 25 1990-Q1 (W.T. 90)	Aug 7-Aug 19 1990-Q3 (W.T. 98)	Oct 18-Nov 18 1990-Q4 (W.T. 101)	May 11- May 2 1991-Q2 (W.T. 106-7)	Aug 4- Aug 11 1991-Q3 (W.T. 109)	Nov 10- Dec 2 1991-Q4 (W.T. 114-5)	May 13-June 7 1992-Q2 (W.T 120-2)
347	184-274	983	12.00 (4)	0.00 (4)	0.75 (4)	1.75 (4)	0.00 (2)	2.00 (2)	0.00 (3)	0.00 (4)	0.00 (4)
366	184-274	1394	12.00 (2)	20.00 (4)	5.20 (5)	16.50 (4)	0.00 (6)	.	0.33 (3)	1.19 (21)	0.50 (6)
369	184-274	961	0.00 (3)	7.67 (3)	0.00 (4)	10.50 (4)	0.00 (4)	0.00 (2)	8.25 (4)	1.78 (9)	0.00 (4)
386	184-274	983	2.86 (7)	18.50 (4)	5.00 (4)	8.43 (7)	15.25 (4)	5.33 (3)	2.33 (3)	0.00 (3)	0.00 (4)
389	184-274	821	6.00 (4)	2.00 (4)	0.00 (3)	21.33 (3)	4.67 (3)	8.33 (3)	0.33 (3)	0.00 (3)	0.00 (3)
391	184-274	282	0.00 (3)	16.50 (2)	4.00 (5)	2.40 (5)	0.00 (2)	0.00 (3)	5.33 (3)	0.00 (3)	3.50 (2)
345	275-366	1432	10.67 (3)	5.50 (4)	1.40 (5)	16.17 (6)	1.00 (5)	3.00 (3)	4.50 (4)	0.25 (4)	0.00 (6)
346	275-366	865	16.25 (4)	24.67 (3)	23.67 (3)	201.86 (7)	61.33 (3)	---	25.25 (4)	9.67 (15)	2.00 (4)
368	275-366	334	---	29.00 (2)	25.00 (2)	1392.60 (7)	79.50 (2)	---	339.75 (4)	42.33 (6)	11.50 (2)
387	275-366	718	13.00 (4)	11.00 (2)	110.67 (3)	278.20 (10)	92.67 (3)	59.67 (3)	173.60 (5)	15.40 (5)	8.33 (3)
388	275-366	361	30.00 (3)	---	24.00 (2)	201.71 (7)	78.00 (2)	32.33 (3)	73.67 (3)	29.00 (3)	2.50 (2)
392	275-366	145	12.33 (3)	322.00 (2)	4.50 (2)	166.33 (9)	25.50 (2)	4.00 (2)	315.67 (3)	14.33 (3)	4.00 (2)
729	367-549	186	2150.00 (2)	1197.00 (2)	165.50 (2)	258.43 (7)	182.50 (2)	20.50 (2)	196.50 (2)	127.67 (3)	68.00 (2)
731	367-549	216	---	---	90.00 (2)	142.67 (6)	235.50 (2)	37.50 (2)	208.00 (3)	44.67 (3)	30.50 (2)
733	367-549	468	353.50 (2)	---	77.00 (2)	397.22 (9)	204.50 (2)	19.50 (2)	486.00 (4)	285.67 (3)	51.50 (2)
735	367-549	272	---	--- (2)	223.50 (2)	484.17 (6)	---	---	93.00 (3)	119.00 (3)	68.50 (2)
730	550-731	170	---	---	89.50 (2)	145.75 (4)	---	169.50 (2)	175.67 (3)	273.50 (2)	96.00 (2)
732	550-731	231	---	---	57.50 (2)	49.89 (9)	154.00 (2)	318.50 (2)	79.33 (3)	35.50 (2)	180.50 (2)
734	550-731	228	354.50 (2)	---	114.50 (2)	214.60 (5)	36.00 (2)	236.00 (2)	47.33 (3)	15.00 (2)	120.00 (2)
736	550-731	175	---	22.50 (2)	185.50 (2)	75.83 (6)	222.00 (2)	---	12.67 (3)	43.50 (2)	56.00 (2)
737	732-914	227	---	---	---	--- ---	---	---	---	.	.
741	732-914	223	---	---	---	---	---	---	---	.	.
745	732-914	348	---	---	---	---	---	---	---	.	.
748	732-914	159	---	---	---	---	---	---	---	.	.
Upper (95% CI)			371.2	58.8	57.0	218.8	60.9	136.3	77.1	52.0	37.4
Weighted mean (by area)			74.7	43.4	32.8	135.0	42.8	30.6	48.5	28.1	15.3
Lower (95% CI)			-221.9	28.0	8.5	51.3	24.6	-75.0	19.9	4.1	-6.8
Abundance of surveyed area (millions)			100.9	57.0	50.6	208.5	63.5	34.5	74.9	43.3	23.6

Table 5. Mean number in Campelen equivalents , Div. 3L (continued)

Stratum	Depth Range (M)	Area (sq. n.) mi	Nov 5-Nov 29 1992-Q4 (W.T 129-30)	May 18-Jun 10 1993-Q2 (W.T 137-8)	Aug 5-Aug 15 1993-Q3 (G.A. 223)	Nov 12- Dec 4 1993-Q4 (W.T. 145-6)	May 22-Jun 10 1994-Q2 (W.T. 153-54)	Nov 8-Dec 7 1994-Q4 (W.T. 161-62)	May 27-Jun 14 1995-Q2 (W.T. 169-70)
347	184-274	983	0.00 (2)	0.00 (4)	0.00 (3)	0.00 (4)	0.00 (4)	0.00 (8)	0.00 (4)
366	184-274	1394	1.75 (24)	0.00 (7)	5.50 (2)	0.21 (14)	0.20 (5)	0.10 (10)	0.00 (5)
369	184-274	961	0.00 (8)	0.00 (5)	0.00 (3)	0.14 (7)	0.33 (3)	0.00 (3)	0.00 (3)
386	184-274	983	0.00 (3)	0.20 (5)	0.00 (3)	0.00 (3)	0.00 (4)	0.00 (3)	0.00 (4)
389	184-274	821	3.67 (3)	0.00 (4)	5.67 (3)	0.00 (3)	0.00 (3)	0.00 (3)	2.75 (4)
391	184-274	282	0.00 (3)	0.00 (2)	0.67 (3)	1.00 (3)	0.00 (2)	2.33 (3)	5.00 (2)
345	275-366	1432	0.25 (4)	0.00 (2)	4.33 (3)	0.00 (3)	0.60 (5)	0.00 (8)	0.00 (5)
346	275-366	865	4.36 (14)	4.00 (6)	12.33 (3)	6.36 (11)	2.33 (3)	0.29 (7)	0.67 (3)
368	275-366	334	26.70 (10)	11.00 (4)	57.33 (3)	17.00 (8)	9.50 (2)	1.17 (12)	6.50 (2)
387	275-366	718	12.00 (3)	5.33 (2)	104.67 (3)	2.33 (3)	1.33 (3)	5.11 (9)	12.00 (3)
388	275-366	361	24.33 (3)	2.00 (3)	23.00 (3)	9.67 (3)	0.00 (2)	7.14 (7)	9.50 (2)
392	275-366	145	5.67 (3)	1.50 (2)	65.00 (3)	8.33 (3)	0.00 (2)	7.00 (3)	61.50 (2)
729	367-549	186	241.50 (3)	36.50 (2)	405.00 (3)	149.33 (3)	19.00 (2)	681.78 (9)	67.00 (2)
731	367-549	216	182.67 (3)	24.00 (3)	309.67 (3)	27.67 (3)	40.00 (2)	42.86 (7)	34.00 (2)
733	367-549	468	176.33 (3)	21.33 (2)	394.67 (3)	19.67 (3)	19.50 (2)	39.33 (9)	10.50 (2)
735	367-549	272	192.67 (3)	19.00 (2)	76.33 (3)	79.00 (3)	58.50 (2)	16.91 (11)	27.00 (2)
730	550-731	170	55.00 (2)	203.50 (2)	77.67 (3)	261.00 (3)	29.50 (2)	18.67 (3)	68.50 (2)
732	550-731	231	161.00 (2)	365.00 (2)	140.33 (3)	16.50 (2)	44.50 (2)	80.67 (3)	46.00 (2)
734	550-731	228	87.50 (2)	19.00 (2)	28.67 (3)	62.00 (2)	39.00 (2)	35.67 (3)	95.00 (2)
736	550-731	175	40.50 (2)	34.50 (2)	17.00 (3)	25.00 (3)	21.00 (2)	22.00 (7)	36.00 (2)
737	732-914	227	.	.	.	.	5.50 (2)	-	.
741	732-914	223	.	.	0.25	.	1.50 (2)	-	.
745	732-914	348	.	.	0.33	.	0.50 (2)	-	.
748	732-914	159	.	.	7.00	.	1.00 (2)	-	.
Upper (95% CI)			42.7	105.6	77.1	20.3	10.2	32.1	12.4
Weighted mean (by area)			29.4	15.0	48.5	13.3	6.5	18.0	9.8
Lower (95% CI)			16.0	-75.5	19.9	6.3	2.7	3.6	7.1
Abundance of surveyed area (millions)			45.3	23.2	74.9	20.6	10.0	27.7	15.1

Table 6. Mean weight (kg) per standard tow from various Canadian surveys in Div. 3L where strata greater than 366 m (200 fath.) were sampled. Dashes (-) represent unsampled strata. Number of successful sets in brackets. The data were generated from Campelen trawl equivalent numbers based on a comparative fishing experiment with an Engel145 otter trawl (see text). G.A. = GadusAtlantica, W.T. = Wilfred Templeman, A.N. = Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	Aug 16-Aug 29 1978-Q3 (G.A. 12)	Sep 4-Sep 10 1979-Q3 (G.A. 25)	May 8-May 13 1980-Q2 (G.A. 36)	Sep 18-Sep 26 1981-Q3 (G.A. 55)	Jul 26-Sep 3 1984-Q3 (W.T. 16-18)	Jan 10-Feb 11 1985-Q1 (W.T. 22-24)	Apr 17-May 26 1985-Q2 (W.T. 28-30)	Jul 27-Aug 25 1985-Q3 (W.T. 32-34)	Oct 9-Nov 18 1985-Q4 (W.T. 37-39)
347	184-274	983	64.75 (3)	0.00 (2)	0.00 (4)	1.61 (4)	0.00 (6)	0.00 (5)	0.02 (5)	0.00 (3)	0.00 (5)
366	184-274	1394	70.50 (3)	3.91 (2)	3.63 (6)	28.33 (6)	2.91 (11)	0.00 (5)	0.21 (6)	4.10 (5)	4.83 (9)
369	184-274	961	0.00 (3)	0.63 (2)	0.17 (4)	5.32 (4)	0.05 (7)	0.00 (5)	0.13 (5)	0.15 (6)	0.00 (6)
386	184-274	983	69.30 (3)	9.52 (2)	1.60 (4)	8.32 (4)	9.96 (8)	0.00 (5)	0.14 (5)	11.30 (5)	0.41 (5)
389	184-274	821	0.10 (3)	---	15.04 (2)	2.77 (3)	7.97 (6)	0.97 (4)	0.02 (5)	0.75 (4)	1.96 (5)
391	184-274	282	0.00 (2)	9.83 (2)	1.63 (2)	0.32 (2)	0.10 (2)	0.00 (2)	0.00 (2)	0.00 (2)	3.71 (2)
345	275-366	1432	50.70 (2)	70.55 (4)	7.51 (4)	33.92 (5)	22.19 (7)	0.93 (3)	2.83 (5)	32.20 (7)	2.84 (9)
346	275-366	865	146.01 (2)	81.03 (4)	16.82 (2)	54.53 (3)	119.76 (6)	5.64 (4)	14.51 (2)	47.61 (3)	44.07 (5)
368	275-366	334	1556.20 (2)	77.48 (3)	10.65 (2)	261.75 (2)	1366.30 (2)	1.66 (2)	4.86 (2)	126.45 (2)	112.15 (2)
387	275-366	718	292.79 (2)	352.46 (5)	11.42 (3)	928.47 (3)	1341.20 (3)	49.01 (4)	3.89 (6)	501.85 (3)	193.26 (4)
388	275-366	361	568.32 (2)	1059.10 (3)	1.94 (2)	233.12 (2)	50.92 (2)	5.72 (3)	7.09 (2)	96.07 (2)	22.46 (2)
392	275-366	145	---	429.96 (3)	12.95 (3)	249.94 (2)	783.64 (2)	1.42 (2)	2.05 (2)	34.58 (2)	342.65 (2)
729	367-549	186	---	277.43 (3)	---	608.41 (2)	162.05 (2)	987.53 (2)	6.45 (2)	419.21 (2)	855.75 (2)
731	367-549	216	339.34 (2)	288.20 (3)	166.22 (2)	95.19 (2)	87.92 (2)	24.70 (3)	14.55 (2)	94.99 (2)	203.45 (2)
733	367-549	468	553.31 (2)	819.89 (3)	24.73 (3)	912.39 (2)	214.76 (4)	670.29 (3)	458.64 (3)	759.06 (2)	255.38 (3)
735	367-549	272	616.36 (2)	291.17 (3)	21.13 (2)	464.28 (2)	319.91 (3)	4.18 (2)	19.11 (2)	147.66 (2)	89.77 (2)
730	550-731	170	709.46 (2)	268.32 (3)	159.42 (2)	319.49 (2)	43.25 (2)	313.63 (2)	3654.40 (2)	140.65 (2)	16.04 (2)
732	550-731	231	57.55 (2)	36.68 (2)	51.77 (2)	36.78 (2)	37.43 (2)	152.24 (2)	45.32 (2)	22.35 (2)	17.48 (2)
734	550-731	228	1084.60 (2)	368.78 (3)	1296.40 (2)	500.24 (2)	258.73 (3)	81.97 (2)	116.80 (2)	429.61 (2)	265.85 (2)
736	550-731	175	95.56 (2)	160.36 (3)	.	53.26 (2)	---	---	129.59 (2)	14.89 (2)	78.29 (2)
737	732-914	227	---	---	---	---	---	---	---	---	---
741	732-914	223	---	---	---	---	---	---	---	---	---
745	732-914	348	---	---	---	---	---	---	---	---	---
748	732-914	159	---	---	---	---	---	---	---	---	---
Upper (95% CI)a			330.9	249.0	193.9	374.5	381.9	87.4	778.0	195.9	105.3
Weighted mean (by area)			207.6	159.2	41.2	169.3	182.7	59.4	82.8	104.3	63.6
Lower (95% CI)a			84.4	69.3	-111.6	-35.9	-16.5	31.4	-612.3	12.7	21.9
Survey biomass index (tons)			311163	227788	61502	261384	277711	90245	127888	161038	98233

Table 6. Mean weight in Campelen equivalents , Div. 3L (continued)

Stratum	Depth Range (M)	Area (sq. n.) mi	Jan 22-Feb 27 1986-Q1 (W.T.42-44)	Nov13-Nov 30 1986-Q4 (A.N. 72)	Jan 17-Jan 25 1990-Q1 (W.T. 90)	Aug 7-Aug 19 1990-Q3 (W.T. 98)	Oct 18-Nov 18 1990-Q4 (W.T. 101)	May 11- May 2 1991-Q2 (W.T. 106-7)	Aug 4- Aug 11 1991-Q3 (W.T. 109)	Nov 10- Dec 2 1991-Q4 (W.T. 114-5)	May 13-June 7 1992-Q2 (W.T 120-2)
347	184-274	983	0.26 (4)	0.00 (4)	0.09 (4)	0.44 (4)	0.00 (2)	0.04 (2)	0.00 (3)	0.00 (4)	0.00 (4)
366	184-274	1394	0.35 (2)	1.36 (4)	0.18 (5)	2.58 (4)	0.00 (6)	---	0.10 (3)	0.05 (21)	0.10 (6)
369	184-274	961	0.00 (3)	1.03 (3)	0.00 (4)	1.03 (4)	0.00 (4)	0.00 (2)	2.79 (4)	0.15 (9)	0.00 (4)
386	184-274	983	0.40 (7)	0.94 (4)	2.58 (4)	0.30 (7)	0.37 (4)	0.17 (3)	0.30 (3)	0.00 (3)	0.00 (4)
389	184-274	821	0.36 (4)	0.70 (4)	0.00 (3)	1.34 (3)	0.57 (3)	0.38 (3)	0.20 (3)	0.00 (3)	0.00 (3)
391	184-274	282	0.00 (3)	4.61 (2)	0.10 (5)	0.29 (5)	0.00 (2)	0.00 (3)	1.24 (3)	0.00 (3)	0.50 (2)
345	275-366	1432	0.21 (3)	3.84 (4)	0.09 (5)	8.04 (6)	0.46 (5)	0.10 (3)	2.14 (4)	0.11 (4)	0.00 (6)
346	275-366	865	1.55 (4)	12.95 (3)	3.38 (3)	120.04 (7)	29.56 (3)	---	9.47 (4)	2.44 (15)	0.49 (4)
368	275-366	334	---	6.84 (2)	5.01 (2)	545.05 (7)	14.43 (2)	---	112.11 (4)	7.15 (6)	4.23 (2)
387	275-366	718	6.81 (4)	2.77 (2)	55.18 (3)	88.37 (10)	29.25 (3)	11.56 (3)	47.10 (5)	5.06 (5)	2.36 (3)
388	275-366	361	5.01 (3)	---	2.89 (2)	42.58 (7)	4.63 (2)	2.80 (3)	10.07 (3)	2.41 (3)	0.35 (2)
392	275-366	145	3.15 (3)	87.30 (2)	2.08 (2)	31.30 (9)	2.76 (2)	0.51 (2)	105.45 (3)	0.95 (3)	1.51 (2)
729	367-549	186	754.72 (2)	378.90 (2)	80.51 (2)	132.44 (7)	63.74 (2)	4.43 (2)	69.30 (2)	32.02 (3)	14.56 (2)
731	367-549	216	--- (1)	---	19.41 (2)	54.61 (6)	82.40 (2)	5.81 (2)	67.96 (3)	8.75 (3)	6.75 (2)
733	367-549	468	152.73 (2)	---	27.89 (2)	233.83 (9)	50.70 (2)	6.06 (2)	210.97 (4)	77.02 (3)	16.76 (2)
735	367-549	272	---	46.11 (2)	45.94 (2)	320.47 (6)	---	---	38.71 (3)	25.86 (3)	18.14 (2)
730	550-731	170	---	---	47.87 (2)	81.28 (4)	---	42.73 (2)	92.11 (3)	175.39 (2)	34.23 (2)
732	550-731	231	---	---	31.33 (2)	25.26 (9)	86.00 (2)	57.51 (2)	36.52 (3)	16.02 (2)	62.14 (2)
734	550-731	228	191.89 (2)	---	62.48 (2)	122.31 (5)	17.70 (2)	44.08 (2)	27.00 (3)	9.60 (2)	43.13 (2)
736	550-731	175	---	12.12 (2)	53.72 (2)	40.46 (6)	106.09 (2)	---	5.56 (3)	18.32 (2)	15.58 (2)
737	732-914	227	---	---	---	---	---	---	---	---	---
741	732-914	223	---	---	---	---	---	---	---	---	---
745	732-914	348	---	---	---	---	---	---	---	---	---
748	732-914	159	---	---	---	---	---	---	---	---	---
Upper (95% CI)			135.9	18.9	24.1	96.0	22.2	11.6	22.2	15.3	11.9
Weighted mean (by area)			27.1	13.0	11.8	60.1	14.0	5.6	13.5	8.8	4.8
Lower (95% CI)			-81.8	7.2	-0.5	24.2	5.7	-0.5	4.8	2.4	-2.3
Survey biomass index (tons)			36568	17119	18202	92840	20743	6267	20838	13665	7404

Table 6. Mean weight in Campelen equivalents , Div. 3L (continued)

Stratum	Depth Range (M)	Area (sq. n.) mi	Nov 5-Nov 29 1992-Q4 (W.T 129-30)	May 18-Jun 10 1993-Q2 (W.T 137-8)	Aug 5-Aug 15 1993-Q3 (G.A. 223)	Nov 12- Dec 4 1993-Q4 (W.T. 145-6)	May 22-Jun 10 1994-Q2 (W.T. 153-54)	Nov 8-Dec 7 1994-Q4 (W.T. 161-62)	May 27-Jun 14 1995-Q2 (W.T. 169-70)
347	184-274	983	0.00 (2)	0.00 (4)	0.00 (3)	0.00 (4)	0.00 (4)	0.00 (8)	0.00 (4)
366	184-274	1394	0.28 (24)	0.00 (7)	1.26 (2)	0.06 (14)	0.07 (5)	0.03 (10)	0.00 (5)
369	184-274	961	0.00 (8)	0.00 (5)	0.00 (3)	0.04 (7)	0.04 (3)	0.00 (3)	0.00 (3)
386	184-274	983	0.00 (3)	0.08 (5)	0.00 (3)	0.00 (3)	0.00 (4)	0.00 (3)	0.00 (4)
389	184-274	821	0.12 (3)	0.00 (4)	0.34 (3)	0.00 (3)	0.00 (3)	0.00 (3)	0.67 (4)
391	184-274	282	0.00 (3)	0.00 (2)	0.23 (3)	0.47 (3)	0.00 (2)	0.63 (3)	0.41 (2)
345	275-366	1432	0.18 (4)	0.00 (2)	0.86 (3)	0.00 (3)	0.24 (5)	0.00 (8)	0.00 (5)
346	275-366	865	0.81 (14)	0.55 (6)	2.57 (3)	1.56 (11)	0.57 (3)	0.08 (7)	0.29 (3)
368	275-366	334	4.69 (10)	3.13 (4)	11.95 (3)	1.38 (8)	0.91 (2)	0.12 (12)	0.40 (2)
387	275-366	718	2.28 (3)	1.97 (2)	24.72 (3)	0.59 (3)	0.18 (3)	0.85 (9)	1.60 (3)
388	275-366	361	3.84 (3)	0.50 (3)	5.33 (3)	2.29 (3)	0.00 (2)	0.98 (7)	0.97 (2)
392	275-366	145	0.62 (3)	0.57 (2)	8.12 (3)	1.60 (3)	0.00 (2)	1.93 (3)	5.01 (2)
729	367-549	186	72.02 (3)	7.45 (2)	107.99 (3)	42.93 (3)	3.74 (2)	179.20 (9)	9.88 (2)
731	367-549	216	41.49 (3)	6.70 (3)	93.33 (3)	5.36 (3)	9.01 (2)	7.31 (7)	5.78 (2)
733	367-549	468	53.68 (3)	5.96 (2)	112.82 (3)	4.60 (3)	5.49 (2)	8.80 (9)	1.60 (2)
735	367-549	272	63.43 (3)	3.41 (2)	16.21 (3)	7.16 (3)	7.50 (2)	2.56 (11)	4.44 (2)
730	550-731	170	27.90 (2)	72.36 (2)	32.21 (3)	122.00 (3)	9.19 (2)	7.02 (3)	18.74 (2)
732	550-731	231	53.62 (2)	91.09 (2)	59.45 (3)	4.21 (2)	12.60 (2)	24.56 (3)	15.28 (2)
734	550-731	228	33.35 (2)	7.72 (2)	13.25 (3)	18.10 (2)	11.64 (2)	12.31 (3)	29.68 (2)
736	550-731	175	11.39 (2)	11.72 (2)	7.99 (3)	6.04 (3)	5.41 (2)	6.67 (7)	11.96 (2)
737	732-914	227	.	.	.	.	1.63 (2)	.	.
741	732-914	223	.	.	0.17	.	0.61 (2)	-	.
745	732-914	348	.	.	0.15	.	0.26 (2)	-	.
748	732-914	159	.	.	1.57	.	0.30 (2)	-	.
Upper (95% CI)			12.83	27.68	22.21	8.07	2.24	8.66	2.57
Weighted mean (by area)			8.69	4.18	13.50	3.89	1.49	4.65	2.13
Lower (95% CI)			4.56	-19.31	4.78	-0.28	0.74	0.63	1.69
Survey biomass index (tons)			13424	6461	20838	6011	2302	7173	3284

Table 7. Mean number per standard tow from various Canadian surveys in Div. 3N where strata greater than 366 m (200 fath.) were sampled. Dashes (-) represent unsampled strata. Number of successful sets in brackets. The data are Campelen trawl equivalent units based on a comparative fishing experiment with an Engel 145 otter trawl (see text). G.A. = Gadus Atlantica, W.T. = Wilfred Templeman.

Stratum	Depth Range (M)	Area (sq. n.) mi	May 3-11 1991-Q2 (W.T. 106)	Aug 11-18 1991-Q3 (W.T.109)	Oct 27-Nov 10 1991-Q4 (W.T. 113-4)	May 2-13 1992-Q2 (W.T.119-20)	Oct 26-Nov 5 1992-Q4 (W.T. 128-9)	May 5-18 1993-Q2 (W.T.136-7)	Aug 15-20 1993-Q3 (G.A.233)	Nov 1-12 1993-Q4 (W.T.144-5)	May 14-22 1994-Q2 (W.T.153)	Oct 29-Dec 13 1994-Q4 (W.T.160-61)	May 13-27 1995-Q2 (W.T.168-69)
382	093-183	647	0.50 (2)	0.00 (3)	0.00 (3)	0.00 (3)	0.00 (2)	0.00 (2)	0.00 (3)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)
377	093-183	100	0.00 (2)	0.00 (2)	---	0.00 (2)	0.00 (2)	0.00 (2)	4.67 (3)	0.50 (2)	0.00 (2)	0.50 (2)	0.00 (2)
359	093-183	421	0.00 (2)	205.75 (4)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	1.00 (3)	0.00 (2)	0.00 (2)	4.00 (2)	0.00 (2)
381	185-274	182	0.50 (2)	5.67 (3)	4.50 (2)	1.00 (2)	---	0.00 (2)	6.00 (4)	3.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)
378	185-274	139	8.00 (3)	26.67 (3)	183.50 (2)	42.00 (2)	1.50 (2)	1.00 (2)	16.67 (3)	4.50 (2)	0.50 (2)	5.00 (2)	2.50 (2)
358	185-274	225	68.00 (2)	979.67 (3)	9350.00 (2)	34.00 (2)	30425.00 (2)	1473.00 (2)	25736.00 (4)	17.50 (2)	68.00 (2)	350.00 (2)	3.50 (2)
380	275-366	116	8.00 (2)	3471.50 (2)	179.50 (2)	0.00 (2)	---	13.50 (2)	793.50 (2)	10.50 (2)	10.50 (2)	0.00 (2)	21.50 (2)
379	275-366	106	56.50 (2)	7880.00 (2)	---	15.50 (2)	123.00 (2)	13.50 (2)	2304.00 (3)	270.50 (2)	59.50 (2)	100.50 (2)	42.50 (2)
357	275-366	164	212.50 (2)	2607.00 (2)	3521.50 (2)	593.00 (2)	5207.50 (2)	395.50 (2)	1408.70 (3)	262.50 (2)	210.50 (2)	3687.50 (2)	159.50 (2)
727	367-549	160	24.50 (2)	109.00 (4)	---	15.50 (2)	---	50.00 (2)	2699.00 (3)	208.00 (2)	46.00 (2)	136.00 (2)	94.00 (2)
725	367-549	105	229.00 (2)	427.00 (3)	---	---	1672.50 (2)	89.50 (2)	1356.30 (3)	270.50 (2)	43.00 (2)	477.50 (2)	48.50 (2)
723	367-549	155	261.00 (2)	---	146.00 (2)	510.50 (2)	---	270.00 (2)	3159.80 (4)	1832.50 (2)	129.00 (2)	1212.00 (2)	112.00 (2)
728	550-731	156	66.50 (2)	16.75 (4)	---	75.50 (2)	---	965.00 (2)	164.67 (3)	---	34.33 (3)	8.50 (2)	109.00 (2)
726	550-731	72	385.00 (2)	73.50 (2)	---	75.00 (2)	---	86.00 (2)	545.50 (2)	65.50 (2)	31.50 (2)	207.00 (2)	163.00 (2)
724	550-731	124	517.50 (2)	---	29.00 (2)	103.50 (2)	---	166.00 (2)	1317.00 (4)	532.00 (2)	57.50 (2)	802.50 (2)	184.50 (2)
760	732-914	154	---	---	---	---	---	---	---	---	3.50 (2)	---	---
756	732-914	106	---	---	---	---	---	---	---	---	5.50 (2)	---	---
752	732-914	134	---	---	---	---	---	---	---	---	1.50 (2)	---	---
Upper (95% CI)			173.0	1536.0	7884.4	129.4	38182.7	1767.0	7088.9	1042.7	96.3	2427.2	136.5
Weighted mean (by area)			*79.8*	*789.6*	*1267.7*	*81.0*	*4136.6*	*221.4*	*2665.2*	*182.1*	*32.3*	*373.3*	*43.0*
Lower (95% CI)			-13.4	43.3	-5349.1	32.6	-29909.5	-1324.1	-1758.6	-678.5	-31.8	-1680.6	-50.6
Abundance of surveyed area (millions)			31.5	281.7	378.9	30.8	1085.2	87.5	1052.9	68.0	14.5	147.5	17.0

Table 8. Mean weight (kg) per standard tow from various Canadian surveys in Div. 3N where strata greater than 366 m (200 fath.) were sampled. Dashes (-) represent unsampled strata. Number of successful sets in brackets. The data were generated from Campelen trawl equivalent numbers based on a comparative fishing experiment with an Engel145 otter trawl (see text). G.A. = GadusAtlantica, W.T. = Wilfred Templeman.

Stratum	Depth Range (M)	Area (sq. n.) mi	May 3-11 1991-Q2 (W.T. 106)	Aug 11-18 1991-Q3 (W.T.109)	Oct 27-Nov 10 1991-Q4 (W.T. 113-4)	May 2-13 1992-Q2 (W.T.119-20)	Oct 26-Nov 5 1992-Q4 (W.T. 128-9)	May 5-18 1993-Q2 (W.T.136-7)	Aug 15-20 1993-Q3 (G.A.233)	Nov 1-12 1993-Q4 (W.T.144-5)	May 14-22 1994-Q2 (W.T.153)	Oct 29-Dec 13 1994-Q4 (W.T.160-61)	May 13-27 1995-Q2 (W.T.168-69)
382	093-183	647	0.2 (2)	0.0 (3)	0.0 (3)	0.0 (3)	0.0 (2)	0.0 (2)	0.0 (3)	0.0 (2)	0.00 (2)	0.00 (2)	0.00 (3)
377	093-183	100	0.0 (2)	0.0 (2)	---	0.0 (2)	0.0 (2)	0.0 (2)	0.9 (3)	0.2 (2)	0.00 (2)	0.13 (2)	0.00 (2)
359	093-183	421	0.0 (2)	4.6 (4)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.2 (3)	0.0 (2)	0.00 (2)	0.29 (2)	0.00 (2)
381	185-274	182	0.1 (2)	1.0 (3)	0.1 (2)	0.2 (2)	---	0.0 (2)	1.0 (4)	1.1 (2)	0.00 (2)	0.00 (2)	0.00 (2)
378	185-274	139	0.9 (3)	3.7 (3)	48.4 (2)	2.4 (2)	0.3 (2)	0.2 (2)	2.2 (3)	0.8 (2)	0.08 (2)	0.33 (2)	0.08 (2)
358	185-274	225	1.2 (2)	115.4 (3)	390.4 (2)	1.3 (2)	3206.1 (2)	104.0 (2)	2069.1 (4)	1.3 (2)	2.49 (2)	26.8 (2)	2.49 (2)
380	275-366	116	0.2 (2)	814.8 (2)	41.9 (2)	0.0 (2)	---	1.1 (2)	135.2 (2)	0.4 (2)	0.37 (2)	0.00 (2)	0.37 (2)
379	275-366	106	5.4 (2)	1086.4 (2)	. (1)	1.3 (2)	16.9 (2)	1.7 (2)	431.4 (3)	30.2 (2)	4.93 (2)	10.8 (2)	4.93 (2)
357	275-366	164	19.1 (2)	517.7 (2)	414.7 (2)	23.7 (2)	727.5 (2)	35.1 (2)	224.9 (3)	23.8 (2)	18.1 (2)	405.3 (2)	18.1 (2)
727	367-549	160	3.4 (2)	33.7 (4)	---	1.7 (2)	.	5.9 (2)	845.9 (3)	39.4 (2)	8.06 (2)	28.6 (2)	8.06 (2)
725	367-549	105	26.9 (2)	135.0 (3)	---	---	491.0 (2)	15.2 (2)	402.3 (3)	69.1 (2)	6.27 (2)	97.7 (2)	6.27 (2)
723	367-549	155	29.7 (2)	---	38.8 (2)	47.1 (2)	---	60.7 (2)	765.1 (4)	293.8 (2)	16.3 (2)	302.3 (2)	16.3 (2)
728	550-731	156	20.2 (2)	7.0 (4)	---	20.2 (2)	---	421.3 (2)	60.8 (3)	---	9.61 (3)	3.12 (2)	9.61 (2)
726	550-731	72	87.8 (2)	32.6 (2)	---	22.9 (2)	---	18.8 (2)	225.7 (2)	26.0 (2)	7.93 (2)	86.4 (2)	7.93 (2)
724	550-731	124	81.6 (2)	---	20.8 (2)	18.6 (2)	---	69.5 (2)	461.8 (4)	220.9 (2)	19.1 (2)	294.6 (2)	19.1 (2)
760	732-914	154	---	---	---	---	---	---	---	---	1.2 (2)	---	---
756	732-914	106	---	---	---	---	---	---	---	---	2.4 (2)	---	---
752	732-914	134	---	---	---	---	---	---	---	---	0.5 (2)	---	---
Upper (95% CI)			26.1	599.1	110.5	10.3	4050.9	340.8	636.0	144.9	5.4	158.1	11.0
Weighted mean (by area)			11.1	133.5	81.0	7.0	468.8	40.8	328.6	35.4	4.1	62.2	6.5
Lower (95% CI)			-4.0	-332.0	51.5	3.7	-3113.2	-259.3	21.1	-74.1	2.9	-33.6	2.0
Survey biomass index (tons)			4375	47624	24221	2662	122990	16112	129808	13222	1860	24584	2572

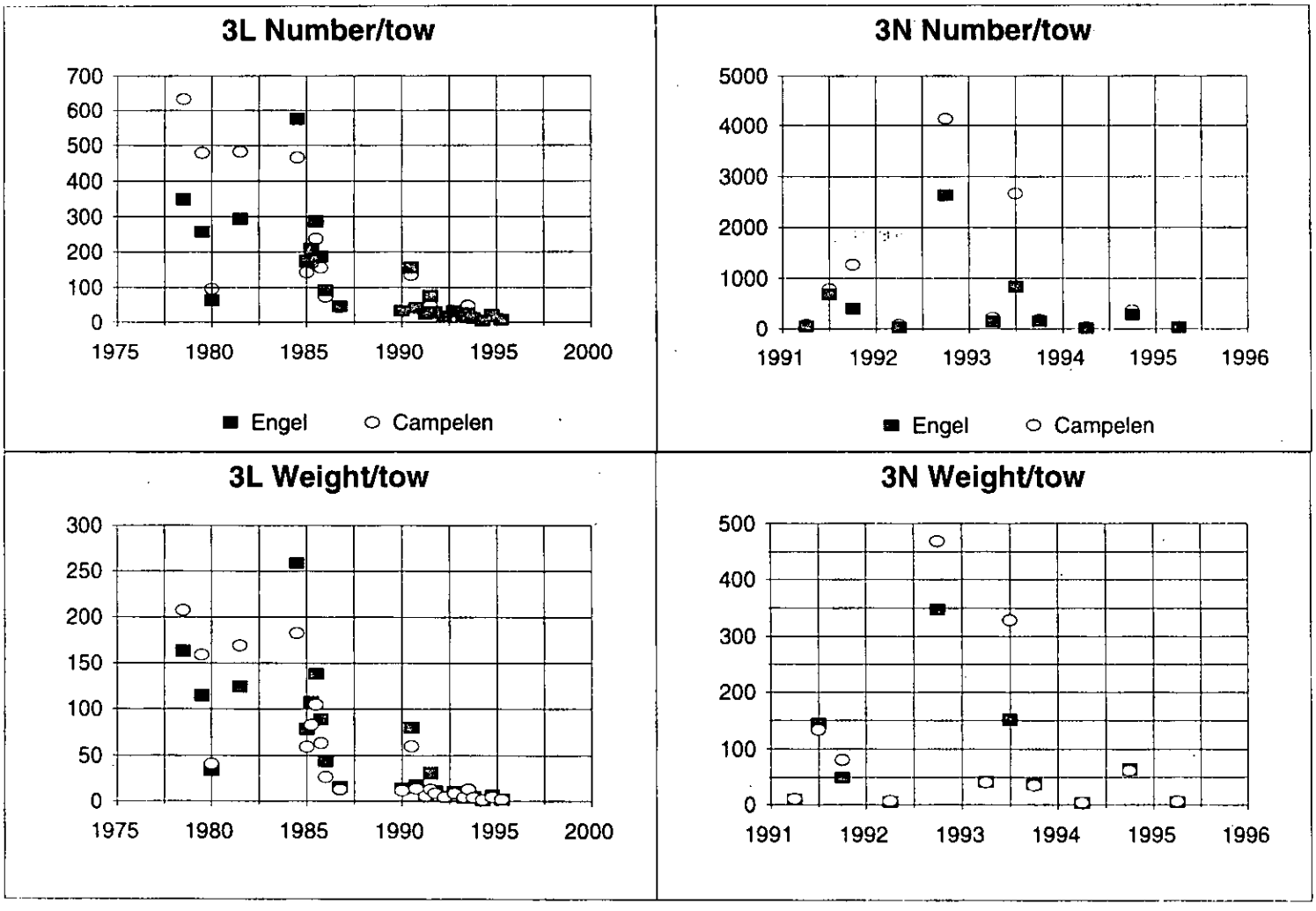

Fig 1. Comparison of survey indices of relative abundance for redfish with the Engels data (squares) and its Campelen equivalent (open circles) based on comparative fishing trials.

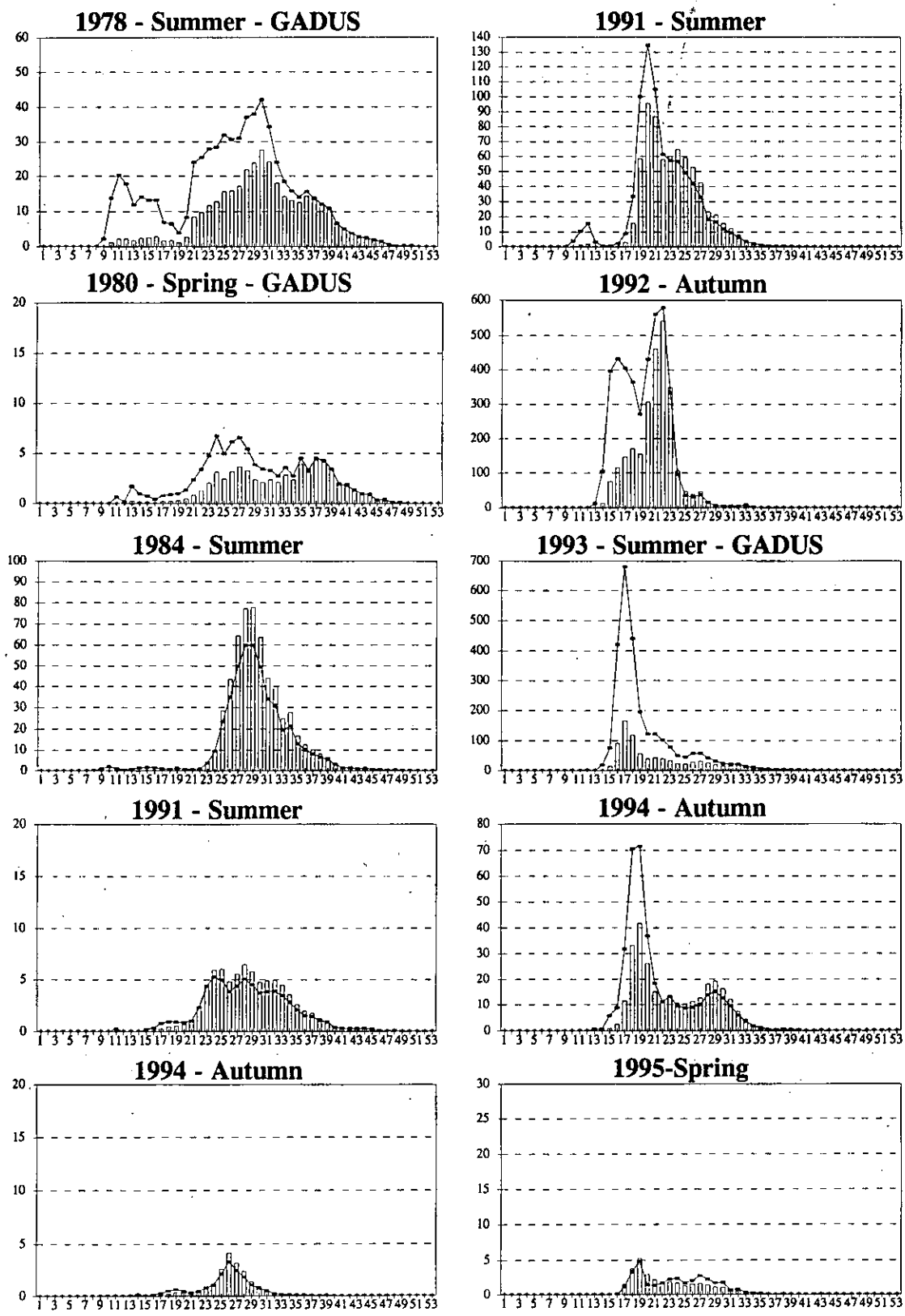

Fig. 2. Length distributions from stratified-random research surveys to Div. 3L (left panels) and Div. 3N (right panels) during various years. Plotted are mean number per standard tow. The bar frequency represents the Engels data and the line represents a conversion into Campelen equivalent units based on a comparative fishing trial (see text)