Northwest Atlantic Fisheries Organization

Serial No. N4285 **NAFO SCR Doc. 00/52**

SCIENTIFIC COUNCIL MEETING – JUNE 1999

A Stock Status Update of Redfish in NAFO Divisions 3LN

by

D. Power

Science Branch, Department of Fisheries and Oceans
P. O. Box 5667, St. John's, Newfoundland, Canada A1C 5X1

Abstract

There are two species of Sebastes that have been commercially fished and reported collectively in fishery statistics in Div. 3LN: the deep sea redfish (*Sebastes mentella)* and the Acadian redfish (*Sebastes fasciatus*) .Catches averaged about 22 000 tons from 1959 to 1985, increased sharply to a historical high of 79 000 tons in 1987 then declined steadily to about 600 tons in 1997. A moratorium on directed fishing was implemented in 1998 and will be continued to 2001. Bycatch of redfish, primarily from Greenland halibut fisheries, increased from 900 tons in 1998 to 2300 tons in 1999. Interpretation of available data remains difficult for this stock. The surveys demonstrate considerable inter-annual variability, the changes frequently being the result of single large catches being taken in different years. Nonetheless, estimates from recent surveys are considerably lower than those from the 1980's indicating a reduced and low stock size. Poor recruitment has persisted in Div. 3L since the early 1980's. The last good recruitment in Div. 3N was the 1986-87 year-classes. Any new year classes will not recruit to any fishery for about 8-10 years after they are born. Thus any recovery of the resource in the short or intermediate term is not anticipated.

Introduction

There are two species of Sebastes that have been commercially fished in Div. 3LN: the deep sea redfish (*Sebastes mentella)* and the Acadian redfish (*Sebastes fasciatus*) The external characteristics are very similar, making them difficult to distinguish, and as a consequence they are reported collectively as “redfish” in the commercial fishery statistics. In September 1998, the Scientific Council of NAFO proposed to the Fisheries Commission that a number of stocks that were under moratoria and not expected to change significantly in the near future should be assessed bi-annually (Anon. 1998). In the interim assessment year the Scientific Council would monitor their status. The Fisheries commission subsequently in 1999 requested bi-annual advice for Redfish in Div. 3LN for 2000 and 2001. This paper represents a monitoring of Redfish in 3LN updating only pertinent information on catch and research vessel surveys.

Nominal Catches and TACs

The average reported catch from Div. 3LN from 1959 to 1985 was about 22,000 t ranging between 10,000 t and 45,000 t (Table 1, Fig. 1). Catches increased sharply from about 21,000 t in 1985, peaked at a historical high of 79,000 t in 1987 and declined steadily to about 600 tons in 1997. Catch since 1997, taken as bycatch from Greenland halibut fisheries, increased from 900 tons in 1998 to 2,300 tons in 1999.

From 1980 to 1990 the TAC each year for this stock has been 25,000 t. The TAC was reduced to 14,000 for 1991 and was maintained at that level to 1995. The TAC was reduced again in 1996 at 11,000 tons and maintained at

that level in 1997. The Fisheries Commission agreed to a moratorium on directed fishing for this stock for 1998 and extended this for 2001. In the 12 year period since 1986, TACs have been exceeded in all but the last four years. In some years catches have been double (1988) and even triple (1987) the agreed TAC.

Research Survey Data

Abundance Indices

Stratified-random surveys have been conducted by Canada in Div. 3L in various years and seasons from 1978 to 1999 in which strata up to a maximum of 732 m (400 fathoms) were sampled. Although these surveys were conducted at various times of the year throughout the period, they provide an indication of relative abundance and dynamics of the population. The design of the surveys was based on a stratification scheme down to 732 metres (400 fathoms) for Div. 3LN. Recently the stratification scheme has been updated to include depths out to 1464 metres (800 fathoms) but only the autumn surveys since 1996 have had some sampling of stations over 732 metres (400 fathoms).

Up until the autumn of 1995 these surveys were conducted with an Engels 145 high lift otter trawl with a small mesh liner (29mm) in the codend and tows planned for 30 minute duration. Starting with the autumn 1995 survey in Div. 3LN, a Campelen 1800 survey gear was adopted with a 12mm liner in the codend and 15 minute tows utilizing SCANMAR. Only Campelen data and Engel data were converted into Campelen equivalents are reported in this assessment. A comparison of the generated data with the original Engel data suggested overall trends in abundance were the same except that the relative measure of abundance estimated for the Campelen trawl conversions were higher (Power and Maddock Parsons MS 1998).

Mean number and calculated mean weight (kg) per Campelen equivalent standard tow continue to show large fluctuations between some adjacent years (Table 2-7). There are also rather large changes in stratum by stratum density estimates in adjacent years where seasons can be compared. Although it is difficult to interpret year to year changes in the estimates, in general, the spring survey biomass index from 1992 to 1995 (Fig. 2) suggests the stock was at its lowest level (average 5,000 t) relative to the time period prior to 1986 for surveys conducted in the first half of the year (winter/spring average 93,000 t). A similar contrast occurs in the autumn survey biomass index from 1992 to 1995 (average 19,000 t.) relative to a time period prior to 1986 for surveys conducted in the second half of the year (summer/autumn average 223,000 t.). From 1996 to 1999 the spring biomass index averaged 19,000 t while the autumn index has averaged 20,000 t. over the same period.

Stratified-random surveys have also been conducted primarily in spring and autumn by Canada in Div 3N from 1991-1999 that also cover to the extent of the stratification (732 m or 400 fathoms). The Campelen trawl and protocol were also utilized on these surveys beginning in the autumn of 1995. These data were also converted into Campelen equivalents where appropriate. Mean number and weight per tow (Table 8-13) are considerably higher than in Div 3L but there are relatively greater variability in these estimates as well. A consistent pattern of higher autumn estimates is also evident. The source of this variability is unclear but is likely due to availability to the trawl gear rather than real changes in population abundance and therefore the interpretation of these data in terms of year to year trends is difficult. The average survey biomass index for the converted spring data in the 1991 to 1995 period (Fig. 3) is about 6,000 t. The average Campelen spring survey biomass index from 1996 to 1999 is about 21,000 t. This average is highly influenced by two large sets which occurred in strata that accounted for 65% of the 32,000 t 1998 estimate, and one large set in a stratum that accounted for 73% the 41,000 t 1999 estimate. For the autumn series the 1991-1994 average biomass index was the same as the 1995-1999 average at 46,000 t.

Recruitment

In the previous assessment (Power and Maddock Parsons, 1999), a review of length distributions indicated that recruitment has been relatively poor in the stock. Length distributions from the 1999 spring and autumn Canadian surveys in Div. 3L did not indicate an improvement to this situation (Fig. 4). These distributions were dominated by fish between 23 cm – 29 cm with a mode at 27cm which corresponds to an age of 15. Length distributions from 1999 spring and autumn Canadian surveys in Div. 3N (Fig. 4) were dominated by fish between 20 cm – 29 cm with a mode at 24 cm in spring and 23 cm in autumn. There was a pulse at 9 cm detected in the spring survey but this was not evident in the autumn survey.

State of the Stock

Interpretation of available data remains difficult for this stock. The surveys demonstrate considerable inter-annual variability, the changes frequently being the result of single large catches being taken in different years. Nonetheless, estimates from recent surveys are considerably lower than those from the 1980's indicating a reduced and low stock size.

Poor recruitment has persisted in Div. 3L since the early 1980's. The last good recruitment in Div. 3N was the 1986-87 year-classes. Any new year classes will not recruit to any fishery for about 8-10 years after they are born. Thus any recovery of the resource in the short or intermediate term is not anticipated.

REFERENCES

ANON. MS 1998. NAFO Scientific Council Report. 257 pp

Power, D. and D. Maddock Parsons. MS 1999. The status of the Redfish resource in NAFO Division 3LN. NAFO SCR Doc. 99/65. Serial No. N4124. 27 p.

Table 1. Summary of nominal catches (t) of redfish in Divisions 3LN (provisional for 1994-1999).

YEAR	3L	3N	TOTAL	TAC
1959	34,107	10,478	44,585	
1960	10,015	16,547	26,562	
1961	8,349	14,826	23,175	
1962	3,425	18,009	21,439 [a]	
1963	8,191	12,906	27,362 [a]	
1964	3,898	4,206	10,261 [a]	
1965	18,772	4,694	23,466	
1966	6,927	10,047	16,974	
1967	7,684	19,504	27,188	
1968	2,378	15,265	17,660 [a]	
1969	2,344	22,356	24,750 [a]	
1970	1,029	13,359	14,419 [a]	
1971	10,043	24,310	34,370 [a]	
1972	3,095	25,838	28,933	
1973	4,709	28,588	33,297	
1974	11,419	10,867	22,286	28,000
1975	3,838	14,033	17,871	20,000
1976	15,971	4,541	20,513	20,000
1977	13,452	3,064	16,516	16,000
1978	6,318	5,725	12,043	16,000
1979	5,584	8,483	14,067	18,000
1980	4,367	11,663	16,030	25,000
1981	9,407	14,873	24,280	25,000
1982	7,870	13,677	21,547	25,000
1983	8,657	11,090	19,747	25,000
1984	2,696	12,065	14,761	25,000
1985	3,677	16,880	20,557	25,000
1986	27,833	14,972	42,805	25,000
1987	30,342	40,949	79,031 [b]	25,000
1988	22,317	23,049	53,266 [b]	25,000
1989	18,947	12,902	33,649 [b]	25,000
1990	15,538	9,217	29,105 [b]	25,000
1991	8,892	12,723	25,815 [b]	14,000
1992	4,630	10,153	27,283 [b]	14,000
1993	5,897	9,077	18,599-24,017 [b,c]	14,000
1994	379	2,274	3,828-7,654 [b,c,d]	14,000
1995	292	1,697	1,989 [d]	14,000
1996	112	339	451 [d]	11,000
1997	150	479	629 [d]	11,000
1998	494	364	858 [d]	Moratorium
1999	517	1315	2318 [b,d]	Moratorium
2000				Moratorium

[a] Includes catch that could not be identified by division.

[b] Includes estimates of unreported catch.

[c] Catch could not be precisely estimated due to discrepancies in figures from available sources.

[d] Provisional.

Table 2. Mean number per standard tow from Canadian spring 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 from 1980-1995 are Campelen trawl equivalent units based on a comparative fishing experiment with an Engel 145 otter trawl (see text). Data from 1996 to present are actual Campelen data. GA=GadusAtlantica, WT=Wilfred Templeman, AN=Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	May 8-May 13 1980-Q2 GA 36	Apr 17-May 26 1985-Q2 WT 28-30	May 11- May 29 1991-Q2 WT106-7	May 13-June 7 1992-Q2 WT 120-2	May 18-Jun 10 1993-Q2 WT 137-8	May 22-Jun 10 1994-Q2 WT 153-54	May 27-Jun 14 1995-Q2 WT 169-70	May-June 1996-Q2 WT 189-191	May-June 1997-Q2 WT 205-208	May-June 1998-Q2 WT 223-224	May-June 1999-Q2 WT 240-241
347	184-274	983	0.00 (4)	3.20 (5)	2.00 (2)	0.00 (4)	0.00 (4)	0.00 (4)	0.00 (4)	0.00 (4)	0.00 (4)	0.00 (4)	0.00 (3)
366	184-274	1394	35.83 (6)	9.83 (6)	---	0.50 (6)	0.00 (7)	0.20 (5)	0.00 (5)	0.18 (5)	7.50 (6)	0.00 (5)	0.00 (4)
369	184-274	961	0.25 (4)	0.20 (5)	0.00 (2)	0.00 (4)	0.00 (5)	0.33 (3)	0.00 (3)	0.00 (4)	0.00 (4)	0.00 (4)	0.00 (3)
386	184-274	983	2.25 (4)	1.80 (5)	5.33 (3)	0.00 (4)	0.20 (5)	0.00 (4)	0.00 (4)	0.50 (4)	0.22 (4)	0.50 (4)	3.00 (3)
389	184-274	821	55.50 (2)	1.60 (5)	8.33 (3)	0.00 (3)	0.00 (4)	0.00 (3)	2.75 (4)	0.00 (4)	5.33 (3)	0.00 (3)	0.00 (3)
391	184-274	282	11.50 (2)	0.00 (2)	0.00 (3)	3.50 (2)	0.00 (2)	0.00 (2)	5.00 (2)	0.00 (2)	0.00 (2)	0.44 (2)	0.50 (2)
345	275-366	1432	22.00 (4)	4.60 (5)	3.00 (3)	0.00 (6)	0.00 (2)	0.60 (5)	0.00 (5)	0.80 (6)	0.20 (5)	1.12 (6)	0.00 (5)
346	275-366	865	45.00 (2)	18.50 (2)	---	2.00 (4)	4.00 (6)	2.33 (3)	0.67 (3)	1.50 (4)	9.00 (3)	0.30 (3)	3.56 (3)
368	275-366	334	59.50 (2)	27.00 (2)	---	11.50 (2)	11.00 (4)	9.50 (2)	6.50 (2)	22.33 (3)	7.05 (2)	13.11 (2)	8.80 (2)
387	275-366	718	54.67 (3)	18.00 (6)	59.67 (3)	8.33 (3)	5.33 (2)	1.33 (3)	12.00 (3)	9.81 (3)	15.50 (2)	34.81 (3)	18.26 (3)
388	275-366	361	18.50 (2)	28.50 (2)	32.33 (3)	2.50 (2)	2.00 (3)	0.00 (2)	9.50 (2)	5.00 (3)	14.00 (2)	16.22 (2)	11.00 (2)
392	275-366	145	63.00 (3)	18.00 (2)	4.00 (2)	4.00 (2)	1.50 (2)	0.00 (2)	61.50 (2)	69.00 (2)	93.50 (2)	107.50 (2)	6.50 (2)
729	367-549	186	---	26.00 (2)	20.50 (2)	68.00 (2)	36.50 (2)	19.00 (2)	67.00 (2)	688.50 (2)	53.48 (3)	169.00 (2)	356.00 (2)
731	367-549	216	640.00 (2)	77.00 (2)	37.50 (2)	30.50 (2)	24.00 (3)	40.00 (2)	34.00 (2)	278.73 (3)	54.50 (2)	123.17 (2)	761.50 (2)
733	367-549	468	85.67 (3)	916.33 (3)	19.50 (2)	51.50 (2)	21.33 (2)	19.50 (2)	10.50 (2)	441.52 (3)	320.00 (2)	157.56 (2)	259.00 (2)
735	367-549	272	73.00 (2)	62.50 (2)	---	68.50 (2)	19.00 (2)	58.50 (2)	27.00 (2)	164.44 (3)	204.44 (2)	1340.00 (2)	306.61 (2)
730	550-731	170	512.00 (2)	6963.50 (2)	169.50 (2)	96.00 (2)	203.50 (2)	29.50 (2)	68.50 (2)	282.33 (2)	3.94 (2)	185.00 (3)	236.00 (2)
732	550-731	231	192.50 (2)	113.50 (2)	318.50 (2)	180.50 (2)	365.00 (2)	44.50 (2)	46.00 (2)	43.47 (2)	56.44 (2)	129.50 (2)	87.00 (2)
734	550-731	228	2065.00 (2)	291.00 (2)	236.00 (2)	120.00 (2)	19.00 (2)	39.00 (2)	95.00 (2)	295.28 (2)	68.20 (2)	191.89 (2)	26.28 (2)
736	550-731	175	---	425.00 (2)	---	56.00 (2)	34.50 (2)	21.00 (2)	36.00 (2)	61.70 (2)	69.00 (2)	16.00 (2)	27.42 (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)			336.1	1496.1	136.3	37.4	105.6	10.2	12.4	87.9	36.1	258.0	220.7
Weighted mean (by area)			96.4	168.9	30.6	15.3	15.0	6.5	9.8	53.9	28.8	58.6	47.5
Lower (95% CI)			-143.4	-1158.4	-75.0	-6.8	-75.5	2.7	7.1	19.9	21.6	-140.8	-125.7
Abundance of surveyed area (millions)			144.0	260.8	34.5	23.6	23.2	10.0	15.1	83.3	44.5	90.4	73.4

Table 3. Mean number per standard tow from various Canadian winter and summer 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). GA=GadusAtlantica, WT=Wilfred Templeman, AN=Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	Jan 10-Feb 11 1985-Q1 WT 22-24	Jan 22-Feb 27 1986-Q1 WT 42-44	Jan 17-Jan 25 1990-Q1 WT 90	Aug 16-Aug 29 1978-Q3 GA 12	Sep 4-Sep 10 1979-Q3 GA 25	Sep 18-Sep 26 1981-Q3 GA 55	Jul 26-Sep 3 1984-Q3 WT 16-18	Jul 27-Aug 25 1985-Q3 WT 32-34	Aug 7-Aug 19 1990-Q3 WT 98	Aug 4- Aug 11 1991-Q3 WT 109	Aug 5-Aug 15 1993-Q3 GA 223
347	184-274	983	0.00 (5)	12.00 (4)	0.75 (4)	303.00 (3)	0.00 (2)	15.75 (4)	0.00 (6)	0.00 (3)	1.75 (4)	0.00 (3)	0.00 (3)
366	184-274	1394	0.00 (5)	12.00 (2)	5.20 (5)	885.33 (3)	63.50 (2)	81.33 (6)	63.55 (11)	44.40 (5)	16.50 (4)	0.33 (3)	5.50 (2)
369	184-274	961	0.00 (5)	0.00 (3)	0.00 (4)	0.00 (3)	1.00 (2)	40.25 (4)	3.43 (7)	0.17 (6)	10.50 (4)	8.25 (4)	0.00 (3)
386	184-274	983	0.00 (5)	2.86 (7)	5.00 (4)	230.67 (3)	12.50 (2)	15.75 (4)	27.25 (8)	17.20 (5)	8.43 (7)	2.33 (3)	0.00 (3)
389	184-274	821	19.50 (4)	6.00 (4)	0.00 (3)	1.00 (3)	---	7.00 (3)	33.00 (6)	4.25 (4)	21.33 (3)	0.33 (3)	5.67 (3)
391	184-274	282	0.00 (2)	0.00 (3)	4.00 (5)	0.00 (2)	43.00 (2)	10.50 (2)	4.00 (2)	0.00 (2)	2.40 (5)	5.33 (3)	0.67 (3)
345	275-366	1432	8.00 (3)	10.67 (3)	1.40 (5)	96.50 (2)	133.00 (4)	74.00 (5)	36.71 (7)	52.00 (7)	16.17 (6)	4.50 (4)	4.33 (3)
346	275-366	865	12.50 (4)	16.25 (4)	23.67 (3)	330.00 (2)	223.75 (4)	85.67 (3)	221.67 (6)	77.33 (3)	201.86 (7)	25.25 (4)	12.33 (3)
368	275-366	334	8.00 (2)	---	25.00 (2)	4307.50 (2)	238.67 (3)	1028.00 (2)	3418.50 (2)	265.50 (2)	1392.60 (7)	339.75 (4)	57.33 (3)
387	275-366	718	87.50 (4)	13.00 (4)	110.67 (3)	936.50 (2)	942.00 (5)	3068.00 (3)	3678.30 (3)	1524.70 (3)	278.20 (10)	173.60 (5)	104.67 (3)
388	275-366	361	28.00 (3)	30.00 (3)	24.00 (2)	2824.50 (2)	5037.00 (3)	891.50 (2)	167.00 (2)	323.50 (2)	201.71 (7)	73.67 (3)	23.00 (3)
392	275-366	145	6.50 (2)	12.33 (3)	4.50 (2)	---	1556.00 (3)	1129.00 (2)	2321.50 (2)	121.50 (2)	166.33 (9)	315.67 (3)	65.00 (3)
729	367-549	186	2767.00 (2)	2150.00 (2)	165.50 (2)	---	816.00 (3)	1714.00 (2)	374.00 (2)	968.00 (2)	258.43 (7)	196.50 (2)	405.00 (3)
731	367-549	216	84.33 (3)	---	90.00 (2)	626.50 (2)	676.33 (3)	309.50 (2)	205.00 (2)	207.50 (2)	142.67 (6)	208.00 (3)	309.67 (3)
733	367-549	468	1519.70 (3)	353.50 (2)	77.00 (2)	1070.00 (2)	1884.70 (3)	1993.00 (2)	376.75 (4)	1313.50 (2)	397.22 (9)	486.00 (4)	394.67 (3)
735	367-549	272	10.00 (2)	---	223.50 (2)	935.50 (2)	664.67 (3)	1147.00 (2)	567.33 (3)	221.00 (2)	484.17 (6)	93.00 (3)	76.33 (3)
730	550-731	170	634.00 (2)	---	89.50 (2)	1604.00 (2)	511.33 (3)	662.00 (2)	83.50 (2)	269.50 (2)	145.75 (4)	175.67 (3)	77.67 (3)
732	550-731	231	325.00 (2)	---	57.50 (2)	110.50 (2)	74.00 (2)	70.00 (2)	72.50 (2)	40.00 (2)	49.89 (9)	79.33 (3)	140.33 (3)
734	550-731	228	152.00 (2)	354.50 (2)	114.50 (2)	1571.00 (2)	669.67 (3)	1009.00 (2)	436.33 (3)	719.00 (2)	214.60 (5)	47.33 (3)	28.67 (3)
736	550-731	175	---	---	185.50 (2)	261.50 (2)	418.67 (3)	116.50 (2)	---	25.50 (2)	75.83 (6)	12.67 (3)	17.00 (3)
737	732-914	227	---	---	---	---	---	---	---	---	---	---	---
741	732-914	223	---	---	---	---	---	---	---	---	---	---	0.25 (3)
745	732-914	348	---	---	---	---	---	---	---	---	---	---	0.33 (3)
748	732-914	159	---	---	---	---	---	---	---	---	---	---	7.00 (3)
Upper (95% CI)			244.5	371.2	57.0	1086.0	1068.5	1156.5	860.6	370.1	218.8	81.5	77.1
Weighted mean (by area)			142.9	74.7	32.8	634.0	479.5	482.2	465.7	237.4	135.0	66.5	48.5
Lower (95% CI)			41.3	-221.9	8.5	182.0	-109.5	-192.0	70.8	104.7	51.3	51.5	19.9
Abundance of surveyed area (millions)			217.2	100.9	50.6	950.1	686.2	744.6	707.9	366.6	208.5	102.7	74.9

Table 4. Mean number per standard tow from Canadian autumn 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 from 1985-1994 are Campelen trawl equivalent units based on a comparative fishing experiment with an Engel 145 otter trawl (see text). Data from 1995 to present are actual Campelen data. GA=GadusAtlantica, WT=Wilfred Templeman, AN=Alfred Needler, T=Teleost.

Stratum	Depth Range (M)	Area (sq. n.) mi	Oct 9-Nov 18 1985-Q4 WT 37-39	Nov13-Nov 30 1986-Q4 AN 72	Oct 18-Nov 18 1990-Q4 WT 101)	Nov 10- Dec 2 1991-Q4 WT 114-5	Nov 5-Nov 29 1992-Q4 WT 129-30	Nov 12- Dec 4 1993-Q4 WT 145-6	Nov 8-Dec 7 1994-Q4 WT 161-62	Oct 3-Nov23 1995-Q4 WT 176-79	Sep-Nov 1996-Q4 WT 196-198 T41	Oct-Dec 1997-Q4 WT 213-217 T56	Nov-Dec 1998-Q4 WT 231-233 T75-76	Nov-Dec 1999-Q4 WT 247-248 T88
347	184-274	983	0.00 (5)	0.00 (4)	0.00 (2)	0.00 (4)	0.00 (2)	0.00 (4)	0.00 (8)	0.00 (4)	0.00 (3)	0.00 (3)	0.00 (3)	0.00 (3)
366	184-274	1394	30.89 (9)	20.00 (4)	0.00 (6)	1.19 (21)	1.75 (24)	0.21 (14)	0.10 (10)	0.60 (5)	1.60 (5)	18.80 (5)	4.80 (3)	4.60 (5)
369	184-274	961	0.00 (6)	7.67 (3)	0.00 (4)	1.78 (9)	0.00 (8)	0.14 (7)	0.00 (3)	14.52 (3)	0.00 (2)	3.00 (3)	0.00 (2)	2.07 (3)
386	184-274	983	0.60 (5)	18.50 (4)	15.25 (4)	0.00 (3)	0.00 (3)	0.00 (3)	0.00 (3)	4.25 (4)	0.00 (3)	5.33 (3)	0.30 (5)	1.33 (3)
389	184-274	821	23.40 (5)	2.00 (4)	4.67 (3)	0.00 (3)	3.67 (3)	0.00 (3)	0.00 (3)	3.33 (3)	8.33 (3)	0.67 (3)	0.00 (2)	10.04 (3)
391	184-274	282	11.50 (2)	16.50 (2)	0.00 (2)	0.00 (3)	0.00 (3)	1.00 (3)	2.33 (3)	3.67 (2)	0.44 (2)	0.00 (2)	1.20 (2)	4.00 (2)
345	275-366	1432	8.67 (9)	5.50 (4)	1.00 (5)	0.25 (4)	0.25 (4)	0.00 (3)	0.00 (8)	0.71 (7)	0.86 (5)	0.00 (5)	0.46 (3)	0.56 (5)
346	275-366	865	86.40 (5)	24.67 (3)	61.33 (3)	9.67 (15)	4.36 (14)	6.36 (11)	0.29 (7)	1.00 (3)	1.00 (3)	2.33 (3)	0.50 (5)	2.07 (3)
368	275-366	334	286.00 (2)	29.00 (2)	79.50 (2)	42.33 (6)	26.70 (10)	17.00 (8)	1.17 (12)	38.00 (2)	0.30 (3)	26.50 (2)	64.00 (3)	132.44 (2)
387	275-366	718	508.25 (4)	11.00 (2)	92.67 (3)	15.40 (5)	12.00 (3)	2.33 (3)	5.11 (9)	12.67 (3)	8.33 (2)	18.61 (2)	31.56 (3)	66.17 (2)
388	275-366	361	75.00 (2)	---	78.00 (2)	29.00 (3)	24.33 (3)	9.67 (3)	7.14 (7)	8.00 (2)	14.00 (2)	23.67 (2)	27.00 (2)	126.50 (2)
392	275-366	145	1164.00 (2)	322.00 (2)	25.50 (2)	14.33 (3)	5.67 (3)	8.33 (3)	7.00 (3)	38.61 (2)	40.44 (2)	12.50 (2)	59.50 (2)	33.50 (2)
729	367-549	186	2143.50 (2)	1197.00 (2)	182.50 (2)	127.67 (3)	241.50 (3)	149.33 (3)	681.78 (9)	145.00 (2)	214.67 (2)	1006.00 (2)	550.00 (2)	329.00 (2)
731	367-549	216	400.00 (2)	---	235.50 (2)	44.67 (3)	182.67 (3)	27.67 (3)	42.86 (7)	123.22 (2)	138.00 (1)	135.00 (2)	287.44 (2)	2421.67 (2)
733	367-549	468	566.33 (3)	---	204.50 (2)	285.67 (3)	176.33 (3)	19.67 (3)	39.33 (9)	1625.50 (2)	22.41 (3)	41.00 (2)	123.67 (2)	270.00 (2)
735	367-549	272	188.50 (2)	--- (2)	---	119.00 (3)	192.67 (3)	79.00 (3)	16.91 (11)	28.50 (2)	139.31 (2)	181.50 (2)	198.50 (2)	154.67 (2)
730	550-731	170	31.00 (2)	---	---	273.50 (2)	55.00 (2)	261.00 (3)	18.67 (3)	72.11 (2)	21.16 (2)	26.00 (2)	645.31 (2)	204.28 (2)
732	550-731	231	32.00 (2)	---	154.00 (2)	35.50 (2)	161.00 (2)	16.50 (2)	80.67 (3)	67.72 (2)	10.80 (2)	359.00 (2)	19.50 (2)	151.50 (2)
734	550-731	228	420.50 (2)	---	36.00 (2)	15.00 (2)	87.50 (2)	62.00 (2)	35.67 (3)	58.40 (2)	61.70 (2)	616.44 (2)	95.11 (2)	132.50 (2)
736	550-731	175	173.50 (2)	22.50 (2)	222.00 (2)	43.50 (2)	40.50 (2)	25.00 (3)	22.00 (7)	73.33 (2)	78.80 (2)	317.50 (2)	105.64 (2)	94.00 (2)
737	732-914	227	---	---	---	---	---	---	---	41.50 (2)	5.50 (2)	2.00 (2)	0.50 (2)	2.00 (2)
741	732-914	223	---	---	---	---	---	---	---	---	2.50 (2)	0.50 (2)	16.21 (2)	3.56 (2)
745	732-914	348	---	---	---	---	---	---	---	---	0.00 (2)	17.00 (2)	4.00 (2)	4.50 (2)
748	732-914	159	---	---	---	---	---	---	---	---	17.00 (2)	1.00 (2)	4.00 (2)	0.50 (2)
Upper (95% CI)			235.9	58.8	60.9	52.0	42.7	20.3	32.1	892.7	19.5	237.7	90.8	598.7
Weighted mean (by area)			155.9	43.4	42.8	28.1	29.4	13.3	18.0	82.1	15.2	52.9	41.6	85.0
Lower (95% CI)			75.9	28.0	24.6	4.1	16.0	6.3	3.6	-728.5	6.5	-131.9	-7.5	-428.6
Abundance of surveyed area (millions)			240.7	57.0	63.5	43.3	45.3	20.6	27.7	129.4	21.3	88.7	69.8	142.5

Table 5. Mean weight (kg) per standard tow from Canadian spring 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 from 1980-1995 are Campelen trawl equivalent units based on a comparative fishing experiment with an Engel 145 otter trawl (see text). Data from 1996 to present are actual Campelen data. GA=GadusAtlantica, WT=Wilfred Templeman, AN=Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	May 8-May 13 1980-Q2 GA 36	Apr 17-May 26 1985-Q2 WT 28-30	May 11- May 29 1991-Q2 WT 106-7	May 13-June 7 1992-Q2 WT 120-2	May 18-Jun 10 1993-Q2 WT 137-8	May 22-Jun 10 1994-Q2 WT 153-54	May 27-Jun 14 1995-Q2 WT169-70	May-June 1996-Q2 WT 189-191	May-June 1997-Q2 WT 205-208	May-June 1998-Q2 WT223-224	May-June 1999-Q2 WT 238-241
347	184-274	983	0.00 (4)	0.02 (5)	0.04 (2)	0.00 (4)	0.00 (4)	0.00 (4)	0.00 (4)	0.00 (4)	0.00 (4)	0.00 (4)	0.00 (3)
366	184-274	1394	3.63 (6)	0.21 (6)	---	0.10 (6)	0.00 (7)	0.07 (5)	0.00 (5)	0.00 (5)	0.62 (6)	0.00 (5)	0.00 (4)
369	184-274	961	0.17 (4)	0.13 (5)	0.00 (2)	0.00 (4)	0.00 (5)	0.04 (3)	0.00 (3)	0.00 (4)	0.00 (4)	0.00 (4)	0.00 (3)
386	184-274	983	1.60 (4)	0.14 (5)	0.17 (3)	0.00 (4)	0.08 (5)	0.00 (4)	0.00 (4)	0.02 (4)	0.00 (4)	0.01 (4)	0.05 (3)
389	184-274	821	15.04 (2)	0.02 (5)	0.38 (3)	0.00 (3)	0.00 (4)	0.00 (3)	0.67 (4)	0.00 (4)	0.77 (3)	0.00 (3)	0.00 (3)
391	184-274	282	1.63 (2)	0.00 (2)	0.00 (3)	0.50 (2)	0.00 (2)	0.00 (2)	0.41 (2)	0.00 (2)	0.00 (2)	0.02 (2)	0.01 (2)
345	275-366	1432	7.51 (4)	2.83 (5)	0.10 (3)	0.00 (6)	0.00 (2)	0.24 (5)	0.00 (5)	0.19 (6)	0.03 (5)	0.53 (6)	0.00 (5)
346	275-366	865	16.82 (2)	14.51 (2)	---	0.49 (4)	0.55 (6)	0.57 (3)	0.29 (3)	0.09 (4)	0.75 (3)	0.12 (3)	0.81 (3)
368	275-366	334	10.65 (2)	4.86 (2)	---	4.23 (2)	3.13 (4)	0.91 (2)	0.40 (2)	3.03 (3)	0.72 (2)	1.39 (2)	1.01 (2)
387	275-366	718	11.42 (3)	3.89 (6)	11.56 (3)	2.36 (3)	1.97 (2)	0.18 (3)	1.60 (3)	2.37 (3)	2.20 (2)	5.53 (3)	3.40 (3)
388	275-366	361	1.94 (2)	7.09 (2)	2.80 (3)	0.35 (2)	0.50 (3)	0.00 (2)	0.97 (2)	0.40 (3)	2.08 (2)	2.47 (2)	1.95 (2)
392	275-366	145	12.95 (3)	2.05 (2)	0.51 (2)	1.51 (2)	0.57 (2)	0.00 (2)	5.01 (2)	7.28 (2)	23.60 (2)	14.50 (2)	0.90 (2)
729	367-549	186	---	6.45 (2)	4.43 (2)	14.56 (2)	7.45 (2)	3.74 (2)	9.88 (2)	140.25 (2)	10.42 (3)	36.78 (2)	100.97 (2)
731	367-549	216	166.22 (2)	14.55 (2)	5.81 (2)	6.75 (2)	6.70 (3)	9.01 (2)	5.78 (2)	43.53 (3)	10.40 (2)	28.30 (2)	225.87 (2)
733	367-549	468	24.73 (3)	458.64 (3)	6.06 (2)	16.76 (2)	5.96 (2)	5.49 (2)	1.60 (2)	79.86 (3)	67.16 (2)	42.55 (2)	60.78 (2)
735	367-549	272	21.13 (2)	19.11 (2)	---	18.14 (2)	3.41 (2)	7.50 (2)	4.44 (2)	17.80 (3)	37.41 (2)	443.88 (2)	97.90 (2)
730	550-731	170	159.42 (2)	3654.40 (2)	42.73 (2)	34.23 (2)	72.36 (2)	9.19 (2)	18.74 (2)	88.44 (2)	1.38 (2)	77.20 (3)	101.78 (2)
732	550-731	231	51.77 (2)	45.32 (2)	57.51 (2)	62.14 (2)	91.09 (2)	12.60 (2)	15.28 (2)	12.77 (2)	15.96 (2)	37.68 (2)	28.98 (2)
734	550-731	228	1296.40 (2)	116.80 (2)	44.08 (2)	43.13 (2)	7.72 (2)	11.64 (2)	29.68 (2)	85.49 (2)	26.97 (2)	69.30 (2)	8.61 (2)
736	550-731	175	---	129.59 (2)	---	15.58 (2)	11.72 (2)	5.41 (2)	11.96 (2)	16.22 (2)	19.38 (2)	6.18 (2)	11.31 (2)
737	732-914	227	---	---	---	---	---	1.63 (2)	---	---	---		---
741	732-914	223	---	---	---	---	---	0.61 (2)	---	---	---		---
745	732-914	348	---	---	---	---	---	0.26 (2)	---	---	---		---
748	732-914	159	---	---	---	---	---	0.30 (2)	---	---	---		---
Upper (95% CI)a			193.9	778.0	11.6	11.9	27.68	2.24	2.57	20.0	9.3	96.0	69.5
Weighted mean (by area)			41.2	82.8	5.6	4.8	4.18	1.49	2.13	10.9	6.0	17.9	13.8
Lower (95% CI)a			-111.6	-612.3	-0.5	-2.3	-19.31	0.74	1.69	1.8	2.7	-60.3	-41.9
Survey biomass index (tons)			61502	127888	6267	7404	6461	2302	3284	16825	9277	27596	21314

Table 6. Mean weight (kg) per standard tow from various Canadian winter and summer 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). GA=GadusAtlantica, WT=Wilfred Templeman, AN=Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	Jan 10-Feb 11 1985-Q1 WT 22-24	Jan 22-Feb 27 1986-Q1 WT 42-44	Jan 17-Jan 25 1990-Q1 WT 90	Aug 16-Aug 29 1978-Q3 GA 12	Sep 4-Sep 10 1979-Q3 GA 25	Sep 18-Sep 26 1981-Q3 GA 55	Jul 26-Sep 3 1984-Q3 WT 16-18	Jul 27-Aug 25 1985-Q3 WT 32-34	Aug 7-Aug 19 1990-Q3 WT 98	Aug 4- Aug 11 1991-Q3 WT 109	Aug 5-Aug 15 1993-Q3 GA 223
347	184-274	983	0.00 (5)	0.26 (4)	0.09 (4)	64.75 (3)	0.00 (2)	1.61 (4)	0.00 (6)	0.00 (3)	0.44 (4)	0.00 (3)	0.00 (3)
366	184-274	1394	0.00 (5)	0.35 (2)	0.18 (5)	70.50 (3)	3.91 (2)	28.33 (6)	2.91 (11)	4.10 (5)	2.58 (4)	0.10 (3)	1.26 (2)
369	184-274	961	0.00 (5)	0.00 (3)	0.00 (4)	0.00 (3)	0.63 (2)	5.32 (4)	0.05 (7)	0.15 (6)	1.03 (4)	2.79 (4)	0.00 (3)
386	184-274	983	0.00 (5)	0.40 (7)	2.58 (4)	69.30 (3)	9.52 (2)	8.32 (4)	9.96 (8)	11.30 (5)	0.30 (7)	0.30 (3)	0.00 (3)
389	184-274	821	0.97 (4)	0.36 (4)	0.00 (3)	0.10 (3)	---	2.77 (3)	7.97 (6)	0.75 (4)	1.34 (3)	0.20 (3)	0.34 (3)
391	184-274	282	0.00 (2)	0.00 (3)	0.10 (5)	0.00 (2)	9.83 (2)	0.32 (2)	0.10 (2)	0.00 (2)	0.29 (5)	1.24 (3)	0.23 (3)
345	275-366	1432	0.93 (3)	0.21 (3)	0.09 (5)	50.70 (2)	70.55 (4)	33.92 (5)	22.19 (7)	32.20 (7)	8.04 (6)	2.14 (4)	0.86 (3)
346	275-366	865	5.64 (4)	1.55 (4)	3.38 (3)	146.01 (2)	81.03 (4)	54.53 (3)	119.76 (6)	47.61 (3)	120.04 (7)	9.47 (4)	2.57 (3)
368	275-366	334	1.66 (2)	---	5.01 (2)	1556.20 (2)	77.48 (3)	261.75 (2)	1366.30 (2)	126.45 (2)	545.05 (7)	112.11 (4)	11.95 (3)
387	275-366	718	49.01 (4)	6.81 (4)	55.18 (3)	292.79 (2)	352.46 (5)	928.47 (3)	1341.20 (3)	501.85 (3)	88.37 (10)	47.10 (5)	24.72 (3)
388	275-366	361	5.72 (3)	5.01 (3)	2.89 (2)	568.32 (2)	1059.10 (3)	233.12 (2)	50.92 (2)	96.07 (2)	42.58 (7)	10.07 (3)	5.33 (3)
392	275-366	145	1.42 (2)	3.15 (3)	2.08 (2)	---	429.96 (3)	249.94 (2)	783.64 (2)	34.58 (2)	31.30 (9)	105.45 (3)	8.12 (3)
729	367-549	186	987.53 (2)	754.72 (2)	80.51 (2)	---	277.43 (3)	608.41 (2)	162.05 (2)	419.21 (2)	132.44 (7)	69.30 (2)	107.99 (3)
731	367-549	216	24.70 (3)	--- (1)	19.41 (2)	339.34 (2)	288.20 (3)	95.19 (2)	87.92 (2)	94.99 (2)	54.61 (6)	67.96 (3)	93.33 (3)
733	367-549	468	670.29 (3)	152.73 (2)	27.89 (2)	553.31 (2)	819.89 (3)	912.39 (2)	214.76 (4)	759.06 (2)	233.83 (9)	210.97 (4)	112.82 (3)
735	367-549	272	4.18 (2)	---	45.94 (2)	616.36 (2)	291.17 (3)	464.28 (2)	319.91 (3)	147.66 (2)	320.47 (6)	38.71 (3)	16.21 (3)
730	550-731	170	313.63 (2)	---	47.87 (2)	709.46 (2)	268.32 (3)	319.49 (2)	43.25 (2)	140.65 (2)	81.28 (4)	92.11 (3)	32.21 (3)
732	550-731	231	152.24 (2)	---	31.33 (2)	57.55 (2)	36.68 (2)	36.78 (2)	37.43 (2)	22.35 (2)	25.26 (9)	36.52 (3)	59.45 (3)
734	550-731	228	81.97 (2)	191.89 (2)	62.48 (2)	1084.60 (2)	368.78 (3)	500.24 (2)	258.73 (3)	429.61 (2)	122.31 (5)	27.00 (3)	13.25 (3)
736	550-731	175	---	---	53.72 (2)	95.56 (2)	160.36 (3)	53.26 (2)	---	14.89 (2)	40.46 (6)	5.56 (3)	7.99 (3)
737	732-914	227	---	---	---	---	---	---	---	---	---	---	---
741	732-914	223	---	---	---	---	---	---	---	---	---	---	0.17 (3)
745	732-914	348	---	---	---	---	---	---	---	---	---	---	0.15 (3)
748	732-914	159	---	---	---	---	---	---	---	---	---	---	1.57 (3)
Upper (95% CI)			87.4	135.9	24.1	330.9	249.0	374.5	381.9	195.9	96.0	31.0	22.21
Weighted mean (by area)			59.4	27.1	11.8	207.6	159.2	169.3	182.7	104.3	60.1	24.3	13.50
Lower (95% CI)			31.4	-81.8	-0.5	84.4	69.3	-35.9	-16.5	12.7	24.2	17.7	4.78
Survey biomass index (tons)			90245	36568	18202	311163	227788	261384	277711	161038	92840	37572	20838

Table 7. Mean weight (kg) per standard tow from Canadian autumn 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 from 1985-1994 are Campelen trawl equivalent units based on a comparative fishing experiment with an Engel 145 otter trawl (see text). Data from 1995 to present are actual Campelen data. GA=GadusAtlantica, WT=Wilfred Templeman, AN=Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	Oct 9-Nov 18 1985-Q4 WT 37-39	Nov13-Nov 30 1986-Q4 AN 72	Oct 18-Nov 18 1990-Q4 WT 101	Nov 10- Dec 2 1991-Q4 WT 114-5	Nov 5-Nov 29 1992-Q4 WT 129-30	Nov 12- Dec 4 1993-Q4 WT 145-6	Nov 8-Dec 7 1994-Q4 WT 161-62	Oct 3-Nov23 1995-Q4 WT176-79	Sep-Nov 1996-Q4 WT196-198 T41	Oct-Dec 1997-Q4 WT213-217 T56	Nov-Dec 1998-Q4 WT231-233 T75-76	Nov-Dec 1999-Q4 WT 246-248 T88
347	184-274	983	0.00 (5)	0.00 (4)	0.00 (2)	0.00 (4)	0.00 (2)	0.00 (4)	0.00 (8)	0.00 (4)	0.00 (3)	0.00 (3)	0.00 (3)	0.00 (3)
366	184-274	1394	4.83 (9)	1.36 (4)	0.00 (6)	0.05 (21)	0.28 (24)	0.06 (14)	0.03 (10)	0.09 (5)	0.03 (5)	0.42 (5)	0.31 (5)	0.29 (5)
369	184-274	961	0.00 (6)	1.03 (3)	0.00 (4)	0.15 (9)	0.00 (8)	0.04 (7)	0.00 (3)	1.82 (3)	0.00 (2)	0.52 (3)	0.00 (3)	0.06 (3)
386	184-274	983	0.41 (5)	0.94 (4)	0.37 (4)	0.00 (3)	0.00 (3)	0.00 (3)	0.00 (3)	0.65 (4)	0.00 (3)	1.22 (3)	0.00 (3)	0.07 (3)
389	184-274	821	1.96 (5)	0.70 (4)	0.57 (3)	0.00 (3)	0.12 (3)	0.00 (3)	0.00 (3)	0.57 (3)	0.26 (3)	0.00 (3)	0.00 (3)	0.73 (3)
391	184-274	282	3.71 (2)	4.61 (2)	0.00 (2)	0.00 (3)	0.00 (3)	0.47 (3)	0.63 (3)	1.32 (2)	0.00 (2)	0.00 (2)	0.09 (2)	1.15 (2)
345	275-366	1432	2.84 (9)	3.84 (4)	0.46 (5)	0.11 (4)	0.18 (4)	0.00 (3)	0.00 (8)	0.06 (7)	0.15 (5)	0.00 (5)	0.02 (5)	0.01 (5)
346	275-366	865	44.07 (5)	12.95 (3)	29.56 (3)	2.44 (15)	0.81 (14)	1.56 (11)	0.08 (7)	0.17 (3)	0.17 (3)	0.23 (3)	0.01 (2)	0.24 (3)
368	275-366	334	112.15 (2)	6.84 (2)	14.43 (2)	7.15 (6)	4.69 (10)	1.38 (8)	0.12 (12)	5.33 (2)	0.00 (3)	2.23 (2)	6.32 (2)	19.31 (2)
387	275-366	718	193.26 (4)	2.77 (2)	29.25 (3)	5.06 (5)	2.28 (3)	0.59 (3)	0.85 (9)	1.75 (3)	0.55 (2)	1.68 (2)	4.64 (2)	10.91 (2)
388	275-366	361	22.46 (2)	---	4.63 (2)	2.41 (3)	3.84 (3)	2.29 (3)	0.98 (7)	1.29 (2)	2.17 (2)	2.38 (2)	4.10 (2)	23.38 (2)
392	275-366	145	342.65 (2)	87.30 (2)	2.76 (2)	0.95 (3)	0.62 (3)	1.60 (3)	1.93 (3)	3.06 (2)	4.44 (2)	2.23 (2)	10.38 (2)	6.98 (2)
729	367-549	186	855.75 (2)	378.90 (2)	63.74 (2)	32.02 (3)	72.02 (3)	42.93 (3)	179.20 (9)	24.97 (2)	35.53 (2)	246.23 (2)	165.19 (2)	68.60 (2)
731	367-549	216	203.45 (2)	---	82.40 (2)	8.75 (3)	41.49 (3)	5.36 (3)	7.31 (7)	17.53 (2)	24.75 (1)	22.18 (2)	75.17 (2)	658.36 (2)
733	367-549	468	255.38 (3)	---	50.70 (2)	77.02 (3)	53.68 (3)	4.60 (3)	8.80 (9)	702.57 (2)	4.13 (3)	7.50 (2)	25.88 (2)	83.50 (2)
735	367-549	272	89.77 (2)	46.11 (2)	---	25.86 (3)	63.43 (3)	7.16 (3)	2.56 (11)	4.45 (2)	28.98 (2)	28.93 (2)	36.85 (2)	36.73 (2)
730	550-731	170	16.04 (2)	---	---	175.39 (2)	27.90 (2)	122.00 (3)	7.02 (3)	24.21 (2)	8.88 (2)	9.73 (2)	239.16 (2)	98.46 (2)
732	550-731	231	17.48 (2)	---	86.00 (2)	16.02 (2)	53.62 (2)	4.21 (2)	24.56 (3)	15.11 (2)	4.08 (2)	95.05 (2)	6.73 (2)	55.53 (2)
734	550-731	228	265.85 (2)	---	17.70 (2)	9.60 (2)	33.35 (2)	18.10 (2)	12.31 (3)	19.99 (2)	23.63 (2)	152.16 (2)	33.98 (2)	67.95 (2)
736	550-731	175	78.29 (2)	12.12 (2)	106.09 (2)	18.32 (2)	11.39 (2)	6.04 (3)	6.67 (7)	16.76 (2)	32.52 (2)	78.95 (2)	24.15 (2)	38.50 (2)
737	732-914	227	---	---	---	---	---	---	---	13.07 (2)	2.58 (2)	0.93 (2)	0.14 (2)	1.08 (2)
741	732-914	223	---	---	---	---	---	---	---	---	0.53 (2)	0.23 (2)	7.33 (2)	1.71 (2)
745	732-914	348	---	---	---	---	---	---	---	---	0.00 (2)	5.85 (2)	1.10 (2)	1.70 (2)
748	732-914	159	---	---	---	---	---	---	---	---	6.30 (2)	0.45 (2)	2.40 (2)	0.35 (2)
Upper (95% CI)			105.3	18.9	22.2	15.3	12.83	8.07	8.66	388.2	5.1	57.2	25.9	165.30
Weighted mean (by area)			63.6	13.0	14.0	8.8	8.69	3.89	4.65	31.8	3.2	11.7	11.1	23.20
Lower (95% CI)			21.9	7.2	5.7	2.4	4.56	-0.28	0.63	-324.6	0.7	-33.9	-3.7	-119.00
Survey biomass index (tons)			98233	17119	20743	13665	13424	6011	7173	50078	4691	19544	18522	38861

Table 8. Mean number per standard tow from Canadian spring 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 from 1991-1995 are Campelen trawl equivalent units based on a comparative fishing experiment with an Engel 145 otter trawl (see text). Data from 1996 to present are actual Campelen data. GA=GadusAtlantica, WT=Wilfred Templeman, AN=Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	May 3-11 1991-Q2 W.T. 106	May 2-13 1992-Q2 WT 119-20	May 5-18 1993-Q2 WT 136-7	May 14-22 1994-Q2 WT 153	May 13-27 1995-Q2 WT 168-69	May22-May30 1996-Q2 WT 189	May-Jun 1997-Q2 WT 205-206	May-Jun 1998-Q2 WT 221-222	May-Jun 1999-Q2 WT 239-240
359	093-183	421	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	3.50 (2)	0.00 (2)	180.50 (2)
377	093-183	100	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.50 (2)	0.50 (2)	1.50 (2)	0.00 (2)
382	093-183	647	0.50 (2)	0.00 (3)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)
358	185-274	225	68.00 (2)	34.00 (2)	1473.00 (2)	68.00 (2)	3.50 (2)	152.00 (2)	144.50 (2)	1680.89 (2)	99.00 (2)
378	185-274	139	8.00 (3)	42.00 (2)	1.00 (2)	0.50 (2)	2.50 (2)	62.00 (2)	11.00 (2)	15.50 (2)	148.50 (2)
381	185-274	182	0.50 (2)	1.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	8.44 (2)	0.50 (2)	0.00 (2)	5.50 (2)
357	275-366	164	212.50 (2)	593.00 (2)	395.50 (2)	210.50 (2)	159.50 (2)	197.33 (2)	245.50 (2)	3096.56 (2)	6973.44 (2)
379	275-366	106	56.50 (2)	15.50 (2)	13.50 (2)	59.50 (2)	42.50 (2)	569.00 (2)	152.50 (2)	195.11 (2)	459.50 (2)
380	275-366	116	8.00 (2)	0.00 (2)	13.50 (2)	10.50 (2)	21.50 (2)	47.50 (2)	72.00 (2)	9.50 (2)	41.00 (2)
723	367-549	155	261.00 (2)	510.50 (2)	270.00 (2)	129.00 (2)	112.00 (2)	252.31 (2)	366.00 (2)	364.50 (2)	401.50 (2)
725	367-549	105	229.00 (2)	---	89.50 (2)	43.00 (2)	48.50 (2)	455.00 (2)	490.40 (2)	130.83 (2)	317.22 (2)
727	367-549	160	24.50 (2)	15.50 (2)	50.00 (2)	46.00 (2)	94.00 (2)	166.06 (2)	248.00 (2)	141.00 (2)	88.00 (2)
724	550-731	124	517.50 (2)	103.50 (2)	166.00 (2)	57.50 (2)	184.50 (2)	120.56 (2)	233.00 (2)	488.44 (2)	142.67 (2)
726	550-731	72	385.00 (2)	75.00 (2)	86.00 (2)	31.50 (2)	163.00 (2)	208.61 (2)	546.00 (2)	1039.00 (2)	565.00 (2)
728	550-731	156	66.50 (2)	75.50 (2)	965.00 (2)	34.33 (3)	109.00 (2)	62.39 (2)	---	94.72 (2)	356.83 (2)
752	732-914	134	---	---	---	1.50 (2)	---	---	---	---	---
756	732-914	106	---	---	---	5.50 (2)	---	---	---	---	---
760	732-914	154	---	---	---	3.50 (2)	---	---	---	---	---
Upper (95% CI)			173.0	129.4	1767.0	96.3	136.5	169.1	197.9	2491.3	5168.5
Weighted mean (by area)			79.8	81.0	221.4	32.3	43.0	103.0	103.2	401.5	536.4
Lower (95% CI)			-13.4	32.6	-1324.1	-31.8	-50.6	36.8	8.5	-1688.3	-4095.6
Abundance of surveyed area (millions)			31.5	30.8	87.5	14.5	17.0	40.7	38.5	158.6	211.9

Table 9. Mean number per standard tow from Canadian summer surveys in Div. 3N where strata greater than 366 m (200 fath.) were sampled. Dashes (---) represent 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). GA = Gadus Atlantica, WT = Wilfred Templeman.

Stratum	Depth Range (M)	Area (sq. n.) mi	Aug 11-18 1991-Q3 WT 109	Aug 15-20 1993-Q3 GA 233
359	093-183	421	205.75 (4)	1.00 (3)
377	093-183	100	0.00 (2)	4.67 (3)
382	093-183	647	0.00 (3)	0.00 (3)
358	185-274	225	979.67 (3)	25736.00 (4)
378	185-274	139	26.67 (3)	16.67 (3)
381	185-274	182	5.67 (3)	6.00 (4)
357	275-366	164	2607.00 (2)	1408.70 (3)
379	275-366	106	7880.00 (2)	2304.00 (3)
380	275-366	116	3471.50 (2)	793.50 (2)
723	367-549	155	---	3159.80 (4)
725	367-549	105	427.00 (3)	1356.30 (3)
727	367-549	160	109.00 (4)	2699.00 (3)
724	550-731	124	---	1317.00 (4)
726	550-731	72	73.50 (2)	545.50 (2)
728	550-731	156	16.75 (4)	164.67 (3)
752	732-914	134	---	---
756	732-914	106	---	---
760	732-914	154	---	---
Upper (95% CI)			1536.0	7088.9
Weighted mean (by area)			789.6	2665.2
Lower (95% CI)			43.3	-1758.6
Abundance of surveyed area (millions)			281.7	1052.9

Table 10. Mean number per standard tow from Canadian autumn 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 from 1991-1994 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	Oct 27-Nov 10 1991-Q4 WT 113-4	Oct 26-Nov 5 1992-Q4 WT 128-9	Nov 1-12 1993-Q4 WT 144-5	Oct 29-Dec 13 1994-Q4 WT 160-61	Sep28-Oct26 1995-Q4 WT 176-77	Nov25-Dec13 1996-Q4 AN 253 T41-42	Oct-Dec 1997-Q4 WT213-217	Sep-Oct 1998-Q4 WT 229-230	Sep-Oct 1999-Q4 WT 246-247
359	093-183	421	0.00 (2)	0.00 (2)	0.00 (2)	4.00 (2)	1.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)
377	093-183	100	---	0.00 (2)	0.50 (2)	0.50 (2)	2.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)
382	093-183	647	0.00 (3)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	3.11 (2)	0.00 (2)	0.00 (2)	0.00 (2)
358	185-274	225	9350.00 (2)	30425.00 (2)	17.50 (2)	350.00 (2)	0.50 (2)	4.40 (2)	11.41 (3)	6664.50 (2)	356.00 (2)
378	185-274	139	183.50 (2)	1.50 (2)	4.50 (2)	5.00 (2)	1.00 (2)	3.00 (2)	48.44 (2)	18.50 (2)	0.00 (2)
381	185-274	182	4.50 (2)	---	3.00 (2)	0.00 (2)	425.78 (2)	74.83 (2)	144.00 (2)	2.50 (2)	0.50 (2)
357	275-366	164	3521.50 (2)	5207.50 (2)	262.50 (2)	3687.50 (2)	733.78 (2)	17.09 (2)	184.22 (2)	9965.50 (2)	---
379	275-366	106	---	123.00 (2)	270.50 (2)	100.50 (2)	548.89 (2)	25.78 (2)	7864.83 (2)	2540.83 (2)	5852.67 (2)
380	275-366	116	179.50 (2)	---	10.50 (2)	0.00 (2)	10297.78 (2)	858.22 (2)	3610.67 (2)	12.83 (2)	356.00 (2)
723	367-549	155	146.00 (2)	---	1832.50 (2)	1212.00 (2)	329.80 (2)	48.50 (2)	930.00 (2)	805.50 (2)	304.50 (2)
725	367-549	105	---	1672.50 (2)	270.50 (2)	477.50 (2)	293.80 (2)	136.50 (2)	1345.60 (2)	1216.00 (2)	410.50 (2)
727	367-549	160	---	---	208.00 (2)	136.00 (2)	791.00 (2)	420.00 (2)	1027.44 (3)	654.56 (2)	267.17 (2)
724	550-731	124	29.00 (2)	---	532.00 (2)	802.50 (2)	243.07 (2)	157.00 (2)	18.00 (2)	255.33 (2)	948.50 (2)
726	550-731	72	---	---	65.50 (2)	207.00 (2)	322.00 (2)	906.00 (2)	9.50 (2)	22.72 (2)	311.06 (2)
728	550-731	156	---	---	---	8.50 (2)	120.86 (2)	339.56 (2)	23.00 (2)	17.50 (2)	250.00 (2)
752	732-914	134	---	---	---	---	---	---	---	1.89 (2)	---
756	732-914	106	---	---	---	---	---	---	---	1.00 (2)	---
760	732-914	154	---	---	---	---	---	---	---	0.00 (2)	---
Upper (95% CI)			7884.4	38182.7	1042.7	2427.2	7503.4	673.1	3693.1	7078.8	1568.3
Weighted mean (by area)			1267.7	4136.6	182.1	373.3	770.0	133.7	676.9	1163.9	389.2
Lower (95% CI)			-5349.1	-29909.5	-678.5	-1680.6	-5963.4	-405.8	-2339.3	-4751.0	-790.0
Abundance of surveyed area (millions)			378.9	1085.2	68.0	147.5	304.2	52.8	267.4	522.9	145.0

Table 11. Mean weight (kg) per standard tow from Canadian spring 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 from 1991-1995 are Campelen trawl equivalent units based on a comparative fishing experiment with an Engel 145 otter trawl (see text). Data from 1996 to present are actual Campelen data. GA=GadusAtlantica, WT=Wilfred Templeman, AN=Alfred Needler.

Stratum	Depth Range (M)	Area (sq. n.) mi	May 3-11 1991-Q2 W.T. 106	May 2-13 1992-Q2 WT 119-20	May 5-18 1993-Q2 WT 136-7	May 14-22 1994-Q2 WT 153	May 13-27 1995-Q2 WT 168-69	May22-May30 1996-Q2 WT 189	May-Jun 1997-Q2 WT 205-206	May-Jun 1998-Q2 WT 221-222	May-Jun 1999-Q2 WT 238-241
359	093-183	421	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.45 (2)	0.00 (2)	2.90 (2)
377	093-183	100	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.09 (2)	0.14 (2)	0.07 (2)	0.00 (2)
382	093-183	647	0.18 (2)	0.00 (3)	0.00 (2)	0.00 (2)	0.00 (3)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)
358	185-274	225	1.17 (2)	1.27 (2)	104.02 (2)	2.49 (2)	2.49 (2)	7.45 (2)	9.78 (2)	253.77 (2)	5.05 (2)
378	185-274	139	0.86 (3)	2.38 (2)	0.19 (2)	0.08 (2)	0.08 (2)	8.57 (2)	1.47 (2)	2.30 (2)	16.05 (2)
381	185-274	182	0.10 (2)	0.19 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.16 (2)	0.00 (2)	0.00 (2)	0.62 (2)
357	275-366	164	19.13 (2)	23.74 (2)	35.10 (2)	18.11 (2)	18.11 (2)	30.56 (2)	23.67 (2)	572.90 (2)	1298.99 (2)
379	275-366	106	5.44 (2)	1.26 (2)	1.70 (2)	4.93 (2)	4.93 (2)	65.43 (2)	19.83 (2)	24.24 (2)	70.48 (2)
380	275-366	116	0.23 (2)	0.00 (2)	1.07 (2)	0.37 (2)	0.37 (2)	4.63 (2)	9.43 (2)	1.08 (2)	6.16 (2)
723	367-549	155	29.65 (2)	47.13 (2)	60.68 (2)	16.31 (2)	16.31 (2)	32.63 (2)	40.28 (2)	97.85 (2)	114.55 (2)
725	367-549	105	26.90 (2)	---	15.20 (2)	6.27 (2)	6.27 (2)	78.18 (2)	76.49 (2)	25.61 (2)	89.29 (2)
727	367-549	160	3.38 (2)	1.66 (2)	5.89 (2)	8.06 (2)	8.06 (2)	19.32 (2)	48.67 (2)	24.53 (2)	21.95 (2)
724	550-731	124	81.56 (2)	18.60 (2)	69.46 (2)	19.14 (2)	19.14 (2)	37.54 (2)	33.63 (2)	204.41 (2)	54.84 (2)
726	550-731	72	87.80 (2)	22.86 (2)	18.84 (2)	7.93 (2)	7.93 (2)	71.41 (2)	138.67 (2)	358.83 (2)	168.23 (2)
728	550-731	156	20.24 (2)	20.22 (2)	421.30 (2)	9.61 (3)	9.61 (2)	12.70 (2)	---	26.80 (2)	106.58 (2)
752	732-914	134	---	---	---	0.51 (2)	---	---	---	---	---
756	732-914	106	---	---	---	2.38 (2)	---	---	---	---	---
760	732-914	154	---	---	---	1.17 (2)	---	---	---	---	---
Upper (95% CI)			26.1	10.3	340.8	5.4	11.0	27.2	28.0	198.0	956.50
Weighted mean (by area)			11.1	7.0	40.8	4.1	6.5	15.2	15.1	80.5	101.70
Lower (95% CI)			-4.0	3.7	-259.3	2.9	2.0	3.1	2.3	-37.0	-753.1
Survey biomass index (tons)			4375	2662	16112	1860	2572	5987	5651	31806	40182

Table 12. Mean weight (kg) per standard tow from Canadian summer surveys in Div. 3N where strata greater than 366 m (200 fath.) were sampled. Dashes (---) represent 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). GA = Gadus Atlantica, WT = Wilfred Templeman.

Stratum	Depth Range (M)	Area (sq. n.) mi	Aug 11-18 1991-Q3 WT 109	Aug 15-20 1993-Q3 GA 233
359	093-183	421	4.6 (4)	0.2 (3)
377	093-183	100	0.0 (2)	0.9 (3)
382	093-183	647	0.0 (3)	0.0 (3)
358	185-274	225	115.4 (3)	2069.1 (4)
378	185-274	139	3.7 (3)	2.2 (3)
381	185-274	182	1.0 (3)	1.0 (4)
357	275-366	164	517.7 (2)	224.9 (3)
379	275-366	106	1086.4 (2)	431.4 (3)
380	275-366	116	814.8 (2)	135.2 (2)
723	367-549	155	---	765.1 (4)
725	367-549	105	135.0 (3)	402.3 (3)
727	367-549	160	33.7 (4)	845.9 (3)
724	550-731	124	---	461.8 (4)
726	550-731	72	32.6 (2)	225.7 (2)
728	550-731	156	7.0 (4)	60.8 (3)
752	732-914	134	---	---
756	732-914	106	---	---
760	732-914	154	---	---
Upper (95% CI)			599.1	636.0
Weighted mean (by area)			133.5	328.6
Lower (95% CI)			-332.0	21.1
Survey biomass index (tons)			47624	129808

Table 13. Mean weight (kg) per standard tow from Canadian autumn 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 from 1991-1994 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	)ct 27-Nov 10 1991-Q4 (W.T. 113-4)	Oct 26-Nov 5 1992-Q4 (W.T. 128-9)	Nov 1-12 1993-Q4 (W.T.144-5)	Oct 29-Dec 13 1994-Q4 (W.T.160-61)	Sep28-Oct26 1995-Q4 WT 176-77	Nov25-Dec13 1996-Q4 AN 253 T41-42	Oct-Dec 1997-Q4 WT213-217	Sep-Oct 1998-Q4 WT 229-230	Sep-Oct 1999-Q4 WT 246-247
359	093-183	421	0.0 (2)	0.0 (2)	0.0 (2)	0.29 (2)	0.00 (2)	0.67 (2)	0.00 (2)	0.00 (2)	0.00 (2)
377	093-183	100	---	0.0 (2)	0.2 (2)	0.13 (2)	0.28 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)
382	093-183	647	0.0 (3)	0.0 (2)	0.0 (2)	0.00 (2)	0.14 (2)	0.00 (2)	0.00 (2)	0.00 (2)	0.00 (2)
358	185-274	225	390.4 (2)	3206.1 (2)	1.3 (2)	26.8 (2)	39.93 (2)	4.98 (2)	14.15 (2)	1018.88 (2)	41.05 (2)
378	185-274	139	48.4 (2)	0.3 (2)	0.8 (2)	0.33 (2)	0.47 (2)	0.38 (2)	5.64 (2)	4.72 (2)	0.00 (2)
381	185-274	182	0.1 (2)	---	1.1 (2)	0.00 (2)	0.00 (2)	1.48 (2)	0.79 (3)	0.65 (2)	0.01 (2)
357	275-366	164	414.7 (2)	727.5 (2)	23.8 (2)	405.3 (2)	1230.70 (2)	175.24 (2)	581.51 (2)	1714.52 (2)	--- (2)
379	275-366	106	. (1)	16.9 (2)	30.2 (2)	10.8 (2)	59.05 (2)	3.96 (2)	1405.50 (2)	500.43 (2)	1098.98 (2)
380	275-366	116	41.9 (2)	---	0.4 (2)	0.00 (2)	117.53 (2)	1.13 (2)	27.54 (2)	2.34 (2)	75.03 (2)
723	367-549	155	38.8 (2)	---	293.8 (2)	302.3 (2)	197.07 (2)	66.11 (2)	217.39 (3)	156.68 (2)	76.15 (2)
725	367-549	105	---	491.0 (2)	69.1 (2)	97.7 (2)	46.88 (2)	24.23 (2)	447.89 (2)	479.89 (2)	87.80 (2)
727	367-549	160	---	---	39.4 (2)	28.6 (2)	35.86 (2)	8.85 (2)	230.07 (2)	165.03 (2)	51.31 (2)
724	550-731	124	20.8 (2)	---	220.9 (2)	294.6 (2)	46.19 (2)	96.44 (2)	8.58 (2)	111.91 (2)	419.93 (2)
726	550-731	72	---	---	26.0 (2)	86.4 (2)	113.38 (2)	272.98 (2)	3.98 (2)	7.43 (2)	117.44 (2)
728	550-731	156	---	---	---	3.12 (2)	60.99 (2)	32.97 (2)	6.71 (2)	6.60 (2)	106.48 (2)
752	732-914	134	---	---	---	---	---	---	---	0.88 (2)	---
756	732-914	106	---	---	---	---	---	---	---	0.17 (2)	---
760	732-914	154	---	---	---	---	---	---	---	---	---
Upper (95% CI)			110.5	4050.9	144.9	158.1	910.5	158.2	717.7	1115.0	172.1
Weighted mean (by area)			81.0	468.8	35.4	62.2	102.9	28.5	129.4	208.6	88.9
Lower (95% CI)			51.5	-3113.2	-74.1	-33.6	-704.7	-101.1	-458.9	-697.8	5.7
Survey biomass index (tons)			24221	122990	13222	24584	40650	11277	51116	93703	33125

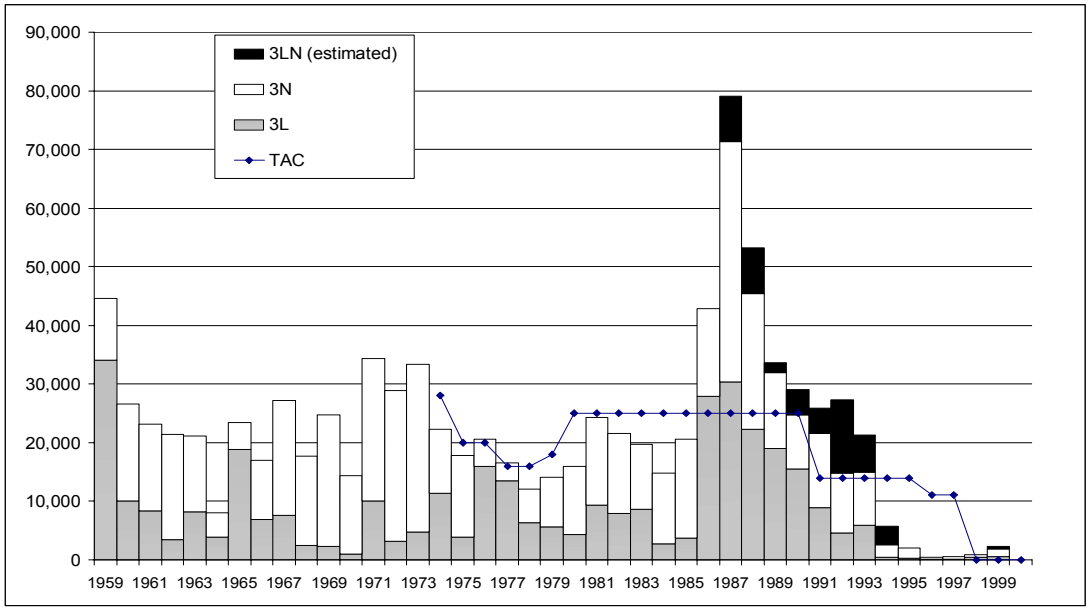

Fig. 1: Nominal catches and TACs of redfish in Div. 3LN (1994-96 are provisional).

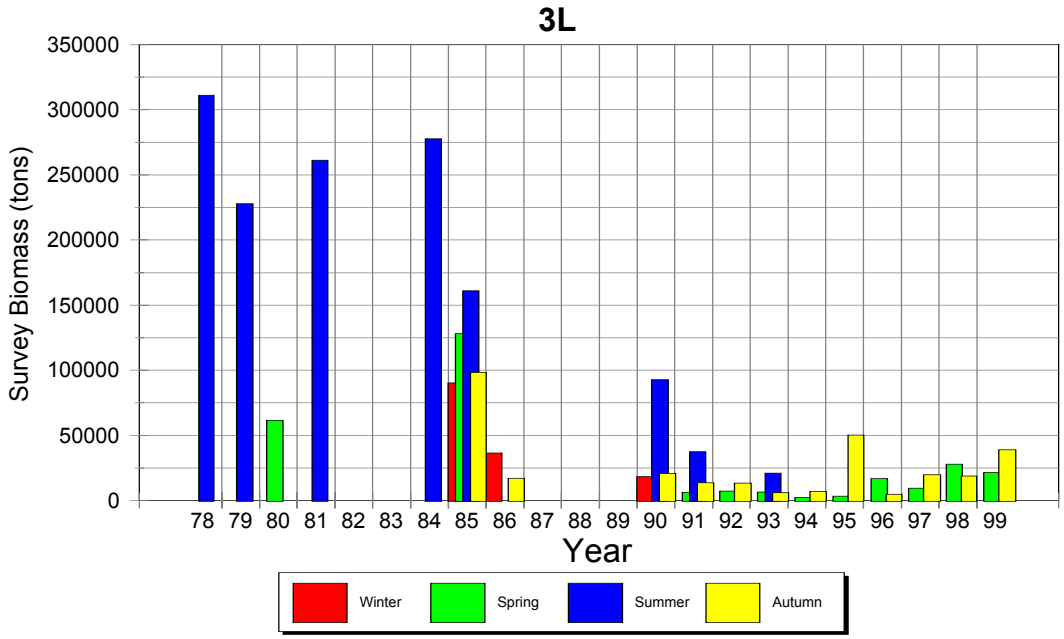

Fig. 2. Survey biomass index for Div. 3L based on Canadian surveys from 1978-1999.

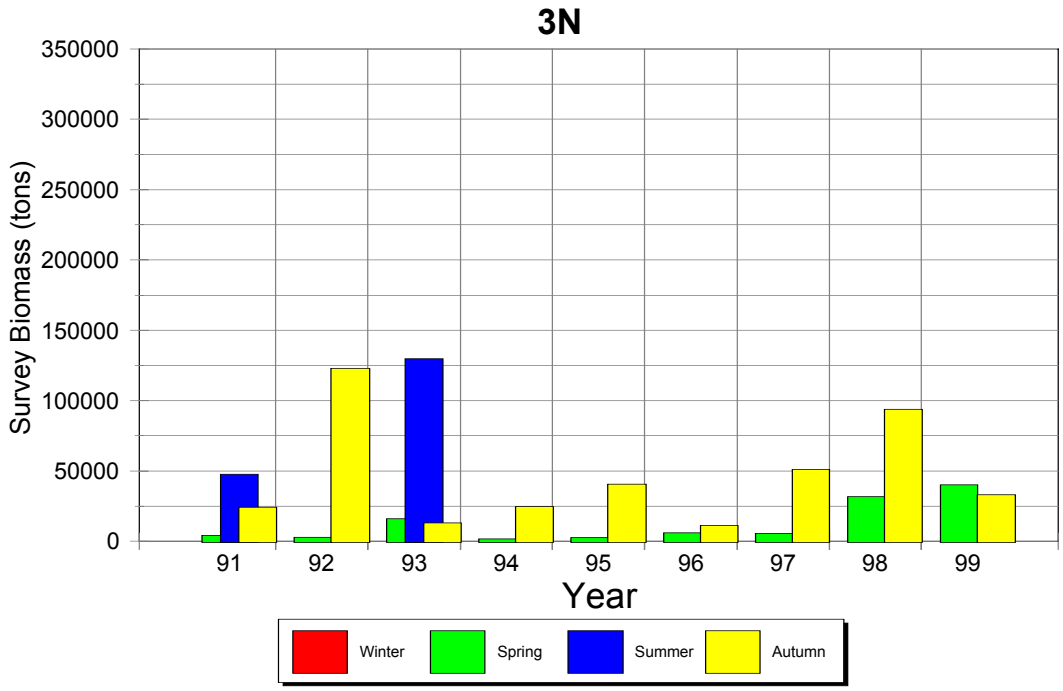

Fig. 3. Survey biomass index for Div. 3N based on Canadian surveys from 1991-1999.

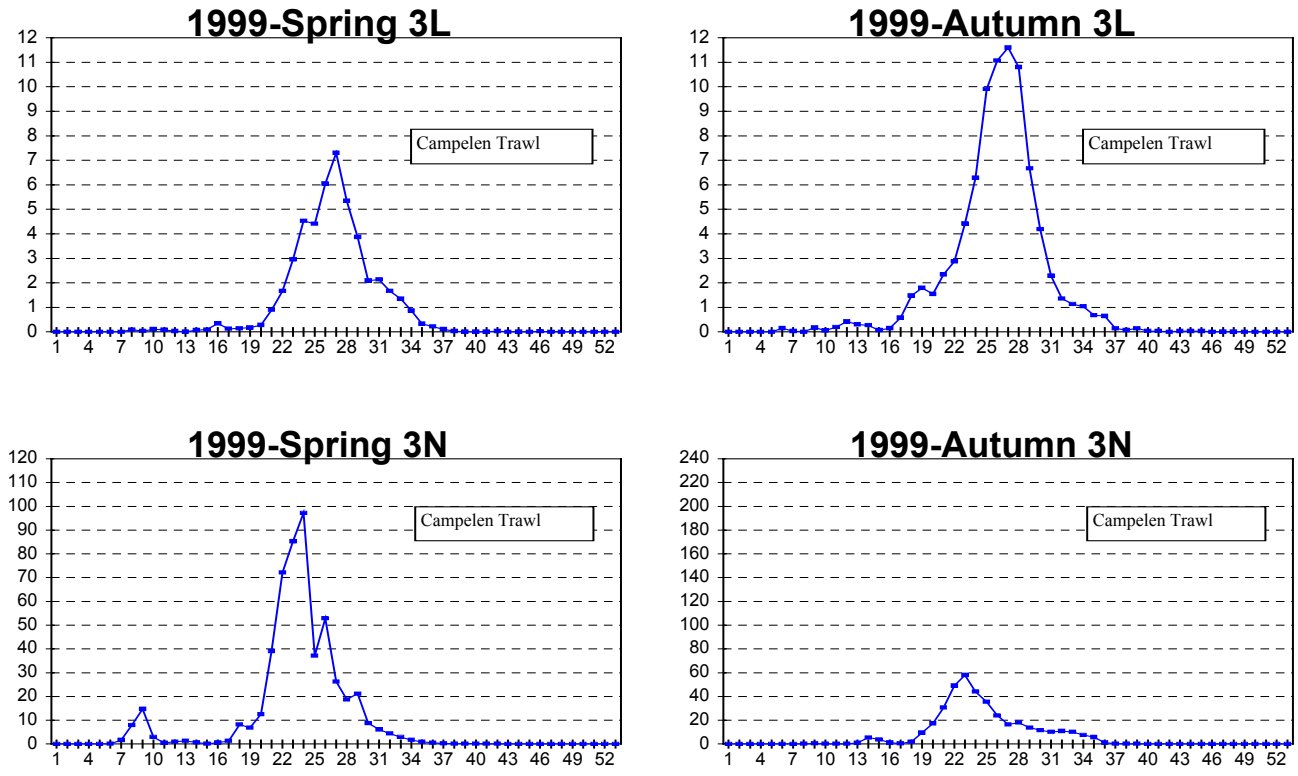

Fig. 4. Recruitment index based on spring and autumn Canadian Surveys in Div. 3LN.