Northwest Atlantic Fisheries Organization

Serial No. N4124 **NAFO SCR Doc. 99/65**

SCIENTIFIC COUNCIL MEETING – JUNE 1999

The Status of the Redfish Resource in NAFO Divisions 3LN

by

D. Power and D. Maddock Parsons

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 500 tons in 1996. Catch increased to 850 tons in 1998. A moratorium on directed fishing was implemented in 1998 and 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.

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 500 tons in 1996 and increased marginally to 600 tons in 1997 and 850 tons in 1998.

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 1999. 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.

Description of the Fishery

In the early 1980's the former USSR, Cuba and Canada were the primary fleets directing for redfish. The rapid expansion of the fishery in 1986 (Table 1-2) and continued high level in 1987 and 1988 was due to new entrants, primarily EU-Portugal and various non-Contracting parties (NCP), most notably South Korea, Panama and Caymen Islands. These countries began to fish in the regulatory area and accounted for a catch of about 24,000 t. In the period from 1988 to 1994 non-Contracting parties had taken between 1,000 t and 19,000 t annually, however, NCPs did not fish in Div. 3LN since 1994. Since 1995 there has been little directed effort. Recent catches have been the result of by-catch from the Greenland halibut fishery in 3LN.

Surveillance sources indicate that fishing pattern changed from the one that concentrated in the vicinity of the Div. 3N and Div. 3O border and the slope edge in Div. 3L in the early 1980's , to one that predominated in an area southwest of the Flemish Cap at the border of Div. 3LNM in the 1990's. Cuba has not fished since 1993 because of a poor fishery and the Baltic states have not directed for redfish since 1994. EU/Portugal has directed predominantly to Div. 3O redfish and other species in the NAFO Regulatory Area since 1994. Russia has also reduced its directed effort in 1996. The reasons for the reduced effort in recent years was varied amongst the fleets involved. The Russian fleet has been affected by economical problems, the Baltic countries have reduced their fleet and have directed to shrimp in Div. 3M. Portugal have directed to other fisheries (Div. 3O) and species (Greenland halibut) because of insufficient quota in Div. 3LN. Cuba has not fished in recent years because of poor yields with the current regulated mesh size of 130 mm. The Canadian fleet has not fished in this area recently because of poor yields.

The most recent pattern of the catches when there was directed effort (Table 3a,b) reveals the fishery occurred during the first half of the year in Div. 3L but mostly from April to September in Div. 3N. Catches for each division by gear since 1986 (Table 4) shows the bottom trawl is the predominant gear in the fishery in the 1980s. Fleets that fished the Div. 3LMN border on the "Beothuk Knoll" probably accounted for most of the midwater catch.

Commercial Fishery Data

Catch and Effort

The annual update for the standardized catch rate series provided little new information probably because of low catches in recent years. Therefore a revised catch rate standardization was not considered to provide anything different from the last analysis. (Power MS 1997)

These data are not considered reflective of year to year changes in population abundance (ANON MS 1996), although they may be indicative of trends over longer periods of time. Because of the limited number of observations and high variability in recent years no judgement can be rendered from the recent data in the series. In any event, these indices of abundance are of little value in determining current stock status.

Commercial fishery sampling

Sampling of redfish as bycatch was conducted by Portugal in Div. 3LN (Alpoim et al., MS 1999) and Spain in 3L (Junquera et al., MS 1999) from the 1998 trawl fishery for Greenland halibut (Fig. 3). The compilation of annual catch at length in Div. 3L suggested the Portuguese catches were dominated by a lengths between 22cm-27cm with a modes at 24cm. A similar compilation for the Spanish sampling in 3L suggested the catches ranged from 24cm-31cm with a mode at 26-27 cm. The Div. 3N Portuguese sampling indicated that dominant lengths of redfish in the catches were between 24cm to 34cm with modes at 27cm and 31cm .

Research Survey Data

Abundance Indices

Stratified-random surveys have been conducted by Canada in Div. 3L in various years and seasons from 1978 to 1998 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 (Fig. 3). 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 5-10, Fig. 4). 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 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 248,000 t.). From 1996 to 1998 the spring biomass index averaged 18,000 t while the autumn index has averaged 14,000 t. over the same period.

Stratified-random surveys have also been conducted primarily in spring and autumn by Canada in Div 3N from 1991-1998 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 11-16, Fig. 5) 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 is about 6,000 t. The average Campelen spring survey biomass index from 1996 to 1998 is about 14,000 t. This average is highly influenced by the 1998 estimate for which two large sets occurred in strata that accounted for 65% of the biomass. For the autumn series the 1991-1994 average biomass index was 46,000 t compared to 1995-1998 average of 49,000 t.

A comparison of the Canadian and Russian bottom trawl surveys in Div. 3L (Fig. 6) indicate a similar trend of decline in density estimates from 1984 to 1990 and both indices have remained at this relatively low level to 1994. The Canadian indices continued to be relatively low to 1998 except for the increase observed in autumn 1995. The situation is unclear for Div. 3N (Fig. 7). The Russian surveys indicate relatively low mean weight per tow from 1989-1991 with a dramatic rise in 1993. This large increase in 1993 relative to 1991 was highly influenced by the trawling conducted in one stratum (see Vaskov (1994), Table 2) which accounted for 70% of the biomass but only represents about 9% of the area surveyed. There have been no Russian surveys conducted in Div. 3L since 1994 or 3N since 1993.

Recruitment

Length distributions in terms of mean number per tow at length from the spring, autumn and summer Canadian surveys in Div. 3L in terms of Campelen units indicate there has been relatively poor recruitment over the time period covered by the surveys (Fig. 8). The 1998 spring and autumn distributions were dominated by fish between 23cm-29cm

which would be in the range of 12-15 years old. In the autumn 1997 survey indicated that the Campelen trawl picked up fish in the 10 cm range for the first time since it has been used as a survey gear. There is no sign of any good recruitment in the recent surveys up to autumn 1998.

Length distributions from spring and autumn Canadian surveys in Div. 3N from 1991-1998 (Fig. 9) show different compositions compared with Div. 3L for each corresponding seasonal survey, generally being composed of size groups that are smaller. There was a relatively good pulse of recruitment picked up in the 1991 autumn survey in the range of 12-14 cm (1986-1987 year classes) that could be tracked through to 1998 survey at about 22-23 cm. There is no sign of any good year classes subsequent to this in the surveys. A mode picked up in the 1997 spring survey had not increased its relative stature in either of the following two surveys up to autumn 1998.

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.

Reference Points under a Precautionary Approach

A non-equilibrium production model (ASPIC) was run using various combinations of Portuguese logbook CPUE, Canadian survey data and Russian survey data. However, no acceptable results were achieved.

Various yield per recruit analyses have been conducted for redfish (see ANON 1989 and Avila de Melo et al, 1998).

Div. 3LN (ANON 1989)			Div. 3M (Avila de Melo et al. 1998)		
F		Yield (kg)	F		Yield (kg)
$F_{0.1}$	0.120	0.173	$F_{0.1}$	0.115	0.115
F_{max}	0.222	0.186	F_{max}	0.227	0.125

While the estimates of F0.1 and Fmax were similar, the estimated yields at these reference points were different. It is believed that these differences are due, in a large part, to differences in ageing methodologies; scales versus otoliths. This type of difficulty with redfish, caused by differences in age reading methodology and interpretation, is a continuing problem and hampers use of age based analyses to develop meaningful reference points. Work is continuing to examine the use of length based information. At present however, it is not possible to determine limit or other reference points for either fishing mortality or biomass for Div. 3LN redfish. It is not possible to determine limit or target reference points based on spawning stock biomass or fishing mortalities.

REFERENCES

Alpoim, R., E. Santos, J. Vargas and A. M. Avila de Melo. MS 1999. Portuguese Research Report for 1998. NAFO SCS Doc. 99/16. Serial No. N4091. 47 p.

ANON. MS 1989. NAFO Scientific Council Report. 180 pp

ANON. MS 1996. NAFO Scientific Council Report. 226 pp

Avila de Melo, A., F. Saborido-Rey and R. Alpoim. MS 1998. An assessment of Redfish in NAFO Division 3M Including an Approach to Precautionary Management Based on Spawning Biomass and Growth. NAFO SCR Doc. 98/53. Serial No. N3044. 51p

Junquera, S., E. de Cardenas, A. Vazquez and H. Murua. MS 1999. Spanish Research Report for 1998. NAFO SCS Doc. 99/6. Serial No. N4062. 11 p.

Power, D. MS 1997. Redfish in NAFO Division 3LN. NAFO SCR Doc. 98/64. Serial No. N2898. 37 p.

Power, D. and D. Maddock Parsons. MS 1998. 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. NAFO SCR Doc. 98/71. Serial No. N3063. 21 p.

Vaskov, A. A. MS 1994. Assessment of redfish stocks in Divisions 3LN and 3M from trawl acoustic survey data, 1993. NAFO SCR Doc. 94/13. Serial. No. N2376. 9p.

Warren, W. G. MS 1996. Report on the Comparative Fishing Trial between the Gadus Atlantica and Teleost. SCR Doc. 96/28. Serial. No. N2701. 16p.

Table 1. Summary of nominal catches (t) of redfish in Divisions 3LN (provisional for 1994-1997).

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				Moratorium

Includes catch that could not be identified by division.

Includes estimates of unreported catch.

Catch could not be precisely estimated due to discrepancies in figures from available sou

Provisional.

Table 2a. Nominal reported catches (t) of redfish in Division 3L by country and year since 1986.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994 [b]	1995 [b]	1996 [b]	1997 [b]	1998 [b]
Canada (M)	2,597	2,352	5,042	1,095	73	37	86	-	-	3	-	-	-
Canada (N)	2,235	2,159	1,444	489	947	362	656	6	-	-	-	20	-
EU/Germany	540	696	694	742	646	1151	1,455	-	-	-	-	-	-
Japan	135	114	152	114	151	84	67	37	82	47	74	68	98
EU/Portugal	13,469	19,858	9,867	5,408	4,820	5,099	769	-	4	-	37	47	61
EU/Spain	199	335	94	109	837	681	625	29	128	242	1	13	314
Russia	8,658	4,459	5,004	10,037	7,003	1,032	571	2,407	22	-	-	-	8
Lithuania	-	-	-	-	-	-	-	676	-	-	-	-	-
Latvia	-	-	-	-	-	-	-	2,156	55	-	-	-	-
Estonia	-	-	-	-	-	-	-	-	88	-	-	-	-
South Korea		364	20	952	1,061	420	370	586	-	-	-	-	-
Others [a]	-	5	-	1	-	26	31	-	-	-	-	2	13
TOTAL	27,833	30,342	22,317	18,947	15,538	8,892	4,630	5,897	379	292	112	150	494

[a] Others include France (M), France (SP), Poland, EEC-UK.
[b] Provisional

Table 2b. Nominal reported catches (t) of redfish in Division 3N by country and year since 1986.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994 [b]	1995 [b]	1996 [b]	1997 [b]	1998 [b]
Canada (M)	-	-	1	22	-	-	-	-	110	-	-	-	-
Canada (N)	17	21	4	4	11		1	40	-	-	-	1	7
EU/Portugal	8,273	7,854	2,147	600	1,235	3,275	1,149	255	60	78	199	102	173
Japan	12	51	-	39	4	4	1	-	-	-	-	-	-
EU/Spain	1,393	132	581	224	416	956	119	7	106	200	106	1	184
Russia	2,227	14,397	6,735	941	359	4,821	3,009	3,212	1,998	1,419	34	375	-
Lithuania	-	-	-	-	-	-	-	1,116	-	-	-	-	-
Latvia	-	-	-	-	-	-	-	1,247	-	-	-	-	-
Estonia	-	-	-	-	-	-	-	1,926	-	-	-	-	-
Cuba	2,429	2,433	2,483	2,869	2,456	1,378	1,308	1,152	-	-	-	-	-
South Korea	617	16,053	11,098	8,203	4,640	2,276	4,560	122	-	-	-	-	-
Others [a]	4	8	-	-	96	13	6	-	-	-	-	-	-
TOTAL	14,972	40,949	23,049	12,902	9,217	12,723	10,153	9,077	2,274	1,697	339	479	364

[a] Others include France (M), France (SP), Poland, EEC-UK.
[b] Provisional

Table 3a. Nominal reported catches (t) of redfish in Division 3L by month and year since 1986.

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Total
1986	423	845	3,470	7,266	3,662	503	975	2,196	544	3,964	2,166	1,819	27,833
1987	2,439	1,631	5,306	1,423	1,765	75	1,233	3,877	3,285	4,215	3,712	1,381	30,342
1988	2,856	1,623	865	1,466	471	1,213	2,776	4,800	1,628	1,869	682	2,068	22,317
1989	786	4,497	4,301	1,140	1,628	501	1,730	1,311	832	1,151	1,002	68	18,947
1990	269	331	297	831	578	1,717	3,061	3,683	1,911	1,611	1,056	193	15,538
1991	328	901	642	821	685	503	613	296	229	692	2,123	1,059	8,892
1992	417	203	137	1,479	1,487	246	15	9	26	30	480	101	4,630
1993	1	9	676	2,721	2,479	2	1	5	1	-	1	1	5,897
1994 [a]	-	-	34	147	13	3	1	2	-	19	27	133	379
1995 [a]	77	65	25	55	44	15	-	-	-	2	-	9	292
1996 [a]	5	16	5	3	9	1	-	-	2	6	17	48	112
1997 [a]	6	21	15	2	14	2	-	-	-	-	-	2	62 [b]

[a] Provisional

[b] Does not include 20 t for Can(n) and 68 t for JPN

Table 3b. Nominal reported catches (t) of redfish in Division 3N by month and year since 1984.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1986	392	665	406	534	454	915	4,392	81	1,196	110	4,131	1,696	14,972
1987	3,787	3,118	1,885	2,203	2,698	2,383	4,339	6,280	7,287	2,431	1,004	3,534	40,949
1988	662	648	815	841	952	1,295	2,327	4,505	3,390	1,419	3,453	2,742	23,049
1989	576	151	274	380	278	1,183	928	4,109	2,085	1,515	1,164	259	12,902
1990	220	366	537	9	1,003	1,679	1,236	1,716	619	754	858	220	9,217
1991	387	91	15	122	312	670	3,241	2,229	1698	2,013	1,085	860	12,723
1992	274	638	87	65	104	2,285	2,352	1,626	432	702	926	662	10,153
1993	228	286	430	2,184	4,095	1,224	164	52	270	12	48	84	9,077
1994 [a]	151	53	5	68	595	723	302	-	1	28	310	38	2,274
1995 [a]	63	80	1	10	147	313	358	251	338	-	48	88	1,697
1996 [a]	-	2	6	7	4	42	58	-	121	68	26	5	339
1997 [a]	38	11		4	12	151	244				13	6	479

[a] Provisional

Table 4. Nominal reported catches by gear type for redfish in Divisions 3L and 3N since 1984.

	Division 3L					Division 3N				
Year	Bottom trawl	Midwater trawl	Gillnets	Misc.	Total	Bottom trawl	MW trawl	Gillnets	Misc.	Total
1986	18,964	8,624	122	123	27,833	10,423	3,405		1,144	14,972
1987	25,294	4,441	276	331	30,342	32,391	8,527		31	40,949
1988	15,435	6,722	105	55	22,317	16,740	6,269	17	23	23,049
1989	7,542	10,922	449	34	18,947	9,131	3,746		25	12,902
1990	7,851	7,537	136	14	15,538	6,511	2,675	10	21	9,217
1991	7,322	1,422	71	77	8,892	11,028	1,628	-	67	12,723
1992	3,538	949	67	76	4,630	8,553	1,518	6	76	10,153
1993	652	5,245	-	-	5,897	3,532	5,441	-	104	9,077
1994 [a]	361	18	-	-	379	276	1,998	-	-	2,274
1995 [a]	292	-	-	-	292	278	1,419	-	-	1,697
1996 [a]	112	-	-	-	112	339	-	-	-	339
1997 [a]	137	-	-	13	150 [b]	103	375	-	1	479

[a] Provisional

Table 5. 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 1 1980-Q2 GA 36	Apr 17-May 2 1985-Q2 WT 28-30	May 11- May 1991-Q2 WT106-7	May 13-June 1992-Q2 WT 120-2	May 18-Jun 1 1993-Q2 WT 137-8	May 22-Jun 1 1994-Q2 WT 153-54	May 27-Jun 1 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
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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
Weighted mean (by area)			96.4	168.9	30.6	15.3	15.0	6.5	9.8	53.9	28.8	58.6
Lower (95% CI)			-143.4	-1158.4	-75.0	-6.8	-75.5	2.7	7.1	19.9	21.6	-140.8
Abundance of surveyed are (millions)			144.0	260.8	34.5	23.6	23.2	10.0	15.1	83.3	44.5	90.4

Table 6. 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 1 1985-Q1 WT 22-24	Jan 22-Feb 2 1986-Q1 WT 42-44	Jan 17-Jan 2 1990-Q1 WT 90	Aug 16-Aug 2 1978-Q3 GA 12	Sep 4-Sep 10 1979-Q3 GA 25	Sep 18-Sep 2 1981-Q3 GA 55	Jul 26-Sep 3 1984-Q3 WT 16-18	Jul 27-Aug 2 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 7. Mean number per standard tow from Canadian autumn surveys in Div. 3L where strata greater than 366 m (200 fath.) were sampled. Dashes (-) represe unsampled strata. Number of successful sets in brackets. The data from 1985-1994 are Campelen trawl equivalent units based on a comparative fishing experi 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 3 1986-Q4 AN 72	Oct 18-Nov 1 1990-Q4 WT 101)	Nov 10- Dec 1991-Q4 WT 114-5	Nov 5-Nov 29 1992-Q4 WT 129-30	Nov 12- Dec 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	Nov-Dec 1998-Q4 WT 231-233
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
733	367-549	468	566.33 (3)	---	204.50 (2)	285.67 (3)	176.33 (3)	19.67 (3)	39.33 (9)	1,625.50 (2)	22.41 (3)	41.00 (2)	123.67 (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)
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)
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)
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)
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)
737	732-914	227	---	---	---	---	---	---	---	41.50 (2)	5.50 (2)	2.00 (2)	0.50 (2)
741	732-914	223	---	---	---	---	---	---	---	---	2.50 (2)	0.50 (2)	16.21 (2)
745	732-914	348	---	---	---	---	---	---	---	---	0.00 (2)	17.00 (2)	4.00 (2)
748	732-914	159	---	---	---	---	---	---	---	---	17.00 (2)	1.00 (2)	4.00 (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
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
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
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

Table 8. 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 1 1980-Q2 GA 36	Apr 17-May 2 1985-Q2 WT 28-30	May 11- May 1991-Q2 WT 106-7	May 13-June 1992-Q2 WT 120-2	May 18-Jun 1 1993-Q2 WT 137-8	May 22-Jun 1 1994-Q2 WT 153-54	May 27-Jun 1 1995-Q2 WT169-70	May-June 1996-Q2 WT 189-191	May-June 1997-Q2 WT 205-208	May-June 1998-Q2 WT223-224
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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
Weighted mean (by area)			41.2	82.8	5.6	4.8	4.18	1.49	2.13	10.9	6.0	17.9
Lower (95% CI)a			-111.6	-612.3	-0.5	-2.3	-19.31	0.74	1.69	1.8	2.7	-60.3
Survey biomass index (tons)			61502	127888	6267	7404	6461	2302	3284	16825	9277	27596

Table 9. 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 1 1985-Q1 WT 22-24	Jan 22-Feb 2 1986-Q1 WT 42-44	Jan 17-Jan 2 1990-Q1 WT 90	Aug 16-Aug 1978-Q3 GA 12	Sep 4-Sep 10 1979-Q3 GA 25	Sep 18-Sep 2 1981-Q3 GA 55	Jul 26-Sep 3 1984-Q3 WT 16-18	Jul 27-Aug 2 1985-Q3 WT 32-34	Aug 7-Aug 1 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 10. 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 3 1986-Q4 AN 72	Oct 18-Nov 1 1990-Q4 WT 101	Nov 10- Dec 1991-Q4 WT 114-5	Nov 5-Nov 29 1992-Q4 WT 129-30	Nov 12- Dec 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
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
737	732-914	227	---	---	---	---	---	---	---	13.07 (2)	2.58 (2)	0.93 (2)	0.14 (2)
741	732-914	223	---	---	---	---	---	---	---	---	0.53 (2)	0.23 (2)	7.33 (2)
745	732-914	348	---	---	---	---	---	---	---	---	0.00 (2)	5.85 (2)	1.10 (2)
748	732-914	159	---	---	---	---	---	---	---	---	6.30 (2)	0.45 (2)	2.40 (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
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
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
Survey biomass index (tons)			98233	17119	20743	13665	13424	6011	7173	50078	4691	19544	18522

Table 11. 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
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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
Weighted mean (by area)			79.8	81.0	221.4	32.3	43.0	103.0	103.2	401.5
Lower (95% CI)			-13.4	32.6	-1324.1	-31.8	-50.6	36.8	8.5	-1688.3
Abundance of surveyed area (millions)			31.5	30.8	87.5	14.5	17.0	40.7	38.5	158.6

Table 12. 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 13. 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.

Stratu	Depth Range (M)	Area (sq. n.) mi	Oct 27-Nov 1 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 1 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
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
726	550-731	72	---	---	65.50 (2)	207.00 (2)	322.00 (2)	906.00 (2)	9.50 (2)	22.72 (2)
727	367-549	160	---	---	208.00 (2)	136.00 (2)	791.00 (2)	420.00 (2)	1027.44 (3)	654.56 (2)
728	550-731	156	---	---	---	8.50 (2)	120.86 (2)	339.56 (2)	23.00 (2)	17.50 (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
Weighted mean (by area)			1267.7	4136.6	182.1	373.3	770.0	133.7	676.9	1163.9
Lower (95% CI)			-5349.1	-29909.5	-678.5	-1680.6	-5963.4	-405.8	-2339.3	-4751.0
Abundance of surveyed area (millions)			378.9	1085.2	68.0	147.5	304.2	52.8	267.4	522.9

Table 14. 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
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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
Weighted mean (by area)			11.1	7.0	40.8	4.1	6.5	15.2	15.1	80.5
Lower (95% CI)			-4.0	3.7	-259.3	2.9	2.0	3.1	2.3	-37.0
Survey biomass index (tons			4375	2662	16112	1860	2572	5987	5651	31806

Table 15. 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.

Stratu	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 16. 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 un 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.

Stratu	Depth Range (M)	Area (sq. n.) mi	Oct 27-Nov 1 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 1 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
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
727	367-549	160	---	.	39.4 (2)	28.6 (2)	35.86 (2)	8.85 (2)	230.07 (2)	165.03 (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)
726	550-731	72	---	---	26.0 (2)	86.4 (2)	113.38 (2)	272.98 (2)	3.98 (2)	7.43 (2)
728	550-731	156	---	---	---	3.12 (2)	60.99 (2)	32.97 (2)	6.71 (2)	6.60 (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
Weighted mean (by area)			81.0	468.8	35.4	62.2	102.9	28.5	129.4	208.6
Lower (95% CI)			51.5	-3113.2	-74.1	-33.6	-704.7	-101.1	-458.9	-697.8
Survey biomass index (tons			24221	122990	13222	24584	40650	11277	51116	93703

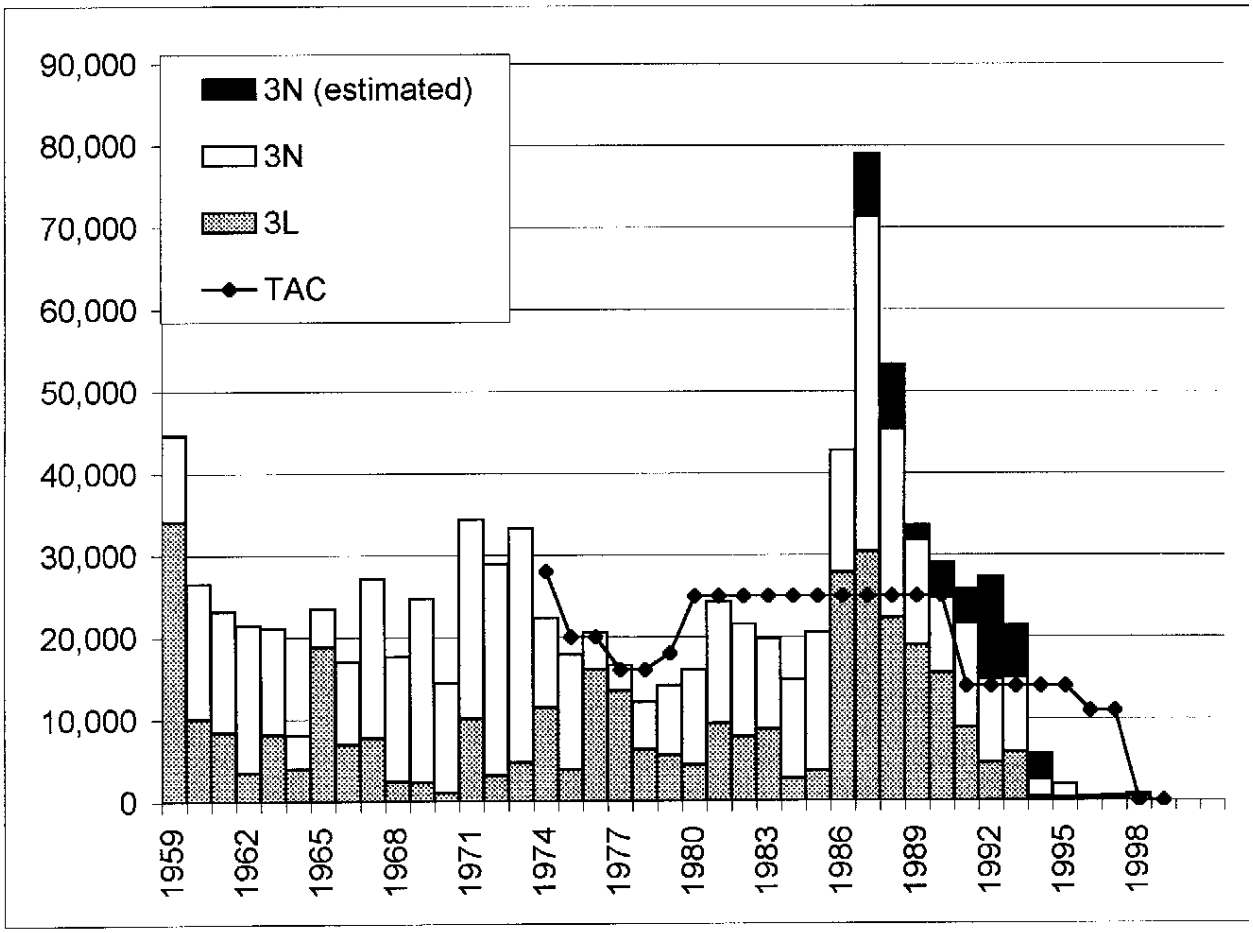

Fig. 1: Nominal catches and TACs of redfish in Div. 3LN (1994-96 are provisional).

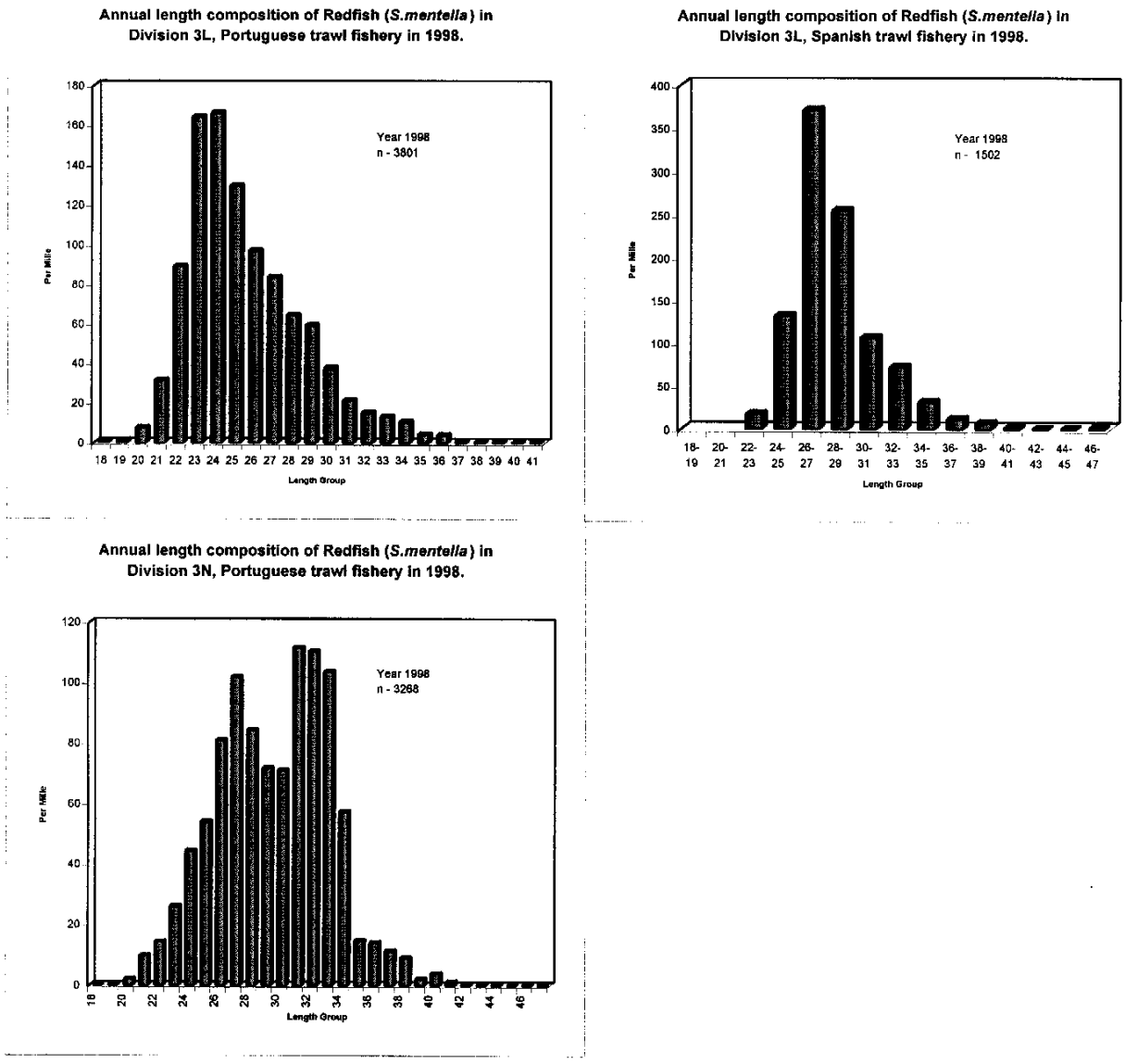

Fig. 2. Annual length composition for redfish in Div. 3LN for 1998 based on sampling from trawl fisheries conducted by Portugal and Spain.

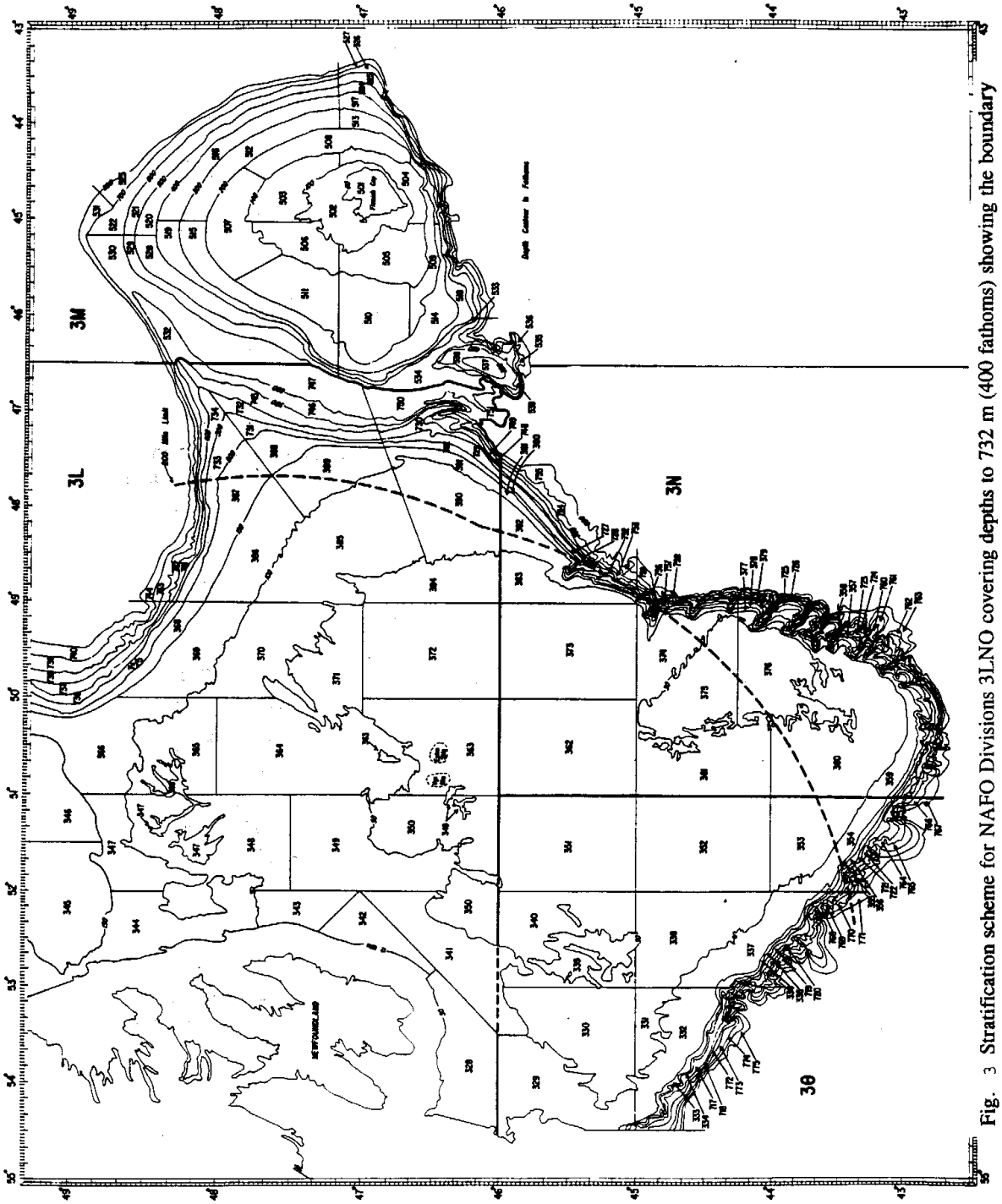

Fig. 3 Stratification scheme for NAFO Divisions 3LNO covering depths to 732 m (400 fathoms) showing the boundary line between the Canadian 200 mile exclusive economic zone and the NAFO Regulatory area.

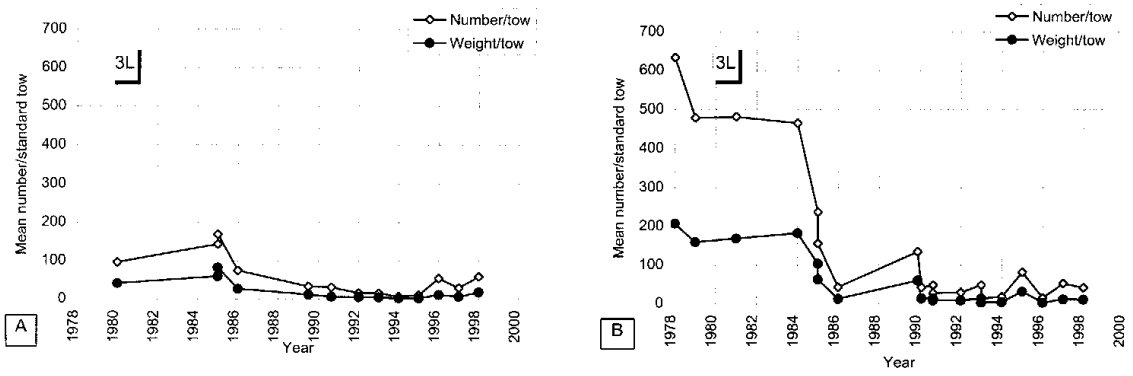

Figure 4. Stratified mean number and weight (kg) per tow in Div. 3L for 1978-1998 from various Canadian surveys where strata greater than 366m were covered. Surveys up to spring 1995 used an Engel trawl (data plotted in Campelen equivalents) and those from autumn 1995 onward used a Campelen trawl.(A) First and second quarter data and (B) third and fourth quarter data.

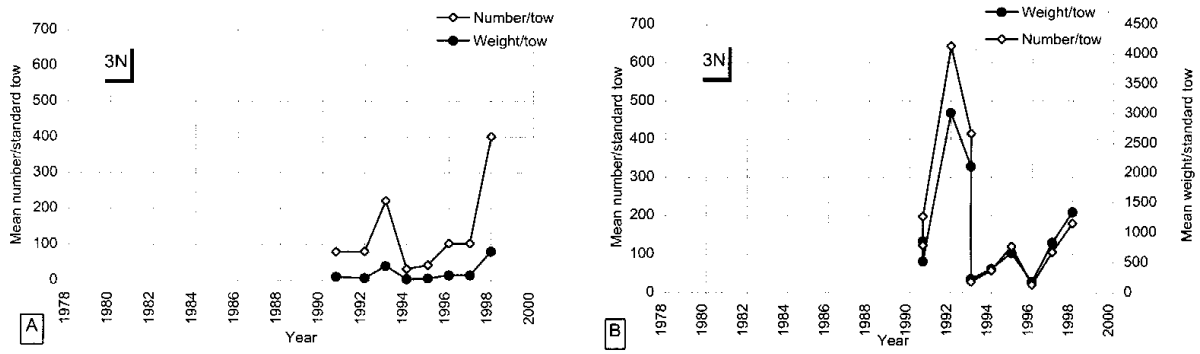

Figure 5. Stratified mean number and weight (kg) per tow in Div. 3N for 1991-1998 Canadian surveys where strata greater than 366m were covered. Surveys up to spring 1995 used an Engel trawl (data plotted in Campelen equivalents) and those from autumn 1995 onward used a Campelen trawl. (A) First and second quarter data and (B) third and fourth quarter data.

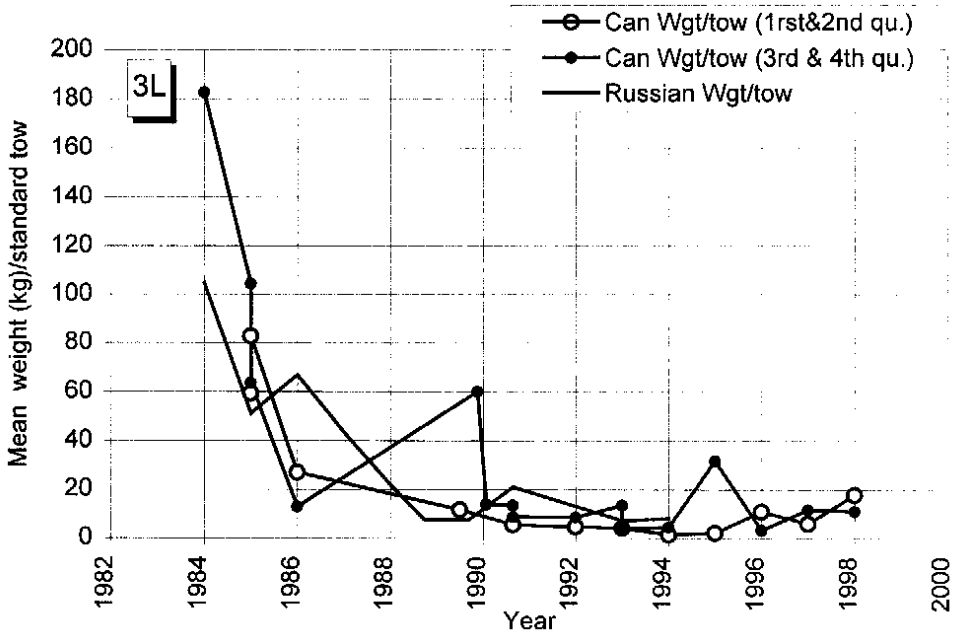

Figure 6. Stratified mean weight (kg) per tow in Div. 3L from Canadian and Russian surveys.

Figure 7. Stratified mean weight (kg) per tow in Div. 3N from Canadian and Russian surveys.

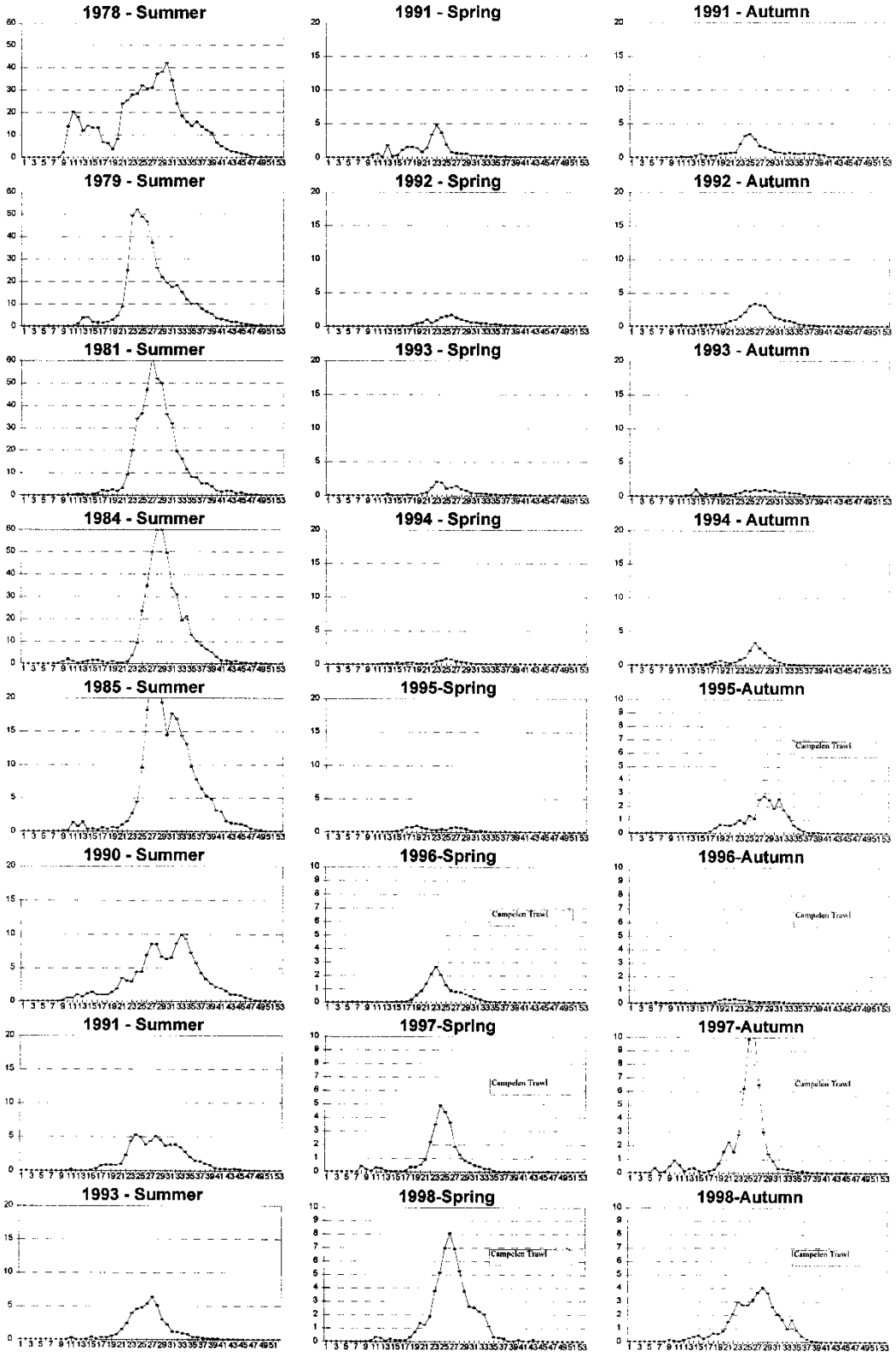

Fig. 8. Length frequency distribution from stratified-random research surveys to Div. 3L from 1978 to 1998. Plotted are mean number per standard tow in Campelen equivalent units. X-axis is forklength in centimetres.

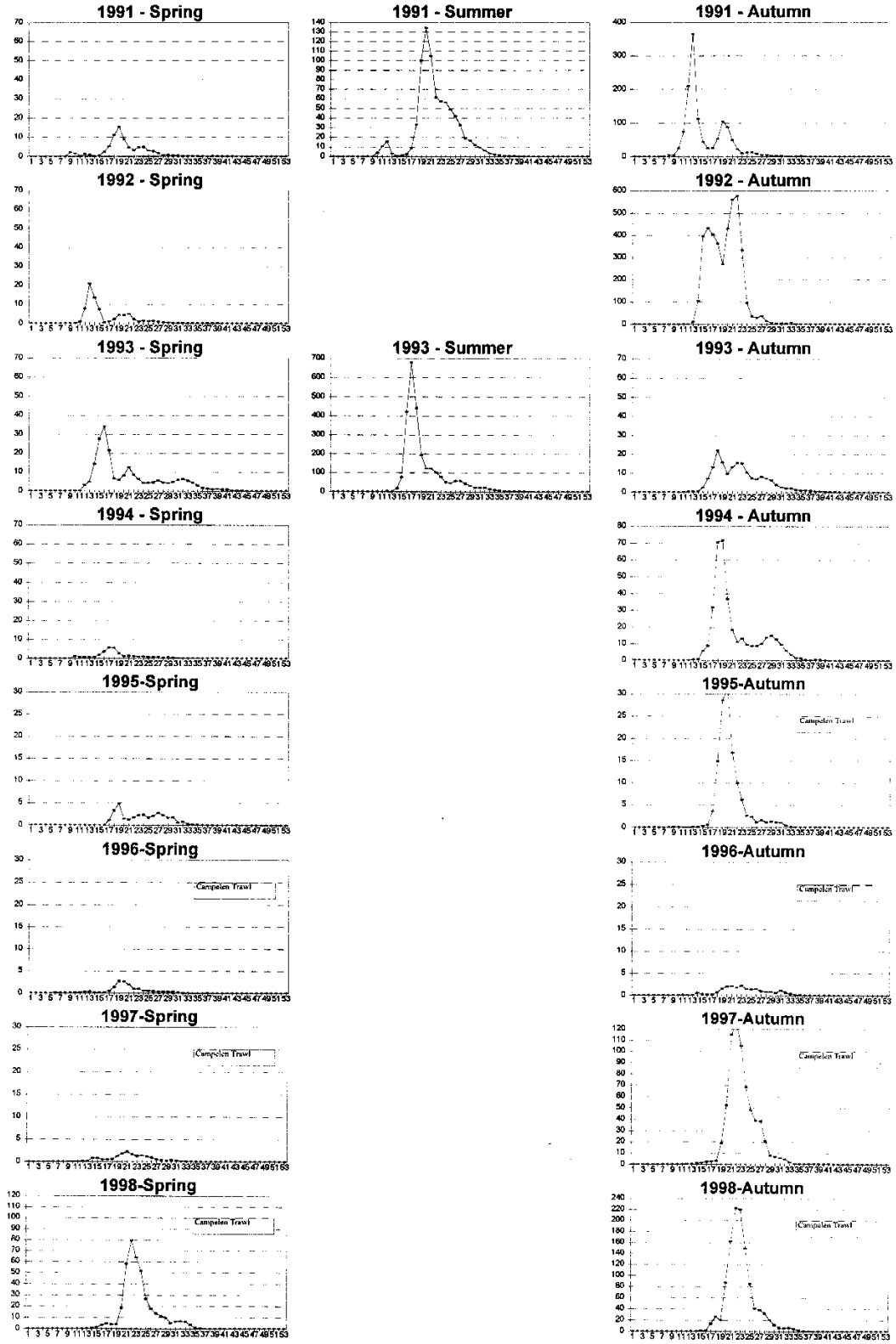

Fig. 9. Length frequency distribution from stratified-random research surveys to Div. 3N from 1991 to 1998. Plotted are mean number per standard tow in Campelen equivalent units. X-axis is forklength in centimetres.