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An Assessment of the Status of the Redfish Resource 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 redfish, the deep-sea redfish (*Sebastes mentella)* and the Acadian redfish (*Sebastes fasciatus*) that have been commercially fished and reported collectively in fishery statistics in Div. 3LN. 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, however, catches taken as by-catch in other fisheries have increased to about 2 000 tons in 1999 and 2000. 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 1980s indicating a reduced and low stock size. Poor recruitment has persisted in Div. 3L since the early-1980s. The last good recruitment in Div. 3N was the 1986-87 year-classes. It takes about 8-10 years before redfish become fully recruited to a directed fishery. 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.

<u>Nominal Catches and TACs</u>

The average reported catch from Div. 3LN from 1959 to 1985 was about 22 000 tons ranging between 10 000 tons and 45 000 tons (Table 1, Fig. 1). Catch increased sharply from about 21 000 tons in 1985, peaked at a historical high of 79 000 tons in 1987 and declined steadily to about 500 tons in 1996. Catch increased to 850 tons in 1998 and has been about 2 000 tons for 1999 and 2000.

From 1980 to 1990 the TAC each year for this stock has been 25 000 tons. The TAC was reduced to 14 000 tons 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 NAFO Fisheries Commission implemented a moratorium on directed fishing for this stock in 1998 and has extended it to 2001. In an 8-year period from 1986-1993, TACs were exceeded annually. In some years catch was double (1988) and even triple (1987) the agreed TAC. In the three years prior to the moratorium (1995-1997), there was no sustained effort toward redfish.

Description of the Fishery

In the early-1980s 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 tons. In the period from 1988 to 1994 non-Contracting parties had taken between 1,000 tons and 19,000 tons 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 Div. 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-1980s, to one that predominated in an area southwest of the Flemish Cap at the border of Div. 3LNM in the 1990s. In the years prior to the moratorium in 1998, a number of countries had reduced effort substantially on Div. 3LN. The reasons for the reduced effort, was varied amongst the fleets involved. Cuba did not fish from 1993-1997 because of poor yield with the current regulated mesh size of 130 mm. The Baltic countries reduced their fleet between 1995-1997 and directed toward shrimp in Div. 3M. EU-Portugal directed predominantly to Div. 3O redfish since 1994 because of insufficient quota in Div. 3LN and also targeted other species in the NAFO Regulatory Area. Russia, affected by economical problems, reduced its directed effort in 1996. 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 1987 (Table 4) shows the bottom trawl was 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 trawl catch.

Commercial Fishery Data

Catch and Effort

The annual update for the standardized catch rate series provided no new information since the last analysis (Power, MS 1997) because catches since 1998 have been taken as by-catch. In any event, these data were not considered reflective of year-to-year changes in stock abundance (Anon, 1996) are of little value in determining current stock status.

Commercial fishery sampling

Sampling of redfish as by-catch was conducted by Portugal in Div. 3LN (Vargas *et al*., MS 2001), Spain in Div. 3L (Junquera *et al*., MS 2001) and Russia in Div. 3LN (Vaskov *et. al*., MS 2001) from the 2000 trawl fishery for primarily for Greenland halibut (Fig. 2). The compilation of annual catch at length as number per thousand in Div. 3L suggested the Portuguese, Spanish and Russian catches were dominated by a lengths between 28 cm-30 cm. The Div. 3N Portuguese and Russian sampling was similar for *S. mentella* suggesting the dominant lengths in the catch were between 28 cm-31 cm for the Portuguese fleet and 29 cm-32 cm for the Russian fleet. The Portuguese sampling also indicated *S. marinus* were caught with lengths dominant between 23 cm-26 cm.

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 (29 mm) 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 12 mm 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 5-7, 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 tons) relative to the time period prior to 1986 for surveys conducted in the first half of the year (winter/spring average 93 000 tons). A similar contrast occurs in the autumn survey biomass index from 1992 to 1995 (average 19 000 tons) relative to a time period prior to 1986 for surveys conducted in the second half of the year (summer/autumn average 248 000 tons). From 1996 to 2000 the spring biomass index has fluctuated around a higher biomass level (average 22 000 tons), than the 1992-1995 period (average 5 000 tons). The autumn index also shows a similar increase from 1996 to 2000 (average 21 000 tons) as compared to 1992-1995 (average 19,000 tons). The effect is less apparent because of the relatively large 1995 index (50 000 tons) used in the averaging.

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 8-10, 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 not clear but it is likely to be 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 tons. The average Campelen spring survey biomass index from 1996 to 2000 is about 27 000 tons. This average is highly influenced by three or four large sets that have occurred among the 1998-2000 surveys. However, there does appear to be an increase since 1996. For the autumn series the 1991-1994 average biomass index was 46 000 tons compared to 1995-2000 average of 51 000 tons. The series since 1996 is highly variable

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 have shown a gradual increase but are still low compared to the pre-1985 period. 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 Div. 3N since 1993 but the Canadian surveys indicate an increase since 1996.

<u>Recruitment</u>

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 2000 spring and autumn distributions were dominated by fish between 25 cm-31 cm, which would be in the range of 12-17 years old. There is no sign of any good recruitment in the recent surveys up to autumn 2000.

Length distributions from spring and autumn Canadian surveys in Div. 3N from 1991-2000 (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 2000 survey at about 23 cm. There is no sign of any good year-classes subsequent to this in the surveys. A mode first detected in the 1999 spring survey at 9 cm had not increased its relative stature in either of the following three surveys up to autumn 2000.

Estimation of Stock Parameters

Catch/Biomass ratio

Ratios of catch to Canadian survey biomass index were calculated for Div. 3L and Div. 3N separately. Biomass was averaged over all seasonal surveys conducted in any given year. The results (Fig. 10) indicate that exploitation in Div. 3L was relatively low from 1978-1985. There is no survey information to relate to the period of high catches from 1987-1989 when large catches were taken. Exploitation increased from 1990-1991, peaked in 1992 and declined sharply by 1995 and has remained low to 2000.

In Div. 3N, approximate exploitation was relatively high in 1991 but declined rapidly by 1995 and continued to decline to 1998 and has been low to 2000.

Size at Maturity

Maturity data for redfish were available from two sources: (1) set-by- set samples taken for length, sex and maturity (LSM) during spring and autumn Canadian research surveys to Div. 3LN from 1996 to 2000, and (2) otolith samples taken for age (A&G) determination during Canadian research surveys to Div. 3LN from 1972 to 1995. Fish were classified as mature or immature based on a visual examination of the fresh gonad at sea. Determination of maturity stage was consistent with that described by Ni and Templeman (1985). LSM sampling for redfish commenced on the surveys in 1996 but utilized a reduced categorization of the extensive Ni and Templeman maturity staging because its purpose was only to determine where and when spawning was occurring and not to describe the reproductive cycle in detail.

A logistic model with a logit link function and binomial error was fit to the data to estimate the length (cm) at 50% maturity (L_{50}). Estimation of parameters was conducted using the Probit procedure of SAS (SAS, 1999). Data sources (1) and (2) were anlayzed separately but within each data source, the data were combined for all years and surveys. There was no attempt to distinguish between *Sebastes fasciatus* and S. mentella.

Data	Div. 3L				Div. 3N			
Source	Male	%Mature	Female	%Mature	Male	%Mature	Female	%Mature
LSM(1)	11 768	43.2	12 437	23.4	17 005	68.2	16 547	36.1
A&G(2)	9 531	67.5	9 798	49.3	4 397	70.5	4 405	36.7

All of the models were significant ($P < .0001$).

The ogives derived for the LSM and A&G data were quite different for females in Div. 3L (Fig. 11). The estimation of L50 plus 95% fiducial limits was higher in the LSM data by about 4 cm compared to the A&G data (34.71 ± .62 cm *versus* 30.52 ± .19 cm). In Div. 3N, the L_{50} estimates for females were similar (30.40 ± .35 cm for the LSM data, 30.19 ± .23 cm for the A&G data), but the shape of the LSM ogive does not show the typically sigmoid shape where the probability of maturity rises very quickly over a relatively narrow length range. This is likely due to the inclusion of adults of various sizes into an LSM category "Immature or will not spawn this year". Data for A&G exist from 1996 to 2000 but were not readily available for this analysis for comparison.

The analysis for males suggest hat for Div. 3L, the L_{50} estimate was 23.94 ± .21 cm for the LSM data and 25.49 ± .14 cm for the A&G data. In Div. 3N estimates were similar for both datasets (20.00 ± .17 cm for SLM *versus* 20.27 ± .35 cm for the A&G data) but were clearly smaller at 50% maturity than Div. 3L.

Ni and Sandeman (1984) reported L_{50} values for *S. mentella* and/or *S. fasciatus* in Div. 3L of 34.65 ± .32 (s.e.) cm for females, 21.80 ± .67 (s.e.) cm for males. In Div. 3N, they reported values of 29.58 ± .27 (s.e.0 for females and 16.32 ± .71 for males. This was based on data collected between 1957 and 1969. By comparison to this analysis, it s appears that L_{50} has increased in Div. 3L for males and possibly have decreased for females. In Div. 3N, this analysis suggests L_{50} has increased for males and females. Further investigation is warranted on an annual basis from the data to see if there is a trend in size at maturity over time.

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 1980s indicating a reduced and low stock size. There are indications of some increases in stock since 1996 due to growth in weight of the relatively strong 1986-87 year-classes and possibly through some immigration of fish from Div. 3O to Div. 3N.

Poor recruitment has persisted in Div. 3L since the early-1980s. The last good recruitment in Div. 3N was the 1986-87 year-classes. These year-classes are recruiting to the spawning stock biomass (SSB) and will make up the greatest proportion of the SSB until at least 2010.

Estimates of exploitation rate suggest that recent catches have not caused high mortality to the stock. The impact on future gains cannot be measured but any removals from the stock at its present low level is cause for concern.

Reference Points under a Precautionary Approach

There is no new information on which to establish reference points with respect to a precautionary approach.

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Table 1. Summary of nominal catches (t) of redfish in Divisions 3LN (provisional for 1999-2000).

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]	14,000
1995	292	1,697	1,989	14,000
1996	112	339	451	11,000
1997	151	479	630	11,000
1998	494	405	899	Moratorium
1999	517	1315	2318 [b,d]	Moratorium
2000	501	383	1717-4565 [b,c,d]	Moratorium
2001				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 2a. Nominal reported catches (t) of redfish in Division 3L by country and year since 1987.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999 [b]
Canada (M)	2,352	5,042	1,095	73	37	86	-	-	3	-	-	-	1
Canada (N)	2,159	1,444	489	947	362	656	6	-	-	-	20	-	-
EU/Germany	696	694	742	646	1151	1,455	-	-	-	-	-	-	-
Japan	114	152	114	151	84	67	37	82	47	74	69	98	141
EU/Portugal	19,858	9,867	5,408	4,820	5,099	769	-	4	-	37	47	62	-
EU/Spain	335	94	109	837	681	625	29	128	242	1	13	313	191
Russia	4,459	5,004	10,037	7,003	1,032	571	2,407	22	-	-	-	8	5
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	4
TOTAL	30,342	22,317	18,947	15,538	8,892	4,630	5,897	379	292	112	151	494	342

[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 1987.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999 [b]
Canada (M)	-	1	22	-	-	-	-	110	-	-	-	-	-
Canada (N)	21	4	4	11		1	40	-	-	-	1	7	5
EU/Portugal	7,854	2,147	600	1,235	3,275	1,149	255	60	78	199	102	174	-
Japan	51	-	39	4	4	1	-	-	-	-	-	-	-
EU/Spain	132	581	224	416	956	119	7	106	200	106	1	224	772
Russia	14,397	6,735	941	359	4,821	3,009	3,212	1,998	1,419	34	375	-	202
Lithuania	-	-	-	-	-	-	1,116	-	-	-	-	-	-
Latvia	-	-	-	-	-	-	1,247	-	-	-	-	-	-
Estonia	-	-	-	-	-	-	1,926	-	-	-	-	-	-
Cuba	2,433	2,483	2,869	2,456	1,378	1,308	1,152	-	-	-	-	-	-
South Korea	16,053	11,098	8,203	4,640	2,276	4,560	122	-	-	-	-	-	-
Others [a]	8	-	-	96	13	6	-	-	-	-	-	-	-
TOTAL	40,949	23,049	12,902	9,217	12,723	10,153	9,077	2,274	1,697	339	479	405	979

[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 1987.

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Total
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	-	-	34	147	13	3	1	2	-	19	27	133	379
1995	77	65	25	55	44	15	-	-	-	2	-	9	292
1996	5	16	5	3	9	1	0	0	2	6	17	48	112
1997	18	39	17	4	14	2	25	9	2	4	-	17	151
1998	14	67	84	56	13	24	7	16	20	75	21	97	494
1999 [a]	60	61	23	17	30	21	14	30	1	3	19	63	342

[a] Provisional

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
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	151	53	5	68	595	723	302	-	1	28	310	38	2,274
1995	63	80	1	10	147	313	358	251	338	-	48	88	1,697
1996	-	2	6	7	4	42	58	-	121	68	26	5	339
1997	38	11	0	4	11	151	245	0	0	0	13	6	479
1998	16	22	64	40	6	48	46	33	51	29	24	26	405
1999 [a]	15	9	69	50	91	9	8	47	230	72	359	20	979

[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
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	361	18	-	-	379	276	1,998	-	-	2,274
1995	292	-	-	-	292	278	1,419	-	-	1,697
1996	112	-	-	-	112	339	-	-	-	339
1997	138	-	-	13	151	103	375	-	1	479
1998	493	1	-	-	494	405	-	-	-	405
1999 [a]	328	-	-	14	342	978	-	-	1	979

[a] Provisional

Table 5. Mean number (upper panel) and weight (kg., lower panel) per standard tow from Canadian SPRING surveys in Div. 3L where strata greater than 366 m (200 ftm.) were sample 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	May8-13 1980-Q2 GA 36	Apr17-May26 1985-Q2 WT28-30	May11-29 1991-Q2 WT106-7	May13-June7 1992-Q2 WT120-2	May18-Jun10 1993-Q2 WT137-8	May22-Jun10 1994-Q2 WT153-54	May27-Jun14 1995-Q2 WT169-70	May-June 1996-Q2 WT189-191	May-June 1997-Q2 WT205-208	May-June 1998-Q2 WT223-224	May-June 1999-Q2 WT240-241	May-June 2000-Q2 WT317-318
347	184-274	983	0.0 (4)	3.2 (5)	2.0 (2)	0.0 (4)	0.0 (4)	0.00 (4)	0.0 (4)	0.0 (4)	0.0 (4)	0.0 (4)	0.0 (3)	0.0 (3)
366	184-274	1394	35.8 (6)	9.8 (6)	---	0.5 (6)	0.0 (7)	0.20 (5)	0.0 (5)	0.2 (5)	7.5 (6)	0.0 (5)	0.0 (4)	8.0 (2)
369	184-274	961	0.3 (4)	0.2 (5)	0.0 (2)	0.0 (4)	0.0 (5)	0.33 (3)	0.0 (3)	0.0 (4)	0.0 (4)	0.0 (4)	0.0 (3)	0.0 (2)
386	184-274	983	2.3 (4)	1.8 (5)	5.3 (3)	0.0 (4)	0.2 (5)	0.00 (4)	0.0 (4)	0.5 (4)	0.2 (4)	0.5 (4)	3.0 (3)	0.0 (2)
389	184-274	821	55.5 (2)	1.6 (5)	8.3 (3)	0.0 (3)	0.0 (4)	0.00 (3)	2.8 (4)	0.0 (4)	5.3 (3)	0.0 (3)	0.0 (3)	15.5 (2)
391	184-274	282	11.5 (2)	0.0 (2)	0.0 (3)	3.5 (2)	0.0 (2)	0.00 (2)	5.0 (2)	0.0 (2)	0.0 (2)	0.4 (2)	0.5 (2)	0.0 (2)
345	275-366	1432	22.0 (4)	4.6 (5)	3.0 (3)	0.0 (6)	0.0 (2)	0.60 (5)	0.0 (5)	0.8 (6)	0.2 (5)	1.1 (6)	0.0 (5)	0.2 (4)
346	275-366	865	45.0 (2)	18.5 (2)	---	2.0 (4)	4.0 (6)	2.33 (3)	0.7 (3)	1.5 (4)	9.0 (3)	0.3 (3)	3.6 (3)	1.0 (3)
368	275-366	334	59.5 (2)	27.0 (2)	---	11.5 (2)	11.0 (4)	9.50 (2)	6.5 (2)	22.3 (3)	7.0 (2)	13.1 (2)	8.8 (2)	21.4 (2)
387	275-366	718	54.7 (3)	18.0 (6)	59.7 (3)	8.3 (3)	5.3 (2)	1.33 (3)	12.0 (3)	9.8 (3)	15.5 (2)	34.8 (3)	18.3 (3)	129.5 (2)
388	275-366	361	18.5 (2)	28.5 (2)	32.3 (3)	2.5 (2)	2.0 (3)	0.00 (2)	9.5 (2)	5.0 (3)	14.0 (2)	16.2 (2)	11.0 (2)	27.0 (2)
392	275-366	145	63.0 (3)	18.0 (2)	4.0 (2)	4.0 (2)	1.5 (2)	0.00 (2)	61.5 (2)	69.0 (2)	93.5 (2)	107.5 (2)	6.5 (2)	30.2 (2)
729	367-549	186	---	26.0 (2)	20.5 (2)	68.0 (2)	36.5 (2)	19.0 (2)	67.0 (2)	688.5 (2)	53.5 (3)	169.0 (2)	356.0 (2)	1481.8 (2)
731	367-549	216	640.0 (2)	77.0 (2)	37.5 (2)	30.5 (2)	24.0 (3)	40.0 (2)	34.0 (2)	278.7 (3)	54.5 (2)	123.2 (2)	761.5 (2)	196.7 (2)
733	367-549	468	85.7 (3)	916.3 (3)	19.5 (2)	51.5 (2)	21.3 (2)	19.5 (2)	10.5 (2)	441.5 (3)	320.0 (2)	157.6 (2)	259.0 (2)	239.7 (2)
735	367-549	272	73.0 (2)	62.5 (2)	---	68.5 (2)	19.0 (2)	58.5 (2)	27.0 (2)	164.4 (3)	204.4 (2)	1340.0 (2)	306.6 (2)	193.0 (2)
730	550-731	170	512.0 (2)	6963.5 (2)	169.5 (2)	96.0 (2)	203.5 (2)	29.5 (2)	68.5 (2)	282.3 (2)	3.9 (2)	185.0 (3)	236.0 (2)	1239.2 (2)
732	550-731	231	192.5 (2)	113.5 (2)	318.5 (2)	180.5 (2)	365.0 (2)	44.5 (2)	46.0 (2)	43.5 (2)	56.4 (2)	129.5 (2)	87.0 (2)	75.5 (2)
734	550-731	228	2065.0 (2)	291.0 (2)	236.0 (2)	120.0 (2)	19.0 (2)	39.0 (2)	95.0 (2)	295.3 (2)	68.2 (2)	191.9 (2)	26.3 (2)	41.0 (2)
736	550-731	175	---	425.0 (2)	---	56.0 (2)	34.5 (2)	21.0 (2)	36.0 (2)	61.7 (2)	69.0 (2)	16.0 (2)	27.4 (2)	99.0 (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	188.2
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	78.1
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	-31.9
ABUNDANCE(millions)			144.0	260.8	34.5	23.6	23.2	10.0	15.1	83.3	44.5	90.4	73.4	120.6
					Campelen Trawl Equivalent 1980-1995					Campelen Trawl 1996-Present				
347	184-274	983	0.0 (4)	0.0 (5)	0.0 (2)	0.0 (4)	0.0 (4)	0.0 (4)	0.0 (4)	0.00 (4)	0.0 (4)	0.0 (4)	0.0 (3)	0.0 (3)
366	184-274	1394	3.6 (6)	0.2 (6)	---	0.1 (6)	0.0 (7)	0.1 (5)	0.0 (5)	0.00 (5)	0.6 (6)	0.0 (5)	0.0 (4)	0.1 (2)
369	184-274	961	0.2 (4)	0.1 (5)	0.0 (2)	0.0 (4)	0.0 (5)	0.0 (3)	0.0 (3)	0.00 (4)	0.0 (4)	0.0 (4)	0.0 (3)	0.0 (2)
386	184-274	983	1.6 (4)	0.1 (5)	0.2 (3)	0.0 (4)	0.1 (5)	0.0 (4)	0.0 (4)	0.02 (4)	0.0 (4)	0.0 (4)	0.1 (3)	0.0 (2)
389	184-274	821	15.0 (2)	0.0 (5)	0.4 (3)	0.0 (3)	0.0 (4)	0.0 (3)	0.7 (4)	0.00 (4)	0.8 (3)	0.0 (3)	0.0 (3)	2.7 (2)
391	184-274	282	1.6 (2)	0.0 (2)	0.0 (3)	0.5 (2)	0.0 (2)	0.0 (2)	0.4 (2)	0.00 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)
345	275-366	1432	7.5 (4)	2.8 (5)	0.1 (3)	0.0 (6)	0.0 (2)	0.2 (5)	0.0 (5)	0.19 (6)	0.0 (5)	0.5 (6)	0.0 (5)	0.0 (4)
346	275-366	865	16.8 (2)	14.5 (2)	---	0.5 (4)	0.6 (6)	0.6 (3)	0.3 (3)	0.09 (4)	0.8 (3)	0.1 (3)	0.8 (3)	0.0 (3)
368	275-366	334	10.7 (2)	4.9 (2)	---	4.2 (2)	3.1 (4)	0.9 (2)	0.4 (2)	3.03 (3)	0.7 (2)	1.4 (2)	1.0 (2)	2.4 (2)
387	275-366	718	11.4 (3)	3.9 (6)	11.6 (3)	2.4 (3)	2.0 (2)	0.2 (3)	1.6 (3)	2.37 (3)	2.2 (2)	5.5 (3)	3.4 (3)	15.5 (2)
388	275-366	361	1.9 (2)	7.1 (2)	2.8 (3)	0.4 (2)	0.5 (3)	0.0 (2)	1.0 (2)	0.40 (3)	2.1 (2)	2.5 (2)	2.0 (2)	2.8 (2)
392	275-366	145	13.0 (3)	2.1 (2)	0.5 (2)	1.5 (2)	0.6 (2)	0.0 (2)	5.0 (2)	7.28 (2)	23.6 (2)	14.5 (2)	0.9 (2)	3.5 (2)
729	367-549	186	---	6.5 (2)	4.4 (2)	14.6 (2)	7.5 (2)	3.7 (2)	9.9 (2)	140.25 (2)	10.4 (3)	36.8 (2)	101.0 (2)	534.5 (2)
731	367-549	216	166.2 (2)	14.6 (2)	5.8 (2)	6.8 (2)	6.7 (3)	9.0 (2)	5.8 (2)	43.53 (3)	10.4 (2)	28.3 (2)	225.9 (2)	42.6 (2)
733	367-549	468	24.7 (3)	458.6 (3)	6.1 (2)	16.8 (2)	6.0 (2)	5.5 (2)	1.6 (2)	79.86 (3)	67.2 (2)	42.6 (2)	60.8 (2)	54.2 (2)
735	367-549	272	21.1 (2)	19.1 (2)	---	18.1 (2)	3.4 (2)	7.5 (2)	4.4 (2)	17.80 (3)	37.4 (2)	443.9 (2)	97.9 (2)	36.9 (2)
730	550-731	170	159.4 (2)	3654.4 (2)	42.7 (2)	34.2 (2)	72.4 (2)	9.2 (2)	18.7 (2)	88.44 (2)	1.4 (2)	77.2 (3)	101.8 (2)	506.3 (2)
732	550-731	231	51.8 (2)	45.3 (2)	57.5 (2)	62.1 (2)	91.1 (2)	12.6 (2)	15.3 (2)	12.77 (2)	16.0 (2)	37.7 (2)	29.0 (2)	23.9 (2)
734	550-731	228	1296.4 (2)	116.8 (2)	44.1 (2)	43.1 (2)	7.7 (2)	11.6 (2)	29.7 (2)	85.49 (2)	27.0 (2)	69.3 (2)	8.6 (2)	21.3 (2)
736	550-731	175	---	129.6 (2)	---	15.6 (2)	11.7 (2)	5.4 (2)	12.0 (2)	16.22 (2)	19.4 (2)	6.2 (2)	11.3 (2)	37.2 (2)
Upper (95% CI)			193.9	778.0	11.6	11.9	27.7	2.2	2.6	20.0	9.3	96.0	69.5	66.9
Weighted mean (by area)			41.2	82.8	5.6	4.8	4.2	1.5	2.1	10.9	6.0	17.9	13.8	23.4
Lower (95% CI)			-111.6	-612.3	-0.5	-2.3	-19.3	0.7	1.7	1.8	2.7	-60.3	-41.9	-20.1
BIOMASS(tons)			61502	127888	6267	7404	6461	2302	3284	16825	9277	27596	21314	36150

3L Spring

Table 6. Mean number (upper panel) and weight (kg., lower panel) per standard tow from Canadian WINTER and SUMMER surveys in Div. 3L where strata greater than 366m (200 ftm.) 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	Jan10-Feb11 1985-Q1 WT22-24	Jan22-Feb27 1986-Q1 WT42-44	Jan17-25 1990-Q1 WT 90	Aug16-29 1978-Q3 GA 12	Sep4-10 1979-Q3 GA 25	Sep18-26 1981-Q3 GA 55	Jul26-Sep3 1984-Q3 WT16-18	Jul 7-Aug25 1985-Q3 WT32-34	Aug7-19 1990-Q3 WT98	Aug4-11 1991-Q3 WT109	Aug5-15 1993-Q3 GA 223
347	184-274	983	0.0 (5)	12.0 (4)	0.8 (4)	303.0 (3)	0.0 (2)	15.8 (4)	0.0 (6)	0.0 (3)	1.8 (4)	0.0 (3)	0.0 (3)
366	184-274	1394	0.0 (5)	12.0 (2)	5.2 (5)	885.3 (3)	63.5 (2)	81.3 (6)	63.6 (11)	44.4 (5)	16.5 (4)	0.3 (3)	5.5 (2)
369	184-274	961	0.0 (5)	0.0 (3)	0.0 (4)	0.0 (3)	1.0 (2)	40.3 (4)	3.4 (7)	0.2 (6)	10.5 (4)	8.3 (4)	0.0 (3)
386	184-274	983	0.0 (5)	2.9 (7)	5.0 (4)	230.7 (3)	12.5 (2)	15.8 (4)	27.3 (8)	17.2 (5)	8.4 (7)	2.3 (3)	0.0 (3)
389	184-274	821	19.5 (4)	6.0 (4)	0.0 (3)	1.0 (3)	---	7.0 (3)	33.0 (6)	4.3 (4)	21.3 (3)	0.3 (3)	5.7 (3)
391	184-274	282	0.0 (2)	0.0 (3)	4.0 (5)	0.0 (2)	43.0 (2)	10.5 (2)	4.0 (2)	0.0 (2)	2.4 (5)	5.3 (3)	0.7 (3)
345	275-366	1432	8.0 (3)	10.7 (3)	1.4 (5)	96.5 (2)	133.0 (4)	74.0 (5)	36.7 (7)	52.0 (7)	16.2 (6)	4.5 (4)	4.3 (3)
346	275-366	865	12.5 (4)	16.3 (4)	23.7 (3)	330.0 (2)	223.8 (4)	85.7 (3)	221.7 (6)	77.3 (3)	201.9 (7)	25.3 (4)	12.3 (3)
368	275-366	334	8.0 (2)	---	25.0 (2)	4307.5 (2)	238.7 (3)	1028.0 (2)	3418.5 (2)	265.5 (2)	1392.6 (7)	339.8 (4)	57.3 (3)
387	275-366	718	87.5 (4)	13.0 (4)	110.7 (3)	936.5 (2)	942.0 (5)	3068.0 (3)	3678.3 (3)	1524.7 (3)	278.2 (10)	173.6 (5)	104.7 (3)
388	275-366	361	28.0 (3)	30.0 (3)	24.0 (2)	2824.5 (2)	5037.0 (3)	891.5 (2)	167.0 (2)	323.5 (2)	201.7 (7)	73.7 (3)	23.0 (3)
392	275-366	145	6.5 (2)	12.3 (3)	4.5 (2)	---	1556.0 (3)	1129.0 (2)	2321.5 (2)	121.5 (2)	166.3 (9)	315.7 (3)	65.0 (3)
729	367-549	186	2767.0 (2)	2150.0 (2)	165.5 (2)	---	816.0 (3)	1714.0 (2)	374.0 (2)	968.0 (2)	258.4 (7)	196.5 (2)	405.0 (3)
731	367-549	216	84.3 (3)	---	90.0 (2)	626.5 (2)	676.3 (3)	309.5 (2)	205.0 (2)	207.5 (2)	142.7 (6)	208.0 (3)	309.7 (3)
733	367-549	468	1519.7 (3)	353.5 (2)	77.0 (2)	1070.0 (2)	1884.7 (3)	1993.0 (2)	376.8 (4)	1313.5 (2)	397.2 (9)	486.0 (4)	394.7 (3)
735	367-549	272	10.0 (2)	---	223.5 (2)	935.5 (2)	664.7 (3)	1147.0 (2)	567.3 (3)	221.0 (2)	484.2 (6)	93.0 (3)	76.3 (3)
730	550-731	170	634.0 (2)	---	89.5 (2)	1604.0 (2)	511.3 (3)	662.0 (2)	83.5 (2)	269.5 (2)	145.8 (4)	175.7 (3)	77.7 (3)
732	550-731	231	325.0 (2)	---	57.5 (2)	110.5 (2)	74.0 (2)	70.0 (2)	72.5 (2)	40.0 (2)	49.9 (9)	79.3 (3)	140.3 (3)
734	550-731	228	152.0 (2)	354.5 (2)	114.5 (2)	1571.0 (2)	669.7 (3)	1009.0 (2)	436.3 (3)	719.0 (2)	214.6 (5)	47.3 (3)	28.7 (3)
736	550-731	175	---	---	185.5 (2)	261.5 (2)	418.7 (3)	116.5 (2)	---	25.5 (2)	75.8 (6)	12.7 (3)	17.0 (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(millions)			217.2	100.9	50.6	950.1	686.2	744.6	707.9	366.6	208.5	102.7	74.9
			Winter			Summer							
347	184-274	983	0.0 (5)	0.3 (4)	0.1 (4)	64.8 (3)	0.0 (2)	1.6 (4)	0.0 (6)	0.0 (3)	0.4 (4)	0.0 (3)	0.0 (3)
366	184-274	1394	0.0 (5)	0.4 (2)	0.2 (5)	70.5 (3)	3.9 (2)	28.3 (6)	2.9 (11)	4.1 (5)	2.6 (4)	0.1 (3)	1.3 (2)
369	184-274	961	0.0 (5)	0.0 (3)	0.0 (4)	0.0 (3)	0.6 (2)	5.3 (4)	0.1 (7)	0.2 (6)	1.0 (4)	2.8 (4)	0.0 (3)
386	184-274	983	0.0 (5)	0.4 (7)	2.6 (4)	69.3 (3)	9.5 (2)	8.3 (4)	10.0 (8)	11.3 (5)	0.3 (7)	0.3 (3)	0.0 (3)
389	184-274	821	1.0 (4)	0.4 (4)	0.0 (3)	0.1 (3)	---	2.8 (3)	8.0 (6)	0.8 (4)	1.3 (3)	0.2 (3)	0.3 (3)
391	184-274	282	0.0 (2)	0.0 (3)	0.1 (5)	0.0 (2)	9.8 (2)	0.3 (2)	0.1 (2)	0.0 (2)	0.3 (5)	1.2 (3)	0.2 (3)
345	275-366	1432	0.9 (3)	0.2 (3)	0.1 (5)	50.7 (2)	70.6 (4)	33.9 (5)	22.2 (7)	32.2 (7)	8.0 (6)	2.1 (4)	0.9 (3)
346	275-366	865	5.6 (4)	1.6 (4)	3.4 (3)	146.0 (2)	81.0 (4)	54.5 (3)	119.8 (6)	47.6 (3)	120.0 (7)	9.5 (4)	2.6 (3)
368	275-366	334	1.7 (2)	---	5.0 (2)	1556.2 (2)	77.5 (3)	261.8 (2)	1366.3 (2)	126.5 (2)	545.1 (7)	112.1 (4)	12.0 (3)
387	275-366	718	49.0 (4)	6.8 (4)	55.2 (3)	292.8 (2)	352.5 (5)	928.5 (3)	1341.2 (3)	501.9 (3)	88.4 (10)	47.1 (5)	24.7 (3)
388	275-366	361	5.7 (3)	5.0 (3)	2.9 (2)	568.3 (2)	1059.1 (3)	233.1 (2)	50.9 (2)	96.1 (2)	42.6 (7)	10.1 (3)	5.3 (3)
392	275-366	145	1.4 (2)	3.2 (3)	2.1 (2)	---	430.0 (3)	249.9 (2)	783.6 (2)	34.6 (2)	31.3 (9)	105.5 (3)	8.1 (3)
729	367-549	186	987.5 (2)	754.7 (2)	80.5 (2)	---	277.4 (3)	608.4 (2)	162.1 (2)	419.2 (2)	132.4 (7)	69.3 (2)	108.0 (3)
731	367-549	216	24.7 (3)	--- (1)	19.4 (2)	339.3 (2)	288.2 (3)	95.2 (2)	87.9 (2)	95.0 (2)	54.6 (6)	68.0 (3)	93.3 (3)
733	367-549	468	670.3 (3)	152.7 (2)	27.9 (2)	553.3 (2)	819.9 (3)	912.4 (2)	214.8 (4)	759.1 (2)	233.8 (9)	211.0 (4)	112.8 (3)
735	367-549	272	4.2 (2)	---	45.9 (2)	616.4 (2)	291.2 (3)	464.3 (2)	319.9 (3)	147.7 (2)	320.5 (6)	38.7 (3)	16.2 (3)
730	550-731	170	313.6 (2)	---	47.9 (2)	709.5 (2)	268.3 (3)	319.5 (2)	43.3 (2)	140.7 (2)	81.3 (4)	92.1 (3)	32.2 (3)
732	550-731	231	152.2 (2)	---	31.3 (2)	57.6 (2)	36.7 (2)	36.8 (2)	37.4 (2)	22.4 (2)	25.3 (9)	36.5 (3)	59.5 (3)
734	550-731	228	82.0 (2)	191.9 (2)	62.5 (2)	1084.6 (2)	368.8 (3)	500.2 (2)	258.7 (3)	429.6 (2)	122.3 (5)	27.0 (3)	13.3 (3)
736	550-731	175	---	---	53.7 (2)	95.6 (2)	160.4 (3)	53.3 (2)	---	14.9 (2)	40.5 (6)	5.6 (3)	8.0 (3)
Upper (95% CI)			87.4	135.9	24.1	330.9	249.0	374.5	381.9	195.9	96.0	31.0	22.2
Weighted mean (by area)			59.4	27.1	11.8	207.6	159.2	169.3	182.7	104.3	60.1	24.3	13.5
Lower (95% CI)			31.4	-81.8	-0.5	84.4	69.3	-35.9	-16.5	12.7	24.2	17.7	4.8
BIOMASS(tons)			90245	36568	18202	311163	227788	261384	277711	161038	92840	37572	20838

3L Winter & Summer

Table 7. Mean number (upper panel) and weight (kg., lower panel) per standard tow from Canadian AUTUMN surveys in Div. 3L where strata greater than 366 m (200 ftm.) were sampled. Dashes (---) represent unsampled strata. Number of successful sets in brackets. The data from 1980-1994 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	Oct9-Nov18 1985-Q4 WT37-39	Nov13-30 1986-Q4 AN 72	Oct18-Nov18 1990-Q4 WT101	Nov10-Dec2 1991-Q4 WT114-5	Nov5-29 1992-Q4 WT129-30 GA226	Nov12-Dec4 1993-Q4 WT145-6	Nov8-Dec7 1994-Q4 WT161-2	Oct3-Nov23 1995-Q4 WT176-9 T23	Sep-Nov 1996-Q4 WT196-8 T41	Oct-Dec 1997-Q4 WT213-17 T57-8	Nov-Dec 1998-Q4 WT231-3 T75-6	Nov-Dec 1999-Q4 WT247-8	Nov-Dec 2000-Q4 WT321-3 T39,42-3
347	184-274	983	0.0 (5)	0.0 (4)	0.0 (2)	0.0 (4)	0.0 (2)	0.0 (4)	0.0 (8)	0.0 (4)	0.0 (3)	0.0 (3)	0.0 (3)	0.0 (3)	0.3 (3)
366	184-274	1394	30.9 (9)	20.0 (4)	0.0 (6)	1.2 (21)	1.8 (24)	0.2 (14)	0.1 (10)	0.6 (5)	1.6 (5)	18.8 (5)	4.8 (3)	4.6 (5)	3.0 (2)
369	184-274	961	0.0 (6)	7.7 (3)	0.0 (4)	1.8 (9)	0.0 (8)	0.1 (7)	0.0 (3)	14.5 (3)	0.0 (2)	3.0 (3)	0.0 (2)	2.1 (3)	0.0 (2)
386	184-274	983	0.6 (5)	18.5 (4)	15.3 (4)	0.0 (3)	0.0 (3)	0.0 (3)	0.0 (3)	4.3 (4)	0.0 (3)	5.3 (3)	0.3 (5)	1.3 (3)	0.7 (3)
389	184-274	821	23.4 (5)	2.0 (4)	4.7 (3)	0.0 (3)	3.7 (3)	0.0 (3)	0.0 (3)	3.3 (3)	8.3 (3)	0.7 (3)	0.0 (2)	10.0 (3)	26.0 (3)
391	184-274	282	11.5 (2)	16.5 (2)	0.0 (2)	0.0 (3)	0.0 (3)	1.0 (3)	2.3 (3)	3.7 (2)	0.4 (2)	0.0 (2)	1.2 (2)	4.0 (2)	3.5 (2)
345	275-366	1432	8.7 (9)	5.5 (4)	1.0 (5)	0.3 (4)	0.3 (4)	0.0 (3)	0.0 (8)	0.7 (7)	0.9 (5)	0.0 (5)	0.5 (3)	0.6 (5)	0.6 (3)
346	275-366	865	86.4 (5)	24.7 (3)	61.3 (3)	9.7 (15)	4.4 (14)	6.4 (11)	0.3 (7)	1.0 (3)	1.0 (3)	2.3 (3)	0.5 (5)	2.1 (3)	5.7 (3)
368	275-366	334	286.0 (2)	29.0 (2)	79.5 (2)	42.3 (6)	26.7 (10)	17.0 (8)	1.2 (12)	38.0 (2)	0.3 (3)	26.5 (2)	64.0 (3)	132.4 (2)	90.0 (2)
387	275-366	718	508.3 (4)	11.0 (2)	92.7 (3)	15.4 (5)	12.0 (3)	2.3 (3)	5.1 (9)	12.7 (3)	8.3 (2)	18.6 (2)	31.6 (3)	66.2 (2)	28.0 (2)
388	275-366	361	75.0 (2)	—	78.0 (2)	29.0 (3)	24.3 (3)	9.7 (3)	7.1 (7)	8.0 (2)	14.0 (2)	23.7 (2)	27.0 (2)	126.5 (2)	21.0 (2)
392	275-366	145	1164.0 (2)	322.0 (2)	25.5 (2)	14.3 (3)	5.7 (3)	8.3 (3)	7.0 (3)	38.6 (2)	40.4 (2)	12.5 (2)	59.5 (2)	33.5 (2)	511.0 (2)
729	367-549	186	2143.5 (2)	1197.0 (2)	182.5 (2)	127.7 (3)	241.5 (3)	149.3 (3)	681.8 (9)	145.0 (2)	214.7 (2)	1006.0 (2)	550.0 (2)	329.0 (2)	131.1 (2)
731	367-549	216	400.0 (2)	—	235.5 (2)	44.7 (3)	182.7 (3)	27.7 (3)	42.9 (7)	123.2 (2)	138.0 (1)	135.0 (2)	287.4 (2)	2421.7 (2)	152.5 (2)
733	367-549	468	566.3 (3)	—	204.5 (2)	285.7 (3)	176.3 (3)	19.7 (3)	39.3 (9)	1625.5 (2)	22.4 (3)	41.0 (2)	123.7 (2)	270.0 (2)	607.2 (2)
735	367-549	272	188.5 (2)	— (2)	—	119.0 (3)	192.7 (3)	79.0 (3)	16.9 (11)	28.5 (2)	139.3 (2)	181.5 (2)	198.5 (2)	154.7 (2)	263.8 (2)
730	550-731	170	31.0 (2)	—	—	273.5 (2)	55.0 (2)	261.0 (3)	18.7 (3)	72.1 (2)	21.2 (2)	26.0 (2)	645.3 (2)	204.3 (2)	101.5 (2)
732	550-731	231	32.0 (2)	—	154.0 (2)	35.5 (2)	161.0 (2)	16.5 (2)	80.7 (3)	67.7 (2)	10.8 (2)	359.0 (2)	19.5 (2)	151.5 (2)	17.5 (2)
734	550-731	228	420.5 (2)	—	36.0 (2)	15.0 (2)	87.5 (2)	62.0 (2)	35.7 (3)	58.4 (2)	61.7 (2)	616.4 (2)	95.1 (2)	132.5 (2)	37.8 (2)
736	550-731	175	173.5 (2)	22.5 (2)	222.0 (2)	43.5 (2)	40.5 (2)	25.0 (3)	22.0 (7)	73.3 (2)	78.8 (2)	317.5 (2)	105.6 (2)	94.0 (2)	261.9 (2)
737	732-914	227	—	—	—	—	—	—	—	41.5 (2)	5.5 (2)	2.0 (2)	0.5 (2)	2.0 (2)	0.0 (2)
741	732-914	223	—	—	—	—	—	—	—	—	2.5 (2)	0.5 (2)	16.2 (2)	3.6 (2)	1.0 (2)
745	732-914	348	—	—	—	—	—	—	—	—	0.0 (2)	17.0 (2)	4.0 (2)	4.5 (2)	0.0 (2)
748	732-914	159	—	—	—	—	—	—	—	—	17.0 (2)	1.0 (2)	4.0 (2)	0.5 (2)	1.0 (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	89.5
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	53.7
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	17.9
ABUNDANCE(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	90.0
			Campelen Trawl Equivalent 1980-1994							Campelen Trawl 1995-Present					
347	184-274	983	0.0 (5)	0.0 (4)	0.0 (2)	0.0 (4)	0.0 (2)	0.0 (4)	0.0 (8)	0.0 (4)	0.0 (3)	0.0 (3)	0.0 (3)	0.0 (3)	0.1 (3)
366	184-274	1394	4.8 (9)	1.4 (4)	0.0 (6)	0.1 (21)	0.3 (24)	0.1 (14)	0.0 (10)	0.1 (5)	0.0 (5)	0.4 (5)	0.3 (5)	0.3 (5)	0.0 (2)
369	184-274	961	0.0 (6)	1.0 (3)	0.0 (4)	0.2 (9)	0.0 (8)	0.0 (7)	0.0 (3)	1.8 (3)	0.0 (2)	0.5 (3)	0.0 (3)	0.1 (3)	0.0 (2)
386	184-274	983	0.4 (5)	0.9 (4)	0.4 (4)	0.0 (3)	0.0 (3)	0.0 (3)	0.0 (3)	0.7 (4)	0.0 (3)	1.2 (3)	0.0 (3)	0.1 (3)	0.2 (3)
389	184-274	821	2.0 (5)	0.7 (4)	0.6 (3)	0.0 (3)	0.1 (3)	0.0 (3)	0.0 (3)	0.6 (3)	0.3 (3)	0.0 (3)	0.0 (3)	0.7 (3)	3.1 (3)
391	184-274	282	3.7 (2)	4.6 (2)	0.0 (2)	0.0 (3)	0.0 (3)	0.5 (3)	0.6 (3)	1.3 (2)	0.0 (2)	0.0 (2)	0.1 (2)	1.2 (2)	0.1 (2)
345	275-366	1432	2.8 (9)	3.8 (4)	0.5 (5)	0.1 (4)	0.2 (4)	0.0 (3)	0.0 (8)	0.1 (7)	0.2 (5)	0.0 (5)	0.0 (5)	0.0 (5)	0.0 (3)
346	275-366	865	44.1 (5)	13.0 (3)	29.6 (3)	2.4 (15)	0.8 (14)	1.6 (11)	0.1 (7)	0.2 (3)	0.2 (3)	0.2 (3)	0.0 (2)	0.2 (3)	0.2 (3)
368	275-366	334	112.2 (2)	6.8 (2)	14.4 (2)	7.2 (6)	4.7 (10)	1.4 (8)	0.1 (12)	5.3 (2)	0.0 (3)	2.2 (2)	6.3 (2)	19.3 (2)	16.2 (2)
387	275-366	718	193.3 (4)	2.8 (2)	29.3 (3)	5.1 (5)	2.3 (3)	0.6 (3)	0.9 (9)	1.8 (3)	0.6 (2)	1.7 (2)	4.6 (2)	10.9 (2)	4.0 (2)
388	275-366	361	22.5 (2)	—	4.6 (2)	2.4 (3)	3.8 (3)	2.3 (3)	1.0 (7)	1.3 (2)	2.2 (2)	2.4 (2)	4.1 (2)	23.4 (2)	1.5 (2)
392	275-366	145	342.7 (2)	87.3 (2)	2.8 (2)	1.0 (3)	0.6 (3)	1.6 (3)	1.9 (3)	3.1 (2)	4.4 (2)	2.2 (2)	10.4 (2)	7.0 (2)	171.8 (2)
729	367-549	186	855.8 (2)	378.9 (2)	63.7 (2)	32.0 (3)	72.0 (3)	42.9 (3)	179.2 (9)	25.0 (2)	35.5 (2)	246.2 (2)	165.2 (2)	68.6 (2)	30.1 (2)
731	367-549	216	203.5 (2)	—	82.4 (2)	8.8 (3)	41.5 (3)	5.4 (3)	7.3 (7)	17.5 (2)	24.8 (1)	22.2 (2)	75.2 (2)	658.4 (2)	35.1 (2)
733	367-549	468	255.4 (3)	—	50.7 (2)	77.0 (3)	53.7 (3)	4.6 (3)	8.8 (9)	702.6 (2)	4.1 (3)	7.5 (2)	25.9 (2)	83.5 (2)	193.1 (2)
735	367-549	272	89.8 (2)	46.1 (2)	—	25.9 (3)	63.4 (3)	7.2 (3)	2.6 (11)	4.5 (2)	29.0 (2)	28.9 (2)	36.9 (2)	36.7 (2)	49.7 (2)
730	550-731	170	16.0 (2)	—	—	175.4 (2)	27.9 (2)	122.0 (3)	7.0 (3)	24.2 (2)	8.9 (2)	9.7 (2)	239.2 (2)	98.5 (2)	43.8 (2)
732	550-731	231	17.5 (2)	—	86.0 (2)	16.0 (2)	53.6 (2)	4.2 (2)	24.6 (3)	15.1 (2)	4.1 (2)	95.1 (2)	6.7 (2)	55.5 (2)	6.0 (2)
734	550-731	228	265.9 (2)	—	17.7 (2)	9.6 (2)	33.4 (2)	18.1 (2)	12.3 (3)	20.0 (2)	23.6 (2)	152.2 (2)	34.0 (2)	68.0 (2)	14.9 (2)
736	550-731	175	78.3 (2)	12.1 (2)	106.1 (2)	18.3 (2)	11.4 (2)	6.0 (3)	6.7 (7)	16.8 (2)	32.5 (2)	79.0 (2)	24.2 (2)	38.5 (2)	84.5 (2)
737	732-914	227	—	—	—	—	—	—	—	13.1 (2)	2.6 (2)	0.9 (2)	0.1 (2)	1.1 (2)	0.0 (2)
741	732-914	223	—	—	—	—	—	—	—	—	0.5 (2)	0.2 (2)	7.3 (2)	1.7 (2)	0.4 (2)
745	732-914	348	—	—	—	—	—	—	—	—	0.0 (2)	5.9 (2)	1.1 (2)	1.7 (2)	0.0 (2)
748	732-914	159	—	—	—	—	—	—	—	—	6.3 (2)	0.5 (2)	2.4 (2)	0.4 (2)	0.4 (2)
Upper (95% CI)			105.3	18.9	22.2	15.3	12.8	8.1	8.7	388.2	5.1	57.2	25.9	165.3	29.5
Weighted mean (by area)			63.6	13.0	14.0	8.8	8.7	3.9	4.6	31.8	3.2	11.7	11.1	23.2	14.9
Lower (95% CI)			21.9	7.2	5.7	2.4	4.6	-0.3	0.6	-324.6	0.7	-33.9	-3.7	-119.0	0.2
BIOMASS(tons)			98233	17119	20743	13665	13424	6011	7173	50078	4691	19544	18522	38861	24917

3L Autumn

Table 8. Mean number (upper panel) and weight (kg., lower panel) per standard tow from Canadian SPRING surveys in Div. 3N where strata greater than 366 m (200 ftm.) 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. WT=Wilfred Templeman.

Stratum	Depth Range (M)	Area (sq. n.) mi	May3-11 1991-Q2 WT106	May2-13 1992-Q2 WT119-20	May5-18 1993-Q2 WT136-7	May14-22 1994-Q2 WT153	May13-27 1995-Q2 WT168-69	May22-30 1996-Q2 WT189	May-Jun 1997-Q2 WT205-6	May-Jun 1998-Q2 WT221-2	May-Jun 1999-Q2 WT239-240	May-Jun 2000-Q2 WT315-18
359	093-183	421	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	3.5 (2)	0.0 (2)	180.5 (2)	0.0 (2)
377	093-183	100	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.5 (2)	0.5 (2)	1.5 (2)	0.0 (2)	0.0 (2)
382	093-183	647	0.5 (2)	0.0 (3)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	1.5 (2)
358	185-274	225	68.0 (2)	34.0 (2)	1473.0 (2)	68.0 (2)	3.5 (2)	152.0 (2)	144.5 (2)	1680.9 (2)	99.0 (2)	23.0 (2)
378	185-274	139	8.0 (3)	42.0 (2)	1.0 (2)	0.5 (2)	2.5 (2)	62.0 (2)	11.0 (2)	15.5 (2)	148.5 (2)	2.7 (2)
381	185-274	182	0.5 (2)	1.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	8.4 (2)	0.5 (2)	0.0 (2)	5.5 (2)	0.5 (2)
357	275-366	164	212.5 (2)	593.0 (2)	395.5 (2)	210.5 (2)	159.5 (2)	197.3 (2)	245.5 (2)	3096.6 (2)	6973.4 (2)	3412.4 (2)
379	275-366	106	56.5 (2)	15.5 (2)	13.5 (2)	59.5 (2)	42.5 (2)	569.0 (2)	152.5 (2)	195.1 (2)	459.5 (2)	507.1 (2)
380	275-366	116	8.0 (2)	0.0 (2)	13.5 (2)	10.5 (2)	21.5 (2)	47.5 (2)	72.0 (2)	9.5 (2)	41.0 (2)	4.1 (2)
723	367-549	155	261.0 (2)	510.5 (2)	270.0 (2)	129.0 (2)	112.0 (2)	252.3 (2)	366.0 (2)	364.5 (2)	401.5 (2)	6421.5 (2)
725	367-549	105	229.0 (2)	---	89.5 (2)	43.0 (2)	48.5 (2)	455.0 (2)	490.4 (2)	130.8 (2)	317.2 (2)	764.0 (2)
727	367-549	160	24.5 (2)	15.5 (2)	50.0 (2)	46.0 (2)	94.0 (2)	166.1 (2)	248.0 (2)	141.0 (2)	88.0 (2)	336.4 (2)
724	550-731	124	517.5 (2)	103.5 (2)	166.0 (2)	57.5 (2)	184.5 (2)	120.6 (2)	233.0 (2)	488.4 (2)	142.7 (2)	322.2 (2)
726	550-731	72	385.0 (2)	75.0 (2)	86.0 (2)	31.5 (2)	163.0 (2)	208.6 (2)	546.0 (2)	1039.0 (2)	565.0 (2)	366.0 (2)
728	550-731	156	66.5 (2)	75.5 (2)	965.0 (2)	34.3 (3)	109.0 (2)	62.4 (2)	---	94.7 (2)	356.8 (2)	185.3 (2)
752	732-914	134	---	---	---	1.5 (2)	---	---	---	---	---	---
756	732-914	106	---	---	---	5.5 (2)	---	---	---	---	---	---
760	732-914	154	---	---	---	3.5 (2)	---	---	---	---	---	---
Upper (95% CI)			173.0	129.4	1767.0	96.3	136.5	169.1	197.9	2491.3	5168.5	2916.7
Weighted mean (by area)			79.8	81.0	221.4	32.3	43.0	103.0	103.2	401.5	536.4	642.4
Lower (95% CI)			-13.4	32.6	-1324.1	-31.8	-50.6	36.8	8.5	-1688.3	-4095.6	-1631.8
ABUNDANCE(millions)			31.5	30.8	87.5	14.5	17.0	40.7	38.5	158.6	211.9	253.8
			Campelen Trawl Equivalent 1991-1995					Campelen Trawl 1996-Present				
359	093-183	421	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.5 (2)	0.0 (2)	2.9 (2)	0.0 (2)
377	093-183	100	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.1 (2)	0.1 (2)	0.1 (2)	0.0 (2)	0.0 (2)
382	093-183	647	0.2 (2)	0.0 (3)	0.0 (2)	0.0 (2)	0.0 (3)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.3 (2)
358	185-274	225	1.2 (2)	1.3 (2)	104.0 (2)	2.5 (2)	0.3 (2)	7.5 (2)	9.8 (2)	253.8 (2)	5.1 (2)	1.8 (2)
378	185-274	139	0.9 (3)	2.4 (2)	0.2 (2)	0.1 (2)	0.3 (2)	8.6 (2)	1.5 (2)	2.3 (2)	16.1 (2)	0.2 (2)
381	185-274	182	0.1 (2)	0.2 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.2 (2)	0.0 (2)	0.0 (2)	0.6 (2)	0.1 (2)
357	275-366	164	19.1 (2)	23.7 (2)	35.1 (2)	18.1 (2)	16.7 (2)	30.6 (2)	23.7 (2)	572.9 (2)	1299.0 (2)	549.0 (2)
379	275-366	106	5.4 (2)	1.3 (2)	1.7 (2)	4.9 (2)	4.2 (2)	65.4 (2)	19.8 (2)	24.2 (2)	70.5 (2)	82.3 (2)
380	275-366	116	0.2 (2)	0.0 (2)	1.1 (2)	0.4 (2)	2.3 (2)	4.6 (2)	9.4 (2)	1.1 (2)	6.2 (2)	0.4 (2)
723	367-549	155	29.7 (2)	47.1 (2)	60.7 (2)	16.3 (2)	14.9 (2)	32.6 (2)	40.3 (2)	97.9 (2)	114.6 (2)	1376.9 (2)
725	367-549	105	26.9 (2)	---	15.2 (2)	6.3 (2)	5.9 (2)	78.2 (2)	76.5 (2)	25.6 (2)	89.3 (2)	167.1 (2)
727	367-549	160	3.4 (2)	1.7 (2)	5.9 (2)	8.1 (2)	15.1 (2)	19.3 (2)	48.7 (2)	24.5 (2)	22.0 (2)	64.9 (2)
724	550-731	124	81.6 (2)	18.6 (2)	69.5 (2)	19.1 (2)	30.1 (2)	37.5 (2)	33.6 (2)	204.4 (2)	54.8 (2)	126.5 (2)
726	550-731	72	87.8 (2)	22.9 (2)	18.8 (2)	7.9 (2)	21.1 (2)	71.4 (2)	138.7 (2)	358.8 (2)	168.2 (2)	133.4 (2)
728	550-731	156	20.2 (2)	20.2 (2)	421.3 (2)	9.6 (3)	29.2 (2)	12.7 (2)	---	26.8 (2)	106.6 (2)	62.2 (2)
752	732-914	134	---	---	---	0.5 (2)	---	---	---	---	---	
756	732-914	106	---	---	---	2.4 (2)	---	---	---	---	---	
760	732-914	154	---	---	---	1.2 (2)	---	---	---	---	---	
Upper (95% CI)			26.1	10.3	340.8	5.4	11.0	27.2	28.0	198.0	956.5	526.4
Weighted mean (by area)			11.1	7.0	40.8	4.1	6.5	15.2	15.1	80.5	101.7	130.8
Lower (95% CI)			-4.0	3.7	-259.3	2.9	2.0	3.1	2.3	-37.0	-753.1	-264.7
BIOMASS(tons)			4375	2662	16112	1860	2572	5987	5651	31806	40182	51692

3N Spring

Table 9. Mean number (upper panel) and weight (kg., lower panel) per standard tow from Canadian SUMMER surveys in Div. 3N where strata greater than 366 m (200 ftm.) 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. WT=Wilfred Templeman.

Stratum	Depth Range (M)	Area (sq. n.) mi	Aug11-18 1991-Q3 WT109	Aug15-20 1993-Q3 GA233
359	093-183	421	205.8 (4)	1.0 (3)
377	093-183	100	0.0 (2)	4.7 (3)
382	093-183	647	0.0 (3)	0.0 (3)
358	185-274	225	979.7 (3)	25736.0 (4)
378	185-274	139	26.7 (3)	16.7 (3)
381	185-274	182	5.7 (3)	6.0 (4)
357	275-366	164	2607.0 (2)	1408.7 (3)
379	275-366	106	7880.0 (2)	2304.0 (3)
380	275-366	116	3471.5 (2)	793.5 (2)
723	367-549	155	---	3159.8 (4)
725	367-549	105	427.0 (3)	1356.3 (3)
727	367-549	160	109.0 (4)	2699.0 (3)
724	550-731	124	---	1317.0 (4)
726	550-731	72	73.5 (2)	545.5 (2)
728	550-731	156	16.8 (4)	164.7 (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(millions)			281.7	1052.9

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
BIOMASS(tons)			47624	129808

3N Summer

Table 10. Mean number (upper panel) and weight (kg., lower panel) per standard tow from Canadian AUTUMN surveys in Div. 3N where strata greater than 366 m (200 ftm.) 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). Data from 1996 to present are actual Campelen data. WT=Wilfred Templeman, T=Teleost.

Stratum	Depth Range (M)	Area (sq. n.) mi	Oct27-Nov10 1991-Q4 WT113-4	Oct26-Nov5 1992-Q4 WT128-9	Nov1-12 1993-Q4 WT144-5	Oct29-Dec13 1994-Q4 WT160-61	Sep28-Oct26 1995-Q4 WT176-77	Nov25-Dec13 1996-Q4 AN253 T41-42	Oct-Dec 1997-Q4 WT213-217	Sep-Oct 1998-Q4 WT229-230 T76	Sep-Oct 1999-Q4 WT246-247	Sep-Oct 2000-Q4 WT320-323 T338-9
359	093-183	421	0.0 (2)	0.0 (2)	0.0 (2)	4.0 (2)	1.0 (2)	0.00 (2)	0.0 (2)	0.0 (2)	0.0 (2)	22.5 (2)
377	093-183	100	---	0.0 (2)	0.5 (2)	0.5 (2)	2.0 (2)	0.00 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)
382	093-183	647	0.0 (3)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	3.11 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)
358	185-274	225	9350.0 (2)	30425.0 (2)	17.5 (2)	350.0 (2)	0.5 (2)	4.40 (2)	11.4 (3)	6664.5 (2)	356.0 (2)	1961.3 (2)
378	185-274	139	183.5 (2)	1.5 (2)	4.5 (2)	5.0 (2)	1.0 (2)	3.00 (2)	48.4 (2)	18.5 (2)	0.0 (2)	23.1 (2)
381	185-274	182	4.5 (2)	---	3.0 (2)	0.0 (2)	425.8 (2)	74.83 (2)	144.0 (2)	2.5 (2)	0.5 (2)	17.0 (2)
357	275-366	164	3521.5 (2)	5207.5 (2)	262.5 (2)	3687.5 (2)	733.8 (2)	17.09 (2)	184.2 (2)	9965.5 (2)	---	11134.9 (2)
379	275-366	106	---	123.0 (2)	270.5 (2)	100.5 (2)	548.9 (2)	25.78 (2)	7864.8 (2)	2540.8 (2)	5852.7 (2)	1831.2 (2)
380	275-366	116	179.5 (2)	---	10.5 (2)	0.0 (2)	10297.8 (2)	858.22 (2)	3610.7 (2)	12.8 (2)	356.0 (2)	42.5 (2)
723	367-549	155	146.0 (2)	---	1832.5 (2)	1212.0 (2)	329.8 (2)	48.50 (2)	930.0 (2)	805.5 (2)	304.5 (2)	1725.3 (2)
725	367-549	105	---	1672.5 (2)	270.5 (2)	477.5 (2)	293.8 (2)	136.50 (2)	1345.6 (2)	1216.0 (2)	410.5 (2)	323.1 (2)
727	367-549	160	---	---	208.0 (2)	136.0 (2)	791.0 (2)	420.00 (2)	1027.4 (3)	654.6 (2)	267.2 (2)	301.2 (2)
724	550-731	124	29.0 (2)	---	532.0 (2)	802.5 (2)	243.1 (2)	157.00 (2)	18.0 (2)	255.3 (2)	948.5 (2)	276.0 (2)
726	550-731	72	---	---	65.5 (2)	207.0 (2)	322.0 (2)	906.00 (2)	9.5 (2)	22.7 (2)	311.1 (2)	172.4 (2)
728	550-731	156	---	---	---	8.5 (2)	120.9 (2)	339.56 (2)	23.0 (2)	17.5 (2)	250.0 (2)	55.3 (2)
752	732-914	134	---	---	---	---	---	---	---	1.9 (2)	---	0.5 (2)
756	732-914	106	---	---	---	---	---	---	---	1.0 (2)	---	0.0 (2)
760	732-914	154	---	---	---	---	---	---	---	0.0 (2)	---	0.4 (2)
Upper (95% CI)			7884.4	38182.7	1042.7	2427.2	7503.4	673.1	3693.1	7078.8	1568.3	4759.1
Weighted mean (by area)			1267.7	4136.6	182.1	373.3	770.0	133.7	676.9	1163.9	389.2	884.0
Lower (95% CI)			-5349.1	-29909.5	-678.5	-1680.6	-5963.4	-405.8	-2339.3	-4751.0	-790.0	-2991.0
ABUNDANCE(millions)			378.9	1085.2	68.0	147.5	304.2	52.8	267.4	522.9	145.0	397.2
			Campelen Trawl Equivalent 1991-1994				Campelen Trawl 1995-Present					
359	093-183	421	0.0 (2)	0.0 (2)	0.0 (2)	0.3 (2)	0.0 (2)	0.67 (2)	0.0 (2)	0.0 (2)	0.0 (2)	3.0 (2)
377	093-183	100	---	0.0 (2)	0.2 (2)	0.1 (2)	0.3 (2)	0.00 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)
382	093-183	647	0.0 (3)	0.0 (2)	0.0 (2)	0.0 (2)	0.1 (2)	0.00 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)
358	185-274	225	390.4 (2)	3206.1 (2)	1.3 (2)	26.8 (2)	39.9 (2)	4.98 (2)	14.2 (2)	1018.9 (2)	41.1 (2)	365.5 (2)
378	185-274	139	48.4 (2)	0.3 (2)	0.8 (2)	0.3 (2)	0.5 (2)	0.38 (2)	5.6 (2)	4.7 (2)	0.0 (2)	7.0 (2)
381	185-274	182	0.1 (2)	---	1.1 (2)	0.0 (2)	0.0 (2)	1.48 (2)	0.8 (3)	0.7 (2)	0.0 (2)	0.3 (2)
357	275-366	164	414.7 (2)	727.5 (2)	23.8 (2)	405.3 (2)	1230.7 (2)	175.2 (2)	581.5 (2)	1714.5 (2)	--- (2)	1887.8 (2)
379	275-366	106	. (1)	16.9 (2)	30.2 (2)	10.8 (2)	59.1 (2)	3.96 (2)	1405.5 (2)	500.4 (2)	1099.0 (2)	336.8 (2)
380	275-366	116	41.9 (2)	---	0.4 (2)	0.0 (2)	117.5 (2)	1.13 (2)	27.5 (2)	2.3 (2)	75.0 (2)	7.2 (2)
723	367-549	155	38.8 (2)	---	293.8 (2)	302.3 (2)	197.1 (2)	66.11 (2)	217.4 (3)	156.7 (2)	76.2 (2)	501.0 (2)
725	367-549	105	---	491.0 (2)	69.1 (2)	97.7 (2)	46.9 (2)	24.23 (2)	447.9 (2)	479.9 (2)	87.8 (2)	81.6 (2)
727	367-549	160	---	---	39.4 (2)	28.6 (2)	35.9 (2)	8.85 (2)	230.1 (2)	165.0 (2)	51.3 (2)	56.9 (2)
724	550-731	124	20.8 (2)	---	220.9 (2)	294.6 (2)	46.2 (2)	96.44 (2)	8.6 (2)	111.9 (2)	419.9 (2)	107.8 (2)
726	550-731	72	---	---	26.0 (2)	86.4 (2)	113.4 (2)	273.0 (2)	4.0 (2)	7.4 (2)	117.4 (2)	85.2 (2)
728	550-731	156	---	---	---	3.1 (2)	61.0 (2)	32.97 (2)	6.7 (2)	6.6 (2)	106.5 (2)	23.4 (2)
752	732-914	134	---	---	---	---	---	---	---	0.9 (2)	---	0.3 (2)
756	732-914	106	---	---	---	---	---	---	---	0.2 (2)	---	0.0 (2)
760	732-914	154	---	---	---	---	---	---	---	---	---	0.3 (2)
Upper (95% CI)			110.5	4050.9	144.9	158.1	910.5	158.2	717.7	1115.0	172.1	870.7
Weighted mean (by area)			81.0	468.8	35.4	62.2	102.9	28.5	129.4	208.6	88.9	168.1
Lower (95% CI)			51.5	-3113.2	-74.1	-33.6	-704.7	-101.1	-458.9	-697.8	5.7	-534.4
BIOMASS(tons)			24221	122990	13222	24584	40650	11277	51116	93703	33125	75544

3N Autumn

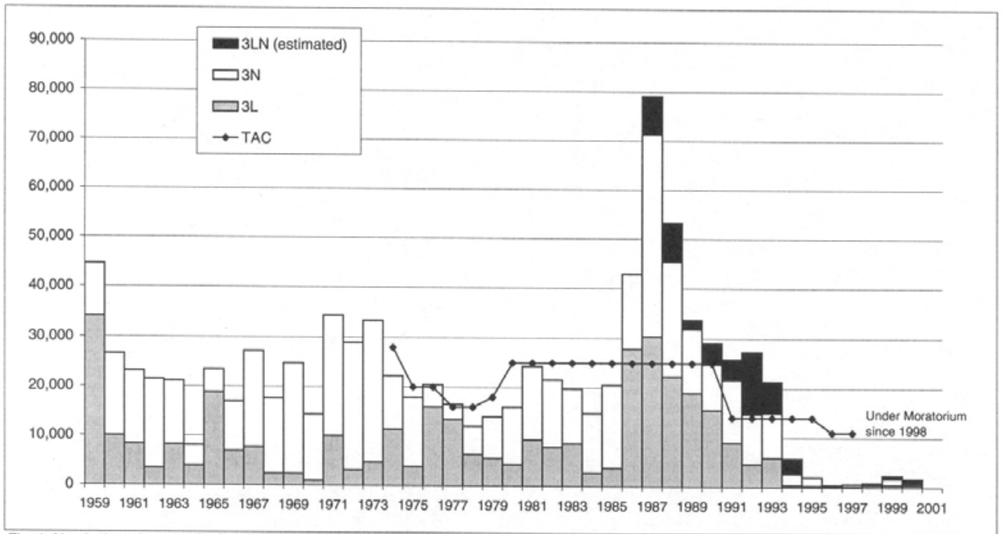


Fig. 1: Nominal catches and TACs of redfish in Div. 3LN (1995-2000 are provisional).

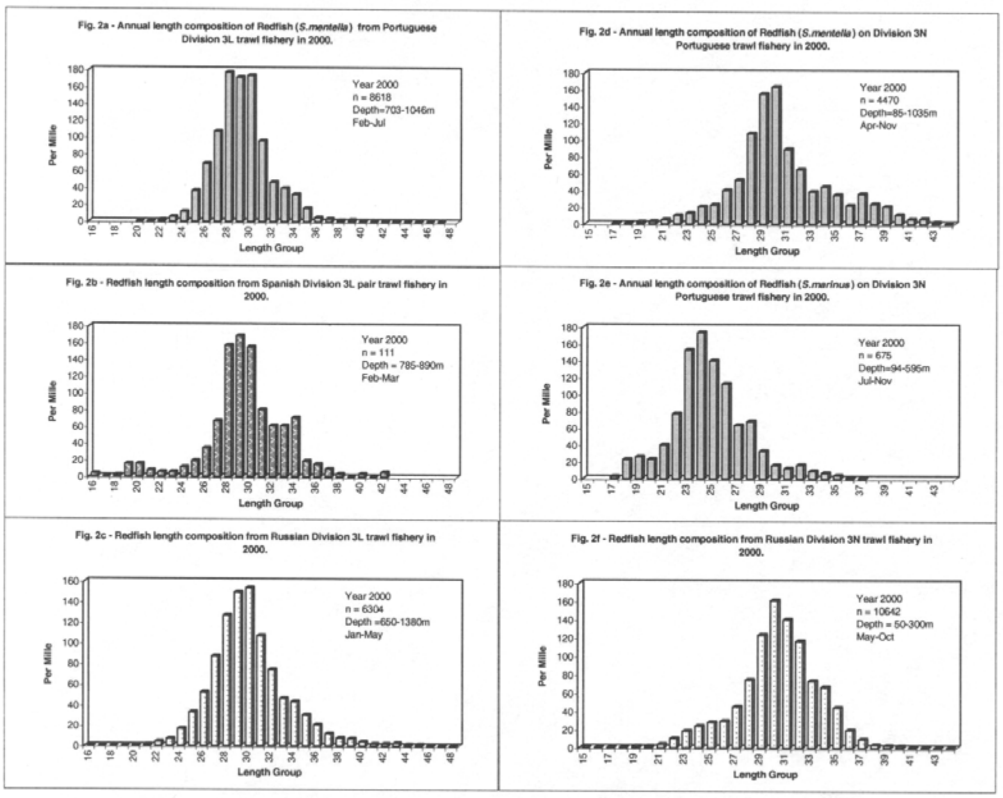


Fig. 2. Length compositions (per mille) of redfish taken as bycatch in Portuguese, Russian and Spanish trawl fisheries in Div. 3L and Div. 3N

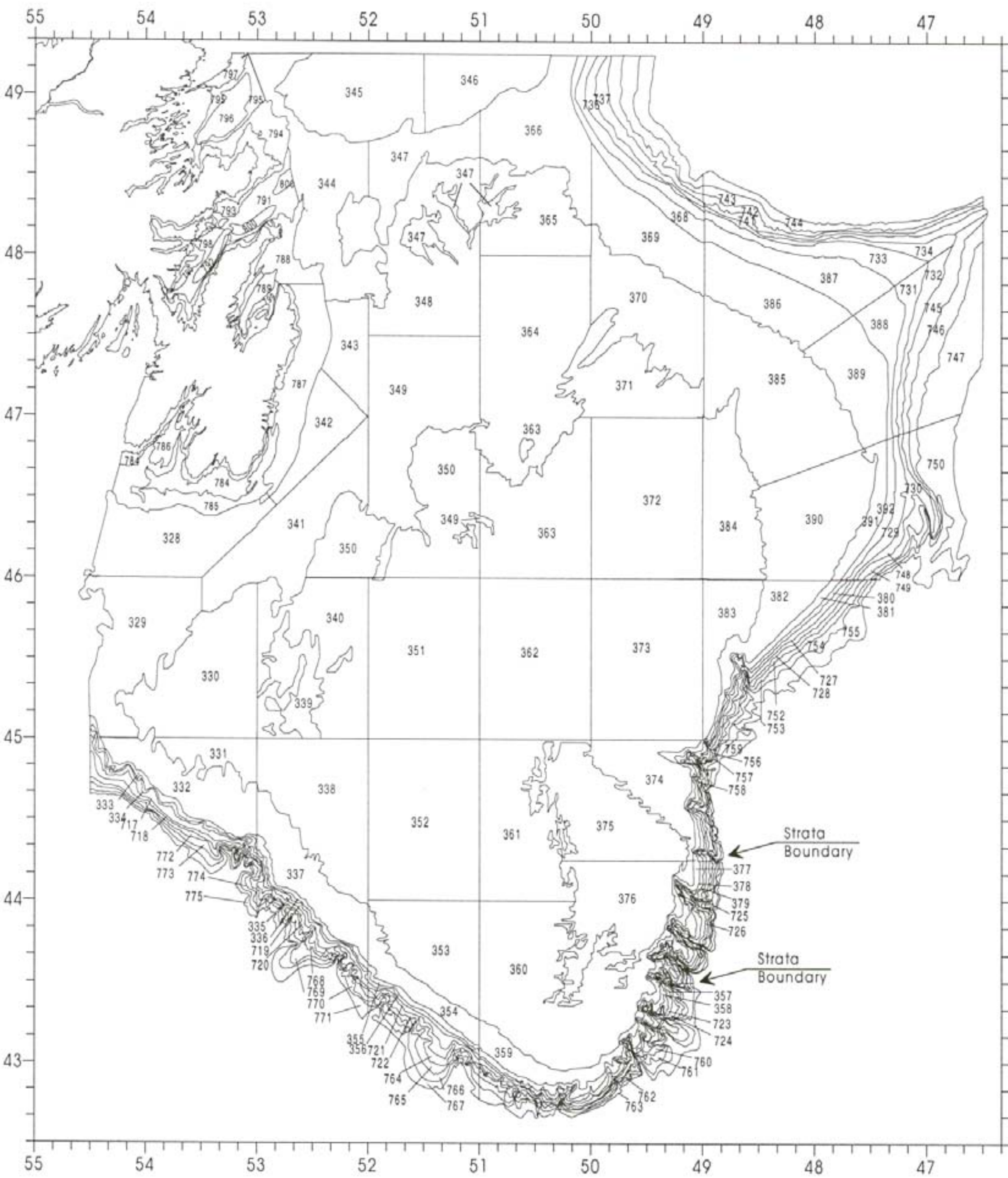


Fig. 3. Stratification chart for Div. 3LN surveys.

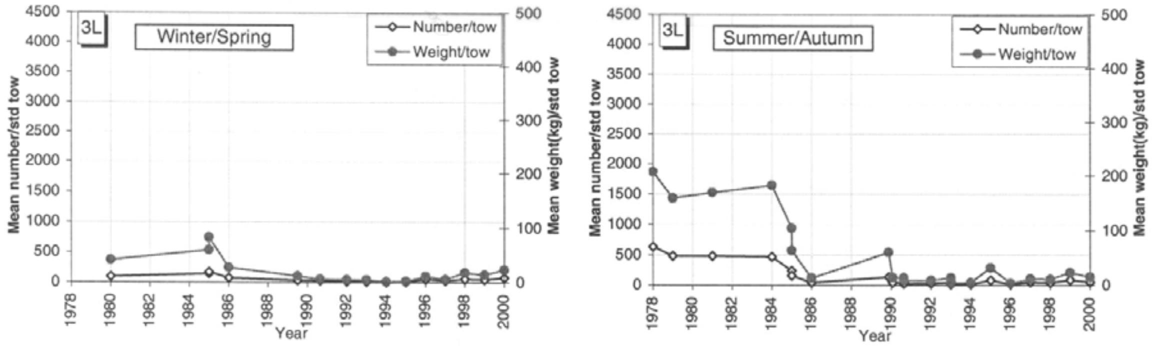


Figure 4. Stratified mean number and weight (kg) per tow in Div. 3L for 1978-2000 from various Canadian surveys where strata greater than 366m were covered. Surveys up to spring 1995 used an Engel trawl (data plotted in Campelen equivalents) and those from autumn 1995 onward used a Campelen trawl. First and second quarter surveys in left panel, third and fourth quarter surveys in right panel.

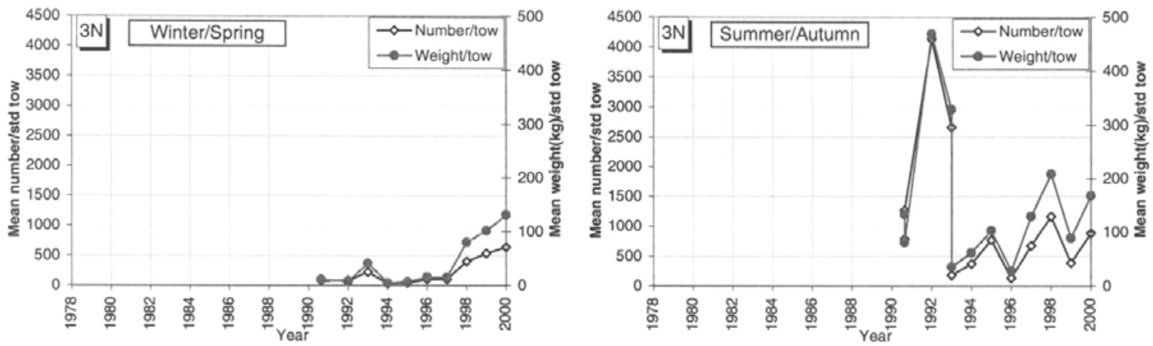


Figure 5. Stratified mean number and weight (kg) per tow in Div. 3N for 1991-2000 Canadian surveys where strata greater than 366m were covered. Surveys up to spring 1995 used an Engel trawl (data plotted in Campelen equivalents) and those from autumn 1995 onward used a Campelen trawl. First First and second quarter surveys in left panel, third and fourth quarter surveys in right panel.

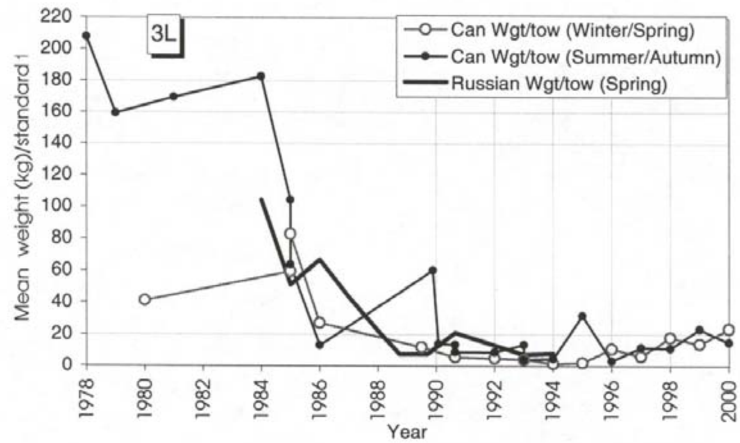


Figure 6. Stratified mean weight (kg) per tow in Div. 3L from Canadian and Russian surveys.

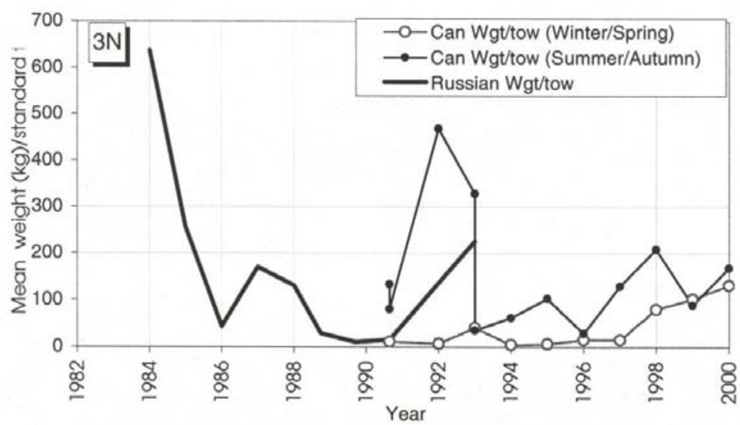


Figure 7. Stratified mean weight (kg) per tow in Div. 3N from Canadian and Russian surveys.

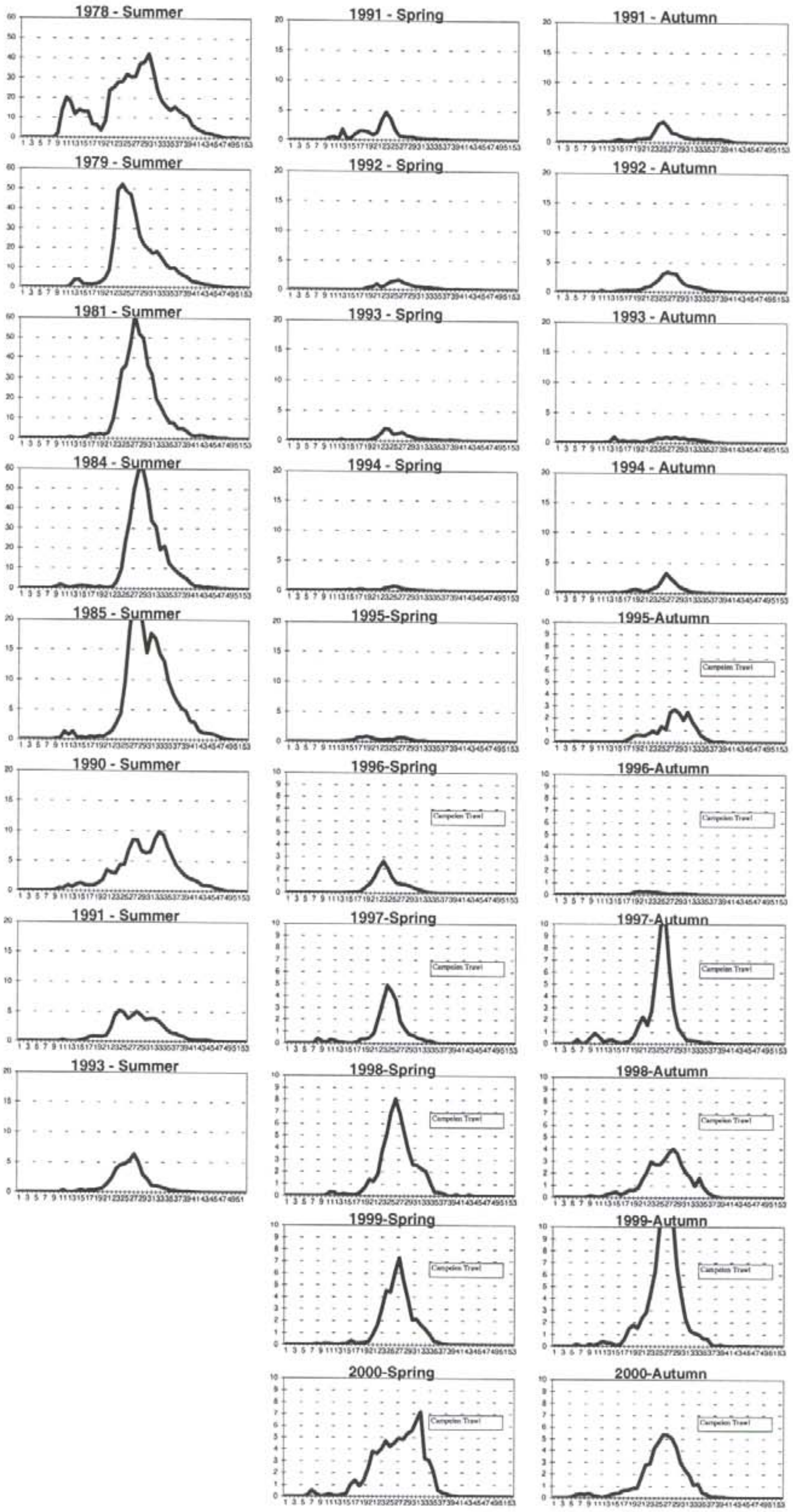


Fig. 8. Length frequency distribution from stratified-random research surveys to Div. 3L from 1978 to 2000. Plotted are mean number per standard tow in Campelen equivalent units. X-axis is forklength

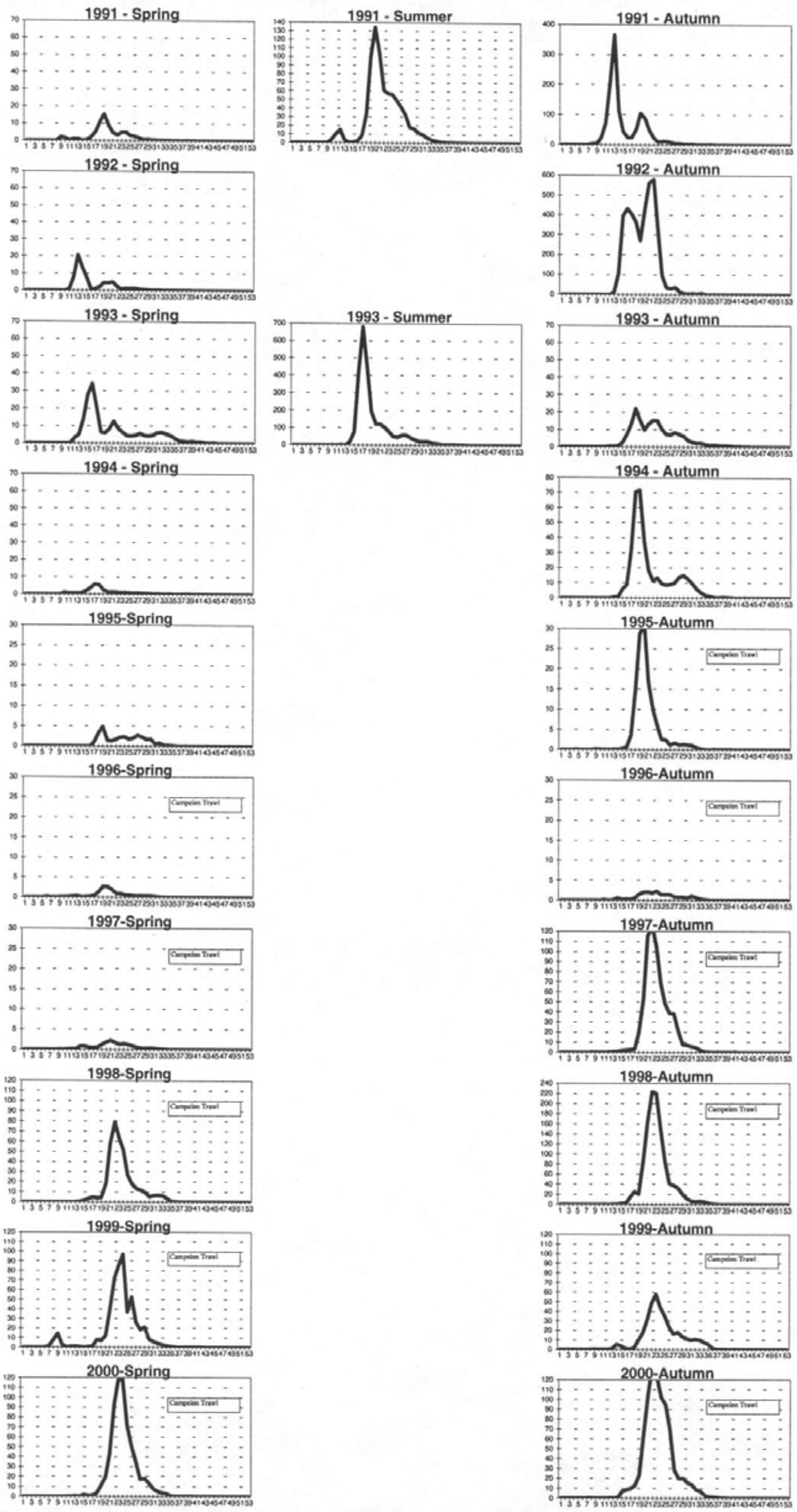


Fig. 9. Length frequency distribution from stratified-random research surveys to Div. 3N from 1991 to 2000. Plotted are mean number per standard tow in Campelen equivalent units. X-axis is forklength in centimetres.

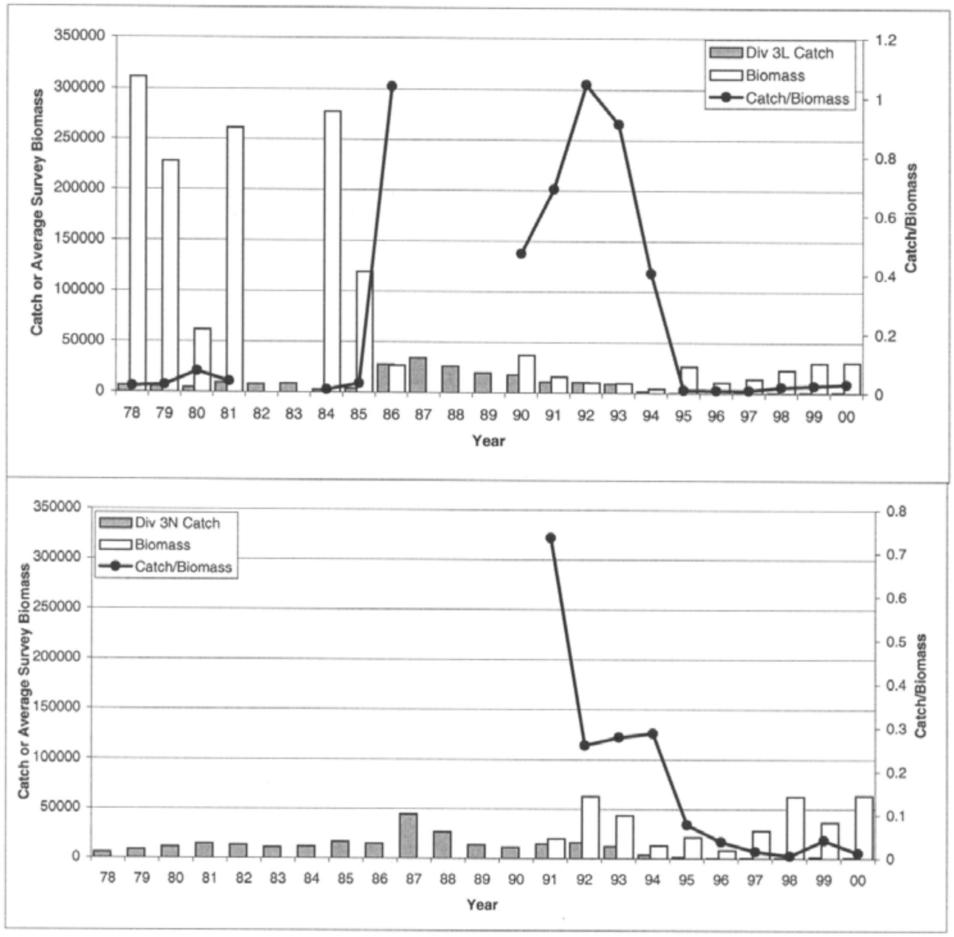
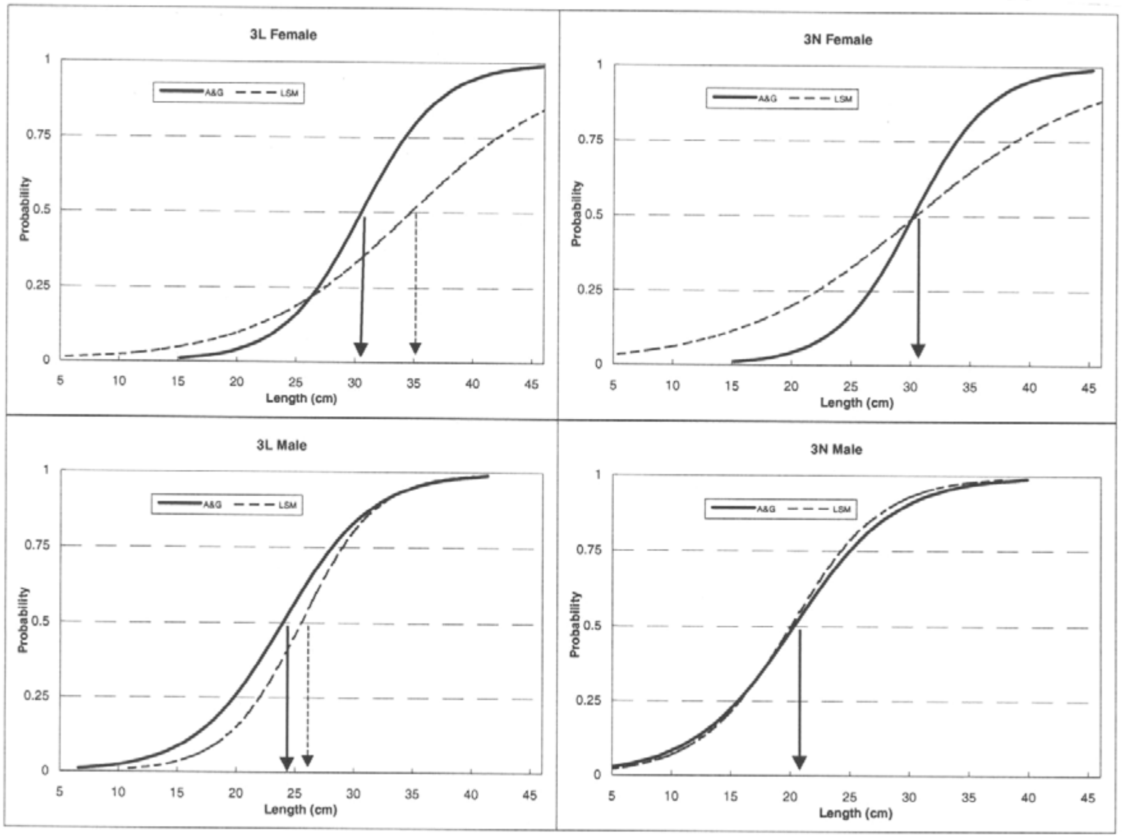


Fig. 10. Catch/Biomass ratios for Div. 3L (Upper Panel) and Div. 3N (Lower Panel) Plotted are average survey biomass for year in which catch was taken.



3L

	A&G Data		LSM Data	
	Male	Female	Male	Female
L75	28.10	34.19	28.99	41.99
L50	23.94	30.53	25.49	34.71
L25	19.79	26.86	21.07	25.52
Ni and Sandeman (1984)				
L50	21.80	34.65		

3N

	A&G Data		LSM Data	
	Male	Female	Male	Female
L75	24.95	33.78	24.24	38.67
L50	20.27	30.19	20.00	30.40
L25	15.59	26.59	14.66	19.98
L50	16.32	29.58		

Fig. 11. Maturity ogives derived separately for LSM sampled and otolith sampled (A&G) data from surveys in Div. 3LN.