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An Assessment of the Status of Redfish in NAFO Division 3O

by

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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. 3O. Nominal catches have ranged between 3 000 t and 35 000 t since 1960. Up to 1986 catches averaged 13 000 tons and subsequently increased to a maximum value of 35 000 tons in 1988, exceeding the TAC by 21,000 tons. Following 1988 catches generally declined down to a low of 3,000 tons in 1995, partly due to reductions in foreign allocations within the Canadian fishery zone since 1993. There was an overall increasing trend in catch over the next five years to a high value of 20 000 tons in 2001. Catch has been declining since that time with a mean of just over 5000 t taken annually between 2007-2009. Assessment of this stock has been primarily based on research survey data due to variable commercial indices and fleets prosecuting different areas of the stock. It is difficult to reconcile year to year changes in the indices, but generally, the Canadian spring survey biomass index suggests the stock may have increased between the early and mid 1990s, fluctuated over 100,000 tons from 1994 to 1999 and declined to 20,000 t in 2002. The index generally has increased since that time up to a mean of 82,000 t for 2007-2009. The Canadian autumn survey, while more stable in the early 1990s, generally supports the pattern of the spring survey index, indicating a gradual increase from 18,000 t in 2003 to over 100 000 t in 2009. Canadian RV surveys do not adequately sample fish greater than 25 cm, which in some years comprise a large portion of the fishery, making interpretation of survey estimates difficult. The fishery since 1998 appeared to target the relatively strong 1988 year class that has grown sufficiently to exceed the small fish protocol of 22 cm. There is concern that there has been little sign in recent surveys of size groups smaller than 17 cm despite using a shrimp trawl, which is very effective at catching small fish.

Introduction

Two species of redfish have been commercially fished in Div. 3O, the deep sea redfish (*Sebastes mentella)* and the Acadian redfish (*Sebastes fasciatus*). The two species are difficult to distinguish based on external characteristics, and as a consequence are reported collectively as “redfish” in the commercial fishery statistics. Most of the habitable redfish area in Div. 3O lies within Canada’s 200 mile exclusive fishery zone and has been subject to management regulation since 1974. Approximately 8% of the habitable redfish area within Div. 3O lies within the NAFO Regulatory Area (NRA) and was brought under TAC regulation starting in 2005.

Nominal Catches and TACs

Nominal catches have ranged between 3 000 tons and 35 000 tons since 1960 (Table 1, Fig. 1). Catches averaged 13 000 t up to 1986 and then increased to 27 000 t in 1987 and 35 000 t in 1988 (exceeding TACs by 7 000 t and 21 000 t, respectively). Catches declined to 13 000 t in 1989, increased gradually to about 16 000 t in 1993 and declined further to about 3 000 t in 1995, partly due to reductions in foreign allocations within the Canadian fishery zone

since 1993. Catches increased to 20 000 t by 2001, and have generally declined since that time, with 2009 catches totalling 6 431 t.

The large redfish catches in 1987 and 1988 were due mainly to increased activity in the NRA by South Korea and non-Contracting parties (NCPs), primarily Panama. There has been no activity by NCPs in the NRA since 1994. Estimates of under-reported catch have ranged from 200 tons to 23 500 tons. There have also been estimates of over-reported catch in the recent period since 2000, with a maximum value of 4 300 t in 2003.

A TAC of 16 000 tons was first implemented by Canada within its 200-mile limit in 1974. The TAC was increased in 1978 to 20 000 tons and generally remained at that level through to 1987. The TAC for 1988 was reduced to 14 000 tons and remained unchanged until 1994 when it was reduced to 10 000 tons as a precautionary measure and maintained at that level to 2003. During 1999 a shift was implemented from a calendar year based TAC to a fiscal year based TAC (i.e. from April 1, 2000 to March 31, 2001). To facilitate this temporal shift in TAC, the 1999 calendar year TAC was extended to March 31, 2000 and increased from 10 000 tons to 10 200 tons to accommodate the extension. In September 2004, the NAFO Fisheries Commission adopted TAC regulation for redfish in 3O, implementing a level of 20 000 tons for the entire division in 2005 and remaining in effect up to 2009.

Description of the Fishery

Russia predominated in the 3O redfish fishery up until 1993 (Table 2) and generally caught about 50% of the total non-Canadian allocation, which accounted for about 2/3 of the Canadian TAC. From 1987 to 1993 Russian catches ranged from 3 800 tons to 7 200 tons. Russia and Cuba, impacted by the reduction and eventual elimination of foreign allocations by Canada, ceased directed fishing in 1994. Russia resumed directed fishing in 2000, rapidly increasing their catch from 2 200 tons to about 11 000 tons from 2001-2003 before a large reduction in catch to only 240 t in 2004 and 170 t in 2005. Catches rose again to nearly 1000 t in 2006, dropped below 100 t in 2007-2008 and increased slightly to 170 t in 2009. Portugal began fishing redfish in Div. 3O in 1992 and averaged about 1 800 tons between 1992 and 1998. Their catches escalated to 5 500 tons in 1999 and have averaged about 4 300 tons to 2009. Spain, who had taken less than 50 tons before 1996, increased catches from 1 200 tons in 1997 to a peak of 4 500 tons in 1999 with a subsequent decline to 300 tons in 2004. Spanish catches then increased again in 2005 to 1 700 t and nearly doubled to 3 200 t in 2006 before dropping below 1000 t again in 2007 and 2008 and rising again to 1400 t in 2009. Although most fleets in the NRA reduced their catch from 2003 to 2004, the total reduction in catch was primarily accounted for in the reduced activity of the Russian fleet.

Canada has had limited interest in a fishery in Div. 3O because of small sizes of redfish encountered in areas suitable for trawling. Canadian landings were less than 200 tons annually from 1983-1991. In 1994, Canada took 1 600 tons due to improved markets related to lobster bait, but reduced catch to less than 200 tons in 1995. Between 1996 and 1999 Canadian catches alternated between levels of about 8 000 tons and 2 500 tons based on market acceptance for redfish near the 22 cm size limit regulated within Canada. From 2000-2006 Canada averaged about 3 600 tons, followed by a decrease to 1000 tons in 2007 and approximately 200 tons in 2008 and 2009.

Although the redfish fishery in Div. 3O has generally occurred throughout the year in the most recent decade, the majority of catch has been taken during the last three quarters of the year (Table 3a). The vast majority (>90%) of catch has been taken via bottom trawling by Canadian, Portuguese and Spanish fleets (Table 3b). Catches via midwater trawl prior to 2005 were taken predominantly by Russia.

Commercial Fishery Data

Catch and Effort

Catch and effort data for 1960 to 1999 were extracted from ICNAF/NAFO Statistical Bulletins and were combined with 2000-2008 STATLANT 21B data and 2009 Canadian logbook data compiled by regional statistical branches of the Canadian Department of Fisheries and Oceans. Initially selected from this database were observations where redfish comprised more than 50% of the total catch and were therefore considered to be redfish directed.

These data were analysed with a multiplicative model (Gavaris 1980) to derive a standardized catch rate index. The effects included in the model were a combination country-gear-tonnage class category type (CGT), month, and a category type representing the amount of by-catch associated with each observation. For this effect five groups were

arbitrarily established: (>50% <=60%), (>60% <=70%), (>70% <=80%), (>80% <=90%) and (>90%) where each group corresponds to the percentage of redfish relative to the total catch associated with each observation. Due to missing effort data for hours fished for some of the principal fleets in the fishery since 1992, only effort in days fished were extracted. In the usual manner, catch less than 10 tons and effort less than 5 days were eliminated prior to analysis in addition to any categories with less than five samples except in the year category type. For all analyses an unweighted regression was run because of unknown percentages of prorating prior to 1984.

Consistent with catch rate analyses since 2003, separate analyses were conducted for the Canadian fleet, which fishes within it's exclusive fishery zone, and for fleets that fish in the NRA because of different trends over time between these two groups (Power, MS 2003). In the past, Canada had bi-lateral fisheries agreements with Russia, Japan and Cuba which enabled their fleets to fish within Canada's exclusive fishery zone. As these arrangements ceased in 1993, the data for these fleets prior to 1994 were not used in the standardization of CPUE for fleets in the NRA.

For the NRA FLEETS "days fished" standardization, the regression was significant (P <0.05), explaining 57% of the variation in catch rate (Table 4). The standardized catch rate (Table 5, Fig. 2 right panel) shows much within year variability and fluctuation prior to 1992. The index increased from 1988 to the second highest value in the series in 1990 and then declined by 50% to the lowest value in 1996. Catch rates increased again peaking in 2000 matching the 1990 value, then declined to a value near the series low in 2006. Since then, the index has doubled to a relatively high value in 2008.

For the CANADIAN FLEET "days fished" standardization, the regression was significant (P <0.05), explaining 55% of the variation in catch rate (Table 6). ANOVA results indicate only a marginally non-significant month effect (P =0.0524). The catch rate index (Table 7, Fig. 2 left panel) shows much within year variability. There are also only short periods of sustained directed effort prior to 1996. The catch rate index increased from 1997 to 2003 and has been relatively stable to 2009. The recent stable period has been amongst the highest values in the series.

Canada has not accounted for a major portion of the reported catches from Div. 3O and has only fished within the 200-mile Canadian fishing zone, with activity being determined by market conditions. Fleets may search for larger fish rather than simply maximizing catch rate. The trend in the Canadian catch rate series shows an increasing trend since 2003 whereas the index in the NRA has shown a decline from 2003 to 2006 then a matching increase to 2008. In summary, these catch rate indices may simply be reflecting fishing success of fleets within their area of operation rather than stock trends. The interpretation of commercial catch rates as an indicator of stock abundance remains difficult for a species like redfish that tend to form patchy aggregations which are at times very dense. In Div. 3O there is a limited amount of fishable area in deeper waters along the steep slope of the southwest Grand Bank where larger fish tend to be located.

Commercial fishery sampling

Sampling of the redfish fisheries was conducted by Canada, Spain (González-Costas et al., MS 2009), Portugal (Vargas *et al*., MS 2009), and Russia (Skryabin and Pochtar, MS 2009) from the 2009 trawl fishery (Fig. 3). The Portuguese fleet fished between 278 and 585 m while the Russian fleet fished from 290-520 m. Logbook information from the Canadian fleets indicated most of the catch was taken at depths between 330-500 m. Sampling details for the Canadian fleets are given in Table 8. Annual catch at length suggested fish between 19-25 cm generally dominated the Canadian catch. Lengths between 16-26 cm (range 14- 34 cm) dominated the Portuguese catch. The Spanish catch was dominated by 17-22 cm fish (range 16-30 cm).

A compilation of catch at length from various fleets from 1995 to 2004 suggested that the size composition has changed over the time period with fleets catching a larger portion of fish >25 cm prior to 1998 (Power, MS 2005). These size compositions were converted to catch at length for 2001 to 2009 and compared to Canadian RV survey numbers at length in Figure 3.

Research Survey Data

Abundance Indices

Stratified random groundfish surveys have been conducted in the spring and autumn in Div. 3O since 1991, with regular coverage of depths to 730 m (and sporadic coverage of deeper strata in the autumn). In addition, a summer survey was conducted in 1993. Surveys utilized an Engel 145 otter trawl (1.75 n. mi. standard tow) from 1991 to spring 1995 and a Campelen 1800 shrimp trawl (0.75 n. mi. standard tow) from autumn 1995 to the present. The Engel 145 data were converted into Campelen 1800 trawl equivalent data based on comparative fishing trials (see Power and Atkinson MS 1998a). Vessel problems during the 2006 spring survey resulted in the completion of only a single tow in redfish depths.

Abundance (Tables 9 and 11) and biomass (Tables 10 and 11) estimates based on spring and autumn data demonstrate large fluctuations between seasons and years for some strata. This is usually accounted for by the influence of one or two large sets on the survey. It is difficult to reconcile year to year changes in the indices, but generally, the spring survey biomass index (Fig. 4) suggests the stock may have increased between the early and mid 1990s, and subsequently declined to 2002 (21 000 t, 24 kg per tow). The low 1997 value is considered a sampling anomaly. The biomass index increased in 2003 and again in 2004 (103 kg per tow) but in 2004 was influenced by one large set in a stratum that represented 40% of the biomass index of 85 000 t. The biomass index has alternated between 60-70 000 t and 90 000 t since 2005 (no data for 2006) and was estimated at 87 000 t (105 kg per tow) in 2009. Biomass estimates from the autumn surveys, while more stable in the early 1990s, generally support the pattern of the spring survey index but with a more gradual and steady increase in biomass index from 2003 (18 600 t: 22.5 kg per tow) to 2009 (104 000 t: 128 kg per tow). It should be noted that the 1996 autumn estimate does not include important strata that were not sampled due to problems on the survey.

Density estimates per stratum were generally lower in the NAFO Regulatory Area (denoted in Tables 9 - 12 as strata 354, 355, 356, 721, 722) than those inside the Canadian 200 mile exclusive fishery zone, although it should be pointed out that part of these strata actually occurs inside the Canadian zone. Estimates of the proportion of survey biomass within the NRA have ranged from 3% to 53% (average 15.2%) for the spring survey and 7% to 36% (average 19.7%) for the autumn survey.

Recruitment

Size distribution from the Canadian spring (Fig. 5) and autumn surveys (Fig. 6) in terms of mean number per tow at length indicates a bimodal distribution in 1991 corresponding to a 1988 and 1984 year-class respectively. The 1984 year-class progressed at about one cm per year up to 1994 and cannot be traced any further. The 1988 year-class remains dominant but progresses slowly between 22-25 cm from 2001-2007 surveys then decreases substantially. Recruitment pulses detected in both surveys in 1999 were greatly diminished by 2002. There was a new relatively large pulse at 17cm in the 2007 surveys corresponding to a 2001 year class that has remained the dominant size to 2009. Although their presence was detected at smaller sizes in previous surveys, the sudden increase in density at 17cm is unusual. Nevertheless, this represents the best sign of recruitment in the population since the 1988 year-class.

The size distributions of the survey catches indicate only a narrow range of sizes caught each year in Div. 3O. Generally fish smaller than about 10 cm and larger than about 25 cm are absent in survey catches from 1991-2000 which cover strata down to 732 m (400 fathoms). It is well documented that the Engel survey gear (e.g. Power MS 1995) and the Campelen survey gear (e.g. Power and Atkinson, MS 1998b) can catch both smaller (than 10 cm) and larger (than 25 cm) redfish. Length sampling from the commercial fisheries in the mid-1990s reveals a higher proportion of fish greater than 25 cm compared to the survey catches (see Power, MS 2005). Therefore, it appears that fish sizes outside this range, especially fish greater than 25 cm, are generally unavailable to the gear in this area. The reasons for this are unknown but may be related to distribution relative to trawlable bottom.

Estimation of Stock Parameters

Catch/Biomass ratio

A fishing mortality proxy was derived by simple catch to survey biomass ratios. In deriving a fishing mortality proxy, and because most of the catch is taken in the last three quarters of the year, the catch in year "n" was divided by the average of the Canadian Spring (year = n) and Autumn (year = n-1) survey biomass estimates to better represent the relative biomass at the time of the year before the catch was taken. Survey catchability (q) for redfish is not known but assumed to be less than one. All fish sizes were included in the survey biomass estimate. The results (Fig. 7) suggest that relative fishing mortality increased from 1998 to the highest estimate in the series in 2002. This relatively high value was maintained in 2003 but declined substantially in 2004. In 2005, relative fishing mortality increased once more and was around the series average. The 2006 estimate of fishing mortality was calculated using only the autumn survey biomass. In 2007-2008 the estimate of fishing mortality dropped to some of the lowest levels since the mid 1990s.

State of the Stock

It is still not possible to determine absolute size of the stock. It is difficult to accept that the CPUE series are representative of the trends in the stock. RV survey estimates suggest that stock size has been gradually increasing since the early 2000s. Using the ratio of catch:biomass as a proxy for fishing mortality suggests a value less than 0.1 for 2007-2009, among the lowest levels observed since the mid 1990s. The appearance of the relatively strong 2001 year class in the 2007 and subsequent surveys constitutes the best sign of recruitment to the population since the relatively strong 1988 year-class. The bulk of the catches in recent years are comprised of fish less than 25 cm, suggesting that these fisheries are targeting predominantly immature fish.

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Table 1. Estimated catches (t) and TACs of redfish in Div. 3O.

Year	Canada	Others	Catch [a]	TAC
1960	100	4900	5000	
1961	1000	10000	11000	
1962	1046	6511	7557	
1963	2155	7025	9180	
1964	1320	14724	16044	
1965	203	19588	19791	
1966	107	15198	15305	
1967	645	18392	19037	
1968	52	6393	6445	
1969	186	15692	15878	
1970	288	12904	13192	
1971	165	19627	19792	
1972	508	15609	16117	
1973	133	8664	8797	
1974	91	13033	13124	16000
1975	103	15007	15110	16000
1976	3664	11684	15348	16000
1977	2972	7878	10850	16000
1978	1841	5019	6860	16000
1979	6404	11333	17737	20000
1980	1541	15765	17306	21900
1981	2577	10027	12604	20000
1982	491	10869	11360	20000
1983	7	7133	7340	20000
1984	167	9861	16978	20000
1985	104	8106	12860	20000
1986	141	10314	11055	20000
1987	183	12837	27170	20000
1988	181	11111	34792	14000
1989	27	11029	13256	14000
1990	155	8887	14242	14000
1991	28	7533	8461	14000
1992	1219	12149	15268	14000
1993	698	12522	15720	14000
1994	1624	3004	5428	10000
1995	177	2637	3214	10000
1996	7255	2390	9845	10000
1997	2554	2558	5112	10000
1998	8972	4380	14052	10000
1999	2344	10249	12593	10200
2000	2206	10584	10003	10000
2001	4893	17681	20274	10000
2002	3000	16453	17234	10000
2003	3125	18466	17246 [b]	10000
2004	2616	3848	3753	10000
2005	5501	6409	11305	20000 [c]
2006	3580	7455	12610	20000
2007	1053	6472	5179	20000
2008	203	4816	4020	20000
2009	255	6233	6431	20000

[a] Totals since 1983 may include adjustments for estimated catches from various sources

[b] Midpoint of estimates ranging between 16100-18400

[c] Prior to 2005 TACs were set by Canada within its fisheries jurisdiction

Table 2. Reported and estimated catches (t) of redfish in Div. 3O by country and year since 1992.

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Canada (M)	27	21	779	4	2124	693	2851	317	1326	336	12	32	276	137	-	-	0	-
Canada (N)	1192	677	845	173	5131	1861	6121	2027	880	4557	2988	3093	2340	5364	3580	1053	203	255
France (SPM)	-	-	-	-	-	134	266	-	-	-	-	-	-	-	-	-	-	-
Japan	125	159	-	264	417	285	355	-	-	-	-	-	2	1	0	61	-	-
Portugal	1468	4794	2918	1935	1635	894	1875	5469	4555	3537	4610	6382	3279	4555	5184	4755	3850	4273
Spain	-	-	26	22	338	1245	1884	4549	3747	2792	660	1289	320	1683	1294	1502	603	1691
Russia	5845	6887	60	416	-	-	-	231	2233	11343	11182	10794	242	170	977	54	82	169
Cuba	2776	665	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ukraine	-	-	-	-	-	-	-	-	-	-	-	1	3	-	-	-	-	-
Estonia	-	-	-	-	-	-	-	-	49	9	-	-	2	-	-	100	42	100
Lithuania	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	139	-
Korea(S)	1935	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Faroe Islands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-
Estimate [a]	1900	2500	800	400	200	-	700	-	2787	2300	2219	4345	2711	605	1575	2346	999	57
Total	15268	15720	5428	3214	9845	5112	14052	12593	10003	20274	17234	17246	3753	11305	12610	5179	4020	6431
TAC [b]	14000	14000	10000	10000	10000	10000	10000	10200	10000	10000	10000	10000	10000	20000	20000	20000	20000	20000

[a] Estimates of catch from other sources (shaded cells are estimates of amounts over-reported)
[b] Prior to 2005 TACs were set by Canada within it's fisheries jurisdiction

Table 3a. Nominal reported catches (t) of redfish in Div. 3O by month and year since 1992.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Unk	Total
1992	0	57	14	10	635	3262	2520	1808	896	1261	797	2108		13368
1993	226	14	754	817	2089	1601	1887	2068	1809	829	630	496		13220
1994	60	93	742	1609	236	83	-	68	1000	540	19	178		4628
1995	7	125	145	2	45	28	56	765	645	879	107	10		2814
1996	0	0	89	119	166	46	773	882	1685	2864	1539	1482		9645
1997	4	0	10	34	86	417	1298	909	622	1274	409	49		5112
1998	40	193	216	279	1329	2723	1924	953	1280	1964	2275	176		13352
1999	100	139	262	463	527	942	1644	2513	2298	2056	1434	215		12593
2000	80	92	943	739	1077	1844	1088	1254	1545	2068	1814	246		12790
2001	31	193	1228	1909	1958	2750	1257	1421	2020	4048	3472	2287		22574
2002	1850	1269	2356	1904	1490	1423	300	2085	2000	2309	1402	1064		19452
2003	453	1212	910	1392	2361	3232	2826	961	2294	2212	2484	1149		21486
2004	323	343	597	794	318	180	336	400	651	1393	859	270		6464
2005	100	12	241	169	436	371	2114	2115	1100	1288	1933	2029		11908
2006	743	485	49	1044	617	654	885	1436	1303	1786	1566	467		11035
2007	225	132	214	475	858	657	950	1298	966	859	358	479		7471
2008	124	328	56	289	187	72	97	433	350	689	1247	966		4838

Table 3b. Nominal reported catches (t) of redfish in Div. 3O by gear since 1992.

	Otter Trawls				
Year	Bottom	Midwater	Gillnets	Misc	Total
1992	10046	3292	1	29	13368
1993	11997	1214	-	9	13220
1994	3085	1498	26	19	4628
1995	2221	525	26	42	2814
1996	9303	335	7	-	9645
1997	5091	10	2	9	5112
1998	13352				13352
1999	11623	970			12593
2000	12750	39		1	12790
2001	21945	629			22574
2002	16586	2866			19452
2003	19226	2260			21486
2004	6308	156	0	0	6464
2005	11908	0	0	0	11908
2006	10058	0	0	977	11035
2007	7471	0	0	0	7471
2008	4838	0	0	0	4838

Table 4. ANOVA results and regression coefficients from a multiplicative model utilized to derive a standardized catch rate series for Redfish in Div. 3O. Effort is DAYS FISHED. Analysis is for FLEETS IN THE NRA.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.757

MULTIPLE R SQUARED..... 0.574

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARE	F-VALUE
INTERCEPT	1	1.81E3	1.81E3	
REGRESSION	45	4.42E1	9.81E²1	6.695
Cntry|Gear|TC	9	6.25E0	6.94E²1	4.734
Month	11	1.86E0	1.69E²1	1.154
Bycatch	4	4.97E0	1.24E0	8.473
Year	21	1.29E1	6.15E²1	4.192
RESIDUALS	224	3.28E1	1.47E²1	
TOTAL	270	1.89E3		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VAR #	REG. COEF	STD. ERR	NO. OBS
Cntry|Gear|TC	17126	INT	3.125	0.317	270
Month	6				
Bycatch	95				
Year	87				
(1)	17127	1	0.404	0.204	6
	19125	2	0.354	0.086	31
	19126	3	0.771	0.163	7
	25126	4	0.185	0.299	7
	25127	5	0.338	0.219	16
	34126	6	0.206	0.094	35
	34127	7	0.293	0.131	14
	34156	8	0.200	0.153	10
	34157	9	0.333	0.156	8
(2)	1	10	²0.196	0.139	13
	2	11	²0.124	0.131	14
	3	12	²0.035	0.120	20
	4	13	²0.080	0.118	18
	5	14	0.099	0.108	24
	7	15	0.103	0.113	22
	8	16	0.158	0.108	27
	9	17	0.048	0.107	27
	10	18	²0.041	0.105	30
	11	19	0.033	0.110	25
	12	20	0.010	0.114	22
(3)	55	21	²0.562	0.119	20
	65	22	²0.417	0.101	24
	75	23	²0.342	0.086	32
	85	24	²0.160	0.065	69
(4)	88	25	²0.578	0.300	4
	89	26	²0.407	0.256	6
	90	27	²0.248	0.296	4
	91	28	²0.363	0.451	1
	92	29	²0.659	0.279	10
	93	30	²0.450	0.332	10
	94	31	²0.808	0.335	9
	95	32	²1.107	0.341	8
	96	33	²1.107	0.363	4
	97	34	²0.902	0.344	7
	98	35	²0.402	0.328	13
	99	36	²0.494	0.335	9
	100	37	²0.275	0.322	19
	101	38	²0.358	0.321	24
	102	39	²0.532	0.323	31
	103	40	²0.418	0.319	39
	104	41	²0.702	0.347	7
	105	42	²0.543	0.328	12
	106	43	²1.043	0.321	19
	107	44	²0.583	0.323	18
	108	45	²0.342	0.342	12

LEGEND FOR ANOVA RESULTS:

CGT CODES: All Vessels are Stern Trawlers

17126 = EU/Prt Otter Trawl TC 6

19125 = EU/Spn " TC 5

25126 = KOR " TC 6

25127 = " " TC 7

34126 = RUS " TC 6

34127 = " " TC 7

34156 = " Midwater Trawl TC 6

34157 = " " TC 7

Table 5. Standardized catch rate index for Redfish in Div. 3O from a multiplicative model utilizing DAYS FISHED as a measure of effort. Index is for FLEETS IN THE NRA.

PREDICTED CATCH RATE

YEAR	LN TRANSFORM MEAN	LN TRANSFORM S.E.	RETRANSFORMED MEAN	RETRANSFORMED S.E.	CATCH	EFFORT	% OF CATCH IN THIS ANALYSIS
1987	3.1252	0.1004	23.298	7.216	12837	551	12.1
1988	2.5475	0.0946	13.112	3.949	11111	847	14.9
1989	2.7177	0.0876	15.602	4.527	11029	707	22.9
1990	2.8775	0.0827	18.350	5.180	8887	484	7.8
1991	2.7626	0.2437	15.088	7.030	7533	499	1.2
1992	2.4665	0.0345	12.464	2.300	12149	975	25.4
1993	2.6753	0.0201	15.468	2.189	12522	810	37.9
1994	2.3176	0.0225	10.803	1.616	3004	278	94.5
1995	2.0178	0.0260	7.991	1.283	2637	330	82.4
1996	2.0186	0.0422	7.933	1.616	2390	301	67.4
1997	2.2229	0.0354	9.764	1.826	2558	262	30.4
1998	2.7228	0.0199	16.223	2.280	4380	270	76.1
1999	2.6315	0.0235	14.780	2.258	10249	693	37.7
2000	2.8499	0.0159	18.458	2.326	10584	573	86.4
2001	2.7671	0.0152	16.998	2.094	17203	1012	86.2
2002	2.5935	0.0168	14.278	1.846	16452	1152	95.2
2003	2.7067	0.0156	15.998	1.998	18466	1154	91.8
2004	2.4228	0.0306	11.954	2.078	3837	321	70.4
2005	2.5819	0.0209	14.084	2.031	5806	412	98.0
2006	2.0820	0.0164	8.563	1.093	9310	1087	67.7
2007	2.5421	0.0158	13.569	1.703	4126	304	141.1
2008	2.7828	0.0295	17.143	2.928	3817	223	106.8

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.192

Table 6. ANOVA results and regression coefficients from a multiplicative model utilized to derive a standardized catch rate series for Redfish in Div. 3O. Effort is DAYS FISHED. Analysis is for CANADIAN fleets (2008-9 based on preliminary data).

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.742

MULTIPLE R SQUARED..... 0.550

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARE	F-VALUE
INTERCEPT	1	1.65E3	1.65E3	
REGRESSION	62	5.79E1	9.34E-1	4.453
Cntry|Gear|TC(1)	10	1.35E1	1.35E0	6.425
Month(2)	9	3.59E0	3.99E-1	1.904
Bycatch(3)	4	7.10E0	1.77E0	8.457
Year(4)	39	2.26E1	5.80E-1	2.767
RESIDUALS	226	4.74E1	2.10E-1	
TOTAL	289	1.75E3		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VAR #	REG. COEF	STD. ERR	NO. OBS
Cntry|Gear|TC	3125	INT	2.644	0.522	289
Month	9				
Bycatch	95				
Year	60				
(1)	2114	1	-0.133	0.235	13
	2125	2	0.340	0.190	14
	3114	3	0.128	0.130	51
	3121	4	-0.096	0.162	16
	3123	5	-0.362	0.123	58
	3124	6	0.114	0.126	53
	3154	7	0.110	0.269	5
	3155	8	0.404	0.226	10
	27123	9	-0.449	0.202	8
	27125	10	0.495	0.134	21
(2)	3	11	-0.424	0.267	6
	4	12	-0.447	0.154	18
	5	13	-0.216	0.128	28
	6	14	-0.309	0.112	36
	7	15	-0.122	0.113	37
	8	16	-0.214	0.109	36
	10	17	-0.059	0.103	45
	11	18	-0.027	0.122	26
	12	19	-0.038	0.156	13
(3)	55	20	-0.724	0.212	11
	65	21	-0.569	0.176	10
	75	22	-0.600	0.149	15
	85	23	-0.359	0.097	38
(4)	61	24	0.027	0.510	6
	62	25	-0.032	0.525	5
	63	26	-0.341	0.531	6
	64	27	-0.097	0.639	2
	67	28	0.083	0.535	5
	70	29	-0.275	0.620	2
	71	30	0.165	0.665	1
(4)	72	31	-0.452	0.545	5
	74	32	-0.934	0.720	1
	75	33	-0.359	0.697	1
	76	34	-0.040	0.537	10
	77	35	-0.206	0.524	12
	78	36	-0.232	0.522	10
	79	37	0.120	0.528	13
	80	38	-0.057	0.534	8
	81	39	0.160	0.538	9
	82	40	0.172	0.612	2
	84	41	0.582	0.692	1
	86	42	0.133	0.709	1
	87	43	0.362	0.697	1
	88	44	0.146	0.697	1
	92	45	-0.659	0.632	2
	93	46	-0.260	0.636	2
	94	47	0.503	0.608	3
	95	48	-0.160	0.638	2
	96	49	-0.565	0.542	15
	97	50	-0.763	0.542	14
	98	51	0.127	0.541	27
	99	52	-0.123	0.546	16
	100	53	-0.131	0.554	10
	101	54	0.123	0.545	18
	102	55	0.213	0.548	16
	103	56	0.346	0.551	15
	104	57	0.334	0.556	11
	105	58	0.373	0.549	14
	106	59	0.349	0.556	11
	107	60	0.444	0.577	5
	108	61	0.887	0.639	2
	109	62	0.350	0.604	3

LEGEND FOR ANOVA RESULTS:

CGT CODES:

2114 = Can(M) (Side) Otter Trawl TC 4
2125 = " (Stern) Otter Trawl TC 5
3114 = Can(N) (Side) Otter Trawl TC 4
3121 = " (Stern) " TC 1
3123 = " " " TC 3
3124 = " " " TC 4
3154 = " " Midwater Trawl TC 4
3155 = " " " TC 5
27123 = Can(M) (Stern) Otter Trawl TC 3
27125 = " " " TC 5

Table 7. Standardized catch rate index for Redfish in Div. 3O from a multiplicative model utilizing DAYS FISHED as a measure of effort. Index is for CANADIAN fleets (2008-9 based on preliminary data).

	PREDICTED CATCH RATE						
	LN TRANSFORM		RETRANSFORMED				% OF CATCH IN
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT	THIS ANALYSIS
1960	2.6438	0.2726	13.630	6.670	100	7	43.0
1961	2.6710	0.0839	15.397	4.378	1000	65	89.5
1962	2.6115	0.0697	14.613	3.801	1046	72	39.1
1963	2.3025	0.0591	10.785	2.590	2155	200	36.5
1964	2.5467	0.1796	12.960	5.266	1320	102	14.2
1967	2.7270	0.0589	16.491	3.954	645	39	76.4
1970	2.3685	0.1264	11.139	3.846	288	26	65.3
1971	2.8091	0.2715	16.089	7.861	165	10	54.5
1972	2.1915	0.0805	9.549	2.661	508	53	58.7
1974	1.7100	0.2855	5.323	2.658	91	17	22.0
1975	2.2851	0.2411	9.674	4.486	103	11	43.7
1976	2.6041	0.0335	14.770	2.688	3664	248	94.7
1977	2.4377	0.0350	12.497	2.322	2972	238	93.0
1978	2.4113	0.0410	12.135	2.438	1841	152	93.1
1979	2.7640	0.0282	17.377	2.906	6404	369	91.5
1980	2.5871	0.0381	14.489	2.807	1541	106	89.4
1981	2.8036	0.0361	18.008	3.397	2577	143	95.2
1982	2.8154	0.1168	17.500	5.821	491	28	83.9
1984	3.2260	0.2389	24.813	11.461	167	7	62.9
1986	2.7769	0.2227	15.966	7.147	141	9	90.8
1987	3.0056	0.2411	19.885	9.221	183	9	80.9
1988	2.7898	0.2411	16.025	7.431	181	11	90.6
1992	1.9845	0.1413	7.530	2.739	1219	162	12.1
1993	2.3838	0.1436	11.213	4.109	698	62	81.8
1994	3.1469	0.1038	24.537	7.720	1624	66	50.0
1995	2.4843	0.1351	12.451	4.435	177	14	91.0
1996	2.0788	0.0250	8.773	1.380	7255	827	94.0
1997	1.8806	0.0263	7.191	1.161	2554	355	82.9
1998	2.7706	0.0209	17.557	2.528	8972	511	93.0
1999	2.5204	0.0338	13.582	2.480	2344	173	83.0
2000	2.5131	0.0347	13.478	2.495	2206	164	74.1
2001	2.7663	0.0271	17.428	2.854	4893	281	92.9
2002	2.8571	0.0305	19.051	3.307	3000	157	90.6
2003	2.9893	0.0312	21.738	3.816	3125	144	98.5
2004	2.9779	0.0387	21.410	4.178	2533	118	79.5
2005	3.0169	0.0276	22.385	3.701	5499	246	67.2
2006	2.9932	0.0357	21.772	4.085	3580	164	74.0
2007	3.0881	0.0612	23.636	5.770	1053	45	76.7
2008	3.5313	0.1371	35.437	12.712	203	6	100.0
2009	2.9938	0.0929	21.169	6.319	254	12	98.8

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.287

Table 8. Commercial sampling of redfish catches from CAN (N) in 2007-2009.

Year		Observer samples				Port samples			
	Month	Samples	n	depth min	depth max	Samples	n	depth min	depth max
2007	APR	2	489	411	457	-	-	-	-
	MAY	5	1325	278	508	2	602	365	457
2008	APR	-	-	-	-	2	622	487	487
	MAY	2	488	361	450	-	-	-	-
2009	NOV	6	572	357	505	-	-	-	-

Table 9. Mean number per standard tow from Canadian SPRING surveys in Div. 3O covering strata from 93 to 731 m (400 ftm.). Dashes (---) represent unsampled strata. Number of successful sets in brackets. Data from 1991-1995 are Campelen trawl equivalent units (see text). Data from 1996 to present are actual Campelen data. G=Gadus Atlantica, W=Wilfred Templeman, A=Alfred Needler.

Stratum	Depth Range (M)	Area sq mi	% Area within NRA	May3-11 1991-Q2 W105	May2-13 1992-Q2 W119-20	May5-18 1993-Q2 W136-7	May14-22 1994-Q2 W153	May13-27 1995-Q2 W168-69	May22-30 1996-Q2 W188	May-Jun 1997-Q2 W204	May-Jun 1998-Q2 W221-2	May-Jun 1999-Q2 W238	May-Jun 2000-Q2 W315-16
329	093-183	1721	0.00	13.3 (9)	0.0 (8)	0.0 (6)	169.6 (5)	19.6 (5)	0.0 (6)	33.5 (6)	0.0 (7)	0.3 (6)	0.0 (5)
332	093-183	1047	0.00	35.5 (6)	1.4 (5)	0.0 (4)	0.0 (4)	1177.8 (4)	181.8 (4)	7.3 (3)	348.0 (4)	899.0 (4)	43.5 (4)
337	093-183	948	0.00	607.2 (5)	6.5 (4)	3.0 (2)	0.0 (3)	3462.8 (4)	5.0 (3)	2.0 (3)	703.5 (4)	339.0 (3)	207.5 (4)
339	093-183	585	0.00	0.0 (3)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)
354	093-183	474	0.52	0.0 (3)	0.0 (2)	2537.0 (2)	0.0 (2)	0.0 (3)	2.5 (2)	0.0 (2)	422.9 (2)	1006.5 (2)	4.5 (2)
333	185-274	151(147)	0.00	1089.0 (2)	3240.0 (2)	8184.5 (2)	50275.0 (2)	979.5 (2)	870.1 (2)	231.9 (2)	4321.3 (2)	5502.4 (2)	1355.9 (2)
336	185-274	121	0.00	187.5 (2)	688.5 (2)	4496.5 (2)	9955.5 (2)	83150.0 (2)	1360.6 (2)	139.1 (2)	34839.0 (2)	1682.7 (2)	1714.3 (2)
355	185-274	103	0.72	119.5 (2)	111.0 (2)	7307.0 (2)	5829.0 (2)	1928.0 (2)	36488.9 (2)	306.2 (2)	5152.0 (2)	2191.6 (2)	4161.1 (2)
334	275-366	92(96)	0.00	733.0 (2)	223.0 (2)	837.0 (2)	1179.0 (2)	159.0 (2)	1206.8 (2)	286.2 (2)	733.5 (2)	2515.2 (2)	3960.3 (2)
335	275-366	58	0.00	39.7 (3)	265.3 (3)	582.5 (2)	6992.0 (2)	2267.0 (2)	15196.4 (2)	531.6 (2)	5796.0 (2)	8671.3 (2)	957.6 (2)
356	275-366	61	0.77	444.0 (2)	805.5 (2)	2552.5 (2)	883.0 (2)	3980.0 (2)	4347.0 (2)	133.6 (2)	3990.2 (2)	9384.4 (2)	24603.5 (2)
717	367-549	93(166)	0.00	1461.5 (2)	324.0 (2)	279.0 (2)	1269.0 (2)	312.5 (2)	597.0 (2)	3398.6 (2)	483.6 (2)	3239.6 (2)	740.9 (2)
719	367-549	76	0.00	277.0 (2)	88.5 (2)	497.5 (2)	1985.0 (2)	331.0 (2)	440.5 (2)	374.3 (2)	1098.0 (2)	1487.6 (2)	1685.1 (2)
721	367-549	76	0.76	176.0 (2)	4369.0 (2)	449.0 (2)	108.0 (2)	7596.5 (2)	575.5 (2)	262.6 (2)	543.0 (2)	3263.2 (2)	687.8 (2)
718	550-731	111(134)	0.00	56.5 (2)	17.5 (2)	174.0 (2)	349.0 (2)	15.5 (2)	47.8 (2)	60.8 (2)	79.3 (3)	35.4 (3)	369.0 (3)
720	550-731	105	0.00	35.5 (2)	113.0 (2)	24.0 (2)	34.5 (2)	40.0 (2)	284.6 (2)	63.2 (2)	35.6 (2)	221.3 (2)	53.6 (2)
722	550-731	93	0.76	186.5 (2)	79.0 (2)	76.0 (2)	327.5 (2)	17.0 (2)	80.0 (2)	91.8 (2)	334.0 (2)	47.5 (2)	640.2 (2)
	Total:	6011	8.25										
Upper (95% CI)				465.3	495.8	1955.9	3238.5	4318.0	8884.4	1255.6	10277.2	1348.6	895.5
Weighted mean (by area)				190.99	180.3	698.4	1748.5	2662.6	953.2	141.7	1250.0	869.5	571.3
Lower (95% CI)				-83.3	-135.1	-559.1	258.6	1007.2	-6978.1	-972.1	-7777.3	390.4	247.1
SURVEY ABUNDANCE ($x10^6$)				155.4	146.7	568.3	1445.8	2201.7	788.2	117.2	1033.6	719.0	472.4
ABUNDANCE within NRA				7.3	42.0	181.1	69.1	106.1	405.0	7.0	100.2	143.6	213.3
% within NRA				4.7	28.6	31.9	4.8	4.8	51.4	6.0	9.7	20.0	45.2

Table 9. Continued…

Stratum	Depth Range (M)	Area sq mi	% Area within NRA	May-Jun 2001-Q2 W365,367	May 2002-Q2 W419,421	May 2003-Q2 W479-480	May 2004-Q2 W546-547	May 2005-Q2 W618-621	May 2006-Q2 W693,A729	May 2007-Q2 W759-761	May 2008-Q2 W827	2009-Q2 A904-05
329	093-183	1721	0.00	0.0 (5)	0.0 (5)	80.0 (5)	0.0 (5)	0.2 (5)	---	25.0 (5)	399.8 (5)	0.0 (5)
332	093-183	1047	0.00	44.0 (3)	23.7 (3)	79.7 (3)	94.8 (3)	69.3 (3)	---	83.7 (3)	0.7 (3)	8.5 (3)
337	093-183	948	0.00	48.7 (3)	2.7 (3)	429.7 (3)	1048.8 (3)	18.5 (3)	---	2886.0 (3)	29.0 (3)	13.0 (3)
339	093-183	585	0.00	0.0 (2)	0.5 (2)	0.0 (2)	0.0 (2)	0.5 (2)	0.4 (2)	0.0 (2)	0.0 (2)	0.0 (2)
354	093-183	474	0.52	81.1 (2)	0.0 (2)	3.0 (2)	1.0 (2)	433.3 (2)	---	27.5 (2)	0.0 (2)	0.0 (2)
333	185-274	151(147)	0.00	1525.5 (2)	941.5 (2)	534.3 (2)	2759.2 (2)	5329.0 (2)	---	1683.1 (2)	4605.1 (2)	614.0 (2)
336	185-274	121	0.00	1742.0 (2)	1048.0 (2)	1456.5 (2)	12646.5 (2)	4701.9 (2)	---	694.2 (2)	8781.5 (2)	726.9 (2)
355	185-274	103	0.72	407.5 (2)	515.2 (2)	1191.0 (2)	1321.6 (2)	643.6 (2)	---	540.0 (2)	3929.5 (2)	9261.3 (2)
334	275-366	92(96)	0.00	730.9 (2)	916.5 (2)	3154.1 (2)	1387.1 (2)	2364.5 (2)	---	617.4 (2)	9238.5 (2)	16761.3 (2)
335	275-366	58	0.00	4730.6 (2)	4291.9 (2)	1155.1 (2)	1037.1 (2)	2563.6 (2)	---	3760.2 (2)	2560.9 (2)	13134.5 (2)
356	275-366	61	0.77	503.2 (2)	2020.9 (2)	521.3 (2)	658.0 (2)	3515.6 (2)	---	924.8 (2)	1489.8 (2)	3027.2 (2)
717	367-549	93(166)	0.00	139.5 (2)	242.0 (2)	584.0 (2)	1349.7 (2)	1211.4 (2)	---	2633.9 (2)	2404.6 (2)	2612.7 (2)
719	367-549	76	0.00	1755.4 (2)	208.8 (2)	602.5 (2)	326.5 (2)	1346.0 (2)	---	2653.8 (2)	1508.8 (2)	3134.0 (2)
721	367-549	76	0.76	541.1 (2)	94.7 (2)	304.4 (2)	116.5 (2)	566.2 (2)	---	470.0 (2)	253.6 (2)	1688.0 (2)
718	550-731	111(134)	0.00	22.5 (2)	79.0 (2)	0.0 (2)	30.2 (2)	55.1 (2)	---	20.5 (2)	18.0 (2)	58.7 (2)
720	550-731	105	0.00	52.1 (2)	93.1 (2)	31.5 (2)	42.0 (2)	23.1 (2)	---	112.4 (2)	32.6 (2)	270.5 (2)
722	550-731	93	0.76	447.9 (2)	86.7 (2)	71.9 (2)	69.5 (2)	60.9 (2)	---	21.8 (2)	2.0 (2)	52.0 (2)
	Total:	6011	8.25									
Upper (95% CI)				288.5	234.6	490.9	1861.6	1909.1		2655.9	1302.7	1033.3
Weighted mean (by area)				204.7	149.3	263.6	610.9	443.6		714.0	752.9	757.0
Lower (95% CI)				121.0	64.1	36.3	-639.8	-1021.9		-1228.0	203.2	480.7
SURVEY ABUNDANCE ($x10^6$)				169.3	123.5	218.0	505.1	366.8		590.4	622.6	625.9
ABUNDANCE within NRA				18.8	19.9	18.7	19.4	49.1		16.4	51.7	127.8
% within NRA				11.1	16.1	8.6	3.8	13.4		2.8	8.3	20.4

Table 10. Mean weight (kg) per standard tow from Canadian SPRING surveys in Div. 3O covering strata from 93 to 731 m (400 ftm.). Dashes (---) represent unsampled strata. Number of successful sets in brackets. Data from 1991-1995 are Campelen trawl equivalent units (see text). Data from 1996 to present are actual Campelen data. G=Gadus Atlantica, W=Wilfred Templeman, A=Alfred Needler.

Stratum	Depth Range (M)	Area sq mi	% Area within NRA	May3-11 1991-Q2 W105	May2-13 1992-Q2 W119-20	May5-18 1993-Q2 W136-7	May14-22 1994-Q2 W153	May13-27 1995-Q2 W168-69	May22-30 1996-Q2 W188	May-Jun 1997-Q2 W204	May-Jun 1998-Q2 W221-2	May-Jun 1999-Q2 W238	May-Jun 2000-Q2 W315-16
329	093-183	1721	0.00	0.3 (9)	0.0 (8)	0.0 (6)	11.2 (5)	0.5 (5)	0.0 (6)	1.0 (6)	0.0 (7)	0.0 (6)	0.0 (5)
332	093-183	1047	0.00	0.7 (6)	0.2 (5)	0.0 (4)	0.0 (4)	148.5 (4)	11.9 (4)	0.3 (3)	49.1 (4)	238.5 (4)	1.7 (4)
337	093-183	948	0.00	16.0 (5)	1.5 (4)	0.9 (2)	0.0 (3)	335.0 (4)	0.1 (3)	0.1 (3)	75.9 (4)	29.5 (3)	14.5 (4)
339	093-183	585	0.00	0.0 (3)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)
354	093-183	474	0.52	0.0 (3)	0.0 (2)	284.6 (2)	0.0 (2)	0.0 (3)	0.0 (2)	0.0 (2)	109.4 (2)	28.7 (2)	0.1 (2)
333	185-274	151(147)	0.00	120.8 (2)	404.0 (2)	1339.7 (2)	5428.5 (2)	113.5 (2)	120.4 (2)	20.2 (2)	696.3 (2)	797.6 (2)	236.2 (2)
336	185-274	121	0.00	11.6 (2)	81.2 (2)	630.9 (2)	1032.9 (2)	8543.1 (2)	161.8 (2)	7.7 (2)	5068.7 (2)	198.9 (2)	226.1 (2)
355	185-274	103	0.72	2.7 (2)	2.8 (2)	972.9 (2)	608.3 (2)	178.4 (2)	4916.3 (2)	7.5 (2)	741.6 (2)	314.7 (2)	502.8 (2)
334	275-366	92(96)	0.00	103.3 (2)	36.5 (2)	202.9 (2)	171.1 (2)	29.4 (2)	220.0 (2)	33.9 (2)	140.3 (2)	478.9 (2)	733.0 (2)
335	275-366	58	0.00	4.3 (3)	54.3 (3)	118.3 (2)	1210.4 (2)	263.7 (2)	2445.8 (2)	58.7 (2)	1053.9 (2)	1460.3 (2)	138.7 (2)
356	275-366	61	0.77	26.6 (2)	113.0 (2)	462.4 (2)	135.8 (2)	468.0 (2)	515.8 (2)	7.5 (2)	651.6 (2)	1600.5 (2)	4317.8 (2)
717	367-549	93(166)	0.00	452.4 (2)	74.3 (2)	83.2 (2)	395.3 (2)	91.4 (2)	191.2 (2)	534.7 (2)	143.1 (2)	670.0 (2)	310.6 (2)
719	367-549	76	0.00	33.7 (2)	12.3 (2)	150.0 (2)	669.7 (2)	71.8 (2)	79.5 (2)	59.6 (2)	291.6 (2)	289.0 (2)	326.3 (2)
721	367-549	76	0.76	24.7 (2)	183.6 (2)	110.5 (2)	22.0 (2)	1220.5 (2)	68.2 (2)	20.9 (2)	153.0 (2)	651.6 (2)	129.6 (2)
718	550-731	111(134)	0.00	42.2 (2)	7.5 (2)	87.7 (2)	156.0 (2)	7.3 (2)	27.2 (2)	15.0 (2)	35.5 (3)	16.7 (3)	174.5 (3)
720	550-731	105	0.00	11.7 (2)	57.7 (2)	9.7 (2)	15.9 (2)	14.6 (2)	129.1 (2)	21.0 (2)	14.5 (2)	103.6 (2)	17.7 (2)
722	550-731	93	0.76	118.4 (2)	12.6 (2)	33.2 (2)	126.1 (2)	6.3 (2)	25.4 (2)	12.2 (2)	137.0 (2)	19.7 (2)	261.0 (2)
	Total:	6011	8.25										
Upper (95% CI)				100.7	104.2	277.6	848.6	451.0	1081.0	189.5	1504.1	268.3	145.8
Weighted mean (by area)				18.8	19.6	103.1	208.3	283.8	124.2	19.0	192.7	148.2	101.0
Lower (95% CI)				-63.2	-65.0	-71.5	-431.9	116.6	-832.6	-151.5	-1118.8	28.1	56.2
SURVEY BIOMASS (tons)				15278	15961	83874	172264	234648	102695	15699	159313	122550	83508
BIOMASS within NRA				1553	2347	23733	8478	14641	54177	410	18024	19914	36624
% within NRA				10.2	14.7	28.3	4.9	6.2	52.8	2.6	11.3	16.2	43.9

Table 10. Continued...

Stratum	Depth Range (M)	Area sq mi	% Area within NRA	May-Jun 2001-Q2 W365,367	May 2002-Q2 W419,421	May 2003-Q2 W479-480	May 2004-Q2 W546-547	May 2005-Q2 W618-621	May 2006-Q2 W693,A729	May 2007-Q2 W759-761	May 2008-Q2 W827	2009-Q2 A904-05
329	093-183	1721	0.00	0.0 (5)	0.0 (5)	3.0 (5)	0.0 (5)	0.0 (5)	---	0.1 (5)	15.3 (5)	0.0 (5)
332	093-183	1047	0.00	2.3 (3)	3.1 (3)	10.3 (3)	5.5 (3)	3.6 (3)	---	0.7 (3)	0.0 (3)	0.1 (3)
337	093-183	948	0.00	4.7 (3)	0.0 (3)	58.3 (3)	152.1 (3)	2.4 (3)	---	405.0 (3)	0.3 (3)	0.2 (3)
339	093-183	585	0.00	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.2 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)
354	093-183	474	0.52	8.4 (2)	0.0 (2)	0.7 (2)	0.2 (2)	43.2 (2)	---	7.5 (2)	0.0 (2)	0.0 (2)
333	185-274	151(147)	0.00	225.7 (2)	154.9 (2)	71.3 (2)	426.0 (2)	705.6 (2)	---	276.7 (2)	301.8 (2)	47.3 (2)
336	185-274	121	0.00	222.9 (2)	133.7 (2)	202.3 (2)	2033.3 (2)	698.5 (2)	---	82.1 (2)	739.2 (2)	63.0 (2)
355	185-274	103	0.72	44.2 (2)	78.3 (2)	154.9 (2)	232.5 (2)	80.3 (2)	---	41.0 (2)	496.2 (2)	849.2 (2)
334	275-366	92(96)	0.00	146.4 (2)	142.3 (2)	447.8 (2)	284.9 (2)	418.2 (2)	---	102.5 (2)	957.5 (2)	2325.4 (2)
335	275-366	58	0.00	741.6 (2)	740.4 (2)	164.1 (2)	192.7 (2)	496.1 (2)	---	605.2 (2)	381.6 (2)	1351.7 (2)
356	275-366	61	0.77	73.3 (2)	302.7 (2)	66.3 (2)	133.5 (2)	713.4 (2)	---	127.9 (2)	255.6 (2)	360.0 (2)
717	367-549	93(166)	0.00	30.2 (2)	45.3 (2)	135.8 (2)	452.0 (2)	352.7 (2)	---	658.3 (2)	720.5 (2)	746.4 (2)
719	367-549	76	0.00	366.5 (2)	52.4 (2)	113.0 (2)	99.1 (2)	312.1 (2)	---	618.7 (2)	396.5 (2)	634.3 (2)
721	367-549	76	0.76	90.7 (2)	17.2 (2)	43.0 (2)	30.0 (2)	154.0 (2)	---	147.0 (2)	64.0 (2)	289.9 (2)
718	550-731	111(134)	0.00	7.4 (2)	18.1 (2)	0.0 (2)	9.3 (2)	33.3 (2)	---	7.1 (2)	7.9 (2)	34.9 (2)
720	550-731	105	0.00	18.2 (2)	30.9 (2)	5.8 (2)	15.0 (2)	6.9 (2)	---	47.5 (2)	11.0 (2)	84.5 (2)
722	550-731	93	0.76	114.2 (2)	26.6 (2)	16.3 (2)	23.2 (2)	25.4 (2)	---	8.7 (2)	1.2 (2)	15.5 (2)
	Total:	6011	8.25									
Upper (95% CI)				45.7	37.4	75.9	298.4	282.2		387.4	126.4	179.9
Weighted mean (by area)				31.7	24.3	35.8	103.0	72.7		111.5	82.9	105.7
Lower (95% CI)				17.6	11.3	-4.2	-92.4	-136.7		-164.4	39.3	31.4
SURVEY BIOMASS (tons)				26183	20126	29642	85170	60138		92202	68519	87362
BIOMASS within NRA				3048	3151	2529	3702	8369		2754	7226	13438
% within NRA				11.6	15.7	8.5	4.3	13.9		3.0	10.5	15.4

Table 11. Mean number per standard tow from Canadian AUTUMN surveys in Div. 3O covering strata from 93 to 731 m (400 ftm.). Data for strata from 732 to 914 m are included for information purposes only and are not included in calculations of mean number per standard tow or abundance. Dashes (---) represent unsampled strata. Number of successful sets are indicated in brackets. Data from 1991-1995 are Campelen trawl equivalent units (see text). Data from 1996 to present are actual Campelen data. G=Gadus Atlantica, W=Wilfred Templeman, A=Alfred Needler.

Stratum	Depth Range (M)	Area sq mi	% Area within NRA	Oct27-Nov10 1991-Q4 W113-4	Oct26-Nov5 1992-Q4 W128-9	Nov1-12 1993-Q4 W144-5	Oct29-Dec13 1994-Q4 W160-61	Sep28-Oct26 1995-Q4 W176-77	Nov25-Dec13 1996-Q4 W200 A253, T42	Oct-Dec 1997-Q4 W212-13	Sep-Oct 1998-Q4 W229-230	Sep-Oct 1999-Q4 W246-247	Sep-Oct 2000-Q4 W319-320 T338
329	093-183	1721	0.00	1.1 (7)	0.0 (3)	0.0 (5)	0.0 (6)	47.8 (5)	0.2 (5)	421.4 (5)	0.8 (5)	0.0 (5)	0.0 (5)
332	093-183	1047	0.00	0.0 (4)	88.3 (3)	49.7 (3)	118.0 (3)	403.0 (3)	11.5 (2)	89.0 (3)	45.3 (3)	32.0 (3)	65.5 (3)
337	093-183	948	0.00	175.5 (4)	667.5 (2)	35.3 (3)	41.5 (2)	515.0 (2)	0.0 (2)	149.3 (3)	273.8 (3)	28.7 (3)	50.6 (3)
339	093-183	585	0.00	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (2)	0.0 (3)	0.0 (2)	0.0 (2)		1.0 (2)
354	093-183	474	0.52	0.0 (2)	628.0 (2)	0.0 (2)	0.0 (2)	8100.0 (3)	427.3 (2)	6357.5 (2)	226.5 (2)	695.5 (2)	0.0 (2)
333	185-274	151(147)	0.00	314.5 (2)	1365.0 (2)	479.0 (2)	2073.0 (2)	923.5 (2)	---	217.0 (2)	155.2 (2)	230.5 (2)	488.8 (2)
336	185-274	121	0.00	364.5 (2)	2760.0 (2)	3298.5 (2)	3807.0 (2)	450.0 (2)	161.5 (2)	918.0 (2)	691.7 (2)	3481.0 (2)	802.0 (2)
355	185-274	103	0.72	9957.0 (2)	6381.0 (2)	1317.5 (2)	2310.5 (2)	2317.3 (2)	391.4 (2)	215.0 (2)	124.5 (2)	2333.5 (2)	1020.5 (2)
334	275-366	92(96)	0.00	8774.0 (2)	3290.0 (2)	2603.7 (3)	975.0 (2)	3474.0 (2)	---	1670.0 (2)	1110.5 (2)	178.1 (2)	378.7 (2)
335	275-366	58	0.00	3853.0 (2)	5346.0 (2)	2541.5 (2)	5648.0 (2)	1667.0 (2)	2895.5 (2)	8352.5 (2)	2459.5 (2)	2748.0 (2)	2403.4 (2)
356	275-366	61	0.77	678.5 (2)	3828.0 (2)	568.5 (2)	2671.0 (2)	3637.1 (2)	868.4 (2)	735.5 (2)	5602.0 (2)	3452.9 (2)	5888.0 (2)
717	367-549	93(166)	0.00	---	---	6079.5 (2)	1172.5 (2)	2247.5 (2)	---	13031.5 (2)	8428.5 (2)	603.2 (2)	5420.1 (2)
719	367-549	76	0.00	813.5 (2)	---	4854.0 (2)	2715.5 (2)	2892.6 (2)	5015.5 (2)	5311.5 (2)	1953.0 (2)	3604.0 (2)	8204.0 (3)
721	367-549	76	0.76	315.5 (2)	---	543.5 (2)	82.5 (2)	9946.8 (2)	575.5 (2)	3882.0 (2)	1872.5 (2)	905.6 (2)	1502.7 (2)
718	550-731	111(134)	0.00	---	---	520.0 (2)	1051.5 (2)	863.8 (2)	---	95.0 (2)	12.5 (2)	169.5 (2)	102.0 (2)
720	550-731	105	0.00	---	---	147.0 (2)	306.0 (2)	43.2 (2)	1560.6 (2)	---	471.0 (2)	103.5 (2)	160.0 (2)
722	550-731	93	0.76	11.5 (2)	---	371.5 (2)	56.5 (2)	365.5 (2)	324.0 (2)	13.8 (2)	278.0 (2)	15.0 (2)	156.4 (2)
	Total:	6011	8.25										
764	732-914	105	1.00	---	---	---	---	---	---	---	5.0 (2)	---	4.5 (2)
768	732-914	99	0.00	---	---	---	---	---	---	---	0.5 (2)	---	0.0 (2)
772	732-914	135	0.00	---	---	---	---	---	---	---	0.0 (2)	---	6.3 (2)
Upper (95% CI)				3059.2	1217.7	587.0	672.0	9437.2	445.6	7592.4	3315.0	686.7	544.6
Weighted mean (by area)				436.0	572.0	371.5	388.6	1233.7	203.8	1304.5	481.3	359.5	434.0
Lower (95% CI)				-2187.1	-73.7	156.0	105.2	-6969.8	-25.1	-4983.5	-2352.4	32.3	323.3
SURVEY ABUNDANCE (x10^6)				336.3	421.8	302.3	321.3	1020.1	153.3	1059.8	398.0	268.3	358.8
ABUNDANCE within NRA				108.4	111.0	25.1	42.0	404.2	31.8	253.2	62.8	77.0	62.0
% within NRA				32.2	26.3	8.3	13.1	39.6	20.8	23.9	15.8	28.7	17.3

Table 11. Continued…

Stratum	Depth Range (M)	Area sq mi	% Area within NRA	Sep-Oct 2001-Q4 W372 T357	Sep-Oct 2002-Q4 W427 T411	Sep-Oct 2003-Q4 W485-6 T469	Nov 2004-Q4 W557	Oct 2005-Q4 W627-628 T608	Oct 2006-Q4 W704	Oct 2007-Q4 W770-771 T750	Oct 2008-Q4 W835-836	2009-Q4 A913-15 T894-95
329	093-183	1721	0.00	746.8 (5)	405.8 (5)	0.4 (5)	0.0 (5)	14.2 (5)	74.2 (5)	0.0 (5)	3.0 (3)	91.8 (5)
332	093-183	1047	0.00	8.7 (3)	12.8 (3)	37.4 (3)	29.7 (3)	41.2 (3)	0.3 (3)	27.3 (3)	0.7 (3)	261.9 (3)
337	093-183	948	0.00	37.3 (3)	61.9 (3)	55.3 (3)	54.9 (3)	90.3 (3)	38.3 (3)	402.0 (3)	0.0 (2)	383.5 (3)
339	093-183	585	0.00	1.0 (2)	0.5 (2)	0.0 (2)	0.6 (2)	3.0 (2)	0.0 (2)	1.5 (2)	0.0 (2)	0.0 (2)
354	093-183	474	0.52	272.5 (2)	150.9 (2)	0.0 (2)	171.6 (2)	69.5 (2)	6.0 (2)	1124.9 (2)	363.6 (2)	1172.9 (2)
333	185-274	151(147)	0.00	320.7 (2)	31.6 (2)	96.5 (2)	77.5 (2)	674.0 (2)	103.8 (2)	159.6 (2)	963.1 (2)	389.3 (2)
336	185-274	121	0.00	131.0 (2)	87.5 (2)	85.5 (2)	273.5 (2)	255.0 (2)	744.0 (2)	722.2 (2)	7145.3 (2)	---
355	185-274	103	0.72	879.1 (2)	614.5 (2)	61.5 (2)	527.0 (2)	643.4 (2)	963.8 (2)	2225.3 (2)	11598.4 (2)	1738.7 (2)
334	275-366	92(96)	0.00	1441.2 (2)	106.2 (2)	872.5 (2)	256.3 (2)	816.5 (2)	569.8 (2)	1474.5 (2)	754.2 (2)	9905.8 (2)
335	275-366	58	0.00	740.5 (2)	781.7 (2)	1051.0 (2)	2291.6 (2)	626.7 (2)	898.0 (2)	7626.0 (2)	8416.0 (2)	4935.4 (2)
356	275-366	61	0.77	2481.2 (2)	692.0 (2)	828.0 (2)	603.4 (2)	2484.4 (2)	5727.5 (2)	1123.1 (2)	8649.7 (2)	3298.4 (2)
717	367-549	93(166)	0.00	1401.5 (2)	488.9 (2)	675.7 (2)	2530.3 (2)	1382.2 (2)	1756.3 (2)	2576.0 (2)	2205.3 (2)	8353.8 (2)
719	367-549	76	0.00	2407.5 (2)	6420.9 (2)	1265.0 (2)	1844.2 (2)	3854.5 (2)	14161.4 (2)	7449.1 (2)	5984.2 (2)	15486.3 (2)
721	367-549	76	0.76	1970.5 (2)	4210.8 (2)	3567.9 (2)	927.6 (2)	648.0 (2)	410.2 (2)	2007.9 (2)	1472.6 (2)	8545.8 (2)
718	550-731	111(134)	0.00	289.5 (2)	545.3 (2)	16.0 (2)	120.5 (2)	45.2 (2)	---	928.7 (2)	64.7 (2)	725.3 (2)
720	550-731	105	0.00	88.4 (2)	12.7 (2)	236.4 (2)	478.9 (2)	4489.7 (2)	1761.3 (2)	786.6 (2)	1005.3 (2)	424.5 (2)
722	550-731	93	0.76	282.3 (2)	336.4 (2)	112.4 (2)	106.9 (2)	35.1 (2)	9.0 (2)	35.6 (2)	7.5 (2)	9.6 (2)
	Total:	6350	9.46									
764	732-914	105	1.00	0.0 (2)	0.5 (2)	---	---	0.0 (2)	---	0.0 (2)	---	73.7 (2)
768	732-914	99	0.00	0.0 (2)	0.0 (2)	---	---	0.0 (2)	---	0.0 (2)	---	2.5 (2)
772	732-914	135	0.00	---	0.6 (2)	1.3 (2)	---	0.0 (2)	---	0.0 (2)	---	0.0 (2)
Upper (95% CI)				1034.7	653.5	467.5	915.3	416.2	2367.8	945.1	2855.5	1524.0
Weighted mean (by area)				430.1	335.0	139.0	193.8	283.3	410.5	547.8	751.1	1083.6
Lower (95% CI)				-174.5	16.4	-189.5	-527.7	150.4	-1546.7	150.6	-1353.3	643.2
SURVEY ABUNDANCE (x10^6)				355.6	277.0	114.9	160.2	234.2	331.9	453.0	621.1	878.0
ABUNDANCE within NRA				52.7	52.7	35.5	23.5	30.5	50.4	84.4	198.1	147.0
% within NRA				14.8	19.0	30.9	14.7	13.0	15.2	18.6	31.9	16.7

Table 12. Mean weight per standard tow from Canadian AUTUMN surveys in Div. 3O covering strata from 93 to 731 m (400 ftm.). Data for strata from 732 to 914 m are included for information purposes only and are not included in calculations of mean weight per standard tow or biomass. Dashes (---) represent unsampled strata. Number of successful sets are indicated in brackets. Data from 1991-1995 are Campelen trawl equivalent units (see text). Data from 1996 to present are actual Campelen data. G=Gadus Atlantica, W=Wilfred Templeman, A=Alfred Needler.

Stratum	Depth Range (M)	Area sq mi	% Area within NRA	Oct27-Nov10 1991-Q4 W113-4	Oct26-Nov5 1992-Q4 W128-9	Nov1-12 1993-Q4 W144-5	Oct29-Dec13 1994-Q4 W160-61	Sep28-Oct26 1995-Q4 W176-77	Nov25-Dec13 1996-Q4 W200 A253, T42	Oct-Dec 1997-Q4 W212-13	Sep-Oct 1998-Q4 W229-230	Sep-Oct 1999-Q4 W246-247	Sep-Oct 2000-Q4 W319-320 T338
329	093-183	1721	0.00	0.0 (7)	0.0 (3)	0.0 (5)	0.00 (6)	1.0 (5)	0.0 (5)	22.6 (5)	0.0 (5)	0.0 (5)	0.0 (5)
332	093-183	1047	0.00	0.0 (4)	13.3 (3)	2.7 (3)	15.59 (3)	31.5 (3)	0.2 (2)	7.7 (3)	2.7 (3)	0.8 (3)	0.8 (3)
337	093-183	948	0.00	30.8 (4)	64.7 (2)	7.0 (3)	5.04 (2)	55.5 (2)	0.0 (2)	17.9 (3)	34.6 (3)	1.9 (3)	12.7 (3)
339	093-183	585	0.00	0.0 (2)	0.0 (2)	0.0 (2)	0.00 (2)	0.0 (2)	0.0 (3)	0.0 (2)	0.0 (2)		0.2 (2)
354	093-183	474	0.52	0.0 (2)	171.5 (2)	0.0 (2)	0.00 (2)	785.3 (3)	15.6 (2)	915.0 (2)	31.5 (2)	69.0 (2)	0.0 (2)
333	185-274	151(147)	0.00	27.1 (2)	168.0 (2)	46.5 (2)	257.7 (2)	107.0 (2)	---	26.5 (2)	20.0 (2)	18.0 (2)	24.4 (2)
336	185-274	121	0.00	18.5 (2)	374.3 (2)	378.8 (2)	357.8 (2)	49.7 (2)	9.1 (2)	117.4 (2)	103.8 (2)	548.7 (2)	98.9 (2)
355	185-274	103	0.72	352.2 (2)	450.7 (2)	77.9 (2)	264.2 (2)	237.0 (2)	37.9 (2)	25.9 (2)	11.9 (2)	387.8 (2)	127.8 (2)
334	275-366	92(96)	0.00	1317.9 (2)	480.7 (2)	380.5 (3)	171.1 (2)	506.8 (2)	---	289.5 (2)	188.3 (2)	22.6 (2)	54.6 (2)
335	275-366	58	0.00	512.6 (2)	850.9 (2)	351.8 (2)	877.1 (2)	187.7 (2)	332.2 (2)	1114.4 (2)	362.1 (2)	443.2 (2)	355.4 (2)
356	275-366	61	0.77	59.4 (2)	684.6 (2)	60.1 (2)	303.8 (2)	387.6 (2)	145.5 (2)	106.1 (2)	914.5 (2)	592.9 (2)	801.6 (2)
717	367-549	93(166)	0.00	---	---	1391.3 (2)	340.4 (2)	588.8 (2)	---	2281.8 (2)	1834.0 (2)	135.7 (2)	1143.7 (2)
719	367-549	76	0.00	268.9 (2)	---	930.5 (2)	536.2 (2)	414.0 (2)	656.4 (2)	880.2 (2)	321.3 (2)	691.0 (2)	1313.7 (3)
721	367-549	76	0.76	53.7 (2)	---	100.4 (2)	16.57 (2)	1666.7 (2)	87.3 (2)	732.5 (2)	410.5 (2)	177.5 (2)	230.2 (2)
718	550-731	111(134)	0.00	---	---	169.3 (2)	442.1 (2)	409.4 (2)	---	37.1 (2)	4.4 (2)	48.0 (2)	24.8 (2)
720	550-731	105	0.00	---	---	50.0 (2)	118.7 (2)	16.5 (2)	572.6 (2)	---	162.6 (2)	21.3 (2)	52.3 (2)
722	550-731	93	0.76	7.7 (2)	---	164.0 (2)	22.71 (2)	125.8 (2)	103.9 (2)	4.0 (2)	108.6 (2)	5.3 (2)	34.9 (2)
	Total:	6011	8.25										
764	732-914	105	1.00	---	---	---	---	---	---	---	1.6	---	2.6 (2)
768	732-914	99	0.00	---	---	---	---	---	---	---	0.3	---	0.0 (2)
772	732-914	135	0.00	---	---	---	---	---	---	---	0.0	---	2.2 (2)
Upper (95% CI)				306.5	147.4	105.2	109.0	972.0	86.2	1182.1	701.7	106.8	88.0
Weighted mean (by area)				44.9	76.3	63.6	64.5	151.9	30.5	190.3	91.5	56.4	72.5
Lower (95% CI)				-216.7	5.2	22.1	20.0	-668.2	-25.1	-801.5	-518.7	6.0	57.0
SURVEY BIOMASS (tons)				34618	56247	51782	53324	125578	22974	154622	75648	42100	59927
BIOMASS within NRA				4473	14818	3584	5008	46022	3565	37798	11437	11585	8663
% within NRA				12.9	26.3	6.9	9.4	36.6	15.5	24.4	15.1	27.5	14.5

Table 12. Continued…

Stratum	Depth Range (M)	Area sq mi	% Area within NRA	Sep-Oct 2001-Q4 W372 T357	Sep-Oct 2002-Q4 W427 T411	Sep-Oct 2003-Q4 W485-6 T469	Nov 2004-Q4 W557	Oct 2005-Q4 W627-628 T608	Oct 2006-Q4 W704	Oct 2007-Q4 W770-771 T750	Oct 2008-Q4 W835-836	2009-Q4 A913-15 T894-95
329	093-183	1721	0.00	42.1 (5)	32.2 (5)	0.0 (5)	0.0 (5)	0.2 (5)	4.5 (5)	0.0 (5)	0.0 (3)	3.3 (5)
332	093-183	1047	0.00	0.1 (3)	1.7 (3)	2.9 (3)	0.1 (3)	0.7 (3)	0.0 (3)	0.8 (3)	0.0 (3)	32.2 (3)
337	093-183	948	0.00	2.9 (3)	3.9 (3)	3.8 (3)	0.3 (3)	1.7 (3)	1.1 (3)	49.9 (3)	0.0 (2)	16.2 (3)
339	093-183	585	0.00	0.2 (2)	0.1 (2)	0.0 (2)	0.0 (2)	0.1 (2)	0.0 (2)	0.1 (2)	0.0 (2)	0.0 (2)
354	093-183	474	0.52	35.2 (2)	10.9 (2)	0.0 (2)	7.2 (2)	3.6 (2)	0.6 (2)	131.2 (2)	26.9 (2)	102.3 (2)
333	185-274	151(147)	0.00	31.0 (2)	3.9 (2)	11.3 (2)	3.0 (2)	53.4 (2)	8.0 (2)	12.5 (2)	81.7 (2)	37.0 (2)
336	185-274	121	0.00	13.5 (2)	9.0 (2)	10.0 (2)	31.9 (2)	25.0 (2)	51.0 (2)	47.3 (2)	613.8 (2)	---
355	185-274	103	0.72	119.0 (2)	64.2 (2)	6.3 (2)	67.2 (2)	59.3 (2)	117.1 (2)	161.8 (2)	853.7 (2)	146.1 (2)
334	275-366	92(96)	0.00	188.8 (2)	13.7 (2)	146.6 (2)	54.9 (2)	162.7 (2)	105.4 (2)	256.1 (2)	122.2 (2)	1044.9 (2)
335	275-366	58	0.00	89.0 (2)	82.5 (2)	136.1 (2)	334.0 (2)	92.2 (2)	126.4 (2)	669.5 (2)	1250.5 (2)	549.1 (2)
356	275-366	61	0.77	370.6 (2)	96.4 (2)	91.3 (2)	82.3 (2)	437.8 (2)	1176.1 (2)	157.0 (2)	1903.0 (2)	328.0 (2)
717	367-549	93(166)	0.00	229.2 (2)	75.9 (2)	115.4 (2)	540.9 (2)	253.7 (2)	355.2 (2)	497.1 (2)	235.5 (2)	1424.6 (2)
719	367-549	76	0.00	373.6 (2)	889.9 (2)	194.9 (2)	385.7 (2)	627.9 (2)	2137.5 (2)	1297.0 (2)	1034.3 (2)	1679.4 (2)
721	367-549	76	0.76	319.2 (2)	762.0 (2)	718.8 (2)	184.1 (2)	119.8 (2)	73.8 (2)	381.7 (2)	339.8 (2)	892.8 (2)
718	550-731	111(134)	0.00	79.5 (2)	118.0 (2)	3.9 (2)	34.8 (2)	12.0 (2)	---	320.0 (2)	24.3 (2)	277.0 (2)
720	550-731	105	0.00	16.1 (2)	2.9 (2)	49.3 (2)	134.1 (2)	1013.5 (2)	403.9 (2)	217.1 (2)	279.2 (2)	103.4 (2)
722	550-731	93	0.76	125.2 (2)	68.1 (2)	33.8 (2)	46.7 (2)	11.2 (2)	3.5 (2)	13.8 (2)	3.5 (2)	2.9 (2)
	Total:	6011	8.25									
764	732-914	105	1.00	0.0 (2)	0.4 (2)	---	---	0.0 (2)	(2)	0.0 (2)	---	7.0 (2)
768	732-914	99	0.00	0.0 (2)	0.0 (2)	---	---	0.0 (2)	(2)	0.0 (2)	---	2.0 (2)
772	732-914	135	0.00	---	0.1 (2)	0.2 (2)	---	0.0 (2)	(2)	0.0 (2)	---	0.0 (2)
Upper (95% CI)				78.2	72.0	88.6	179.4	69.2	356.1	141.5	144.0	220.5
Weighted mean (by area)				45.1	41.1	22.5	33.4	46.1	65.9	80.6	93.8	128.37
Lower (95% CI)				12.0	10.2	-43.6	-112.6	23.0	-224.3	19.8	43.6	36.2
SURVEY BIOMASS (tons)				37286	33969	18601	27631	38125	53291	66682	77562	104013
BIOMASS within NRA				8567	8390	6720	3385	4619	9439	10285	24651	14222.6
% within NRA				23.0	24.7	36.1	12.3	12.1	17.7	15.4	31.8	13.7

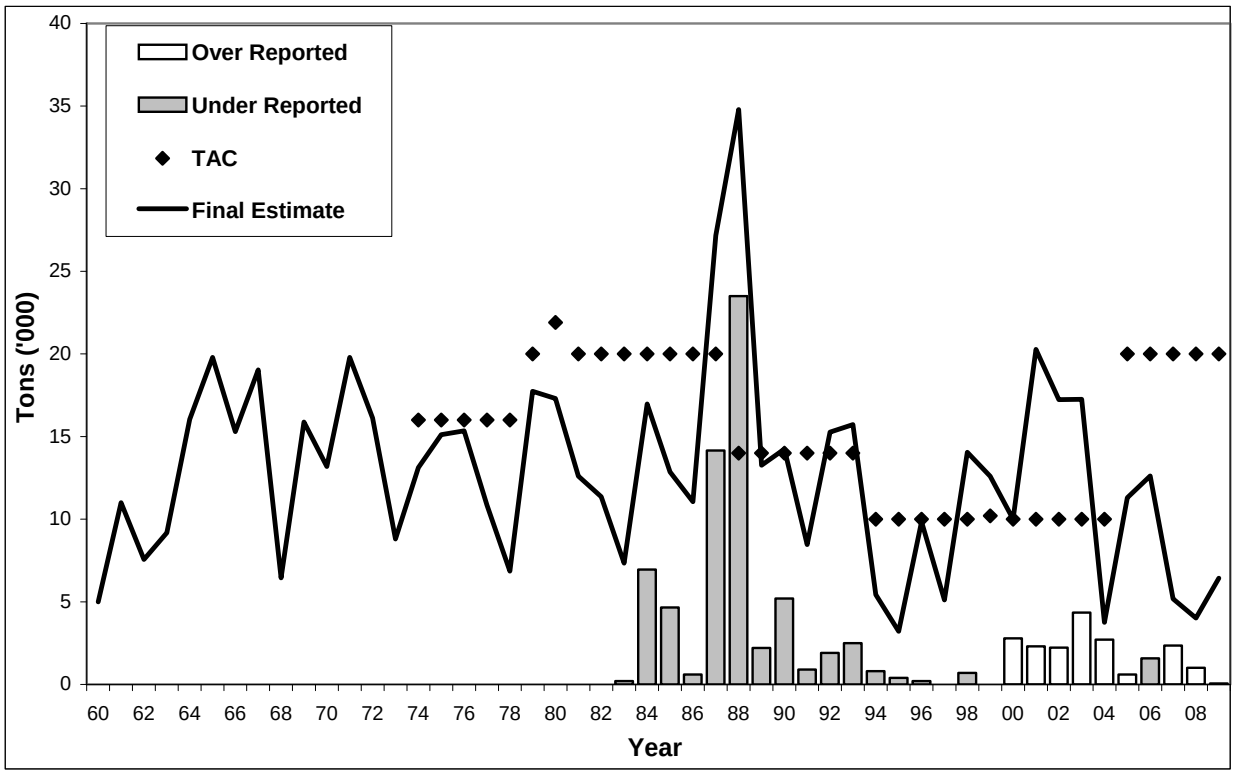

Fig. 1: Nominal catches and TACs of redfish in Div. 3O. TAC to 2004 was only for Canadian fishery zone. Over and under-reported catches represent the difference between reported and final estimates of catch.

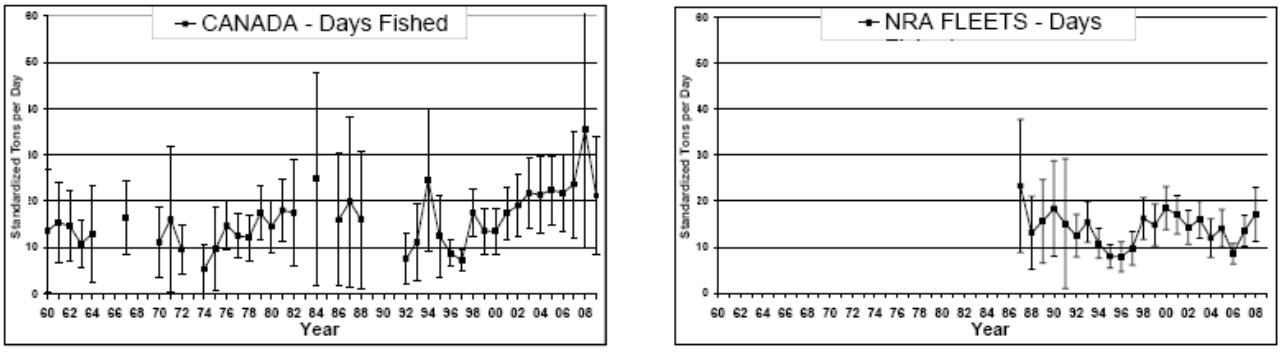

Fig. 2. Standardized Mean CPUE ± 2 standard errors for Redfish in Div. 3O from 1960-2009 utilizing effort in DAYS fished.

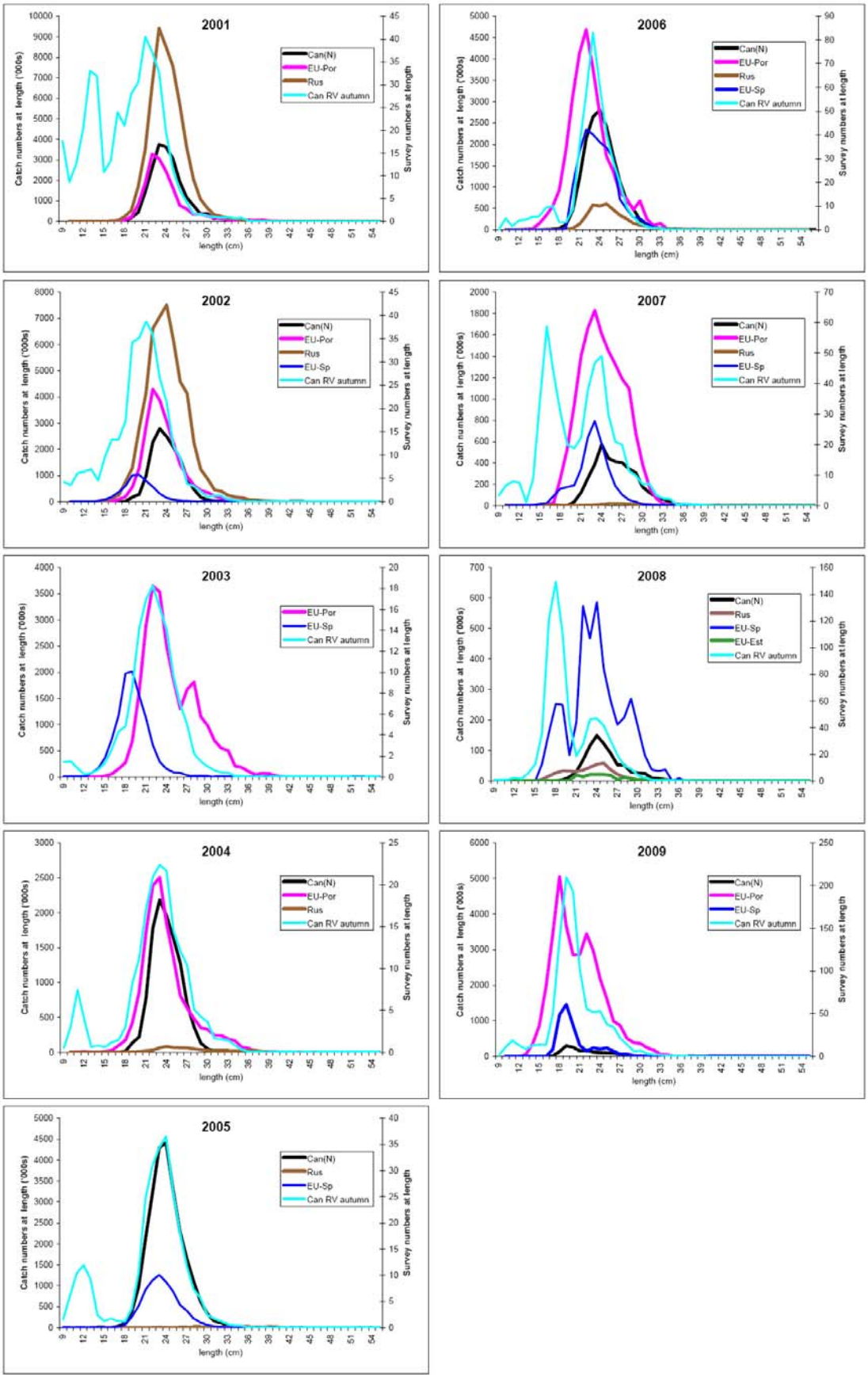

Figure 3. Catch numbers at length ('000s) and Canadian RV survey numbers at length.

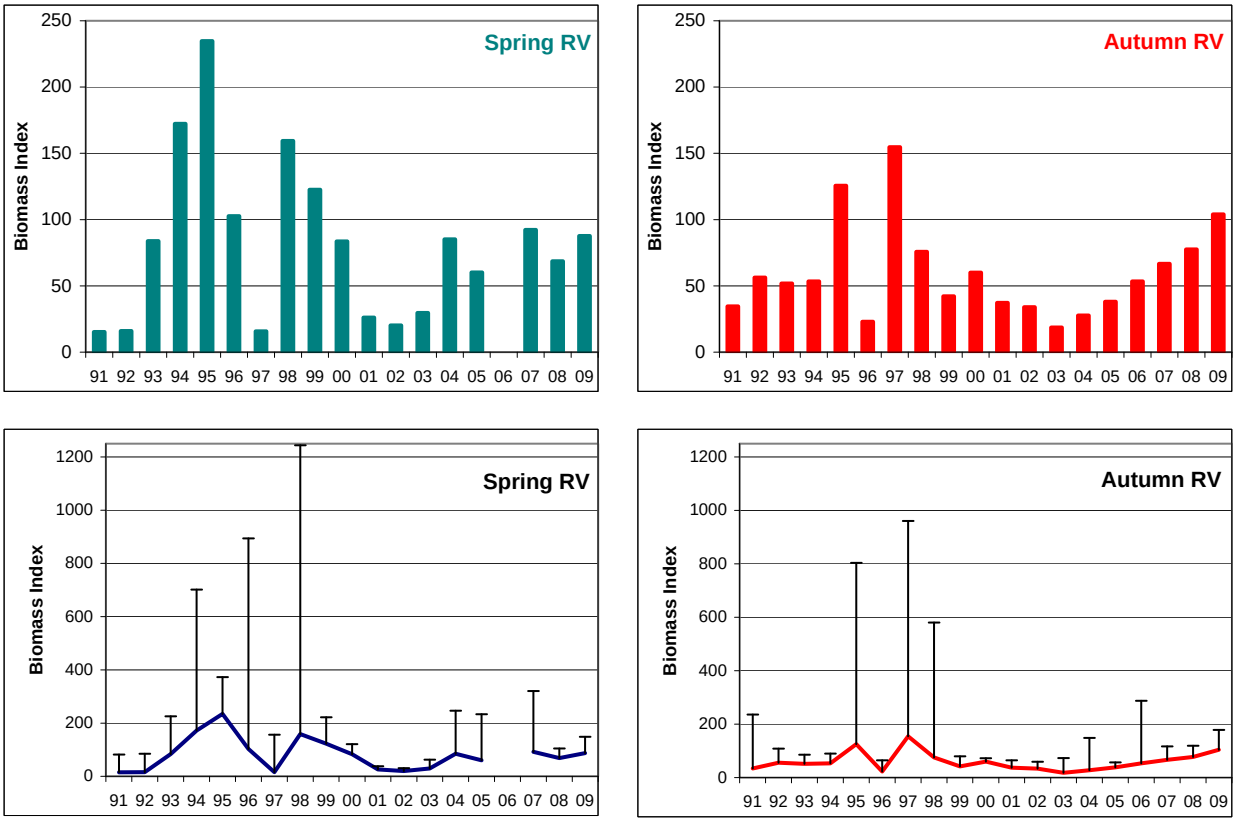

Fig. 4. Survey biomass index (thousands of tons) for Div. 3O redfish for spring (left) and autumn (right) surveys from 1991-2009. Upper panels depict trends in the estimates while lower panels emphasize uncertainty in the estimates by presenting upper 95% CI. For clarity of presentation, lower CI have not been presented. Surveys prior to autumn 1995 utilized an Engel trawl. Estimates were converted into Campelen equivalents based on comparative fishing trials.

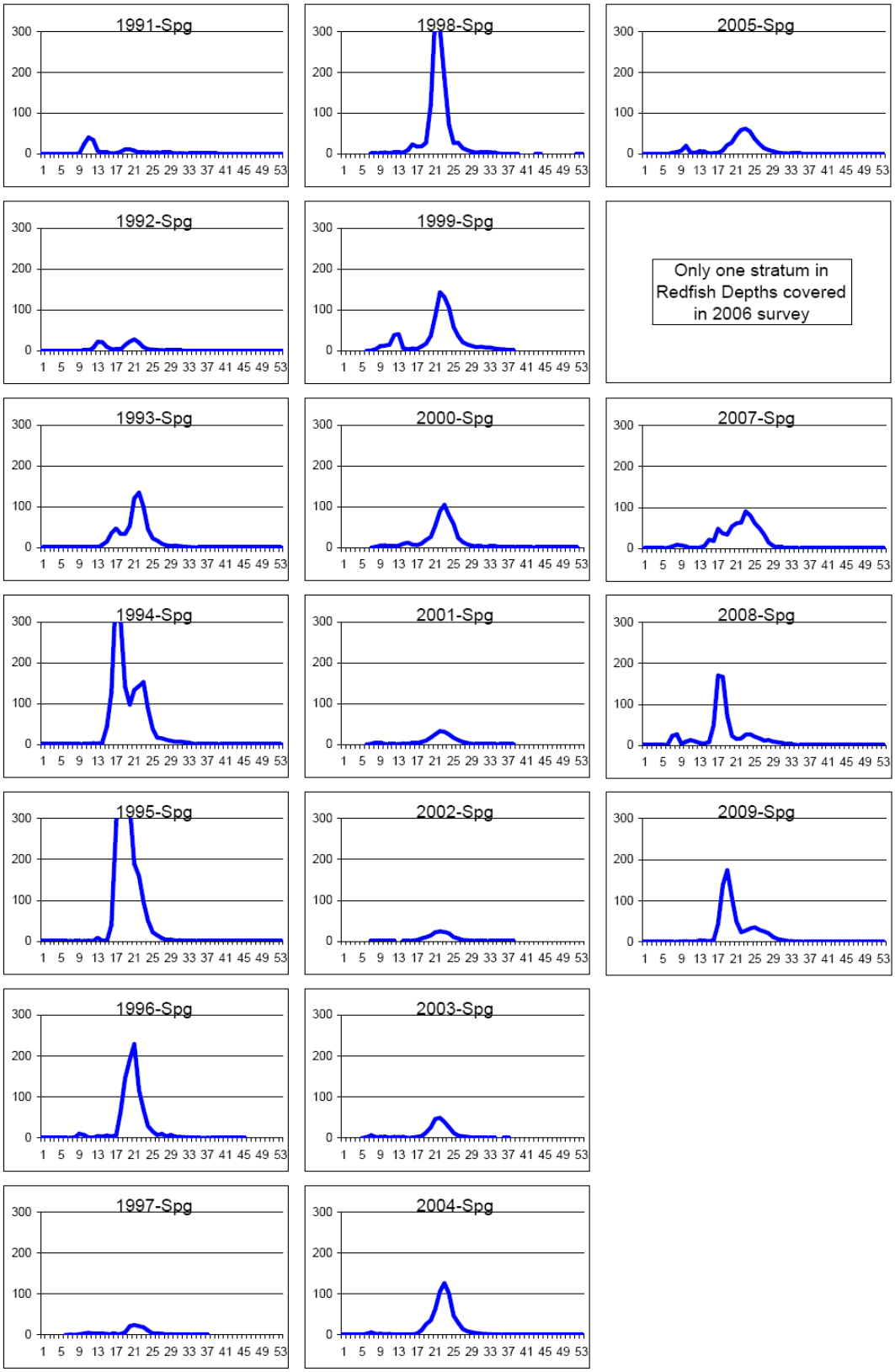

Fig. 5. Length distributions from RV surveys to Div. 3O in SPRING from 1991-2009. Plotted are mean per standard tow. The 1991-1994 data are convertions into Campelen equivalents based on comparative fishing experiments.

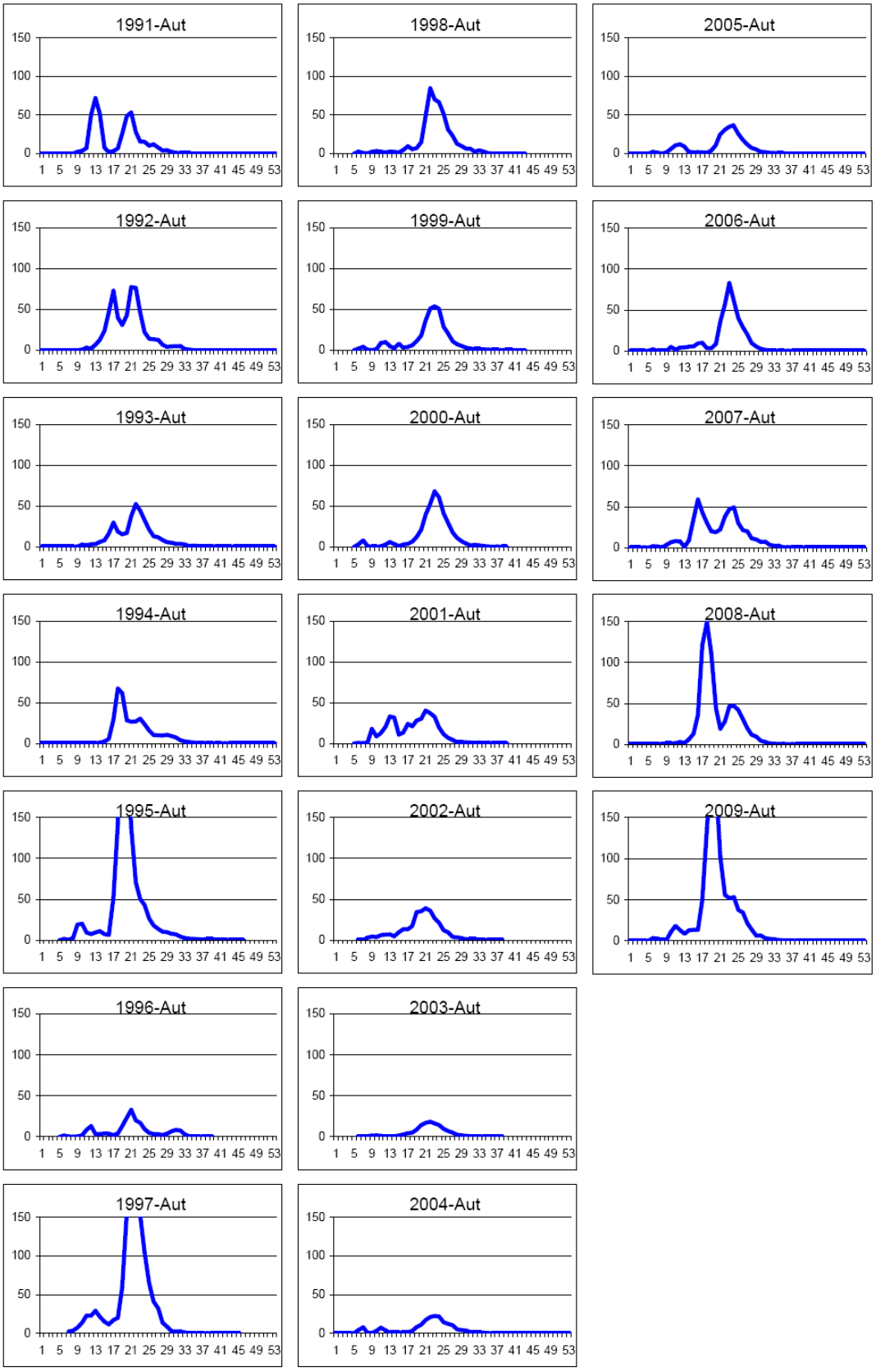

Fig. 6. Length distributions from RV surveys to Div. 3O in AUTUMN from 1991-2009. Plotted are mean per standard tow. The 1991-1994 data are convertions into Campelen equivalents based on comparative fishing experiments.

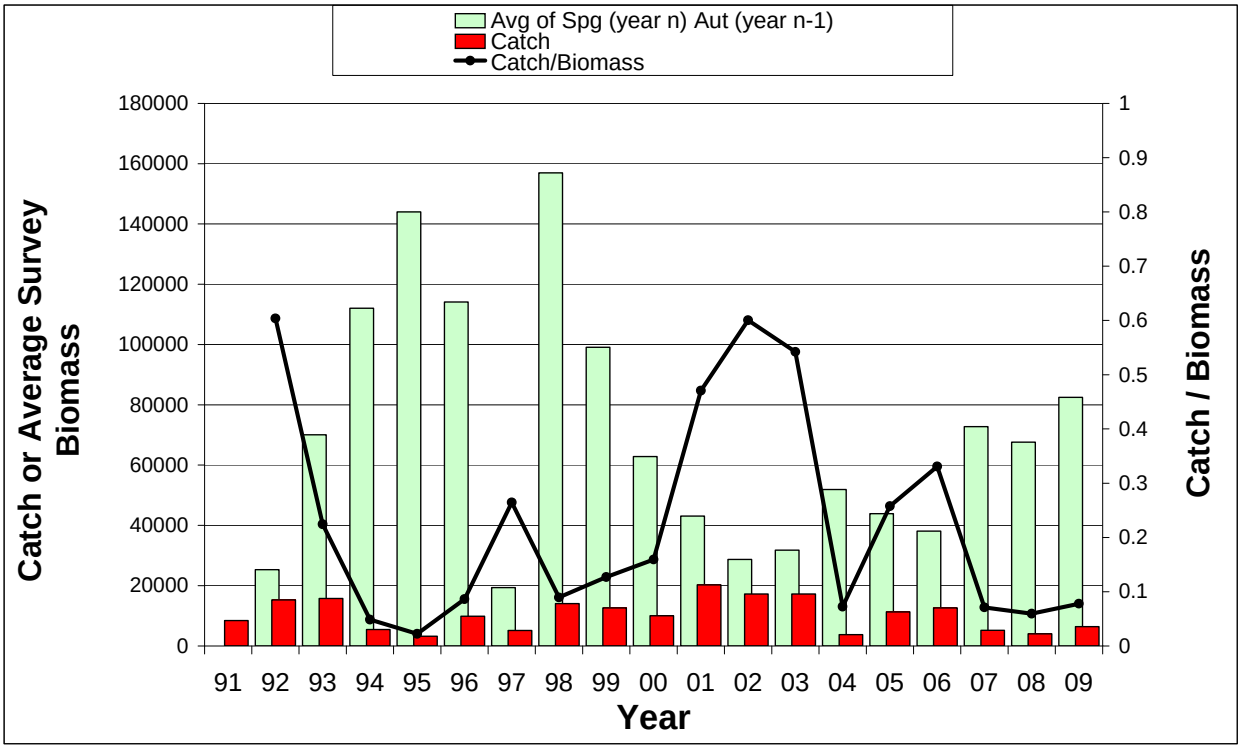

Fig. 7. Catch/Biomass ratios for Div. 3O. Plotted are average survey biomass between spring (n) and autumn (n-1) for year (n) in which catch was taken. The 2006 value of biomass comes only from the autumn survey.