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The Status of Redfish in SA2+Div. 3K

État du stock de sébaste de la sous-zone 2 et de la division 3K

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Abstract

The highest reported catch from this stock was 187,000 t in 1959. From 1961 to 1985 catches ranged between 15,000 t to 56,000 t and averaged about 27,000 t. Catches declined dramatically from about 29,000 t in 1985 to 280 t in 1991 when directed fisheries essentially ceased. In 1997 the stock was put under moratorium to direct fishing which is still in effect. Catches averaged about 160 t from 1998-2000 and are primarily the result of bycatch discarded from shrimp fisheries in the NAFO Div. 2GHJ and 3K areas. Approximately 2.5 million redfish in the length range from 5cm to 19cm were discarded during the 2000 shrimp fishery, which represents a relative exploitation of less than 1%. Preliminary catch data for the 2001-2002 fishing year indicates 1,300 t have been taken in Div 2J in August by Russia and Lithuania. This catch was taken outside the 200-mile limit utilizing large midwater trawls and is likely from the pelagic stock of redfish that resides primarily in the Irminger Sea. RV surveys indicate the population declined very rapidly over a ten-year period from 1980 to 1990. The relative exploitation rate generated from catches over this time period cannot totally account for the decline in the biomass. RV surveys continue to indicate the resource is at a very low level and there has been over 25 years of recruitment failure.

Résumé

C'est en 1959 que les plus fortes prises issues de ce stock, qui se chiffraient à 187 000 t, ont été signalées. De 1961 à 1985, elles se situaient entre 15 000 t et 56 000 t, atteignant une moyenne d'environ 27 000 t, puis elles ont chuté en flèche d'environ 29 000 t en 1985 jusqu'à 280 t en 1991, lorsque les prises dirigées ont essentiellement pris fin. En 1997, le stock a été mis sous le coup d'un moratoire de la pêche dirigée, encore en vigueur. De 1998 à 2000, les prises, rejetées à la mer, qui se chiffraient à quelque 160 t en moyenne, étaient essentiellement des prises accessoires de la pêche de la crevette dans les divisions 2GHJ et 3K de l'OPANO. Environ 2,5 millions de sébastes d'une gamme de longueurs s'étalant entre 5 et 19 cm ont été rejetés à la mer durant la pêche e la crevette de 2000, ce qui représente un taux d'exploitation relatif de moins de 1 %. Les données préliminaires sur les prises pour la saison de pêche 2001-2002 révèlent que la Russie et la Lituanie ont en pris 1 300 t dans la division 2J en août. Ces prises, récoltées à l'extérieur de la limite des 200 milles à l'aide de gros chaluts semi-pélagiques, proviennent probablement du stock pélagique de sébaste qui réside principalement dans la mer d'Irminger. Des relevés de NR indiquent que la taille de la population a diminué très rapidement sur une période de dix ans allant de 1980 à 1990. Le taux d'exploitation relatif généré par ces prises sur cette période de temps ne peut complètement expliquer le déclin de la biomasse. Les relevés de NR continuent d'indiquer que la ressource est à un très faible niveau d'abondance et que le recrutement a fait défaut pendant plus de 25 ans.

INTRODUCTION

Three species of redfish are present in the Northwest Atlantic (*Sebastes mentella*, *S. fasciatus* and *S. marinus* [=*S. norvegicus*]). These three species are similar and are nearly impossible to distinguish by their appearance. They are not separated in the fishery, and they are managed together. The most abundant of these are *Sebastes mentella* and *S. fasciatus*.

This paper presents information relevant to the assessment of stock status to October 2001 and provision of advice for the April 1, 2002 to March 31, 2003 fishing year for redfish in NAFO Subarea 2 + Div. 3K.

DESCRIPTION OF MANAGEMENT REGULATIONS AND THE FISHERY

Management Regulations

The fishery has been under TAC regulation since 1974 when a 30,000 t. quota was implemented. The TAC was increased to 35,000 t in 1980 and remained at that amount until it lowered to 20,000 t in 1991. The TAC decreased to 1, 000 t in 1994 and was reduced to 200 t in 1995 with the constraint that any directed fishing was to be conducted under a “scientific protocol”. This remained in effect for 1996. In 1997 the stock was put under moratorium to directed fishing which has remained in effect ever since. During 1999 a shift was implemented from a calendar year based TAC to a fiscal year based TAC currently in effect from April 1, 2001 to March 31, 2002.

Nominal Catch

The highest catch taken from this stock was 187,000 t in 1959. Between 1961 and 1979 catches averaged about 30,000 t, ranging between 17,500 t and 56,000 t (Table 1, Fig. 1). From 1980-83 catches averaged 16,000 t, increased to about 27,000 t from 1984-1986 in response to improved markets and declined thereafter. There has not been a persistent directed effort on this stock since 1990 when 2,400 t were landed. Landings declined to 280 t in 1991, and have been less than 18 t in each year from 1992-2000. In addition, estimates of redfish bycatch discarded from shrimp fisheries in the area from Div. 2G to Div. 2K have ranged from 14 t in 1983 to 665 tons in 1990. In 2000 an estimated 91 tons of redfish were taken as bycatch and discarded in the shrimp fisheries within SA2+Div. 3K. Preliminary catch data for the 2001-2002 fishing year indicates 1,300 t have been taken in Div 2J in August by Russia and Lithuania. This catch was taken outside the 200-mile limit utilizing large midwater trawls and is likely from the pelagic stock of redfish that resides primarily in the Irminger Sea.

Canada has accounted for most of the landings since the implementation of the 200-mile economic zone in 1977 (Table 2, Fig. 2). The steady reduction since 1986 was due primarily to a major redirection of effort to other redfish fisheries by domestic fleets and there was no effort by foreign countries (Russia and Japan) fishing Canadian quotas since 1987.

Historically, catches were taken throughout the year (Table 3, Fig. 3). Prior to 1977 a higher proportion of the catch was taken the first half of the year (foreign vessels), but after 1977 a higher proportion came from the second half of the year (domestic vessels). In the 1980s, most of the landings were taken from Div. 3K (Table 1, Fig. 1). This was primarily due to the prevalence of external parasites in Div. 2J (see below). Throughout the existence of this fishery, the predominant fishing gear has been the bottom otter trawl.

Industry Experience

A number of reasons have been cited for the substantial reduction in landings since 1986 according to Canadian companies which had a directed fishery for this stock. First there was the continuous complaint of parasite infestation (Sphyrion lumpi, an external copepod which attaches itself to the flesh), particularly in Div. 2J. In addition there is a bacterial infection of the skin which also renders them undesirable for the prime market. Secondly, according to veteran trawler captains of this fishery, concentrations of fish had diminished on their traditional fishing grounds. Finally the major Canadian stakeholder, National Sea Products, had diverted effort to other fisheries because of the viability of the Div. 2J3K fishery. In early 1995, National Sea Products conducted a short experimental fishery in Div. 3K on traditional redfish grounds. Although only a few sets were conducted the results were very poor and the area steamed over was considered a desert in terms of viable concentrations of redfish.

AVAILABLE DATA

Commercial Fishery Data

There has been very limited data available since 1990 when the directed fishery was considerably reduced. In the mid-1980s prior to the decline in catches the bulk of the directed fishery consisted of fish in the 28-40 cm range which correspond to ages from 10-20 years.

Length sampling of redfish bycatch discarded in shrimp fisheries in 2000 was available through the observer program. Abundance at length was estimated separately for two shrimp fleets, those vessels less than 500 gross registered tons (GRT) and the traditional large vessel fleet (500+ GRT). Set by set samples were adjusted to the turnout weight of the set, summed, then adjusted to the total redfish catch of the observed sets only. An abundance at length per ton of observed shrimp catch was derived to provide the basis for estimating the redfish removal based on the amount of shrimp landed for the year. The weight to length relationship used in estimating the final removals was derived separately for males and females from DFO surveys from 1997-1999 in Div. 2GHJ3K. These surveys use a Campelen 1800 shrimp trawl with a liner in the codend. The length-weight results were:

$$\text{Wgt. in grams (males)} = 0.000009581 * \text{Forklength}^{3.101663187}$$
$$\text{Wgt. in grams (females)} = 0.000008845 * \text{Forklength}^{3.129168941}$$

Bycatch sampling information:

	# Sets			Redfish Catch (kg)			Shrimp Catch (tons)		
Fleet	Observed	Sampled	%	Observed	Sampled	%	Observed	Landed[a]	%
<500 GRT	1452	28	1.93	2502	28	1.12	3633	42651	8.52
500+ GRT	5904	116	1.96	48774	805	1.65	30178	43716	69.03

[a]Figures taken from Orr et. al. (2001) for shrimp areas 4-6 (within SA2+Div. 3K)

Based on this approach, an estimated 2.5 million redfish were discarded by the shrimp fleet in 2000. The length range was between 5cm to 27cm (Fig. 4). The bulk of the bycatch (80%) came from the 12cm-18cm length range (fish approximately 4 to 6 years old).

Research Survey Data

Indices of Abundance

Stratified random groundfish surveys have been conducted in the fall in Div. 2J and 3K since 1977. These surveys generally cover strata to depths of 1000m but have been extended to deeper water in 1996. Generally though, the abundance of redfish drops off sharply beyond 800m in the slope area. The stratification scheme was redesigned for the 1993 survey to redefine stratum boundaries based on more recent information on depth soundings (Bishop, MS 1994). Although it is difficult to compare the results of certain strata to those previous to 1993, in general the total area of revised stratification is only slightly different from the previous scheme used from 1977-1992. Up until the autumn of 1995 these surveys were conducted with an Engels 145 high lift otter trawl with a small mesh liner (29mm) in the codend and tows planned for 30 minute duration. Starting with the autumn 1995 survey, a Campelen 1800 survey gear was adopted with a 12mm liner in the codend and 15 minute tows utilizing SCANMAR. The Engel data were converted into Campelen equivalents units for 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 Orr MS 2001).

The resulting indices of stock size suggest the population in Div. 2J and Div. 3K were at historically low levels in 1994. Although there have been rather large fluctuations between some years in the both series, there has been a decline in the Div. 2J biomass index from about an average of about 485,000 t from 1978-1981 to an average of 6,000 t from 1992-1995 (Tables 4-5, Fig. 5). The Div. 3K biomass index suggests an even larger reduction from an average of 844,000 t from 1978-1981 to an average of 4,600 t from 1992-1995 (Tables 6-7, Fig. 5). Average catch per tow was less than 12 kg in Div. 2J and less than 9 kg in Div. 3K since 1991 compared to an average of 245 kg and 210 kg respectively from 1978-1981 surveys. Survey biomass estimates for Div. 2J3K from 1995-2000 (average 32,000 t), are less than 5% of the average from 1978 to 1990 (775,000 t) based on the converted Engel data.

Stratified random groundfish surveys have been conducted in Div. 2G and 2H sporadically since 1978. The information from these surveys prior to 1992 suggests that

density and survey biomass of redfish in these areas was relatively low when compared to surveys in Div. 2J3K conducted in equivalent years (Power and Atkinson MS, 1990). The more recent surveys from 1996-1999 with the Campelen gear suggest that the survey biomass index in Div. 2GH is slightly lower (average 23,000 t) than in Div 2J3K (average 32,000 t for the combined area). However, the abundance is higher than in Div. 2J3K because on average smaller sizes were caught in the survey.

Greenland halibut directed surveys have also been conducted in Div. 3K in 1991, 1994 and 1995 during which redfish information was collected. The 1991 survey was a line transect survey conducted in September and the 1994 survey a stratified random design conducted in February-March. Both surveys covered depths from 750 m - 1500 m. The 1995 survey, conducted in March-April was also stratified random but had more extensive coverage from 500 m - 1500 m. Trawlable biomass was estimated about 4000 t in the 1991 survey, primarily due to one large set and there were no redfish caught in the 1994 survey (Morgan et al MS 1994). The trawlable biomass from the 1995 survey was about 1700 t.

It had been suggested previously that the timing and coverage of the fall Div. 2J3K surveys may not be optimum to fully understand the dynamics of the stock because distribution plots of Div. 2J3K survey catches indicated that in some years large concentrations of fish were at the border of the surveyed area (Power and Atkinson MS 1990). The data from the Greenland Halibut surveys suggest that there was no large abundance of redfish missed because of distribution in deeper water in the 1991, 1993 and 1994 fall surveys to Div. 3K.

Indices of Recruitment

Length distributions from the surveys in Div. 2J3K in terms of mean number per tow at length from Div. 2J and 3K surveys (Fig. 6) indicate that the stock is at a very low level and recruitment has been extremely poor since the year classes of the early 1970s. The age classes currently comprising the stock are primarily those born since 1990 in the length range from 16 cm - 25 cm. Included in this are two pulses of recruitment at 6cm (2.5 inches) and 10cm (4 inches) that correspond to the 1999 and 1997 year-classes respectively. However, abundance in the survey is very low for all size groups compared to the late 1970s surveys. The distributions also reveal a contraction in the size range. Prior to the mid-1980s, the surveys indicated a significant portion of the survey catch was comprised of fish greater that 30cm. Since then, dramatic changes have occurred both in overall abundance and in the proportion greater than 30cm.

Estimation of Stock Parameters

Exploitation rates

The impact of redfish bycatch from Div. 2GHJ3K shrimp fisheries was assessed by comparing the estimated numbers at length of fish discarded during 2000 to DFO survey abundance at length from the autumn 1999 survey as an estimate of the beginning of the year population numbers. Relative exploitation by length group was

generally less than 5% and over the entire range of the catch (5cm to 27cm) was estimated to be less than 1% in 2000.

An approximation of an relative exploitation rate for the total redfish catch from all fisheries was derived by calculating a ratio of catch weight in year 'x' from Div. 2J3K to survey biomass from the fall surveys in year 'x-1' as an estimate of stock size at the beginning of the year. The results (Fig. 8) suggest that relative exploitation on this stock based on the Engel survey estimates has been above 9% only in the period from 1984 to 1987 when it ranged from 12%-18%. In general, relative exploitation has been below 7% no matter which survey estimates (Engel or Campelen converted) are used. These estimates are considered to be below the F0.1 level (F=.12 or 11%) based on yield per recruit calculations from neighboring Div. 3LN (ANON 1989).

SUMMARY AND PROGNOSIS

It is not possible to provide an estimate of the absolute size of this stock. The estimates of trawlable biomass from RV surveys in Div. 2J and Div. 3K combined indicate the population declined very rapidly over a ten-year period from 1980 to 1990. The relative exploitation rate generated from catches over this time period cannot totally account for the decline in the biomass even though there has been over 25 years of recruitment failure.

This stock remains at a very low level. Most of the abundance in the 2000 RV survey is composed of fish less than 25cm (10 inches) which are typically immature (Ni and Sandeman 1984). From a conservation point of view, exploitation of this stock is unjustifiable. There are no indications that the status of this stock will change in a positive way in the near future. Any good recruitment coming into this stock will need at least 10 years before it will start contributing to the spawning stock because of the relatively slow growth rate of redfish.

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Table 1 : Summary of Nominal Catches (t) of Redfish in SA2 + Div. 3K

Year	2G	2H	2J	3K	Total	TAC
1959		23	52,519	134,065	186,837 [a]	
1960		56	80,292	45,698	126,164 [a]	
1961		542	25,052	29,861	55,465 [a]	
1962		155	7,576	11,925	19,659 [a]	
1963	245	16	5,873	17,510	28,898 [a]	
1964	120	938	16,001	23,044	56,232 [a]	
1965	1,103	2,878	19,516	20,042	43,539	
1966	197	4,678	9,135	18,720	32,730	
1967	24	3,327	13,699	9,112	26,162	
1968	670	3,156	4,938	10,104	18,908 [a]	
1969	177	869	7,128	16,407	24,635 [a]	
1970	90	501	8,372	12,834	21,819 [a]	
1971	471	1,079	5,084	12,672	19,312 [a]	
1972	22	637	8,879	10,495	20,033	
1973	192	742	10,545	27,486	38,965	
1974	85	429	5,943	23,688	30,145	30,000
1975	67	383	14,096	11,013	25,559	30,000
1976	89	1,606	14,412	9,858	25,965	30,000
1977	99	770	6,509	10,161	17,539	30,000
1978	29	554	11,804	16,759	29,146	30,000
1979	14	256	16,659	13,801	30,730	30,000
1980	2	47	4,423	10,047	14,604 [b]	35,000
1981	24	203	4,241	13,174	17,893 [b]	35,000
1982		583	7,048	10,352	18,099 [b]	35,000
1983		158	2,166	12,987	15,325 [b]	35,000
1984	49	81	2,329	21,230	23,716 [b]	35,000
1985		133	867	28,225	29,436 [b]	35,000
1986		69	3,456	23,494	27,114 [b]	35,000
1987		16	3,212	15,283	18,688 [b]	35,000
1988	8	28	994	5,912	7,558 [b]	35,000
1989	1	3	79	3,084	3,807 [a,b]	35,000
1990	2		316	2,104	3,087 [b]	35,000
1991		1	8	271	683 [b]	20,000
1992			1	14	423 [b]	20,000
1993				2	204 [b]	20,000
1994	1				126 [b]	1,000
1995	1		1	1	3	200
1996			1	3	4	200
1997				3	3	Moratorium
1998	0	0	0	3	183 [b]	Moratorium
1999-2000	0	2	1	2	185 [b,c]	Moratorium
2000-2001				18	113 [b,d]	Moratorium [e]
2001-2002			1,300	26	1,326 [d]	Moratorium [e]

[a] Totals include catch in SA2 + Div. 3K which could not be separated by division.

[b] Includes estimates of discards from shrimp fisheries in SA2 + Div. 3K.

[c] Provisional, catches and TAC are for January 1, 1999 to March 31, 2000

[d] Provisional to Oct. 7, 2001 (Canadian Atlantic Quota Reports)

Table 2: Nominal catches of Redfish by country from SA2 + Div. 3K from 1960-1998.

Year	Can (M)	Can (NF)	Germany	Iceland	Japan	Poland	USSR	Portugal	Others	TOTAL
1960		1	29636	10964			85315		130	126046
1961	2		12762	4236		214	38226		15	55455
1962			3298	2106		1188	12999		65	19656
1963		1	1366	4405		11066	6788		18	23644
1964		13	6333	2373		20578	10794		12	40103
1965	246	20	12278	1895		21678	7355		67	43539
1966		54	13824	1899		11643	5256		54	32730
1967	1	28	11751	1937		6292	6102		51	26162
1968	10	173	6115	328	2	6902	5304		34	18868
1969		6	4870	294		5752	13458		201	24581
1970		63	5266		10	5223	10379		856	21797
1971		153	2756	209	44	6188	9785		171	19306
1972		49	2870	296		2136	13481	620	581	20033
1973		374	5833			4489	24230	2784	1255	38965
1974		153	9058			3646	11898	4820	570	30145
1975	21	424	4284			4219	13575	2971	65	25559
1976	1943	1951	2376	2		3950	14881	823	39	25965
1977	2012	1486	2108		4	2269	8014	845	801	17539
1978	11114	10938	3066		255	625	2685	378	85	29146
1979	15492	11095	611			302	2578	544	108	30730
1980	4017	3768	1250		9	870	4208	266	131	14604
1981	3118	10298	720		4	635	2474	393	0	17893
1982	3784	7350	605		2662	24	3073	456	29	18099
1983	3884	5413	703			1406	3722	183	0	15325
1984	5069	12298	596		1218	366	3690	437	15	23716
1985	6716	14863	305		3471	66	3689	106	9	29436
1986	7860	10933	197		4178	297	3528	20	6	27114
1987	3429	8719	443		2127	41	3733		19	18688
1988	923	4437	0		698	36	848		0	7558
1989	585	1594	0		489	8	491		0	3807
1990	242	1806	0		240		134		0	3087
1991	10	161	0		66		1		42	683
1992		9	0						6	423
1993		2	0						0	204
1994			0						0	126
1995		1	0						0	3
1996		2	0		1				1	4
1997		3	0						0	3
1998		3	0						0	183
1999-2000	2	3								185
2000-2001	1	17								113
2001-2002		26					1067		233	1326
	70481	108688	145280	30944	15478	122109	333761	15646	5669	852549

NOTE: Canadian discards from shrimp fisheries within the area are included where available since 1980

Table 3: Nominal catches of Redfish by month from SA2 + Div. 3K from 1960-1998.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	UNK	TOTAL
1960	19827	19696	15651	15910	31134	12931	1385	1051	1248	2668	693	3840	12	126046
1961	4310	8807	6705	13006	18567	1644	603	195	96	308	656	558	0	55455
1962	606	1569	4011	6231	3820	559	0	255	1643	413	549	0	0	19656
1963	230	3071	790	5211	4989	1008	2527	2596	1446	1261	204	311	0	23644
1964	1427	3481	1871	3338	5302	5318	4563	3279	4727	2794	1337	2666	0	40103
1965	2856	3521	4074	8426	7474	3223	5013	6053	2060	128	338	373	0	43539
1966	2037	1116	6495	6874	2807	1986	1418	896	1408	2672	3005	2016	0	32730
1967	659	1186	2902	2766	1377	1171	246	663	437	6964	5055	2736	0	26162
1968	1154	989	1551	2423	2324	697	1722	2105	799	1268	2020	1814	2	18868
1969	479	403	1417	5166	7271	2001	1289	2997	1107	295	665	1476	15	24581
1970	1921	2184	6586	6025	2274	252	618	575	845	194	58	265	0	21797
1971	1227	4808	5102	2585	859	780	144	1065	344	671	548	1173	0	19306
1972	2300	5250	688	3499	1886	350	73	976	254	714	2919	504	620	20033
1973	7202	5231	1354	4888	1451	1656	962	6678	4965	2178	1372	1019	9	38965
1974	1538	3178	8289	1706	2430	1277	2158	2786	1401	520	2017	2845	0	30145
1975	4911	4198	4888	3293	1033	917	2088	2506	647	277	500	301	0	25559
1976	4698	2440	1023	567	242	410	2599	7971	2359	896	793	1967	0	25965
1977	479	2139	1354	444	270	536	4651	2712	2953	907	831	263	0	17539
1978	1188	807	4712	2742	1763	413	735	4646	5494	2055	2277	2314	0	29146
1979	364	1231	1910	1800	1778	1019	2476	6594	7524	5490	342	202	0	30730
1980	164	566	1255	1730	1334	146	210	1864	3491	559	1951	1249	0	14519
1981	367	407	576	1097	630	3436	4638	3981	743	207	545	1015	0	17642
1982	133	430	303	639	1384	809	2144	4427	2912	762	2334	1706	0	17983
1983	484	1298	2654	1447	972	785	1067	4041	595	573	377	1018	0	15311
1984	924	1327	1795	2934	2706	1050	1198	4683	2243	3056	950	823	0	23689
1985	1534	2378	2609	2671	2061	1702	2207	5277	2515	1582	1717	2972	0	29225
1986	1034	1932	2374	1353	1925	902	212	4014	5578	2362	3533	1800	0	27019
1987	523	634	798	1597	740	1232	958	2381	2480	2592	1322	3254	0	18511
1988	523	402	513	298	444	394	264	476	1095	1685	676	172	0	6942
1989	82	75	250	29	233	170	166	417	821	654	215	55	0	3167
1990	23	36	166	377	422	192	162	22	308	416	97	201	0	2422
1991	57	3	3	2	0	73	15	59	9	10	30	19	0	280
1992	0	0	0	0	0	5	1	8	0	1	0	0	0	15
1993	0	1	0	0	0	0	0	0	1	0	0	0	0	2
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	1	0	0	0	0	0	1
1996	0	0	0	0	0	1	1	1	0	0	0	0	0	3
1997	0	0	0	0	0	2	1	1	0	0	0	0	0	4
1998	0	0	0	0	0	0	1	2	0	0	0	0	0	3
1999-2000	0	0	2	0	0	1	1	1	0	0	0	0	0	5
2000-2001	0	0	0	0	0	1	11	4	2	0	0	0	0	18
2001-2002	0	0	0	0	0	0	0	1300	0	0	0	0	0	1300
	65261	84794	94671	111074	111902	49049	48526	89559	64550	47132	39926	40927	658	848030

Note: Discards not included

Table 4. Mean number (upper panel) and weight (kg., lower panel) per standard tow from Canadian AUTUMN surveys in Div. 2J. Number of successful sets in brackets, NS' = unsampled strata. The data are Campelen trawl equivalent units based on a comparative fishing experiment with an Engel 145 otter trawl (see text).

Stratum	Depth range (m)	Area (sq.n.mi.)	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
209	201-300	1608	38.5 (2)	0.0 (2)	10.5 (2)	0.7 (6)	1.0 (11)	0.9 (7)	0.1 (7)	0.1 (9)	0.0 (7)	2.5 (8)	0.0 (5)	0.0 (8)	0.0 (6)	0.0 (7)	0.0 (5)
210	201-300	774	598.7 (3)	19.5 (2)	5.0 (2)	0.0 (3)	73.7 (6)	1.5 (2)	153.0 (4)	3.3 (4)	0.7 (3)	0.0 (4)	41.3 (3)	0.0 (4)	0.0 (3)	1.0 (7)	4.0 (7)
213	201-300	1725	554.7 (3)	462.7 (3)	2.0 (3)	22.8 (6)	21.7 (10)	632.3 (10)	300.6 (5)	2.6 (9)	0.0 (9)	2.1 (9)	2.1 (8)	0.0 (9)	1.5 (8)	0.8 (14)	1.6 (19)
214	201-300	1171	522.3 (3)	11.0 (2)	0.0 (2)	257.6 (5)	134.0 (8)	126.8 (8)	1.3 (4)	2.8 (6)	9.3 (6)	4.8 (6)	15.5 (6)	1.0 (6)	1.6 (5)	1.8 (15)	2.7 (14)
215	201-300	1270	53.7 (3)	22.0 (2)	61.5 (2)	4.4 (5)	10.7 (9)	9.9 (8)	8.3 (3)	5.3 (6)	10.0 (5)	0.9 (7)	2.0 (7)	4.2 (6)	3.0 (6)	2.6 (15)	8.0 (10)
228	201-300	1428	688.7 (3)	33.5 (2)	1658.0 (2)	8259.2 (6)	219.0 (10)	362.2 (6)	376.1 (7)	0.7 (7)	97.2 (6)	31.0 (7)	23.0 (5)	13.3 (8)	20.0 (6)	20.3 (3)	17.2 (5)
203	301-400	480	70.5 (2)	19.0 (2)	40.0 (2)	22.5 (2)	32.3 (3)	26.7 (3)	39.5 (2)	7.0 (3)	1.5 (2)	1.0 (3)	0.0 (2)	4.7 (3)	0.0 (2)	0.0 (3)	0.0 (3)
208	301-400	448	270.0 (2)	2376.0 (2)	42.5 (2)	30.5 (2)	43.7 (3)	29.0 (2)	88.7 (3)	67.3 (3)	1.0 (2)	6.5 (2)	1.5 (2)	8.5 (2)	0.0 (2)	2.7 (3)	6.7 (3)
211	301-400	330	101.0 (2)	71.0 (2)	92.5 (2)	1113.0 (2)	86.0 (2)	1.0 (2)	193.0 (2)	251.7 (3)	2.5 (2)	17.0 (2)	2.5 (2)	36.5 (2)	6.0 (2)	6.2 (5)	5.2 (6)
216	301-400	384	6744.0 (2)	1000.0 (2)	2580.0 (2)	306.0 (2)	741.5 (2)	613.0 (3)	820.5 (2)	331.5 (2)	1132.0 (2)	665.0 (2)	209.5 (2)	108.5 (2)	13.5 (2)	20.7 (3)	17.0 (3)
222	301-400	441	5265.5 (2)	1536.5 (2)	1898.0 (2)	4246.5 (2)	3382.7 (3)	3948.7 (3)	1440.7 (3)	657.5 (2)	177.5 (2)	194.5 (2)	3468.0 (2)	49.0 (2)	14.0 (2)	12.3 (3)	21.0 (3)
229	301-400	567	384.0 (2)	636.5 (2)	1052.5 (2)	2459.0 (2)	2263.3 (4)	2021.3 (4)	436.0 (3)	508.0 (3)	1072.0 (3)	38.0 (3)	8.7 (3)	134.3 (3)	30.5 (2)	90.3 (3)	26.0 (3)
204	401-500	354	94.0 (2)	50.0 (2)	NS	49.5 (2)	4.3 (3)	39.3 (3)	56.5 (2)	0.0 (2)	1.0 (2)	0.0 (2)	0.5 (2)	2.5 (2)	13.0 (2)	4.7 (3)	3.3 (3)
217	401-500	268	2762.5 (2)	714.0 (2)	1229.0 (2)	210.0 (2)	703.5 (2)	688.5 (2)	NS	228.5 (2)	626.0 (2)	302.0 (2)	787.5 (2)	71.0 (2)	320.5 (2)	50.7 (3)	208.7 (3)
223	401-500	180	3810.0 (2)	865.5 (2)	1556.0 (2)	1220.0 (2)	879.0 (2)	686.0 (2)	858.0 (2)	753.0 (2)	1182.5 (2)	207.0 (2)	942.5 (2)	133.0 (2)	68.5 (2)	62.7 (3)	61.0 (3)
227	401-500	686	1476.0 (2)	306.0 (2)	290.5 (2)	34.5 (2)	258.4 (5)	189.5 (4)	161.7 (3)	127.3 (4)	355.3 (3)	84.0 (4)	10.7 (3)	21.8 (4)	311.7 (3)	62.7 (6)	74.3 (6)
235	401-500	420	21.5 (2)	93.5 (2)	58.0 (2)	15.5 (2)	30.0 (3)	49.5 (2)	138.3 (3)	20.5 (2)	8.5 (2)	27.0 (2)	63.5 (2)	4.5 (2)	114.5 (2)	33.7 (3)	13.0 (3)
212	501-750	664	8.0 (2)	20.0 (2)	5.0 (2)	6.0 (2)	11.6 (5)	12.7 (3)	27.3 (3)	9.0 (4)	10.7 (3)	5.5 (4)	0.0 (2)	1.5 (4)	8.3 (3)	21.0 (2)	12.0 (2)
218	501-750	420	1205.5 (2)	NS	634.0 (2)	200.5 (2)	109.5 (2)	211.0 (2)	NS	118.0 (2)	76.5 (2)	435.5 (2)	383.0 (2)	155.5 (2)	83.5 (2)	15.5 (2)	307.0 (2)
224	501-750	270	1367.0 (2)	995.5 (2)	644.0 (2)	432.0 (2)	187.5 (2)	216.0 (2)	307.0 (2)	43.5 (2)	250.0 (2)	252.5 (2)	514.0 (2)	29.0 (2)	23.5 (2)	54.5 (2)	55.5 (2)
230	501-750	237	2833.5 (2)	NS	311.5 (2)	159.5 (2)	263.0 (2)	149.0 (2)	181.0 (2)	140.0 (2)	550.0 (2)	260.5 (2)	58.0 (2)	149.5 (2)	410.5 (2)	130.5 (2)	85.0 (2)
219	751-1000	213	NS	NS	NS	19.0 (2)	NS	2.0 (2)	NS	0.0 (2)	26.5 (2)	1.0 (2)	3.0 (2)	0.0 (2)	12.0 (2)	0.0 (2)	1.0 (2)
231	751-1000	182	0.0 (2)	NS	3.0 (2)	NS	5.5 (2)	7.0 (2)	43.5 (2)	35.0 (2)	10.0 (2)	2.0 (2)	9.5 (2)	NS	0.0 (2)	2.0 (2)	12.5 (2)
236	751-1000	122	NS	NS	NS	12.5 (2)	6.0 (2)	6.0 (2)	10.5 (2)	25.0 (2)	7.5 (2)	3.5 (2)	0.0 (2)	NS	0.5 (2)	0.0 (2)	3.0 (2)
Stratified Analysis:		Upper	1118.0	766.5	2005.9	3245.3	563.6	709.4	317.7	157.1	289.1	148.2	744.2	37.2	63.9	23.3	30.5
		Mean	830.5	320.6	452.5	1140.4	305.6	381.5	218.5	84.9	147.5	63.9	166.4	24.6	39.5	17.4	25.8
		Lower	543.0	-125.3	-1100.8	-964.5	47.5	53.6	119.3	12.6	5.8	-20.5	-411.4	12.1	15.2	11.5	21.1
Total Survey Abundance (millions)			**1719**	**593.9**	**868.6**	**2268.4**	**606.5**	**768.4**	**413.1**	**170.9**	**297.1**	**128.6**	**335.1**	**48.6**	**79.7**	**35.0**	**52.0**

Stratum	Depth range (m)	Area (sq.n.mi.)	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
209	201-300	1608	0.4 (2)	0.0 (2)	3.6 (2)	0.4 (6)	0.0 (11)	0.2 (7)	0.1 (7)	0.1 (9)	0.0 (7)	0.1 (8)	0.0 (5)	0.0 (8)	0.0 (6)	0.0 (7)	0.0 (5)
210	201-300	774	10.6 (3)	4.4 (2)	1.8 (2)	0.0 (3)	5.7 (6)	0.7 (2)	6.0 (4)	0.1 (4)	0.2 (3)	0.0 (4)	1.4 (3)	0.0 (4)	0.0 (3)	0.1 (7)	0.4 (7)
213	201-300	1725	107.8 (3)	129.7 (3)	0.6 (3)	4.7 (6)	6.5 (10)	158.3 (10)	73.7 (5)	1.1 (9)	0.0 (9)	0.8 (9)	0.6 (8)	0.0 (9)	0.2 (8)	0.2 (14)	0.0 (19)
214	201-300	1171	131.8 (3)	4.6 (2)	0.0 (2)	79.6 (5)	41.0 (8)	45.3 (8)	0.5 (4)	1.0 (6)	2.4 (6)	1.8 (6)	3.3 (6)	0.3 (6)	0.4 (5)	0.3 (15)	0.4 (14)
215	201-300	1270	13.2 (3)	7.8 (2)	13.1 (2)	1.5 (5)	1.1 (9)	2.7 (8)	3.1 (3)	0.5 (6)	2.8 (5)	0.3 (7)	0.2 (7)	0.2 (6)	0.6 (6)	0.1 (15)	0.4 (10)
228	201-300	1428	67.1 (3)	4.6 (2)	597.6 (2)	2399.7 (6)	53.8 (10)	133.7 (6)	127.5 (7)	0.0 (7)	24.3 (6)	9.5 (7)	8.1 (5)	2.9 (8)	2.3 (6)	1.0 (3)	1.0 (5)
203	301-400	480	5.3 (2)	2.2 (2)	7.9 (2)	2.4 (2)	4.4 (3)	4.7 (3)	6.7 (2)	0.7 (3)	0.4 (2)	0.1 (3)	0.0 (2)	0.8 (3)	0.0 (2)	0.0 (3)	0.0 (3)
208	301-400	448	71.1 (2)	1507.5 (2)	21.2 (2)	6.9 (2)	10.5 (3)	5.4 (2)	29.8 (3)	17.5 (3)	0.3 (2)	1.2 (2)	1.2 (2)	2.0 (2)	0.0 (2)	0.4 (3)	1.1 (3)
211	301-400	330	25.3 (2)	24.0 (2)	47.4 (2)	778.5 (2)	23.5 (2)	0.3 (2)	58.6 (2)	89.1 (3)	1.0 (2)	4.8 (2)	1.1 (2)	4.5 (2)	1.1 (2)	0.6 (5)	0.6 (6)
216	301-400	384	2564.8 (2)	368.0 (2)	1068.8 (2)	105.5 (2)	281.5 (2)	197.3 (3)	335.3 (2)	109.7 (2)	357.2 (2)	218.2 (2)	70.4 (2)	18.8 (2)	3.8 (2)	4.3 (3)	3.5 (3)
222	301-400	441	1965.9 (2)	483.2 (2)	616.7 (2)	1504.7 (2)	970.2 (3)	1413.8 (3)	452.7 (3)	223.5 (2)	63.7 (2)	78.4 (2)	1438.5 (2)	10.1 (2)	3.2 (2)	0.6 (3)	3.7 (3)
229	301-400	567	94.3 (2)	239.4 (2)	385.9 (2)	984.0 (2)	668.5 (4)	579.8 (4)	176.4 (3)	147.2 (3)	408.2 (3)	10.1 (3)	3.0 (3)	37.0 (3)	5.1 (2)	5.7 (3)	3.3 (3)
204	401-500	354	10.5 (2)	6.3 (2)	. NS	6.5 (2)	0.8 (3)	6.3 (3)	9.9 (2)	0.0 (2)	0.2 (2)	0.0 (2)	0.2 (2)	0.9 (2)	3.6 (2)	0.8 (3)	0.3 (3)
217	401-500	268	1049.1 (2)	235.6 (2)	579.9 (2)	92.0 (2)	284.0 (2)	302.9 (2)	NS	93.7 (2)	235.9 (2)	121.1 (2)	349.7 (2)	26.9 (2)	51.9 (2)	9.1 (3)	34.3 (3)
223	401-500	180	1572.3 (2)	308.7 (2)	716.9 (2)	565.6 (2)	427.6 (2)	332.4 (2)	342.7 (2)	382.1 (2)	653.9 (2)	95.3 (2)	489.1 (2)	41.6 (2)	13.5 (2)	11.9 (3)	10.8 (3)
227	401-500	686	963.0 (2)	157.0 (2)	158.4 (2)	11.1 (2)	119.0 (5)	86.8 (4)	72.6 (3)	57.6 (4)	205.7 (3)	40.1 (4)	6.6 (3)	7.2 (4)	135.0 (3)	10.2 (6)	11.6 (6)
235	401-500	420	5.1 (2)	24.2 (2)	26.5 (2)	5.4 (2)	9.0 (3)	17.1 (2)	49.5 (3)	7.3 (2)	2.3 (2)	10.7 (2)	19.5 (2)	1.6 (2)	56.9 (2)	7.0 (3)	2.3 (3)
212	501-750	664	3.0 (2)	6.5 (2)	0.9 (2)	2.9 (2)	4.5 (5)	4.1 (3)	11.3 (3)	3.0 (4)	3.8 (3)	1.0 (4)	0.0 (2)	0.4 (4)	1.4 (3)	7.2 (2)	2.2 (2)
218	501-750	420	691.8 (2)	NS	363.7 (2)	106.0 (2)	61.7 (2)	115.9 (2)	NS	52.3 (2)	45.4 (2)	221.1 (2)	232.3 (2)	69.2 (2)	33.2 (2)	4.9 (2)	61.8 (2)
224	501-750	270	853.6 (2)	476.5 (2)	339.3 (2)	234.0 (2)	106.4 (2)	119.2 (2)	141.3 (2)	26.4 (2)	157.4 (2)	144.3 (2)	317.8 (2)	13.2 (2)	7.8 (2)	12.5 (2)	15.1 (2)
230	501-750	237	1414.1 (2)	NS	193.3 (2)	88.5 (2)	144.7 (2)	78.4 (2)	80.2 (2)	77.7 (2)	336.5 (2)	156.3 (2)	42.6 (2)	83.8 (2)	172.3 (2)	37.8 (2)	25.2 (2)
219	751-1000	213	NS	NS	NS	9.1 (2)	NS	2.0 (2)	NS	0.0 (2)	15.3 (2)	0.4 (2)	1.6 (2)	0.0 (2)	3.6 (2)	0.0 (2)	0.7 (2)
231	751-1000	182	0.0 (2)	NS	2.3 (2)	NS	3.4 (2)	3.3 (2)	22.3 (2)	13.9 (2)	5.9 (2)	1.7 (2)	5.8 (2)	NS	0.0 (2)	0.7 (2)	2.7 (2)
236	751-1000	122	NS	NS	NS	4.9 (2)	3.5 (2)	3.2 (2)	5.3 (2)	13.7 (2)	5.4 (2)	2.6 (2)	0.0 (2)	NS	0.3 (2)	0.0 (2)	1.7 (2)
Stratified Analysis:		Upper	411.3	812.8	715.6	981.6	172.9	253.0	101.9	53.5	98.7	51.3	322.1	11.6	26.5	3.9	5.3
		Mean	299.0	133.3	179.4	368.3	97.2	127.5	71.9	31.1	62.2	27.0	73.2	7.9	13.9	2.9	4.6
		Lower	186.6	-546.3	-356.8	-245.0	21.6	2.1	41.9	8.7	25.6	2.7	-175.8	4.2	1.3	1.8	3.8
Total Survey Biomass ('000 tons)			**618.8**	**246.9**	**344.4**	**732.6**	**193.0**	**256.9**	**135.9**	**62.7**	**125.2**	**54.4**	**147.4**	**15.6**	**28.0**	**5.7**	**9.2**

2J Autumn 1978-1992

Table 5. Mean number (upper panel) and weight (kg, lower panel) per standard tow from Canadian AUTUMN surveys in Div. 2J. Number of successful sets in brackets, 'NS' = unsampled strata. Data from 1993-1994 are Campelen trawl equivalent units based on a comparative fishing trials with an Engel 145 otter trawl (see text). The data from 1995 onwards are empiracal Campelen data. A revision of the stratification scheme based on improved depth charts was also implemented in 1993.

Stratum	Depth range (m)	Area 1978-1992	Area 1993-Onwards	1993	1994	1995	1996	1997	1998	1999	2000
209	201-300	1608	680	0.0 (3)	0.0 (2)	4.5 (2)	4.3 (3)	14.3 (3)	4.4 (3)	1.7 (3)	3.3 (3)
210	201-300	774	1035	0.0 (4)	0.0 (6)	0.0 (3)	0.0 (4)	1.3 (4)	0.5 (4)	9.3 (4)	2.3 (4)
213	201-300	1725	1583	0.5 (6)	0.3 (3)	0.8 (6)	41.1 (6)	4.7 (6)	29.5 (6)	0.5 (6)	17.2 (6)
214	201-300	1171	1341	0.0 (5)	0.3 (6)	1.5 (4)	12.6 (5)	6.0 (5)	12.9 (5)	5.8 (5)	3.4 (5)
215	201-300	1270	1302	3.8 (5)	1.2 (5)	0.0 (2)	3.1 (5)	8.3 (5)	27.2 (5)	17.2 (5)	12.4 (5)
228	201-300	1428	2196	2.1 (9)	4.3 (3)	18.0 (7)	94.9 (8)	63.9 (8)	78.5 (8)	43.0 (8)	47.9 (8)
203	301-400	480	487	3.0 (2)	0.0 (2)	0.8 (2)	3.0 (2)	0.0 (2)	1.5 (2)	1.5 (2)	1.5 (2)
208	301-400	448	588	0.0 (2)	0.0 (3)	2.5 (2)	1.0 (2)	16.5 (2)	42.0 (2)	13.5 (2)	10.8 (2)
211	301-400	330	251	0.0 (2)	0.0 (3)	30.0 (2)	31.0 (2)	117.5 (2)	204.3 (2)	34.4 (2)	43.7 (2)
216	301-400	384	360	10.5 (2)	6.0 (2)	33.6 (2)	22.1 (2)	38.5 (2)	39.1 (2)	50.6 (2)	33.0 (2)
222	301-400	441	450	4.5 (2)	8.0 (3)	59.5 (2)	86.0 (2)	38.0 (2)	145.1 (2)	126.5 (2)	54.5 (2)
229	301-400	567	536	21.0 (2)	3.7 (3)	137.5 (2)	35.8 (2)	36.5 (2)	210.0 (2)	90.5 (2)	55.5 (2)
204	401-500	354	288	1.5 (2)	14.3 (3)	0.0 (2)	2.0 (2)	0.0 (2)	1.0 (2)	3.9 (2)	8.0 (2)
217	401-500	268	241	70.0 (2)	67.7 (3)	23.7 (2)	172.8 (2)	173.0 (2)	167.4 (2)	410.5 (2)	51.0 (2)
223	401-500	180	158	52.5 (2)	5.7 (3)	32.0 (2)	34.4 (2)	160.5 (2)	209.8 (2)	309.0 (2)	NS
227	401-500	686	598	26.7 (3)	8.4 (5)	21.5 (2)	17.8 (2)	69.0 (2)	157.5 (2)	45.5 (2)	184.0 (3)
235	401-500	420	414	9.0 (3)	26.3 (3)	12.5 (2)	35.1 (2)	35.5 (2)	17.5 (2)	20.3 (2)	39.1 (2)
240	401-500	.	133	NS	NS	136.3 (2)	290.5 (2)	772.0 (2)	287.5 (2)	1300.0 (2)	169.0 (2)
212	501-750	664	557	12.0 (2)	5.0 (3)	103.1 (2)	17.7 (2)	59.0 (2)	28.0 (2)	94.0 (2)	79.5 (2)
218	501-750	420	362	48.0 (2)	65.0 (2)	184.3 (3)	765.5 (2)	477.5 (2)	226.4 (3)	292.8 (2)	134.0 (2)
224	501-750	270	228	162.5 (2)	100.3 (3)	171.0 (3)	215.0 (2)	201.5 (2)	125.8 (2)	276.9 (2)	145.0 (2)
230	501-750	237	185	17.0 (2)	140.3 (3)	302.5 (2)	229.2 (2)	377.5 (2)	388.0 (2)	594.0 (2)	304.5 (2)
219	751-1000	213	283	17.0 (2)	0.5 (2)	32.5 (2)	0.5 (2)	1.5 (2)	4.0 (2)	8.0 (2)	4.1 (2)
231	751-1000	182	186	3.5 (2)	3.7 (3)	1.5 (2)	5.5 (2)	0.5 (2)	5.6 (2)	19.5 (2)	103.5 (2)
236	751-1000	122	193	8.0 (2)	1.0 (3)	153.5 (2)	0.0 (2)	1.5 (2)	8.0 (2)	0.0 (2)	15.5 (2)
	Stratified Analysis:		Upper	40.3	14.6	47.6	142.4	63.1	78.6	98.8	46.9
			Mean	10.0	9.3	32.1	53.2	50.8	59.3	61.1	38.1
			Lower	-20.2	3.9	16.5	-36.1	38.5	40.0	23.5	29.2
	Total Survey Abundance (millions)			**20.4**	**18.8**	**65.1**	**118.9**	**113.6**	**132.6**	**134.1**	**84.3**

Stratum	Depth range (m)	Area	Area	1993	1994	1995	1996	1997	1998	1999	2000
209	201-300	1608	680	0.0 (3)	0.0 (2)	0.0 (2)	0.1 (3)	0.5 (3)	0.0 (3)	0.0 (3)	0.0 (3)
210	201-300	774	1035	0.0 (4)	0.0 (6)	0.0 (3)	0.0 (4)	0.1 (4)	0.0 (4)	0.2 (4)	0.6 (4)
213	201-300	1725	1583	0.3 (6)	0.4 (3)	0.0 (6)	1.3 (6)	0.3 (6)	0.4 (6)	0.0 (6)	0.7 (6)
214	201-300	1171	1341	0.0 (5)	0.1 (6)	0.2 (4)	0.6 (5)	0.2 (5)	0.2 (5)	0.3 (5)	0.2 (5)
215	201-300	1270	1302	0.3 (5)	0.1 (5)	0.0 (2)	0.2 (5)	0.8 (5)	0.8 (5)	1.0 (5)	0.5 (5)
228	201-300	1428	2196	0.1 (9)	0.3 (3)	0.8 (7)	2.9 (8)	2.0 (8)	2.4 (8)	1.1 (8)	0.9 (8)
203	301-400	480	487	0.4 (2)	0.0 (2)	0.1 (2)	0.2 (2)	0.0 (2)	0.1 (2)	0.3 (2)	0.1 (2)
208	301-400	448	588	0.0 (2)	0.0 (3)	0.1 (2)	0.2 (2)	0.3 (2)	1.2 (2)	0.5 (2)	0.4 (2)
211	301-400	330	251	0.0 (2)	0.0 (3)	1.3 (2)	2.5 (2)	8.8 (2)	13.2 (2)	2.1 (2)	3.2 (2)
216	301-400	384	360	1.7 (2)	0.4 (2)	4.1 (2)	2.6 (2)	4.9 (2)	4.7 (2)	2.9 (2)	2.8 (2)
222	301-400	441	450	0.9 (2)	1.6 (3)	2.1 (2)	12.4 (2)	3.1 (2)	7.3 (2)	10.5 (2)	3.7 (2)
229	301-400	567	536	2.5 (2)	0.1 (3)	9.0 (2)	3.3 (2)	5.2 (2)	9.4 (2)	5.6 (2)	4.6 (2)
204	401-500	354	288	0.2 (2)	1.5 (3)	0.0 (2)	0.2 (2)	0.0 (2)	0.1 (2)	0.2 (2)	0.9 (2)
217	401-500	268	241	12.3 (2)	13.3 (3)	2.2 (2)	26.9 (2)	26.8 (2)	27.0 (2)	60.8 (2)	6.3 (2)
223	401-500	180	158	10.5 (2)	1.7 (3)	3.9 (2)	5.4 (2)	31.0 (2)	38.0 (2)	47.5 (2)	NS
227	401-500	686	598	6.1 (3)	1.9 (5)	2.0 (2)	1.6 (2)	9.7 (2)	15.8 (2)	6.8 (2)	18.7 (3)
235	401-500	420	414	1.9 (3)	4.7 (3)	1.0 (2)	5.2 (2)	5.0 (2)	1.7 (2)	1.5 (2)	5.3 (2)
240	401-500	.	133	NS	NS	14.4 (2)	50.6 (2)	185.6 (2)	47.1 (2)	306.4 (2)	18.6 (2)
212	501-750	664	557	2.0 (2)	0.9 (3)	12.4 (2)	2.7 (2)	9.1 (2)	3.6 (2)	16.0 (2)	11.4 (2)
218	501-750	420	362	13.2 (2)	16.7 (2)	20.9 (3)	156.4 (2)	101.6 (2)	53.1 (3)	67.7 (2)	32.0 (2)
224	501-750	270	228	36.3 (2)	23.2 (3)	20.2 (3)	43.2 (2)	57.5 (2)	32.3 (2)	74.5 (2)	34.6 (2)
230	501-750	237	185	4.5 (2)	37.1 (3)	45.7 (2)	76.8 (2)	134.5 (2)	88.5 (2)	228.8 (2)	70.4 (2)
219	751-1000	213	283	6.1 (2)	0.2 (2)	6.6 (2)	0.2 (2)	0.1 (2)	1.1 (2)	1.0 (2)	1.5 (2)
231	751-1000	182	186	1.5 (2)	1.7 (3)	0.1 (2)	1.2 (2)	0.2 (2)	2.1 (2)	4.9 (2)	43.9 (2)
236	751-1000	122	193	2.7 (2)	0.4 (3)	22.3 (2)	0.0 (2)	0.4 (2)	2.8 (2)	0.0 (2)	5.9 (2)
	Stratified Analysis:		Upper	8.9	5.8	5.5	46.9	13.9	9.5	19.8	7.5
			Mean	2.1	2.0	3.3	7.3	8.7	6.0	11.1	4.8
			Lower	-4.7	-1.9	1.0	-32.4	3.5	2.5	2.4	2.2
	Total Survey Biomass ('000 tons)			**4.2**	**4.0**	**6.6**	**16.3**	**19.4**	**13.4**	**24.3**	**10.7**

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Table 6. Mean number (upper panel) and weight (kg, lower panel) per standard tow from Canadian AUTUMN surveys in Div. 3K. Number of successful sets in brackets, NS' = unsampled strata. The data are Campelen trawl equivalent units based on a comparative fishing experiment with an Engel 145 otter trawl (see text).

Stratum	Depth range (m)	Area (sq.n.mi.)	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
620	201-300	2709	184.0 (5)	91.0 (3)	54.0 (3)	20.4 (10)	1.4 (9)	10.4 (10)	0.4 (13)	4.7 (14)	0.0 (9)	1.4 (14)	3.2 (12)	4.5 (15)	0.0 (8)	1.4 (14)	0.0 (3)
621	201-300	2859	36.4 (5)	12.7 (3)	30.3 (3)	3.6 (11)	6.6 (14)	2.1 (12)	2.1 (14)	7.9 (15)	3.9 (14)	1.3 (12)	0.5 (10)	0.4 (17)	1.3 NS	2.8 (5)	0.0 (3)
624	201-300	668	5998.5 (4)	825.0 (2)	28.0 (2)	66.0 (2)	14.3 (4)	25.5 (4)	47.5 (4)	15.0 (4)	27.0 (2)	15.3 (3)	14.0 (3)	11.3 (3)	21.0 (4)	0.0 (2)	2.7 (3)
634	201-300	1618	1218.3 (4)	81.0 (2)	404.0 (2)	80.4 (7)	206.4 (11)	17406.0 (5)	108.3 (7)	59.6 (9)	88.0 (5)	27.5 (11)	22.0 (6)	37.1 (7)	6.9 (2)	9.4 (25)	1.9 (25)
635	201-300	1274	3467.8 (4)	647.7 (3)	220.0 (2)	4977.0 (5)	17.0 (5)	19.2 (6)	100.3 (8)	34.1 (7)	30.5 (6)	16.5 (6)	17.2 (5)	45.1 (7)	2.7 NS	5.5 (4)	8.3 (3)
636	201-300	1455	3511.0 (4)	381.0 (2)	4239.5 (2)	122.8 (6)	66.2 (10)	164.8 (6)	54.8 (8)	20.8 (8)	43.0 (4)	16.9 (7)	24.8 (6)	18.2 (5)	2.0 NS	0.3 (3)	6.7 (3)
637	201-300	1132	1896.6 (5)	1805.0 (3)	604.0 (2)	1034.2 (6)	80.0 (7)	472.2 (5)	42.5 (6)	114.4 (7)	41.8 (4)	18.5 (6)	37.5 (8)	12.0 (5)	2.2 (2)	6.8 (6)	0.0 (3)
623	301-400	1027	188.0 (3)	NS	198.5 (2)	17.8 (4)	11.2 (5)	137.2 (6)	29.8 (5)	12.3 (6)	11.8 (4)	3.2 (5)	46.8 (5)	21.3 (6)	1.2 (5)	6.5 (6)	19.7 (3)
625	301-400	850	370.0 (3)	164.5 (2)	137.0 (2)	484.3 (4)	35.5 (2)	436.3 (3)	40.4 (5)	135.6 (5)	1.3 (3)	48.0 (4)	12.8 (4)	46.3 (4)	2.0 (4)	4.0 (3)	0.0 (3)
626	301-400	919	269.0 (3)	68.5 (2)	70.0 (2)	239.6 (5)	236.0 (5)	21.8 (4)	22.5 (6)	58.8 (5)	18.5 (4)	36.6 (5)	1.0 (5)	498.6 (5)	0.0 NS	9.7 (3)	1.0 (3)
628	301-400	1085	107.5 (2)	57.3 (3)	9.5 (2)	59.8 (6)	11.3 (6)	21.0 (6)	12.1 (7)	4.2 (6)	0.0 (3)	6.4 (5)	6.8 (5)	1.8 (4)	0.0 NS	4.3 (3)	0.0 (3)
629	301-400	499	600.3 (3)	NS	151.5 (2)	94.7 (3)	61.5 (2)	3306.0 (3)	61.0 (4)	45.3 (4)	45.7 (3)	28.7 (3)	27.5 (2)	7.3 (3)	3132.5 NS	9.5 (4)	5.0 (3)
630	301-400	544	431.5 (2)	182.0 (2)	81.0 (2)	46.5 (2)	NS	236.0 (2)	320.0 (3)	33.8 (4)	67.0 (2)	2.7 (3)	2.0 (3)	6.7 (3)	11.0 NS	2.3 (3)	18.3 (3)
633	301-400	2179	11091.0 (4)	170.3 (4)	662.0 (3)	468.3 (8)	2511.3 (7)	1399.8 (12)	271.7 (10)	1529.9 (12)	84.1 (8)	53.1 (11)	98.1 (8)	39.3 (10)	98.6 (11)	217.0 (25)	12.3 (25)
638	301-400	2059	804.7 (3)	340.0 (2)	1516.3 (3)	247.8 (8)	158.1 (15)	279.1 (11)	288.8 (10)	177.7 (11)	64.8 (4)	139.3 (10)	1106.1 (8)	57.7 (11)	296.4 (2)	17.4 (25)	3.1 (25)
639	301-400	1463	1336.3 (4)	3501.5 (2)	555.5 (2)	228.5 (6)	1087.5 (10)	12649.0 (7)	1200.6 (8)	1331.4 (8)	2096.2 (6)	311.3 (7)	447.0 (6)	36.9 (8)	647.9 (3)	69.7 (3)	5.5 (25)
622	401-500	632	402.0 (2)	26.7 (3)	40.5 (2)	44.5 (2)	27.7 (3)	33.0 (2)	13.0 (4)	9.0 (4)	13.0 (2)	2.0 (3)	3.7 (3)	33.3 (3)	3.5 (2)	13.3 (3)	11.7 (3)
627	401-500	1184	9.5 (2)	59.3 (3)	89.5 (2)	14.0 (6)	35.0 (7)	38.0 (6)	26.4 (8)	8.6 (7)	6.8 (5)	4.5 (6)	2.0 (5)	53.7 (6)	31.8 NS	1.0 (3)	3.0 (3)
631	401-500	1202	19.5 (2)	57.0 (3)	96.3 (3)	38.2 (5)	17.5 (2)	81.0 (5)	781.0 (5)	270.7 (7)	26.5 (4)	17.0 (6)	37.7 (6)	45.0 (7)	13.3 (2)	24.8 (6)	63.0 (3)
640	401-500	198	2499.5 (2)	NS	1908.0 (2)	613.0 (2)	782.0 (2)	NS	475.0 (2)	817.0 (3)	457.5 (2)	491.0 (2)	804.0 (2)	112.5 (2)	229.5 NS	109.0 (3)	21.3 (3)
645	401-500	204	2622.5 (2)	NS	2019.0 (2)	848.5 (2)	1184.7 (3)	2620.5 (2)	239.0 (2)	2159.7 (3)	NS	625.5 (2)	1031.0 (2)	3771.0 (2)	413.0 (2)	142.0 (3)	40.7 (3)
641	501-750	584	918.0 (2)	220.0 (2)	512.5 (2)	287.0 (2)	266.8 (4)	71.7 (3)	129.7 (3)	168.8 (4)	NS	70.0 (3)	NS	NS	39.5 NS	62.5 (2)	12.0 (2)
646	501-750	333	3017.0 (2)	27.0 (2)	139.0 (2)	180.0 (2)	1510.5 (2)	1265.0 (2)	572.0 (2)	353.7 (3)	NS	390.5 (2)	NS	NS	23.0 (2)	345.0 (3)	116.3 (3)
642	751-1000	931	1.5 (2)	NS	5.0 (2)	2.0 (3)	6.5 (6)	NS	7.7 (6)	19.0 (5)	NS	2.2 (5)	NS	NS	4.3 NS	0.0 (2)	2.5 (2)
647	751-1000	409	26.0 (2)	0.5 (2)	57.0 (2)	11.0 (2)	0.5 (2)	NS	NS	234.7 (3)	NS	NS	NS	NS	13.5 (2)	37.0 (3)	1.7 (3)
Stratified Analysis:		Upper	3765.5	2552.2	3560.2	1037.2	715.7	4898.1	292.3	433.4	439.0	85.2	344.1	459.7	969.4	58.0	18.5
		Mean	1637.1	410.6	547.5	399.8	342.4	2063.4	185.1	267.5	153.9	54.8	147.6	73.6	128.8	33.5	8.8
		Lower	-491.3	-1731.1	-2465.1	-237.5	-30.9	-771.3	77.9	101.5	-131.3	24.3	-48.9	-312.5	-711.8	9.1	-0.8
Total Survey Abundance (millions)			**6920.9**	**1546.2**	**2110.2**	**1540.8**	**1293.9**	**7515.9**	**703.0**	**1030.8**	**540.9**	**208.0**	**523.0**	**260.8**	**496.4**	**129.2**	**34.1**

Stratum	Depth range (m)	Area (sq.n.mi.)	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
620	201-300	2709	19.6 (5)	5.8 (3)	4.1 (3)	3.1 (10)	0.1 (9)	2.7 (10)	0.1 (13)	0.2 (14)	0.0 (9)	0.2 (14)	0.1 (12)	0.3 (15)	0.0 (8)	0.1 (14)	0.0 (3)
621	201-300	2859	2.9 (5)	1.3 (3)	3.9 (3)	0.7 (11)	0.5 (14)	0.1 (12)	0.2 (14)	0.3 (15)	0.1 (14)	0.1 (12)	0.0 (10)	0.0 (17)	0.1 NS	0.1 (5)	0.0 (3)
624	201-300	668	324.6 (4)	49.0 (2)	6.5 (2)	6.1 (2)	2.4 (4)	1.1 (4)	7.5 (4)	1.0 (4)	1.5 (2)	0.7 (3)	0.9 (3)	0.3 (3)	0.6 (4)	0.0 (2)	0.1 (3)
634	201-300	1618	153.8 (4)	11.5 (2)	59.7 (2)	14.8 (7)	60.0 (11)	4322.4 (5)	25.7 (7)	14.5 (9)	23.5 (5)	6.5 (11)	5.3 (6)	6.3 (7)	1.3 (2)	1.2 (25)	0.1 (25)
635	201-300	1274	244.6 (4)	165.7 (3)	24.2 (2)	1592.4 (5)	2.9 (5)	2.6 (6)	23.7 (8)	6.7 (7)	1.9 (6)	2.0 (6)	1.0 (5)	20.0 (7)	1.2 NS	0.1 (4)	0.3 (3)
636	201-300	1455	394.0 (4)	46.2 (2)	2327.3 (2)	18.3 (6)	20.1 (10)	77.2 (6)	7.2 (8)	4.9 (8)	6.1 (4)	2.4 (7)	3.0 (6)	1.2 (5)	0.3 NS	0.3 (3)	0.1 (3)
637	201-300	1132	219.3 (5)	360.7 (3)	67.3 (2)	399.4 (6)	23.5 (7)	174.4 (5)	6.1 (6)	35.2 (7)	4.8 (4)	1.7 (6)	3.6 (8)	1.6 (5)	0.4 (2)	0.5 (6)	0.0 (3)
623	301-400	1027	19.3 (3)	NS	42.3 (2)	3.7 (4)	3.5 (5)	74.6 (6)	7.4 (5)	3.2 (6)	1.2 (4)	0.6 (5)	2.0 (5)	1.1 (6)	0.3 (5)	0.9 (6)	1.6 (3)
625	301-400	850	57.0 (3)	23.5 (2)	54.7 (2)	283.3 (4)	6.1 (2)	227.7 (3)	11.6 (5)	36.3 (5)	0.4 (3)	15.5 (4)	0.8 (4)	3.0 (4)	0.3 (4)	0.5 (3)	0.0 (3)
626	301-400	919	67.7 (3)	17.2 (2)	26.7 (2)	86.1 (5)	41.8 (5)	3.9 (4)	3.5 (6)	18.0 (5)	1.0 (4)	5.0 (5)	0.2 (5)	224.7 (5)	0.0 NS	1.0 (3)	0.1 (3)
628	301-400	1085	49.2 (2)	46.6 (3)	7.9 (2)	18.6 (6)	3.7 (6)	11.0 (6)	6.8 (7)	1.6 (6)	0.0 (3)	0.9 (5)	0.7 (5)	0.4 (4)	0.0 NS	0.2 (3)	0.0 (3)
629	301-400	499	402.0 (3)	NS	59.8 (2)	29.2 (3)	16.4 (2)	1223.5 (3)	13.0 (4)	10.4 (4)	6.8 (3)	11.2 (3)	5.7 (2)	2.1 (3)	1518.5 NS	1.4 (4)	0.6 (3)
630	301-400	544	213.1 (2)	62.6 (2)	27.7 (2)	9.8 (2)	NS	60.2 (2)	131.7 (3)	15.9 (4)	21.8 (2)	1.4 (3)	0.2 (3)	0.8 (3)	0.7 NS	0.4 (3)	1.3 (3)
633	301-400	2179	3271.3 (4)	45.2 (4)	241.2 (3)	102.4 (8)	740.3 (7)	447.7 (12)	87.3 (10)	516.2 (12)	21.1 (8)	12.3 (11)	14.0 (8)	7.3 (10)	22.0 (11)	72.9 (25)	1.5 (25)
638	301-400	2059	271.7 (3)	112.1 (2)	447.4 (3)	62.9 (8)	44.7 (15)	83.4 (11)	94.0 (10)	61.7 (11)	9.6 (4)	62.4 (10)	568.2 (8)	19.1 (11)	133.5 (2)	3.4 (25)	0.4 (25)
639	301-400	1463	472.5 (4)	1170.5 (2)	267.3 (2)	44.0 (6)	283.9 (10)	3244.2 (7)	439.5 (8)	381.5 (8)	885.2 (6)	98.2 (7)	97.3 (6)	13.8 (8)	196.2 (3)	9.2 (3)	0.6 (25)
622	401-500	632	29.9 (2)	5.4 (3)	9.5 (2)	17.6 (2)	14.0 (3)	14.1 (2)	5.4 (4)	2.0 (4)	3.4 (2)	0.6 (3)	0.2 (3)	2.8 (3)	1.1 (2)	0.9 (3)	1.3 (3)
627	401-500	1184	2.9 (2)	12.7 (3)	21.7 (2)	4.0 (6)	7.9 (7)	13.5 (6)	6.6 (8)	1.9 (7)	1.1 (5)	1.0 (6)	0.5 (5)	17.5 (6)	5.6 NS	0.1 (3)	0.7 (3)
631	401-500	1202	6.8 (2)	15.0 (3)	26.4 (3)	9.4 (5)	4.7 (2)	29.2 (5)	223.8 (5)	98.0 (7)	7.1 (4)	4.4 (6)	6.3 (6)	9.0 (7)	1.3 (2)	4.2 (6)	9.1 (3)
640	401-500	198	843.4 (2)	NS	678.8 (2)	247.6 (2)	271.8 (2)	NS	151.7 (2)	334.8 (3)	94.1 (2)	141.1 (2)	196.1 (2)	24.1 (2)	49.0 NS	17.9 (3)	3.2 (3)
645	401-500	204	1075.3 (2)	NS	739.6 (2)	307.3 (2)	389.4 (3)	942.3 (2)	77.9 (2)	741.3 (3)	NS	258.4 (2)	319.6 (2)	985.4 (2)	101.3 (2)	28.4 (3)	6.8 (3)
641	501-750	584	463.6 (2)	95.3 (2)	273.0 (2)	124.7 (2)	115.2 (4)	37.9 (3)	65.9 (3)	67.1 (4)	NS	33.8 (3)	NS	NS	14.3 NS	18.2 (2)	2.9 (2)
646	501-750	333	1675.9 (2)	14.7 (2)	82.5 (2)	106.8 (2)	810.8 (2)	632.2 (2)	332.7 (2)	183.0 (3)	NS	248.2 (2)	NS	NS	8.0 (2)	78.8 (3)	24.9 (3)
642	751-1000	931	0.9 (2)	NS	3.2 (2)	0.8 (3)	2.3 (6)	NS	3.2 (6)	6.5 (5)	NS	1.1 (5)	NS	NS	1.5 NS	0.0 (2)	0.9 (2)
647	751-1000	409	18.0 (2)	0.3 (2)	18.8 (2)	3.8 (2)	0.2 (2)	NS	NS	150.0 (3)	NS	NS	NS	NS	7.1 (2)	15.1 (3)	0.5 (3)
Stratified Analysis:		Upper	978.2	833.2	1805.1	333.7	216.2	1261.1	100.1	142.9	180.8	31.9	161.5	61.7	426.6	17.3	2.6
		Mean	383.8	110.2	220.2	127.6	103.2	552.2	61.8	87.9	57.3	19.4	57.5	22.0	51.0	8.7	1.2
		Lower	-210.6	-612.7	-1364.8	-78.4	-9.8	-156.7	23.5	33.0	-66.1	6.9	-46.6	-17.7	-324.7	0.1	-0.1
Total Survey Biomass ('000 tons)			**1622.4**	**415.2**	**848.6**	**491.9**	**390.2**	**2011.4**	**234.7**	**338.9**	**201.6**	**73.6**	**203.7**	**78.0**	**196.5**	**33.6**	**4.7**

3K Autumn 1978-1992

Table 7. Mean number (upper panel) and weight (kg, lower panel) per standard tow from Canadian AUTUMN surveys in Div. 3K. Number of successful sets in brackets, 'NS' = unsampled strata. Data from 1993-1994 are Campelen trawl equivalent units based on a comparative fishing trials with an Engel 145 otter trawl (see text). The data from 1995 onwards are empiracal Campelen data. A revision of the stratification scheme based on improved depth charts was also implemented in 1993.

Stratum	Depth range (m)	Area 1978-1992	Area 1993-Onwards	1993	1994	1995	1996	1997	1998	1999	2000
620	201 - 300	2709	2545	0.0 (3)	0.0 (5)	6.2 (3)	0.5 (11)	0.1 (11)	0.5 (11)	0.7 (11)	0.6 (11)
621	201 - 300	2859	2537	0.0 (3)	0.0 (3)	0.3 (6)	0.0 (11)	1.7 (11)	0.0 (11)	0.4 (11)	0.2 (11)
624	201 - 300	668	1105	9.9 (7)	0.0 (3)	21.8 (4)	34.4 (5)	48.2 (5)	53.8 (5)	50.0 (5)	59.8 (5)
634	201 - 300	1618	1555	3.1 (16)	1.5 (4)	5.7 (7)	32.9 (7)	3.4 (7)	35.7 (7)	28.0 (7)	92.1 (7)
635	201 - 300	1274	1274	1.3 (3)	0.0 (4)	3.8 (6)	1.0 (5)	1.6 (5)	5.2 (5)	4.8 (5)	7.7 (5)
636	201 - 300	1455	1455	2.7 (3)	0.0 (3)	12.9 (7)	17.1 (6)	28.8 (6)	28.5 (6)	47.8 (6)	36.7 (6)
637	201 - 300	1132	1132	0.0 (3)	1.4 (14)	4.4 (5)	2.0 (5)	4.4 (5)	12.8 (5)	12.0 (5)	NS
617	201 - 300	.	593	NS	NS	8.5 (2)	17.0 (3)	5.7 (3)	23.6 (3)	9.7 (3)	12.3 (3)
623	301 - 400	1027	494	1.3 (4)	0.0 (3)	21.5 (2)	11.4 (2)	6.5 (2)	0.0 (2)	0.0 (2)	0.5 (2)
625	301 - 400	850	888	6.7 (3)	8.7 (3)	50.5 (3)	7.3 (4)	69.3 (4)	25.3 (4)	37.3 (4)	26.8 (4)
626	301 - 400	919	1113	0.0 (3)	0.0 (3)	2.3 (4)	0.7 (5)	8.4 (5)	119.6 (5)	0.8 (5)	1.9 (5)
628	301 - 400	1085	1085	2.0 (3)	0.0 (6)	0.8 (5)	1.0 (5)	0.4 (5)	0.4 (5)	0.8 (5)	1.4 (5)
629	301 - 400	499	495	4.0 (3)	2.5 (4)	0.9 (2)	2.0 (2)	5.0 (2)	0.5 (2)	5.5 (2)	5.8 (2)
630	301 - 400	544	332	0.0 (3)	0.7 (3)	0.5 (2)	6.0 (2)	7.0 (2)	33.5 (2)	0.0 (2)	6.6 (2)
633	301 - 400	2179	2067	14.8 (18)	3.4 (5)	41.4 -8	122.0 (9)	32.4 (9)	114.0 (9)	48.4 (9)	108.0 (9)
638	301 - 400	2059	2059	2.5 (20)	4.2 (21)	21.0 (9)	36.4 (9)	42.4 (9)	21.3 (9)	66.0 -8	36.8 (5)
639	301 - 400	1463	1463	8.0 (15)	12.6 (8)	24.2 (7)	53.1 (6)	58.7 (6)	60.8 (6)	75.5 (7)	78.1 (3)
622	401 - 500	632	691	4.3 (4)	4.4 (5)	16.6 (3)	4.4 (3)	3.3 (3)	6.0 (3)	12.8 (3)	10.3 (3)
627	401 - 500	1184	1255	5.3 (3)	2.8 (8)	7.2 (5)	1.1 (5)	7.8 (5)	3.8 (5)	16.1 (5)	15.0 (5)
631	401 - 500	1202	1321	5.7 (3)	9.8 (4)	27.5 (5)	11.8 (6)	17.5 (6)	20.0 (6)	11.2 (6)	5.6 (6)
640	401 - 500	198	69	74.0 (3)	100.3 (3)	61.5 (2)	961.8 (2)	267.0 (2)	737.5 (2)	472.5 (2)	395.0 (2)
645	401 - 500	204	216	48.3 (3)	47.0 (3)	167.0 (2)	445.5 (2)	325.2 (2)	296.2 (2)	529.0 (2)	437.0 (2)
650	401 - 500	.	134	NS	NS	22.0 (2)	80.5 (2)	138.0 (2)	269.0 (2)	153.5 (2)	NS
641	501 - 750	584	230	63.7 (3)	31.3 (3)	273.5 (2)	206.5 (2)	218.0 (2)	234.5 (2)	38.7 (2)	NS
646	501 - 750	333	325	46.0 (3)	89.0 (3)	196.5 (2)	222.0 (2)	525.5 (2)	360.5 (2)	620.0 (2)	431.7
651	501 - 750	.	359	NS	NS	105.5 (2)	45.5 (2)	61.0 (2)	592.5 (2)	176.0 (2)	NS
642	751 -1000	931	418	3.3 (3)	2.0 (3)	1.0 (2)	3.0 (2)	0.0 (2)	0.5 (2)	0.0 (2)	0.5 (2)
647	751 -1000	409	360	3.0 (3)	17.7 (3)	72.5 (2)	1.5 (2)	1.5 (2)	15.5 (2)	1.0 (2)	0.0 (2)
652	751 -1000	.	516	NS	NS	8.0 (2)	2.5 (2)	0.5 (2)	12.0 (2)	6.0 (2)	5.0 (2)
	Stratified Analysis:		Upper	6.8	6.6	24.2	39.4	100.4	56.7	45.2	44.0
			Mean	5.5	5.0	19.7	28.8	26.7	42.6	34.8	35.6
			Lower	4.2	3.5	15.3	18.2	-47.0	28.5	24.4	27.2
	Total Survey Abundance (millions)			**21.8**	**19.6**	**82.9**	**121.8**	**113.0**	**180.3**	**147.3**	**141.4**

Stratum	Depth range (m)	Area (sq.n.mi.)	Area (sq.n.mi.)	1993	1994	1995	1996	1997	1998	1999	2000
620	201 - 300	2709	2545	0.0 (3)	0.0 (5)	0.5 (3)	0.0 (11)	0.0 (11)	0.0 (11)	0.0 (11)	0.0 (11)
621	201 - 300	2859	2537	0.0 (3)	0.0 (3)	0.1 (6)	0.0 (11)	0.0 (11)	0.0 (11)	0.0 (11)	0.0 (11)
624	201 - 300	668	1105	0.3 (7)	0.0 (3)	1.3 (4)	1.2 (5)	1.1 (5)	2.1 (5)	2.4 (5)	0.8 (5)
634	201 - 300	1618	1555	0.5 (16)	0.3 (4)	0.2 (7)	0.8 (7)	0.1 (7)	1.4 (7)	1.1 (7)	1.4 (7)
635	201 - 300	1274	1274	0.3 (3)	0.0 (4)	0.1 (6)	0.0 (5)	0.1 (5)	0.1 (5)	0.3 (5)	0.3 (5)
636	201 - 300	1455	1455	0.2 (3)	0.0 (3)	0.3 (7)	0.8 (6)	0.4 (6)	0.5 (6)	1.6 (6)	0.9 (6)
637	201 - 300	1132	1132	0.0 (3)	0.0 (14)	0.0 (5)	0.1 (5)	0.1 (5)	0.4 (5)	0.4 (5)	NS
617	201 - 300	.	593	NS	NS	0.5 (2)	1.4 (3)	0.3 (3)	2.3 (3)	0.4 (3)	1.3 (3)
623	301 - 400	1027	494	0.3 (4)	0.0 (3)	1.8 (2)	0.1 (2)	0.2 (2)	0.0 (2)	0.0 (2)	0.2 (2)
625	301 - 400	850	888	1.0 (3)	0.6 (3)	2.4 (3)	0.4 (4)	1.4 (4)	1.2 (4)	2.3 (4)	1.4 (4)
626	301 - 400	919	1113	0.0 (3)	0.0 (3)	0.1 (4)	0.0 (5)	0.3 (5)	59.5 (5)	0.1 (5)	0.1 (5)
628	301 - 400	1085	1085	0.2 (3)	0.0 (6)	0.1 (5)	0.1 (5)	0.1 (5)	0.1 (5)	0.1 (5)	0.1 (5)
629	301 - 400	499	495	0.2 (3)	0.6 (4)	0.0 (2)	0.3 (2)	0.6 (2)	0.0 (2)	0.5 (2)	0.6 (2)
630	301 - 400	544	332	0.0 (3)	0.1 (3)	0.0 (2)	0.6 (2)	0.6 (2)	2.2 (2)	0.0 (2)	0.8 (2)
633	301 - 400	2179	2067	1.4 (18)	0.8 (5)	2.7 -8	10.9 (9)	2.6 (9)	8.8 (9)	4.2 (9)	9.9 (9)
638	301 - 400	2059	2059	0.4 (20)	0.2 (21)	1.0 (9)	1.4 (9)	1.0 (9)	1.2 (9)	6.5 -8	1.9 (5)
639	301 - 400	1463	1463	0.9 (15)	1.3 (8)	0.6 (7)	2.4 (6)	3.5 (6)	4.1 (6)	7.6 (7)	5.4 (3)
622	401 - 500	632	691	0.7 (4)	0.5 (5)	1.2 (3)	0.6 (3)	0.2 (3)	0.4 (3)	0.9 (3)	0.9 (3)
627	401 - 500	1184	1255	0.4 (3)	0.4 (8)	1.0 (5)	0.1 (5)	0.9 (5)	0.3 (5)	2.4 (5)	1.4 (5)
631	401 - 500	1202	1321	0.5 (3)	0.9 (4)	2.0 (5)	1.5 (6)	1.9 (6)	3.2 (6)	1.1 (6)	0.6 (6)
640	401 - 500	198	69	8.7 (3)	10.1 (3)	4.7 (2)	134.6 (2)	41.1 (2)	107.3 (2)	57.3 (2)	43.6 (2)
645	401 - 500	204	216	8.2 (3)	7.0 (3)	15.1 (2)	70.9 (2)	63.3 (2)	46.8 (2)	70.1 (2)	44.5 (2)
650	401 - 500	.	134	NS	NS	2.2 (2)	9.9 (2)	20.1 (2)	48.2 (2)	22.5 (2)	NS
641	501 - 750	584	230	12.6 (3)	7.9 (3)	36.9 (2)	45.0 (2)	55.5 (2)	63.7 (2)	12.3 (2)	NS
646	501 - 750	333	325	11.2 (3)	20.1 (3)	28.2 (2)	66.7 (2)	138.5 (2)	107.0 (2)	149.1 (2)	90.8 (2)
651	501 - 750	.	359	NS	NS	13.4 (2)	14.6 (2)	18.4 (2)	128.3 (2)	58.0 (2)	NS
642	751 -1000	931	418	1.3 (3)	0.3 (3)	0.6 (2)	0.4 (2)	0.0 (2)	0.1 (2)	0.0 (2)	0.2 (2)
647	751 -1000	409	360	NS	NS	18.1 (2)	0.3 (2)	0.5 (2)	4.6 (2)	0.6 (2)	0.0 (2)
652	751 -1000	.	516	1.0 (3)	6.7 (3)	1.8 (2)	0.6 (2)	0.1 (2)	4.3 (2)	1.3 (2)	0.9 (2)
	Stratified Analysis:		Upper	1.0	1.2	2.1	5.0	20.5	13.7	6.5	4.6
			Mean	0.8	0.8	1.8	3.3	3.4	7.5	4.7	3.0
			Lower	0.6	0.4	1.5	1.6	-13.7	1.2	2.9	1.4
	Total Survey Biomass ('000 tons)			**3.2**	**3.2**	**7.5**	**14.0**	**14.5**	**31.6**	**19.8**	**11.9**

3K Autumn 1993-2000

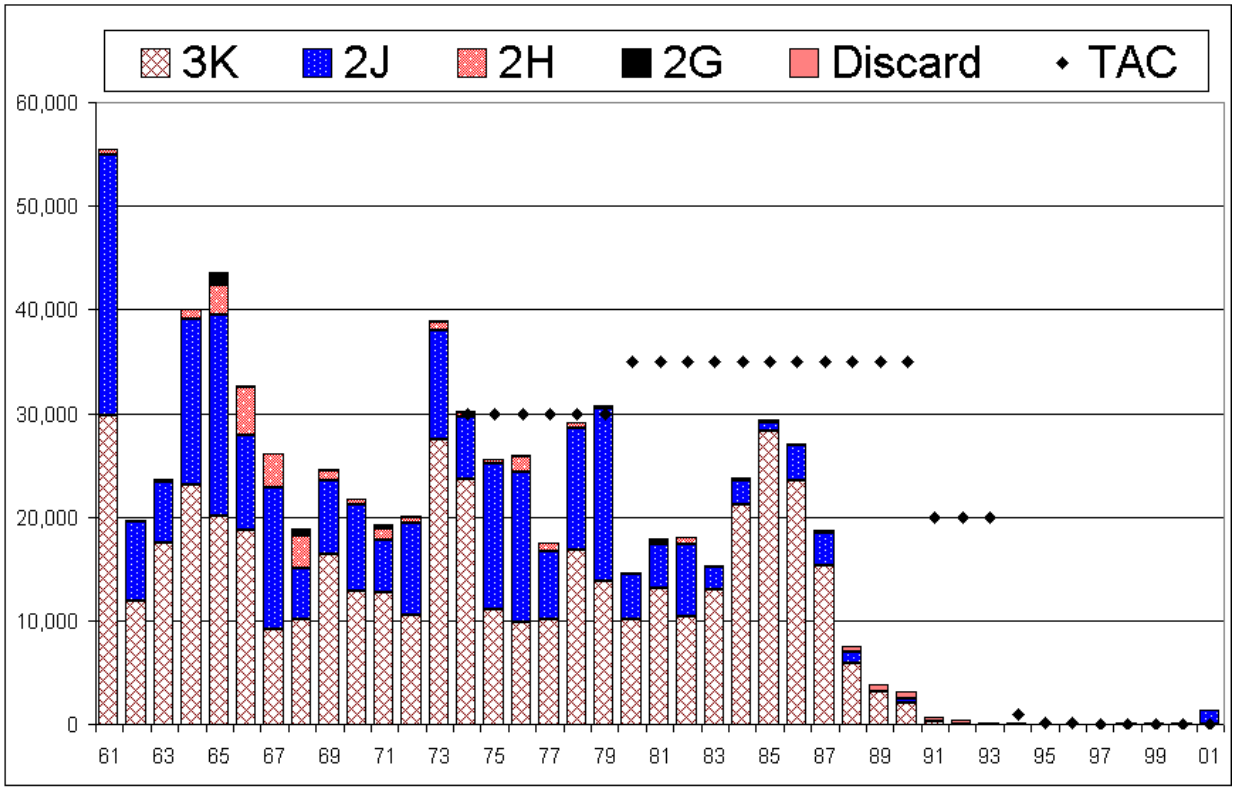

Fig. 1. Nominal catch of redfish in SA 2+3K from 1961-2001 (provisional to Oct. 7). For 1980 onwards estimates of discards in shrimp fisheries occurring within SA2+ Div. 3K are included where available.

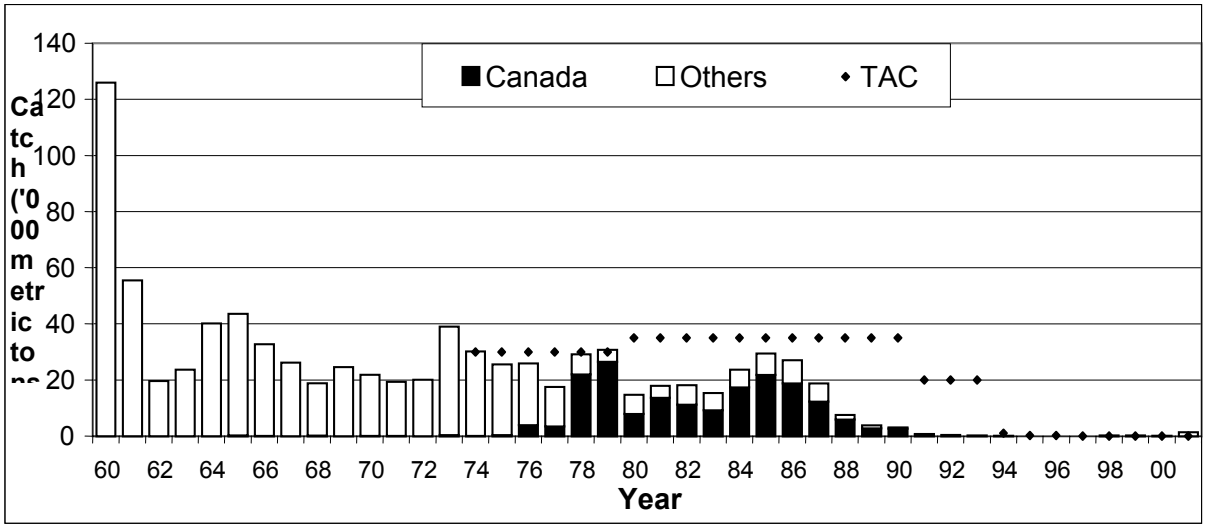

Fig. 2. Nominal catch of redfish in SA 2+3K by country from 1961-2001 (provisional to Oct. 7)
Country from 1961-2001 (provisional to Oct. 7)

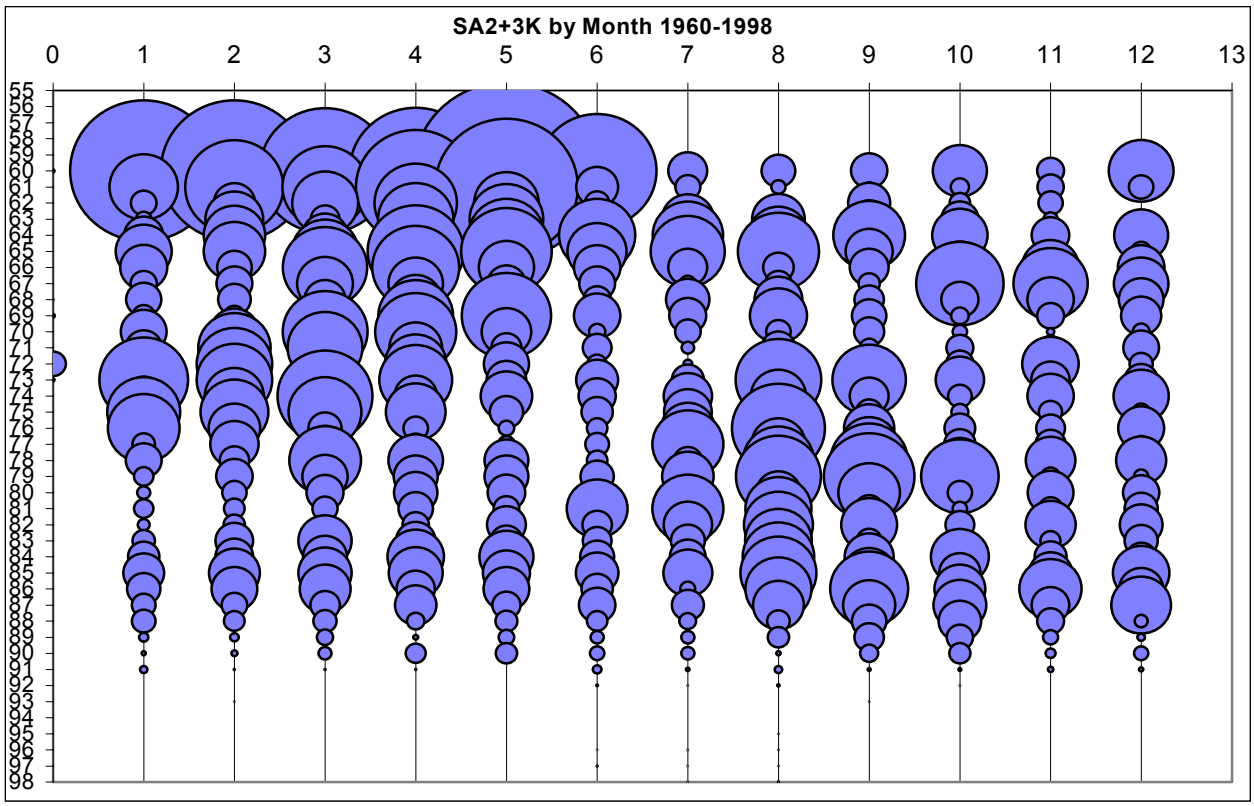

Fig. 3. Nominal catch of redfish in SA 2+3K by month from 1961-1998.

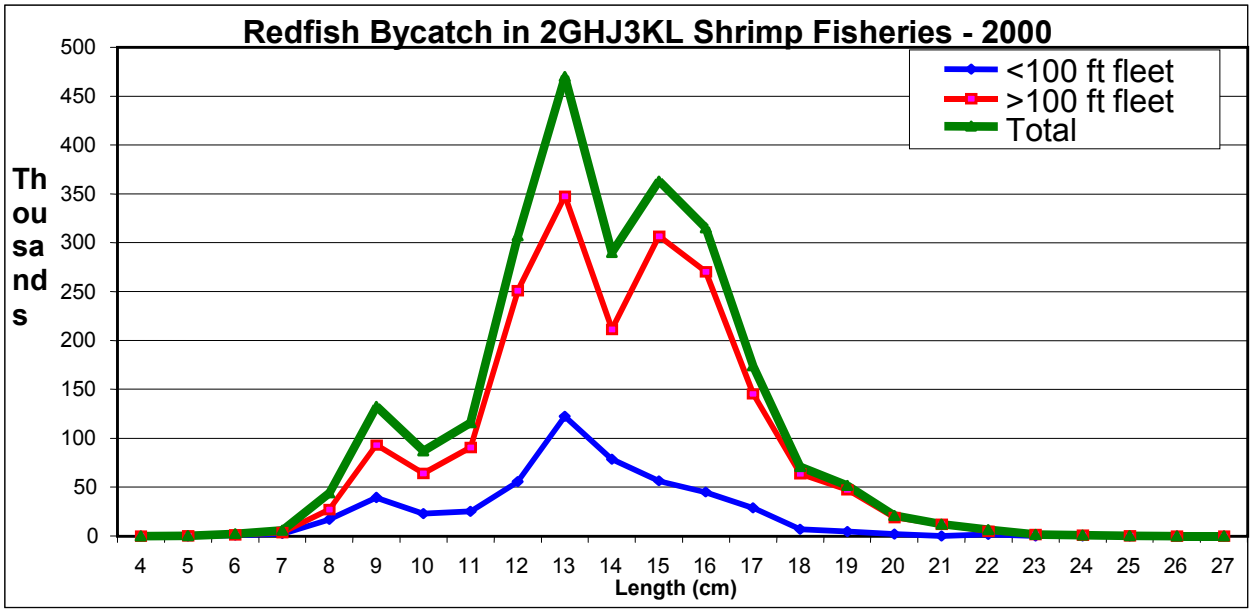

Fig. 4. Estimates of redfish bycatch at length based on observer data from shrimp fisheries within SA2+Div 3K.

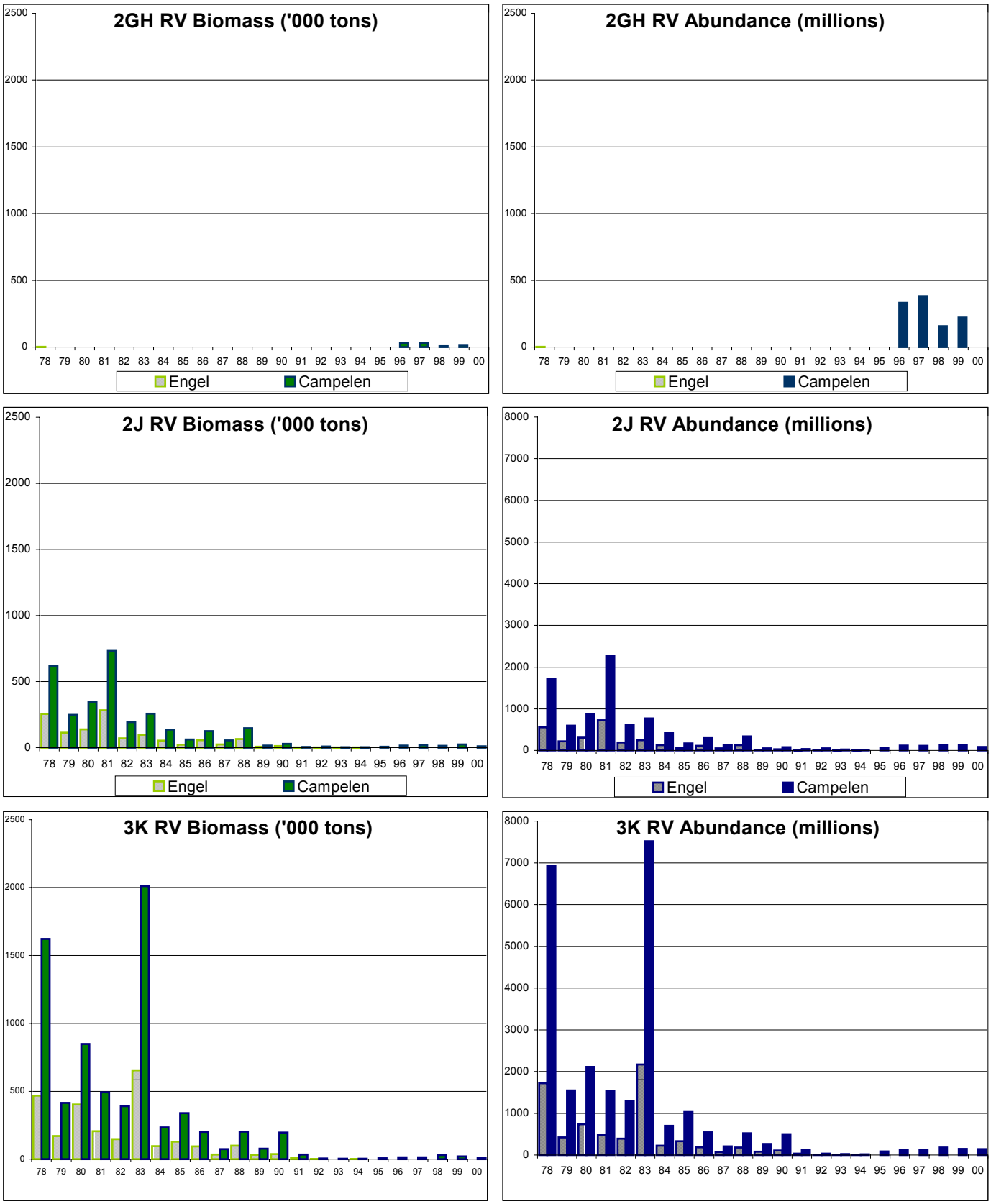

Fig 5. Survey indices of relative abundance for redfish in SA2 + 3K from autumn surveys. The 1978-1994 data for the Campelen series are converted data.

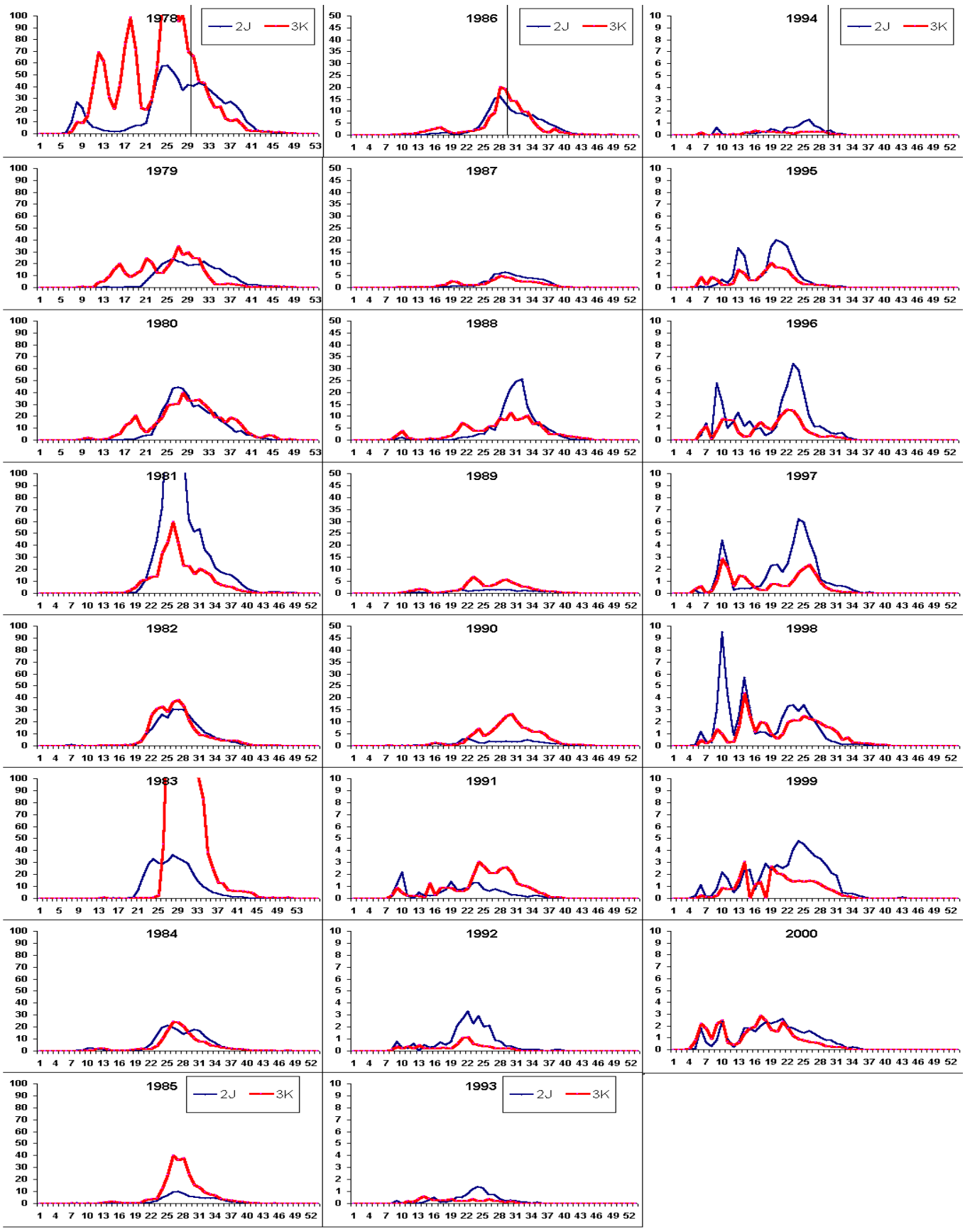

Fig. 6. Length frequency distribution from stratified-random research surveys to Div. 2J3K from 1978-2000. Plotted are mean number per standard tow. X-axis is forklength in cm. Data from 1978-94 are Campelen equivalent values.

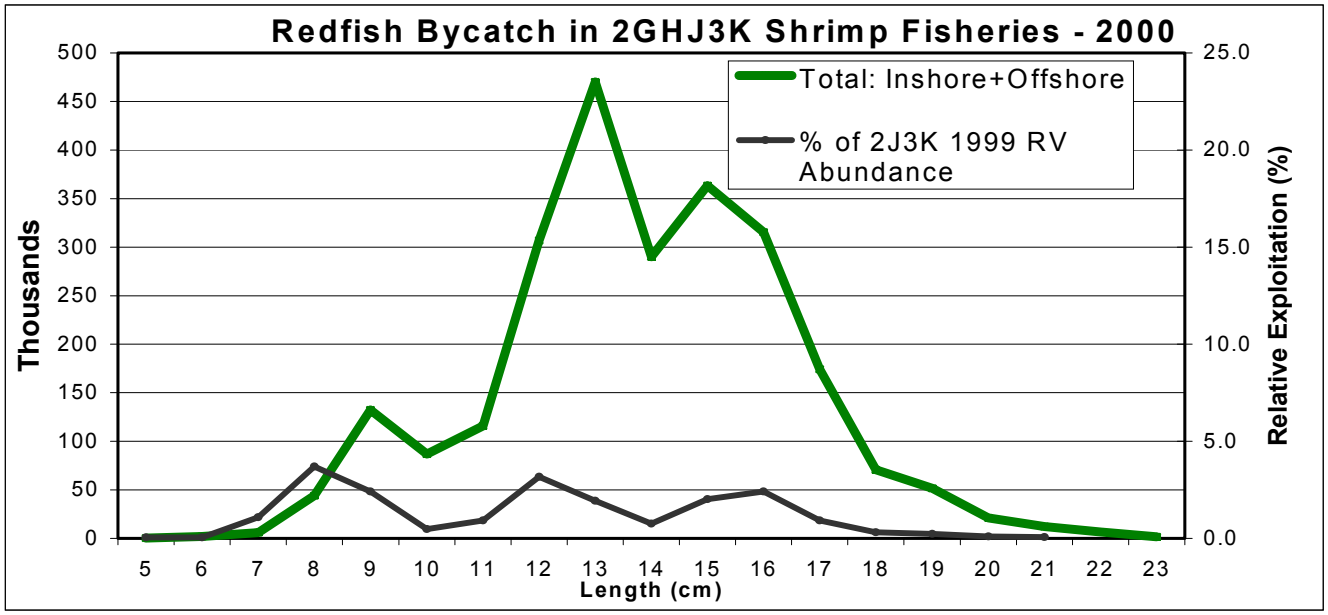

Fig. 7. Estimates of relative exploitation of redfish bycatch from shrimp fisheries in SA2 + Div. 3K in 2000 based on a ratio of numbers caught to RV survey abundance index from the 1999 autumn RV surveys in Div 2GHJ3K as beginning of year population numbers.

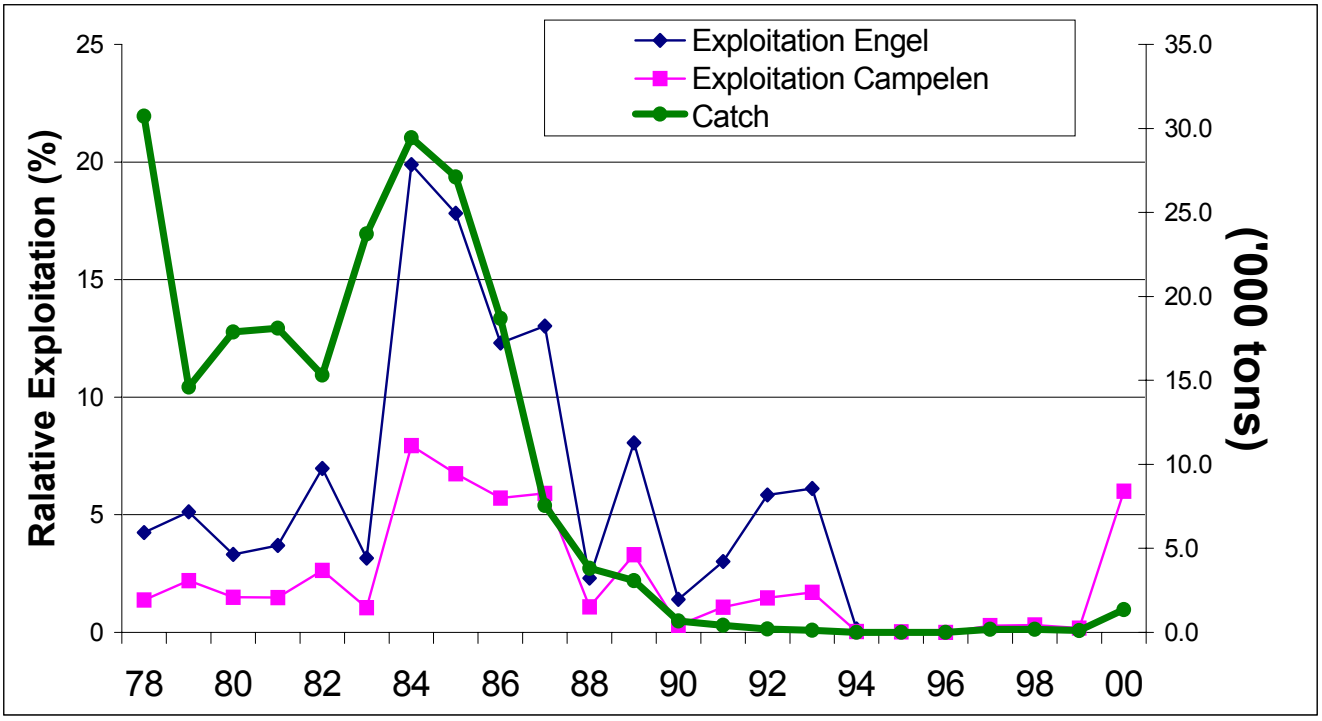

Fig. 8. Estimates of relative exploitation rate derived by calculating a ratio of catch in year 'x' in Division 2J3K to RV biomass index in year "x-1" from fall surveys.