NOT TO BE CITED WITHOUT PRIOR
REFERENCE TO THE AUTHOR(S)

Northwest Atlantic Fisheries Organization

Serial No. N4693 **NAFO SCR Doc. 02/79**

SCIENTIFIC COUNCIL MEETING – JUNE 2002

Information Relevant to the Canadian Request to the Scientific Council with Respect to the Redfish Stock in Division 3O

by

D. Power and D. Orr

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

Introduction

This paper contains information to address a request by Canada to the Scientific Council (SCS Doc. 02/03) with respect to the redfish stock in Division 3O. There were eight specific items requested under item 4 (a to h). Each of these items is addressed to the extent possible with the data available up to the beginning of the June meeting.

Background

Historically, Canadian industry has not had a great deal of interest in redfish in this area because of the relatively small sizes of fish found in the areas with trawlable bottom. Recent declines in other groundfish resources and the improved marketability for small redfish have resulted in increased interest in fishing in this area. There is a TAC set by Canada that has been applied to domestic fleets and countries that have had bilateral fishing agreements in the past.

A TAC of 16,000 t was first imposed on this stock in 1974. The TAC was increased in 1978 to 20,000 t and generally remained at that level through to 1987. The TAC was reduced in 1988 to 14,000 t and maintained there until 1994 when it was lowered to 10,000 t as a precautionary measure. A small fish protocol at 22 cm was implemented inside the 200-mile limit in 1995. The current TAC is divided into a Canadian quota (8,500 t), and a French (St. Pierre et Miquelon) quota (1,500 t). About 10% of the stock area lies outside Canada's 200 mile Exclusive Economic Zone (EEZ) and subject only to mesh regulations. Between 1985 and 1995, Canadian surveillance estimates of unreported non-Canadian catches have ranged between 400 t (1995) and 24,000 t (1988). From 1996 to 1998 the average was 300 t.

Nominal catches have ranged between 3,000 t and 35,000 t since 1960 (Table 1, Fig. 1). Up to 1986 catches averaged 13,000 t, increased to 27,000 t in 1987 with a further increase to 35,000 t in 1988. Catches declined to 13,000 t in 1989, and were about this amount annually through to 1993. The decrease of the catch in 1994, at about 5,400 t was related to a reduction in foreign allocations and catches generally remained at this level through 1997. Total catches from 1998 to 2001 fishing year have exceeded 12,500 tons each year due to increased activity by non-Canadians in the NAFO Regulatory area (NRA) outside the Canadian EEZ.

Catches by country (Table 2) indicate the primary fleets in recent years are Canada, Portugal, Spain and Russia. Catch by month (Table 3) and gear (Table 4) indicates most of the catch was taken between May to November with bottom otter trawls.

Research Surveys

Stratified random Canadian bottom trawl surveys have been conducted in the spring and autumn in Division 3O since 1991, with coverage of depths to 730 m. From 1991 to spring 1995 an Engel 145 otter trawl was used (1.75 n. mi. standard tow) and from autumn 1995 onwards a Campelen 1800 shrimp trawl (0.75 n. mi. standard tow). The 1991 to spring 1995 Engel 145 data were converted into Campelen 1800 trawl equivalent data. Details of the comparative fishing trials and data modelling can be found in Power and Atkinson (MS 1998a).

The series of mean weight per standard tow for spring (Table 5) and autumn (Table 6) exhibits large fluctuations in estimates between seasons and years for some strata, not uncommon for bottom trawl surveys for redfish. 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. 2) suggests the stock may have increased since the early 1990s, and stabilized above 100,000 t between 1994-1999. The low 1997 value is considered a sampling anomaly. The autumn surveys, while more stable in the early 1990s, generally supports this pattern. It should also be noted that the 1996 autumn estimate is not comparable because of important strata that weren't sampled due to problems on the survey. The additional survey estimates since 1999 for both spring and autumn continues to indicate that stock status has not improved, and may be declining somewhat.

In most surveys, stratum by stratum density estimates in the NRA (denoted in Tables 5 and 6 as strata 354, 355, 356, 721, 722, see also Fig. 3) were generally lower than in the Canadian EEZ, although there is a portion of these strata that actually overlaps both. The distribution of the survey catches in spring (Fig. 4) and autumn (Fig. 5) generally illustrate this point more clearly. The spring series has full coverage of the strata and the largest catches usually occur in the Canadian EEZ. It is also evident that catches increased in magnitude from the early 1990s and this is generally supported by the autumn series. Differences between the spring and autumn surveys may be related to changes in availability between these seasons.

Size at Maturity

Maturity data for redfish were available from two sources: (1) set by set samples taken for length distribution, sex and maturity (LSM) during spring and autumn DFO research surveys to Div. 3O from 1996 to spring 1998, and, (2) otolith samples taken for age (A&G) determination during DFO research surveys to Div. 3O from 1972 to 1995. A logistic model with a logit link function and binomial error was fit to the data to estimate the length (cm) at 50% maturity (L_{50}). Estimation of parameters was conducted using the Probit procedure of SAS (SAS, 1989). Fish were classified as mature or immature based on a visual examination of the fresh gonad at sea. Determination of maturity stage was consistent with that described by Ni and Templeman (1985). Data sources (1) and (2) were analyzed separately but within each data source, the data were combined for all years and surveys. There was no attempt to distinguish between *Sebastes fasciatus* and *S. mentella*. Sample sizes are given in the table below:

Data Source	Females	Males
A&G	6931	6033
LSM	12722	14605

The ogives derived for the LSM and A&G data were quite different, especially for males (Fig. 6). The estimation of L_{50} plus 95% fiducial limits was higher in the A&G data by at least 1 cm for males (20.12 ± .22 cm versus 21.36 ± .38 cm). The fitted curve for the LSM data for males does not show the typically sigmoid shape where the probability of maturity rises very quickly over a narrow length range. This is assumed an artefact of the LSM codes which has one category for both sexually immature fish (juveniles) and fish that are mature but just won't spawn in the current year. Estimation of L_{50} for females was 28.08 ± .13 cm for the A&G data and 28.25 ± .22 cm for the LSM data. The A&G data covers sampling each year back to 1972, which reflect a more historical perspective of size at maturity. A further investigation is warranted to see if there is a trend in size at maturity over time. In any case, averaging between the two estimated values results in an L_{50} of 21.5 cm for males and 27.5 cm for females. Ni and Sandeman (1984) reported L_{50} values for *S. mentella* and/or *S. fasciatus* of 18.23 cm for males and 27.73 cm for females in Div. 3O. This was based on data collected between 1957 and 1969. It appears, based on the current data, that size at maturity for males has changed within areas of Div. 3O.

Other Information

Other sources of information available to address the Canadian request included the Can(N) regional database of commercial statistics and commercial sampling information for Canada, EU/Portugal, EU/Spain and Russia as provided in the national research reports for 2001.

a) Information on the fishing mortality on redfish in Division 3O in recent years, as well as information on by-catches of other groundfish in the 3O redfish fishery;

It is not possible to estimate fishing mortality for this stock. There is insufficient historical catch sampling for some fleets and no data for others to conduct analytical assessments. A fishing mortality proxy was derived by simple catch to biomass ratios. Catches by month since 1988 (Table 2) indicated that most of the catch was taken between May to October. 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 less than one. All fish sizes were included in the survey biomass estimate. The results (Fig. 7) suggest that relative fishing mortality decreased rapidly from the highest in the series in 1992 (0.60) to the lowest in 1995 (0.02) but has since increased to the second highest estimate in the series in 2001 (0.47). It is difficult to accept these as an indication of trend in fishing mortality because there is extremely high variability around the survey estimates are therefore not considered to be reflective of year-to-year changes in stock abundance. There is some doubt about the magnitude of actual catches reported from Div. 3O as it is not regulated by TAC in the Regulatory Area. Accepting this caveat and the observation that Canadian spring and autumn survey estimates of Div. 3O redfish are relatively stable in the last few years, the increase in catches in Div. 3O in recent years, particularly in 2001 at 20 000 tons, suggests that fishing mortality may have increased in 2001.

With regard to by-catches of other groundfish in the Div 3O redfish fishery, based on the NAFO STATLANT 21B data for the principal fleets for 1998-2000 (Table 7), Atlantic cod, American plaice, Greenland halibut, witch flounder, and yellowtail flounder constitute the major by-catch species in the directed redfish fishery in Div. 3O. The percentage of by-catch, calculated as the sum of by-catch for all species as a percentage of redfish catch, suggests that there are differences by fleet and by year, which ranged between 2% to 20% from 1998-2000. There were large differences between by-catch within the Canadian EEZ (at less than 3% each year) and by-catch within the NRA (between 12% to 20% annually depending on the fleet). It would be useful to compare these figures with observer data.

b) Information on abundance indices and the distribution of the stock in relation to groundfish resources, particularly for the stocks which are under moratorium;

Although research survey indices were described previously, they are not considered as being indicative of year to year changes in stock abundance but may indicate long term trend. With regard to distribution of the stock in relation to groundfish resources, redfish reside on the slopes of the shelf primarily from 100-750 m in an area that encompasses about 6 400 square nautical miles of the 20 000 square nautical miles of the total bank and shelf area of Div. 3O to 1 500 m. Based on the Canadian survey data pooled from 1999-2001 separately for spring and autumn, a comparison was made of the relative distribution of redfish with stocks currently under moratorium (Div. 3NO Atlantic cod, Div. 3LNO American plaice and Div. 3NO witch flounder, Fig. 8-10 respectively). For cod and American plaice, the greatest overlap occurs in depths between 100 m to 200 m. For witch flounder, redfish overlap with its distribution with the exception of the area >750 m. There are also differences in the amount of overlap for all species between spring and autumn with greater overlap generally occurring in the spring with Atlantic cod and witch flounder and in the autumn with American plaice.

c) Information on the distribution of redfish in Division 3O, as well as a description of the relative distribution inside and outside the NAFO Regulatory Area;

Distribution has been described in the previous section. The relative distribution inside and outside the NRA was determined based on Canadian survey data by strata (derived from Tables 5-6). For those survey strata that have portions inside and outside the NRA, a planimeter was used to measure the amount of area in each portion and this used to split the stratum estimate. As noted earlier, redfish reside primarily in the 100m to 750 m depth zone. The

area of redfish habitat in the NRA is about 496 square nautical miles compared to 5 515 square nautical miles inside the Canadian EEZ. This represents about 8.25% of the area. Based on spring survey data, the proportion of the redfish survey biomass in the NRA ranged from 1.4% to 37.9% with an average of about 12%. Based on the autumn surveys, the proportion ranges from 3.4% to 16.4% with an average of about 9%.

d) Advice on reference points and conservation measures that would allow for exploitation of this resource in a precautionary manner;

There is insufficient information to determine biological reference points for this resource because it is not possible to determine the current level or historic levels of fishing mortality or stock biomass. Research survey results are highly variable and, while considered useful for determining longer term stock trends, are not considered a reliable indicator of actual abundance and are therefore of limited value in providing information for establishing reference points.

Given that the fishery in the NRA is currently unregulated, an initial conservation measure should be to bring the stock under a quota management regime that is applicable throughout the stock area.

e) Information on annual yield potential for this stock in the context of (d) above;

There is insufficient information on which to base predictions of annual yield potential for this resource. Stock dynamics and recruitment patterns are also poorly understood. Catches have averaged about 13 000 tons since 1960 and over the longer term, catches at this level do not appear to have been detrimental.

f) Identification and delineation of fishery areas and exclusion zones where fishing would not be permitted, with the aim of reducing the impact on the groundfish stocks which are under moratorium, particularly juveniles;

Information from Canadian spring and autumn surveys indicate that the area of overlap between redfish and juveniles of groundfish stocks which are under moratorium (Div. 3NO Atlantic cod, Div. 3LNO American plaice and Div. 3NO witch flounder) diminished as depth increases beyond 100 m (Fig. 11-13, respectively). The research survey data pooled from 1999-2001, indicated that redfish were caught in only a few of the sets in depths less than 100 m where most of the juveniles of cod (<= 40cm) and American plaice (<=30 cm) and witch flounder (<=25 cm) reside. The densities of juveniles of these species are relatively low beyond 200 m. Therefore, fishing at depths greater than 200 m for redfish should minimize the impact on juveniles of these species. Information from the commercial fisheries with regard to depth fished while directing for redfish for the primary fleets in 2001 are as follows:

Canada: 65 m-450 m
EU/Spain: 200 m-600 m (del Rio *et al*., MS 2002)
EU/Portugal: 68 m-553 m (Alpoim *et al*., MS 2002)
Russia: 300 m-600 m (Vaskov *et al*., MS 2002)

g) Determination of the appropriate level of research that would be required to monitor the status of this resource on an ongoing basis with the aim of providing catch options that could be used in the context of management by Total Allowable Catch (TAC);

There are spring and autumn surveys that are conducted by Canada in Div. 3O that sufficiently cover the redfish habitat. Estimates of abundance and biomass have been highly variable from these surveys and part of the reason may be due to vertical and horizontal migrations of redfish in the area. There is also uncertainty regarding the integrity of Div. 3O as a separate management unit. Recent technological advances in the tagging of deepwater fish at depth is one possible avenue of research that may help address the problems of the resource surveys and provide another method of estimating stock size as well as assisting in better understanding of stock structure. The utilization of the NAFO Observer Program set-by-set data would have been beneficial in addressing this request on Div. 3O redfish and could be an important source of data to aid in monitoring of this resource.

h) Information on the size composition in the current catches and comment on these sizes in relation to the size at sexual maturity.

Commercial sampling from the most current catches (2001) was available from Canada, EU/Portugal (Alpoim et al MS 2002), EU/Spain (del Rio et al MS 2002) and Russia (Vaskov *et al*., MS 2002). These data indicate that fish between 21-25 cm dominated the size composition of the 2001 catches (Fig. 14). Based on recent size at maturity data, the female portion of these catches will largely be immature (size at 50% maturity is approximately 27.5 cm). It should be noted that size at maturity was based on data that did not separate *S. mentella* and *S. fasciatus* and that it is possible that there are different maturity rates between these species. However, it is not expected that these differences would be large.

REFERENCES

Alpoim, R., J. Vargas, E. Santos and A. M. Ávila de Melo. 2002 MS. Portuguese research report for 2001. NAFO SCS Doc. 02/06 Ser. No N4604, 49p.

Power, D. and D. B. Atkinson. MS 1998a. Update on the status of Redfish in 3O. CSAS Res. Doc. 98/110. 20pp

Ni, I-H., and E. J. Sandeman. 1984. Size at maturity for Northwest Atlantic redfishes (*Sebastes)*. Can. J. Fish. Aquat. Sci. 41:1753-1762.

Ni, I-H., and W. Templeman. 1985. Reproductive cycles of redfishes (*Sebastes*) in Southern Newfoundland waters. J. Northw. Atl. Fish. Sci., 6: 57-63.

del Rio, J.L., P. Durán Muñoz, A. Vázquez, H. Murua, E. Román and F. Gonzalez. 2002 MS. Spanish research report for 2001. NAFO SCS Doc. 02/07 Ser. No N4623, 26p.

SAS Institute Inc. 1989. SAS/STAT User's Guide. SAS Institute Inc. Cary, NC.

Vaskov, A.A., K.V.Gorchinsky, T.M.Igashov, V.M.Kiseleva, S.E.Lobodenko and S.P.Melnikov. 2002 MS. Russian research report for 2001. Part II- PINRO Research. NAFO SCS Doc. 02/04 Ser. No N4597, 24p.

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

Year	Canada	Others	Total	TAC
1960	100	4,900	5,000	
1961	1,000	10,000	11,000	
1962	1,046	6,511	7,557	
1963	2,155	7,025	9,180	
1964	1,320	14,724	16,044	
1965	203	19,588	19,791	
1966	107	15,198	15,305	
1967	645	18,392	19,037	
1968	52	6,393	6,445	
1969	186	15,692	15,878	
1970	288	12,904	13,192	
1971	165	19,627	19,792	
1972	508	15,609	16,117	
1973	133	8,664	8,797	
1974	91	13,033	13,124	16,000
1975	103	15,007	15,110	16,000
1976	3,664	11,684	15,348	16,000
1977	2,972	7,878	10,850	16,000
1978	1,841	5,019	6,860	16,000
1979	6,404	11,333	17,737	20,000
1980	1,541	15,765	17,306	21,900
1981	2,577	10,027	12,604	20,000
1982	491	10,869	11,360	20,000
1983	7	7,333	7,340	20,000
1984	167	16,811	16,978	20,000
1985	104	12,756	12,860	20,000
1986	141	10,914	11,055	20,000
1987	183	26,987	27,170	20,000
1988	181	34,611	34,792	14,000
1989	27	13,229	13,256	14,000
1990	155	14,087	14,242	14,000
1991	28	8,433	8,461	14,000
1992	1,219	14,049	15,268	14,000
1993	698	15,022	15,720	14,000
1994	1,624	3,804	5,428	10,000
1995	177	3,037	3,214	10,000
1996	7,255	2,590	9,845	10,000
1997	2,588	2,559	5,147	10,000
1998	8,931	5,121	14,052	10,000
1999	2,322	10,250	12,572	10,000
2000	2,206	10,584	12,790	10,000
2001	4,899	15,405	20,304	10,000
2002				10,000

[a] Provisional

Table 2. Nominal catches (t) of redfish in Div. 3O by country and year since 1987 (2000-2001 are provisional).

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000a	2001a
Canada (M)	18	27	4	27	21	779	4	2124	693	2850	317	1326	4533
Canada (N)	9	128	24	1192	677	845	173	5131	1895	6081	2027	880	336
France (SPM)	-	-	-	-	-	-	-	-	134	266	-	-	-
Japan	1724	1406	226	125	159	-	264	417	285	355	-	-	-
Portugal	12	83	3	1468	4794	2918	1935	1635	894	1875	5469	4555	3535
Spain	-	4	-	-	-	26	22	338	1245	1925	4549	3747	2314
Russia	4517	3811	4427	5845	6887	60	416	-	-	-	231	2233	11343
Cuba	2138	2750	2748	2776	665	-	-	-	-	-	-	-	-
USA	-	-	-	-	-	-	-	-	-	-	-	-	-
Korea(S)	2638	833	129	1935	17	-	-	-	-	-	-	-	-
Estonia	-	-	-	-	-	-	-	-	-	-	-	49	-
OTHER[b]	2200	5200	900	1900	2500	800	400	200	-	700	NA		-1787
Total	13256	14242	8461	15268	15720	5428	3214	9845	5146	14052	12593	12790	20274
TAC	14000	14000	14000	14000	14000	10000	10000	10000	10000	10000	10200	10000	10000

[a] Provisional

[b] Estimates of non-reported or over-reported catch

Table 3. Nominal catches (t) of redfish in Div. 3O by month and year since 1988 (not including estimates).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1982	-	1	1121	1258	545	652	4555	2245	661	233	89	-	11360
1983	254	355	2904	1227	71	156	576	938	319	1	73	266	7140
1984	219	155	2	32	85	257	446	3210	2799	1882	435	506	10028
1985	1522	-	453	239	118	252	227	1711	1486	350	35	1817	8210
1986	707	-	427	593	69	710	3491	3712	58	1	319	368	10455
1987	102	40	1052	37	1010	757	2001	4142	429	344	1326	1780	13020
1988	15	1	493	684	915	1	1755	3922	1286	1057	915	248	11292
1989	228	585	224	6	674	1411	1143	3311	2737	666	51	20	11056
1990	108	23	257	26	1220	2474	1534	1571	1002	686	28	113	9042
1991	17	47	96	1	713	2054	2346	1118	830	338	-	1	7561
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	-	-	88	119	166	46	704	783	1582	2814	1524	1481	9307
1997	4	-	-	43	87	416	1299	943	622	963	435	49	4861
1998	-	174	22	74	890	2485	1685	239	598	1374	1251	142	8934
1999	100	139	262	463	527	942	1644	2513	2298	2056	1434	215	12593
2000 [a]	80	92	943	739	1077	1844	1088	1254	1545	2068	1814	246	12790

[a] Provisional

Table 4. Nominal catches (t) of redfish in Div. 3O by gear since 1988 (not including estimates).

	Otter Trawls				
Year	Bottom	Midwater	Gillnets	Misc	Total
1982	9394	1966	-	-	11360
1983	5217	1923	-	-	7140
1984	7451	2577	-	-	10028
1985	4431	3778	-	1	8210
1986	5231	5224	-	-	10455
1987	8601	4419	-	-	13020
1988	6692	4596	-	4	11292
1989	7026	4030	-	-	11056
1990	5501	3537	-	4	9042
1991	4625	2936	-	-	7561
1992	10046	3292	1	29	13368
1993	11997	1214	-	9	13220
1994	3085	1498	26	19	4628
1995	2221	525	26	42	2814
1996	8966	334	7	-	9307
1997	4841	10	2	-	4853
1998	8932	-	-	2	8934
1999	11623	970	-	-	12593
2000 [a]	12750	37	3	-	12790

[a] Provisional

Table 5. Mean number (upper panel) and weight (kg., lower panel) per standard tow from Canadian SPRING surveys in Div. 3O where strata greater than 366 m (200 ftm.) were sampled. Dashes (---) represent unsampled strata. Number of successful sets in brackets. The data from 1991-1995 are Campelen trawl equivalent units (see text). Data from 1996 to present are actual Campelen data. G=GadusAtlantica, W=Wilfred Templeman, A=Alfred Needler.

Stratum	Depth Range (M)	Area sq mi	Area within NRA 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	May-Jun 2001-Q2 W365,367	May 2002-Q2 W419,421
329	093-183	1721	0	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)	0.0 (5)	0.0 (5)
332	093-183	1047	0	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)	44.0 (3)	23.7 (3)
337	093-183	948	0	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)	48.7 (3)	2.7 (3)
339	093-183	585	0	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)	0.0 (2)	0.5 (2)
354	093-183	474	246	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)	81.1 (2)	0.0 (2)
333	185-274	151(147)	0	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)	1525.5 (2)	
336	185-274	121	0	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)	1742.0 (2)	1048.0 (2)
355	185-274	103	74	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)	407.5 (2)	470.0 (2)
334	275-366	92(96)	0	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)	730.9 (2)	438.5 (2)
335	275-366	58	0	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)	4730.6 (2)	4604.0 (2)
356	275-366	61	47	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)	503.2 (2)	2273.5 (2)
717	367-549	93(166)	0	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)	139.5 (2)	242.0 (2)
719	367-549	76	0	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)	1755.4 (2)	167.0 (2)
721	367-549	76	58	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)	541.1 (2)	106.5 (2)
718	550-731	111(134)	0	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)	22.5 (2)	79.0 (2)
720	550-731	105	0	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)	52.1 (2)	97.5 (2)
722	550-731	93	71	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)	447.9 (2)	92.0 (2)
	Total:	6011	496	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	288.5	235.8
Weighted mean (by area)					190.987	180.3	698.4	1748.5	2662.6	953.2	141.7	1250.0	869.5	571.3	204.7	126.4
Lower (95% CI)					-83.3	-135.1	-559.1	258.6	1007.2	-6978.1	-972.1	-7777.3	390.4	247.1	121.0	16.9
ABUNDANCE(millions)					155.4	146.7	568.3	1445.8	2201.7	788.2	117.2	1033.6	719.0	472.4	169.3	101.9
ABUNDANCE(millions) within NRA					4.2	31.4	113.5	47.7	80.2	292.1	4.5	68.3	100.3	157.3	10.2	15.4
% ABUNDANCE(millions) within NR					2.7	21.4	20.0	3.3	3.6	37.1	3.8	6.6	14.0	33.3	6.0	15.1
						Campelen Trawl Equivalent 1991-1995					Campelen Trawl 1996-Present					
329	093-183	1721	0	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)	0.0 (5)	0.0 (5)
332	093-183	1047	0	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)	2.3 (3)	3.1 (3)
337	093-183	948	0	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)	4.7 (3)	0.0 (3)
339	093-183	585	0	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)	0.0 (2)	0.0 (2)
354	093-183	474	246	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)	8.4 (2)	0.0 (2)
333	185-274	151(147)	0	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)	225.7 (2)	---
336	185-274	121	0	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)	222.9 (2)	133.7 (2)
355	185-274	103	74	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)	44.2 (2)	71.1 (2)
334	275-366	92(96)	0	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)	146.4 (2)	142.3 (2)
335	275-366	58	0	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)	741.6 (2)	794.5 (2)
356	275-366	61	47	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)	73.3 (2)	340.5 (2)
717	367-549	93(166)	0	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)	30.2 (2)	45.3 (2)
719	367-549	76	0	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)	366.5 (2)	41.9 (2)
721	367-549	76	58	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)	90.7 (2)	19.4 (2)
718	550-731	111(134)	0	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)	7.4 (2)	18.1 (2)
720	550-731	105	0	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)	18.2 (2)	33.1 (2)
722	550-731	93	71	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)	114.2 (2)	28.4 (2)
	Total:	6011	496	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	45.7	39.1
Weighted mean (by area)					18.8	19.6	103.1	208.3	283.8	124.2	19.0	192.7	148.2	101.0	31.7	21.8
Lower (95% CI)					-63.2	-65.0	-71.5	-431.9	116.6	-832.6	-151.5	-1118.8	28.1	56.2	17.6	4.6
BIOMASS(tons)					15278	15961	83874	172264	234648	102695	15699	159313	122550	83508	26183	17609
BIOMASS(tons) within NRA					302	1701	15091	5260	11068	38943	219	11523	14746	25979	1388	2334
% BIOMASS(tons) within NRA					2.0	10.7	18.0	3.1	4.7	37.9	1.4	7.2	12.0	31.1	5.3	13.3

3O Spring

Table 6. Mean number (upper panel) and weight (kg., lower panel) per standard tow from Canadian AUTUMN surveys in Div. 3O where strata greater than 366 m (200 ftm.) were sampled. Dashes () represent unsampled strata. Number of successful sets in brackets. The data from 1991-1994 are Campelen trawl equivalent units (see text). Data from 1996 to present are actual Campelen data. G=GadusAtlantica, W=Wilfred Templeman, A=Alfred Needler.

Stratum	Depth Range (M)	Area sq mi	Area within NRA 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		Sep-Oct 2001-Q4 W372 T357	
329	093-183	1721	0	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)	746.8	(5)
332	093-183	1047	0	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)	8.7	(3)
337	093-183	948	0	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)	37.3	(3)
339	093-183	585	0	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)	1.0	(2)
354	093-183	474	246	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)	272.5	(2)
333	185-274	151(147)	0	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)	320.7	(2)
336	185-274	121	0	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)	131.0	(2)
355	185-274	103	74	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)	879.1	(2)
334	275-366	92(96)	0	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)	1441.2	(2)
335	275-366	58	0	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)	740.5	(2)
356	275-366	61	47	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)	2481.2	(2)
717	367-549	93(166)	0	0.00					6079.5	(2)	1172.5	(2)	2247.5	(2)			13031.5	(2)	8428.5	(2)	603.2	(2)	5420.1	(2)	1401.5	(2)
719	367-549	76	0	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)	2407.5	(2)
721	367-549	76	58	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)	1970.5	(2)
718	550-731	111(134)	0	0.00					520.0	(2)	1051.5	(2)	863.8	(2)			95.0	(2)	12.5	(2)	169.5	(2)	102.0	(2)	289.5	(2)
720	550-731	105	0	0.00					147.0	(2)	306.0	(2)	43.2	(2)	1560.6	(2)			471.0	(2)	103.5	(2)	160.0	(2)	88.4	(2)
722	550-731	93	71	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)	282.3	(2)
764	732-914	105	105	1.00															5.0				4.5		0.0	(2)
768	732-914	99	0	0.00															0.5				0.0		0.0	(2)
772	732-914	135	0	0.00															0.0				6.3			
	Total:	6350	601	9.46																						
Upper (95% CI)					3059.2		1217.7		587.0		672.0		9437.2		445.6		7592.4		3138.3		686.7		515.7		1000.7	
Weighted mean (by area)					436.0		572.0		371.5		388.6		1233.7		203.8		1304.5		455.7		359.5		411.0		416.0	
Lower (95% CI)					-2187.1		-73.7		156.0		105.2		-6969.8		-25.1		-4983.5		-2226.9		32.3		306.3		-168.7	
ABUNDANCE(millions)					336.3		421.8		302.3		321.3		1020.1		153.3		1059.8		398.0		268.3		359.0		355.6	
ABUNDANCE(millions) within NRA					78.2		65.7		18.5		31.1		98.4		13.1		29.0		42.3		39.9		47.1		32.9	
% ABUNDANCE(millions) within NR					23.3		15.6		6.1		9.7		9.6		8.5		2.7		10.6		14.9		13.1		9.2	
					Campelen Trawl Equivalent 1991-1994										Campelen Trawl 1995-Present											
329	093-183	1721	0	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)	42.1	(5)
332	093-183	1047	0	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)	0.1	(3)
337	093-183	948	0	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)	2.9	(3)
339	093-183	585	0	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)	0.2	(2)
354	093-183	474	246	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)	35.2	(2)
333	185-274	151(147)	0	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)	31.0	(2)
336	185-274	121	0	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)	13.5	(2)
355	185-274	103	74	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)	119.0	(2)
334	275-366	92(96)	0	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)	188.8	(2)
335	275-366	58	0	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)	89.0	(2)
356	275-366	61	47	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)	370.6	(2)
717	367-549	93(166)	0	0.00					1391.3	(2)	340.4	(2)	588.8	(2)			2281.8	(2)	1834.0	(2)	135.7	(2)	1143.7	(2)	229.2	(2)
719	367-549	76	0	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)	373.6	(2)
721	367-549	76	58	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)	319.2	(2)
718	550-731	111(134)	0	0.00					169.3	(2)	442.1	(2)	409.4	(2)			37.1	(2)	4.4	(2)	48.0	(2)	24.8	(2)	79.5	(2)
720	550-731	105	0	0.00					50.0	(2)	118.7	(2)	16.5	(2)	572.6	(2)			162.6	(2)	21.3	(2)	52.3	(2)	16.1	(2)
722	550-731	93	71	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)	125.2	(2)
764	732-914	105	105	1.00															1.6				2.6	(2)	0.0	(2)
768	732-914	99	0	0.00															0.3				0.0	(2)	0.0	(2)
772	732-914	135	0	0.00															0.0				2.2	(2)		
	Total:	6350	601	9.46																						
Upper (95% CI)					306.5		147.4		105.2		109.0		972.0		86.2		1182.1		664.3		106.8		83.3		75.6	
Weighted mean (by area)					44.9		76.3		63.6		64.5		151.9		30.5		190.3		86.6		56.4		68.7		43.6	
Lower (95% CI)					-216.7		5.2		22.1		20.0		-668.2		-25.1		-801.5		-491.0		6.0		54.0		11.6	
BIOMASS(tons)					34618		56247		51782		53324		125578		22974		154622		75676		42100		60004		37286	
BIOMASS(tons) within NRA					3256		6707		2703		3716		14752		2308		5208		7953		6910		6591		5594	
% BIOMASS(tons) within NRA					9.4		11.9		5.2		7.0		11.7		10.0		3.4		10.5		16.4		11.0		15.0	

3O Autumn

Table 7. Bycatch of various groundfish species from the directed Redfish fishery in Div. 3O based on the NAFO Statlant 21B database for the principal fleets.

Year	Species	CANADA	PORTUGAL	RUSSIA	SPAIN	Grand Total
1998	Atl Halibut	8	9			17
	Cod	59	53			112
	G. Halibut	3	72			75
	Haddock	9	3			12
	Other Groundfish	81	30			111
	Plaice	12	59			71
	Pollock	2				2
	Red Hake		5			5
	Redfish	8964	1875			10839
	Witch	3	37			40
	Yellowtail		11			11
1998 Total		9141	2154			11295
% Bycatch 1998		2.0	14.9			4.2
1999	Atl Halibut	8	23	1		32
	Cod	14	186	6		206
	G. Halibut	1	68	11		80
	Haddock	3	11			14
	Other Groundfish	13	107			120
	Plaice	25	195	9		229
	Red Hake		50	1		51
	Redfish	2344	5469	231		8044
	Witch	3	101	9		113
	Yellowtail	4	64	8		76
1999 Total		2415	6274	276		8965
% Bycatch 1999		3.0	14.7	19.5		11.4
2000	Atl Halibut	2	12	2	2	18
	Cod	21	84	20		125
	G. Halibut		281	28	54	363
	Haddock	2	7			9
	Other Groundfish	9	16	3	73	101
	Plaice	6	103	89	120	318
	Red Hake		21	108	9	138
	Redfish	2205	4555	2233	3219	12212
	Witch	3	47	36	62	148
	Yellowtail	1	4	38	58	101
2000 Total		2249	5130	2557	3597	13533
% Bycatch 2000		2.0	12.6	14.5	11.7	10.8
Grand Total		13805	13558	2833	3597	33793
% Bycatch 1998-2000		2.2	13.9	15.0	11.7	8.7

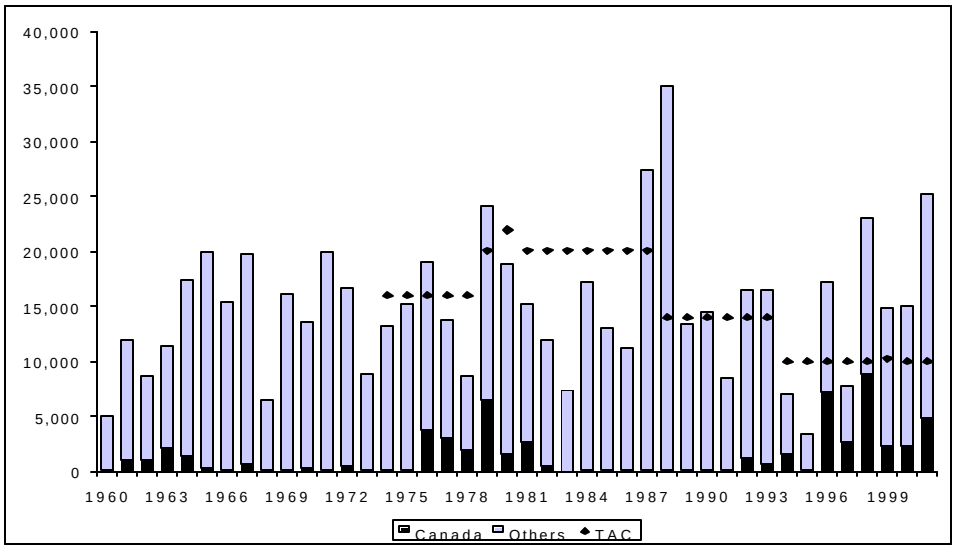

Fig. 1. Nominal catches and TACs for Division 3O redfish.

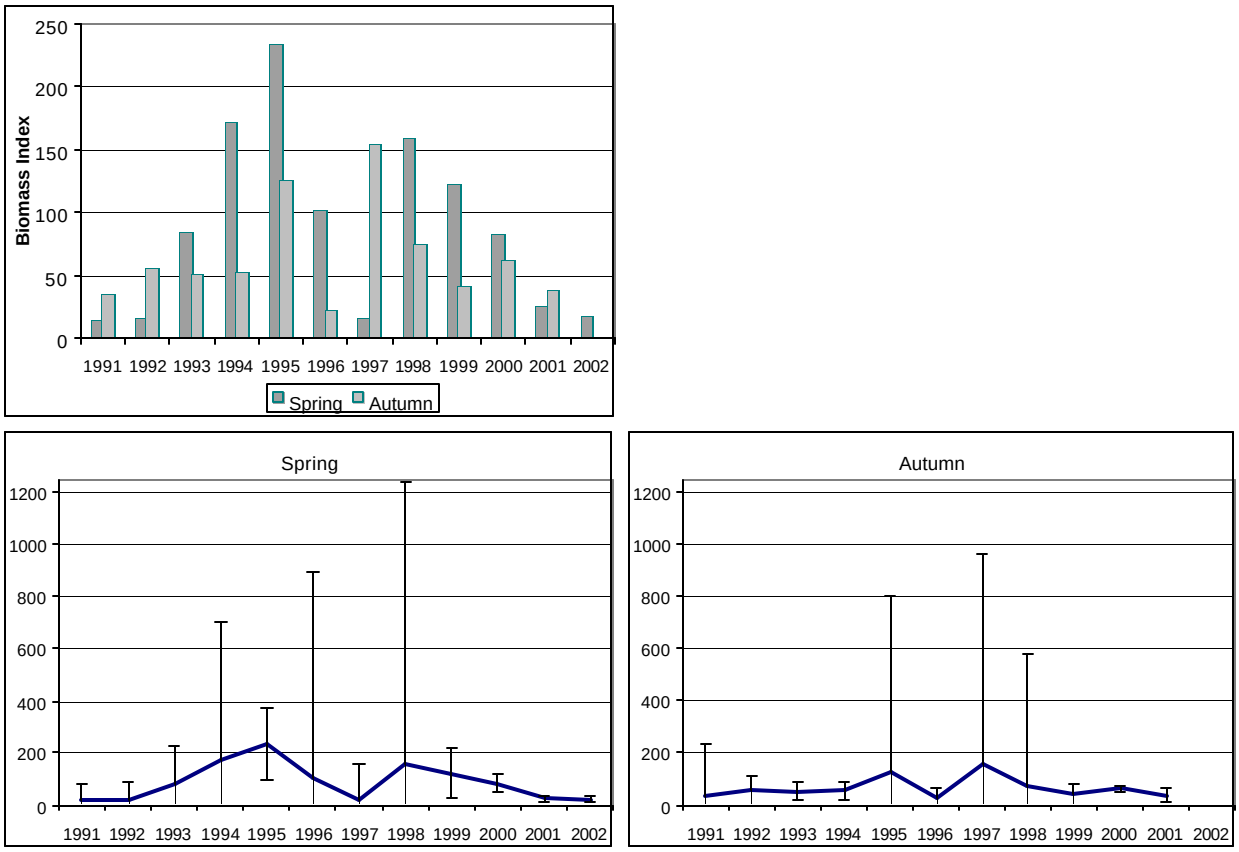

Fig. 2. Indices of survey biomass for redfish in Div. 3O for spring and autumn surveys from 1991-2002 (upper panel) with 95% CI (lower panels). Surveys prior to autumn 1995 utilized an Engel trawl. Estimates were converted into Campelen equivalents based on comparative fishing trials.

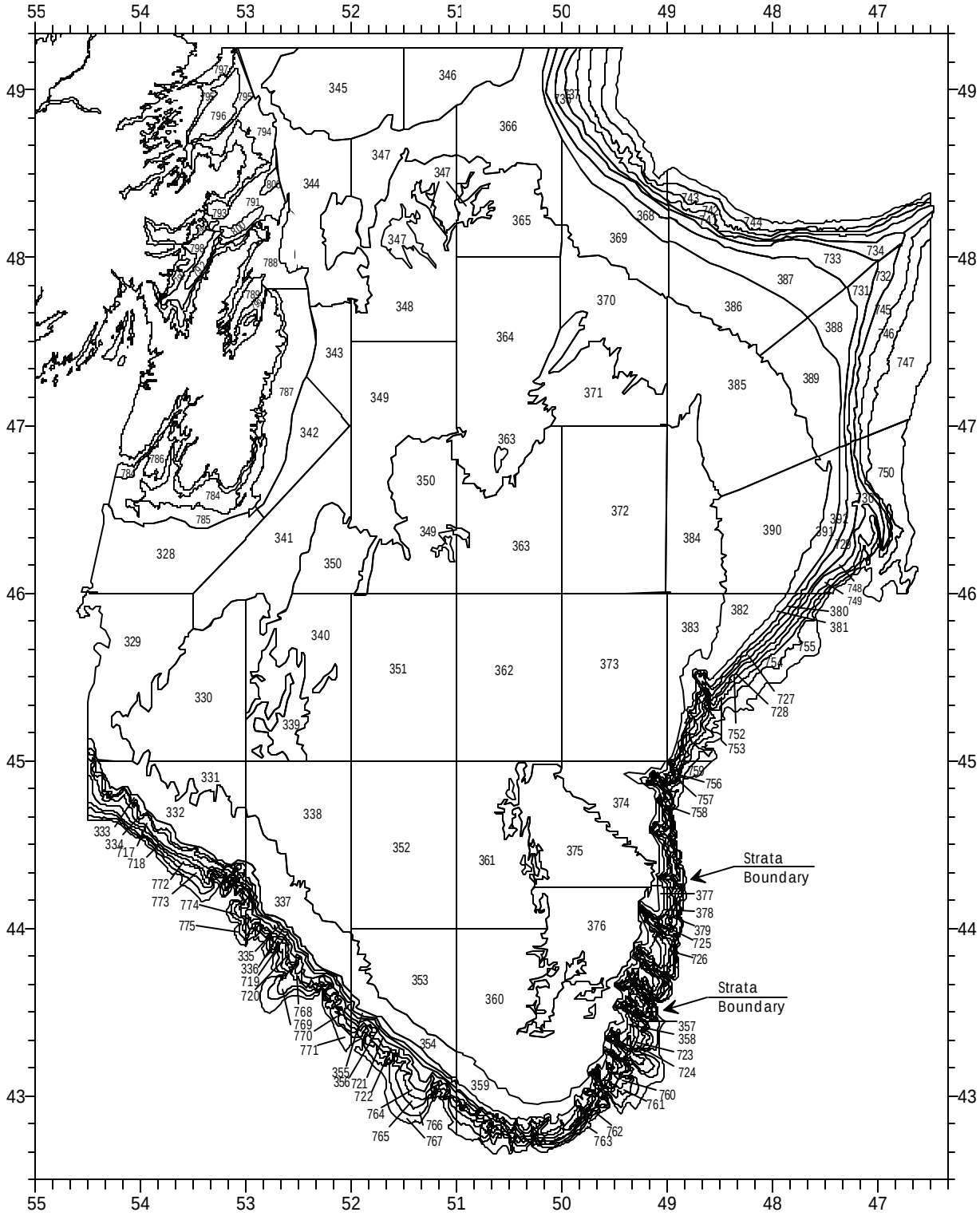

Fig. 3. Research survey stratification chart for Div. 3LNO

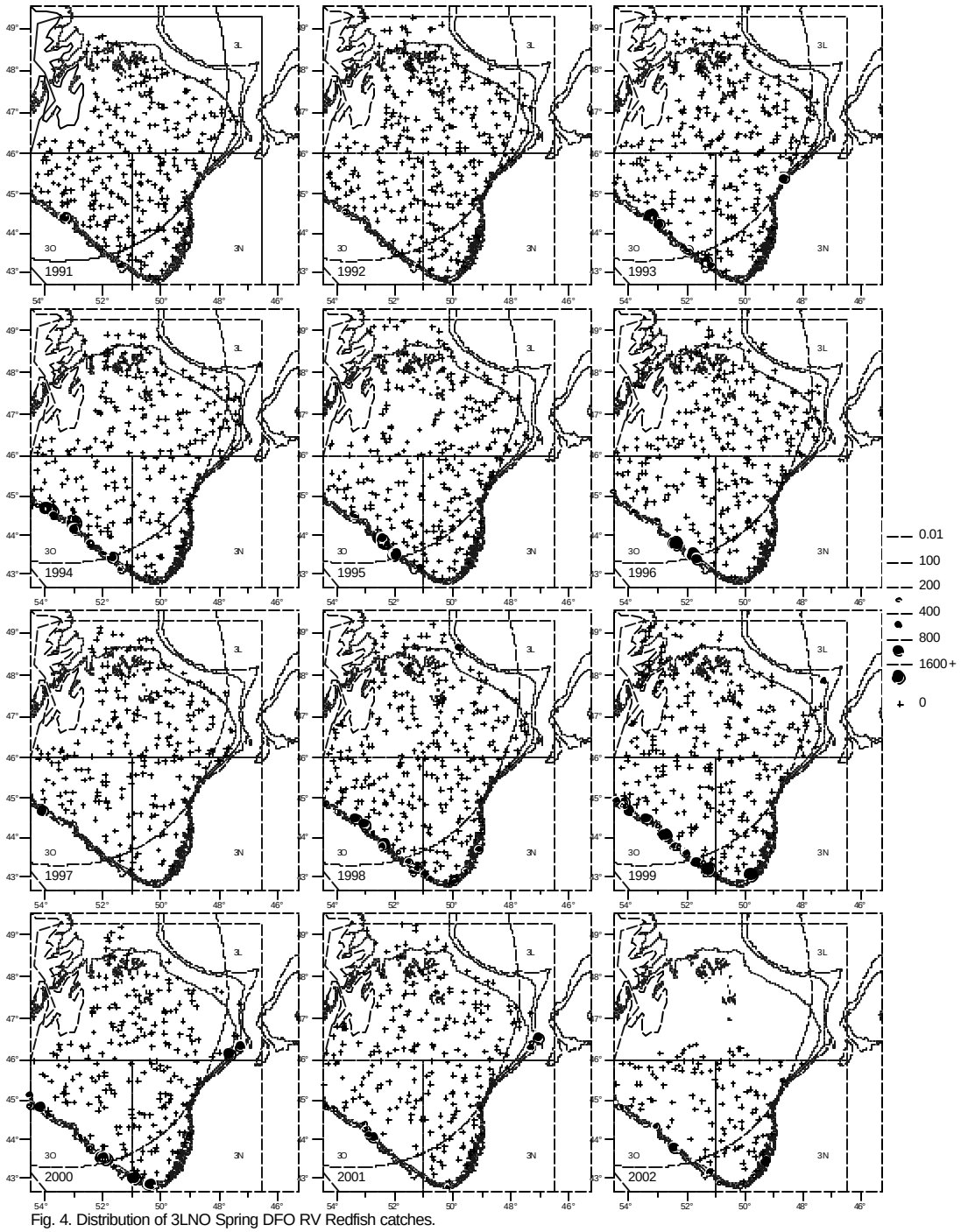

Fig. 4. Distribution of 3LNO Spring DFO RV Redfish catches.

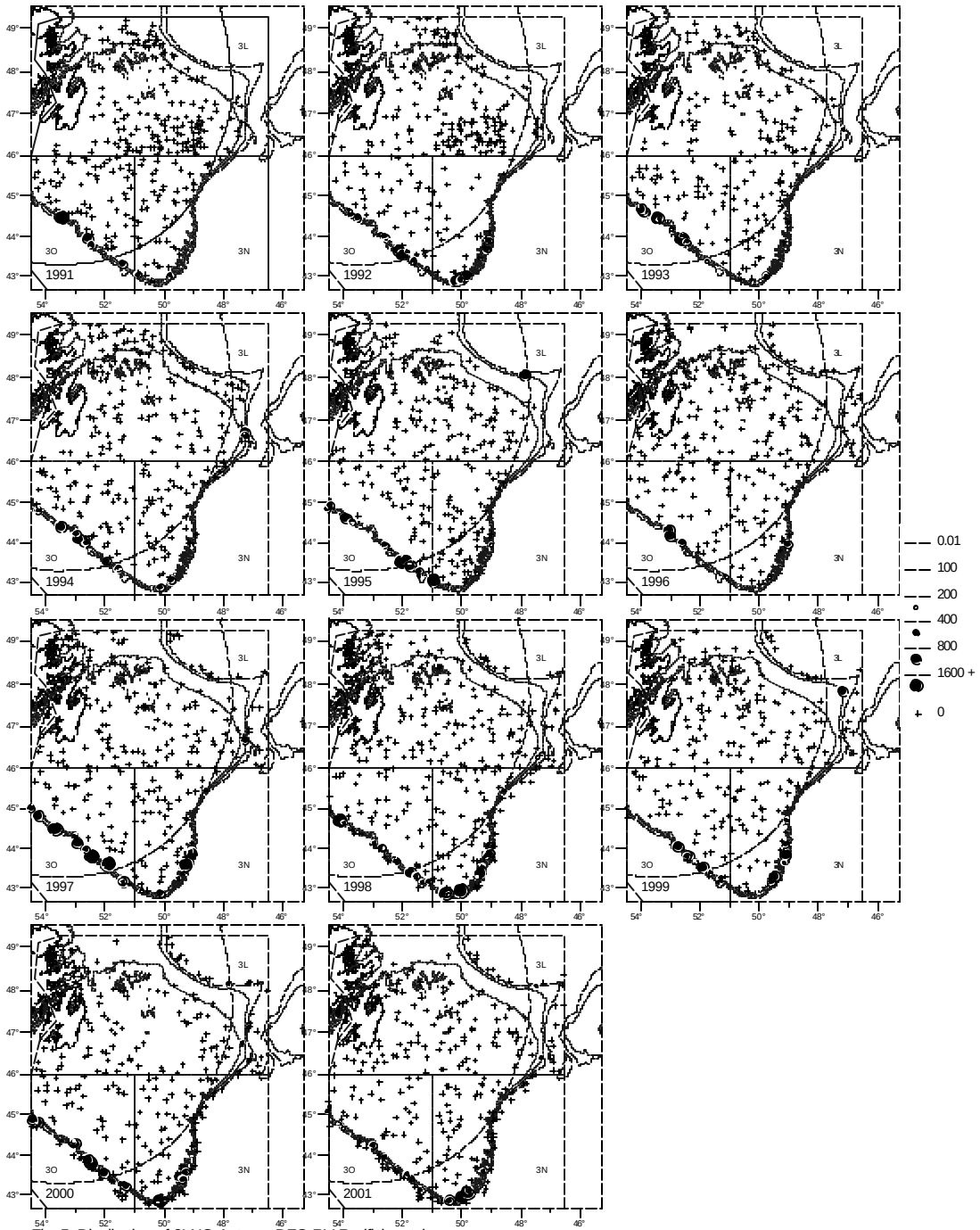

Fig. 5. Distribution of 3LNO Autumn DFO RV Redfish catches.

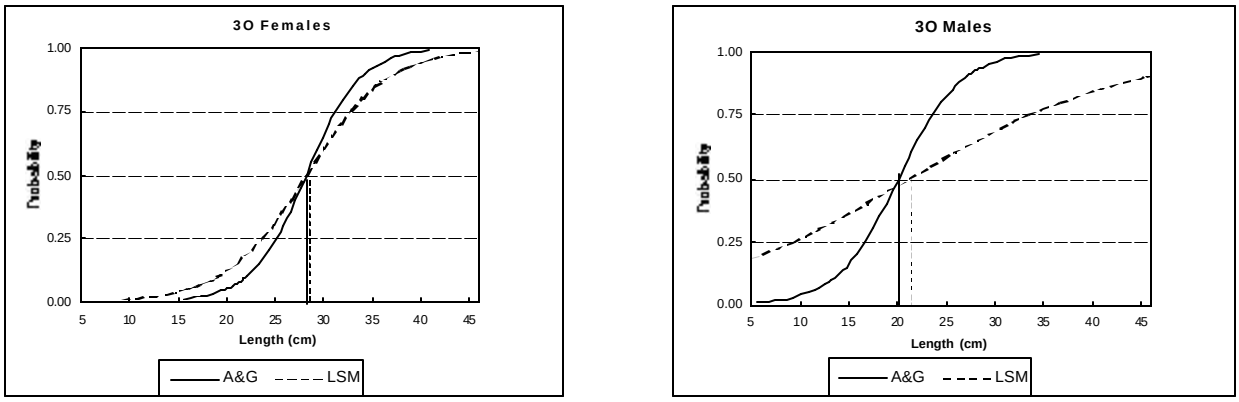

Fig. 6. Maturity ogives derived separately for otolith sampled (A&G) and LSM sampled data from research surveys in Div. 3O.

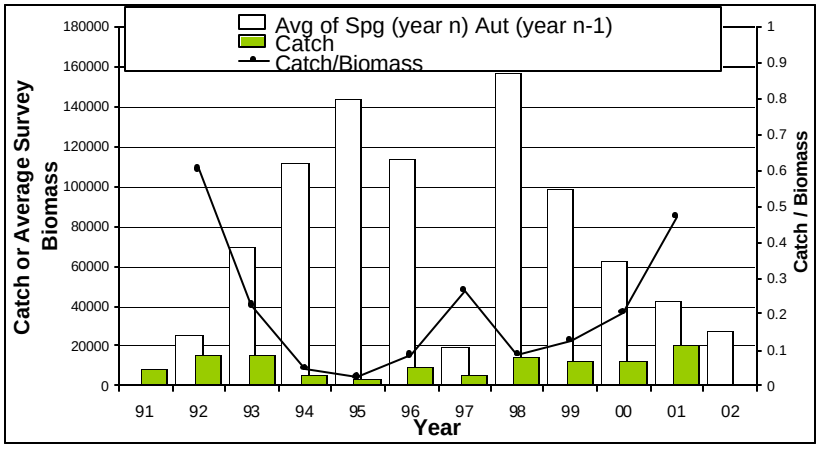

Fig. 7. Catch/Biomass ratios for Div. 3O. Average survey biomass between Spring (n) and Autumn (n-1) was taken as pre-fishery biomass for year (n) in which catch was taken.

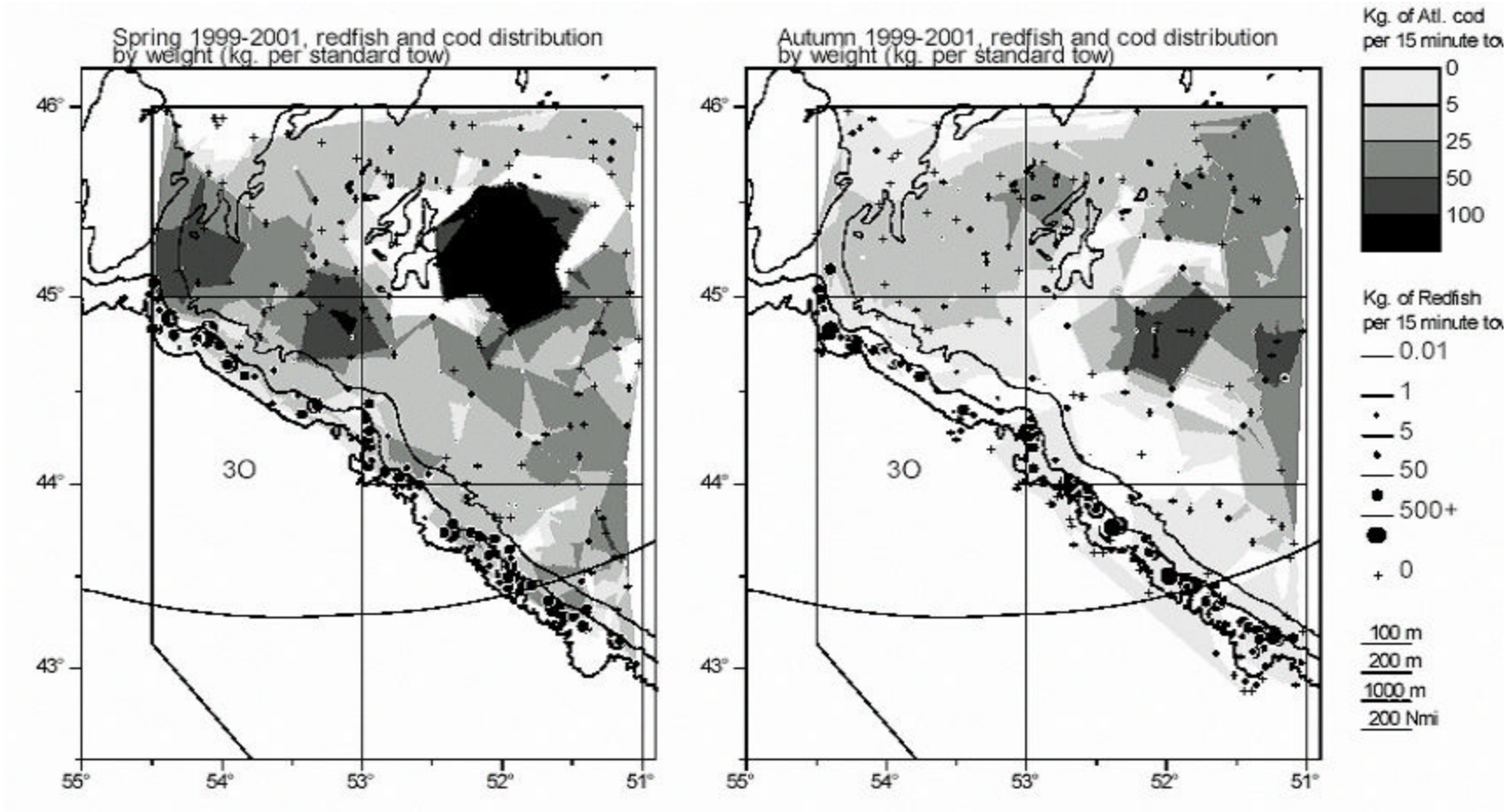

Fig. 8. Distribution of redfish catch (filled circles) in relation to catch of Atlantic cod (contours of kg per standard tow) for Div. 3O aggregated from 1999-2001.

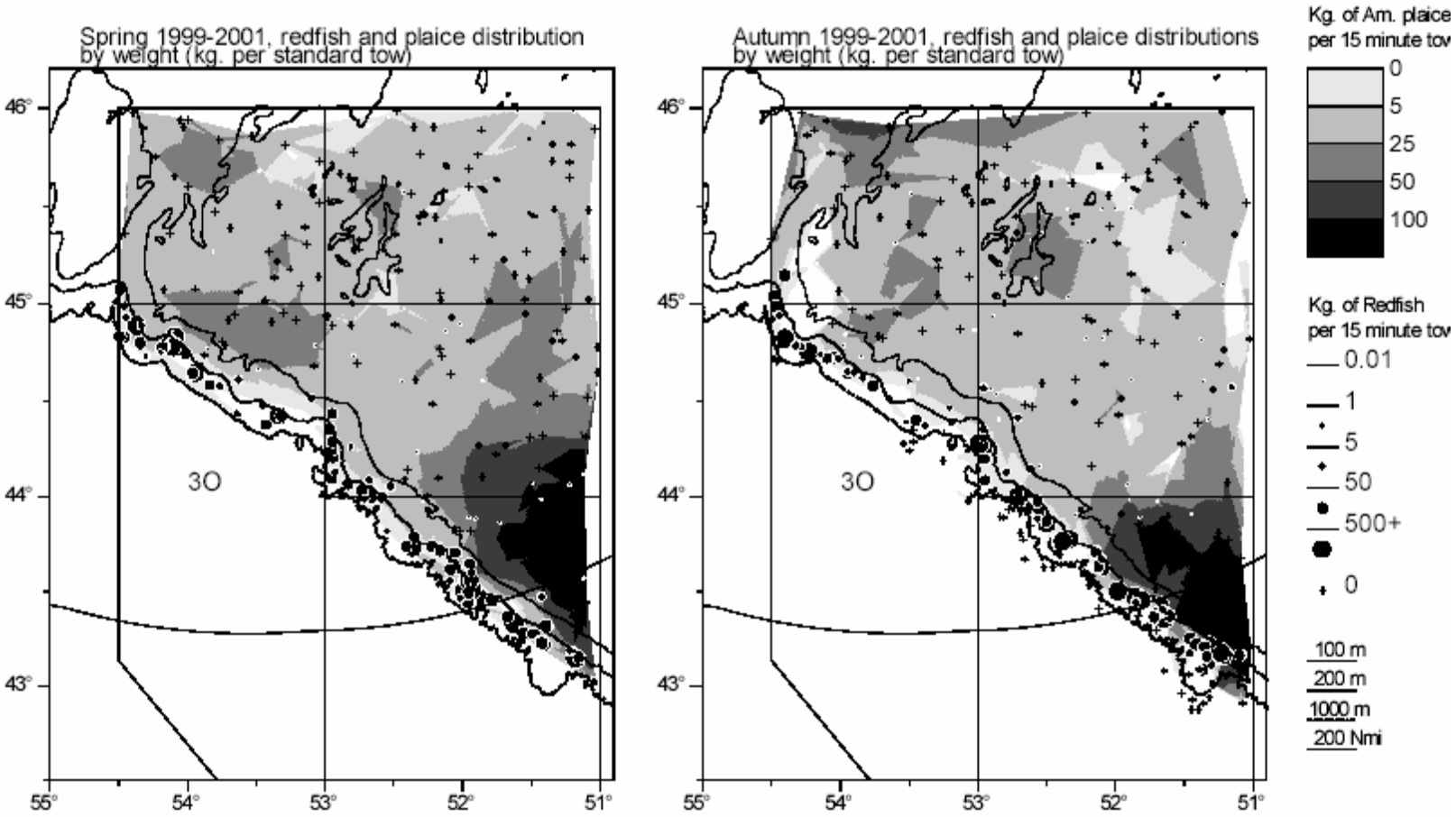

Fig. 9. Distribution of redfish catch (filled circles) in relation to catch of American plaice (contours of kg per standard tow) for Div. 3O aggregated from 1999-2001.

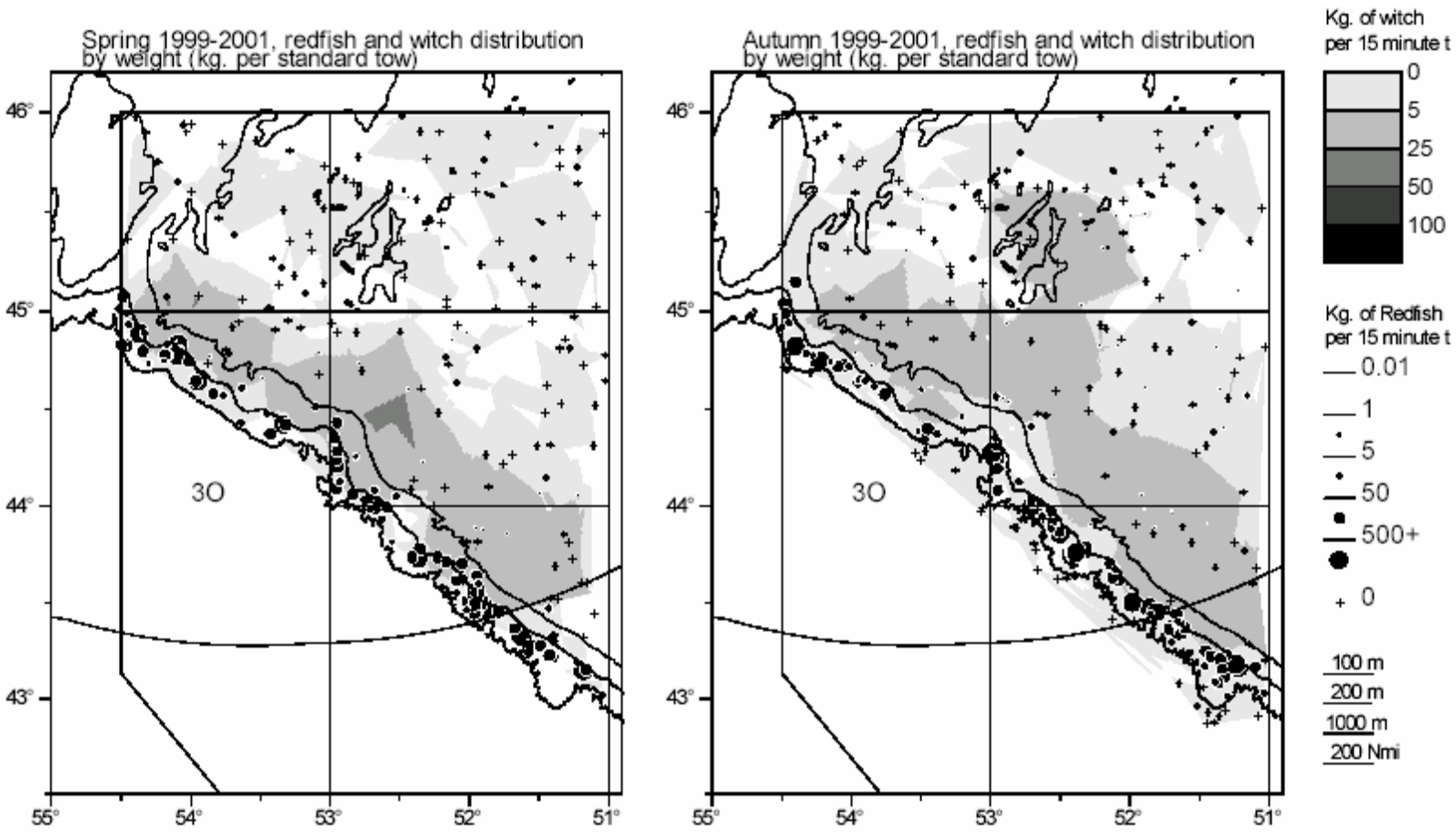

Fig. 10. Distribution of redfish catch (filled circles) in relation to catch of witch flounder (contours of kg per standard tow) for Div. 3O aggregated from 1999-2001.

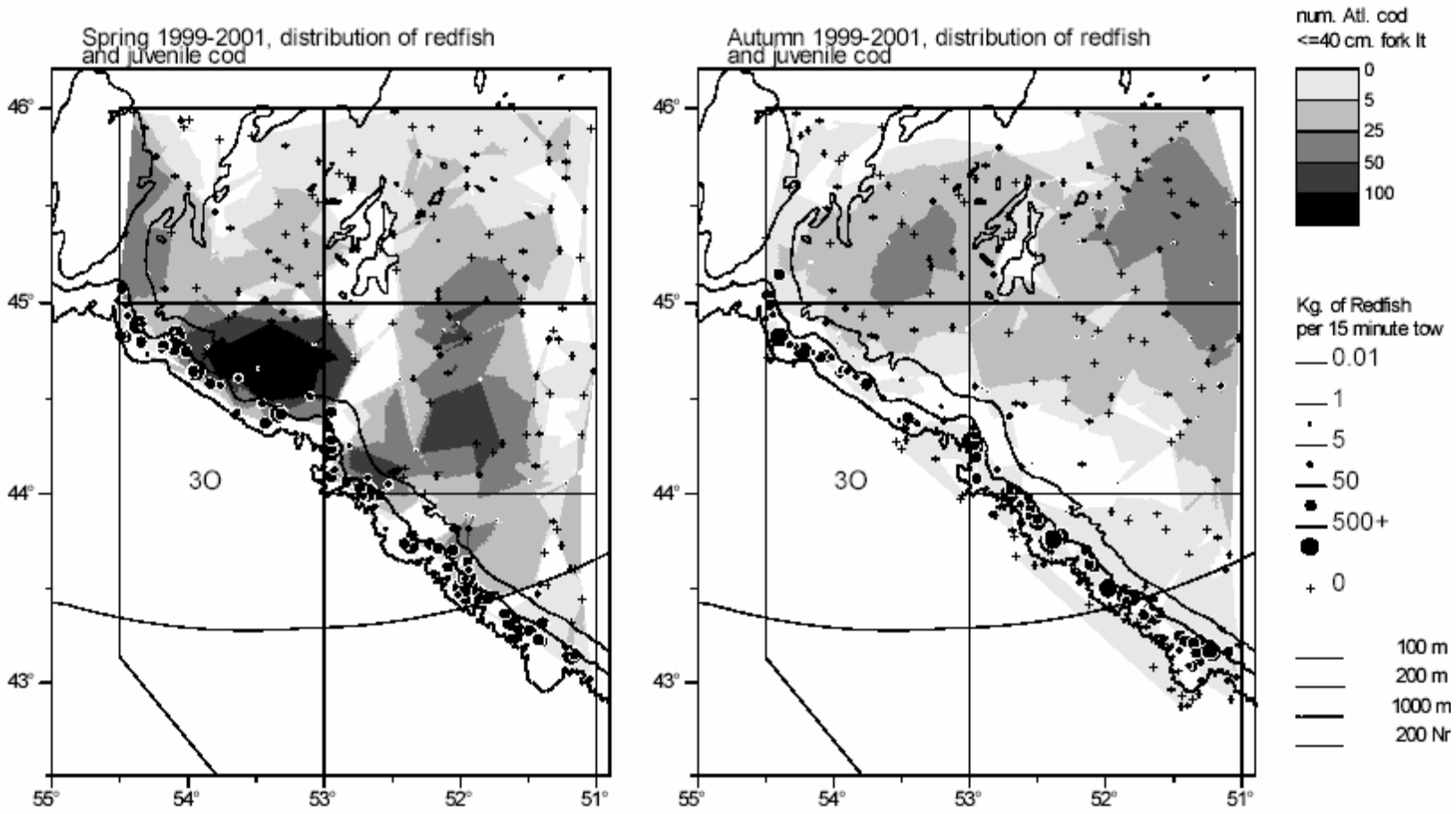

Fig. 11. Distribution of redfish catch (filled circles) in relation to catch of juvenile Atlantic cod (contours of numbers <=40 cm caught) for Div. 3O aggregated from 1999-2001.

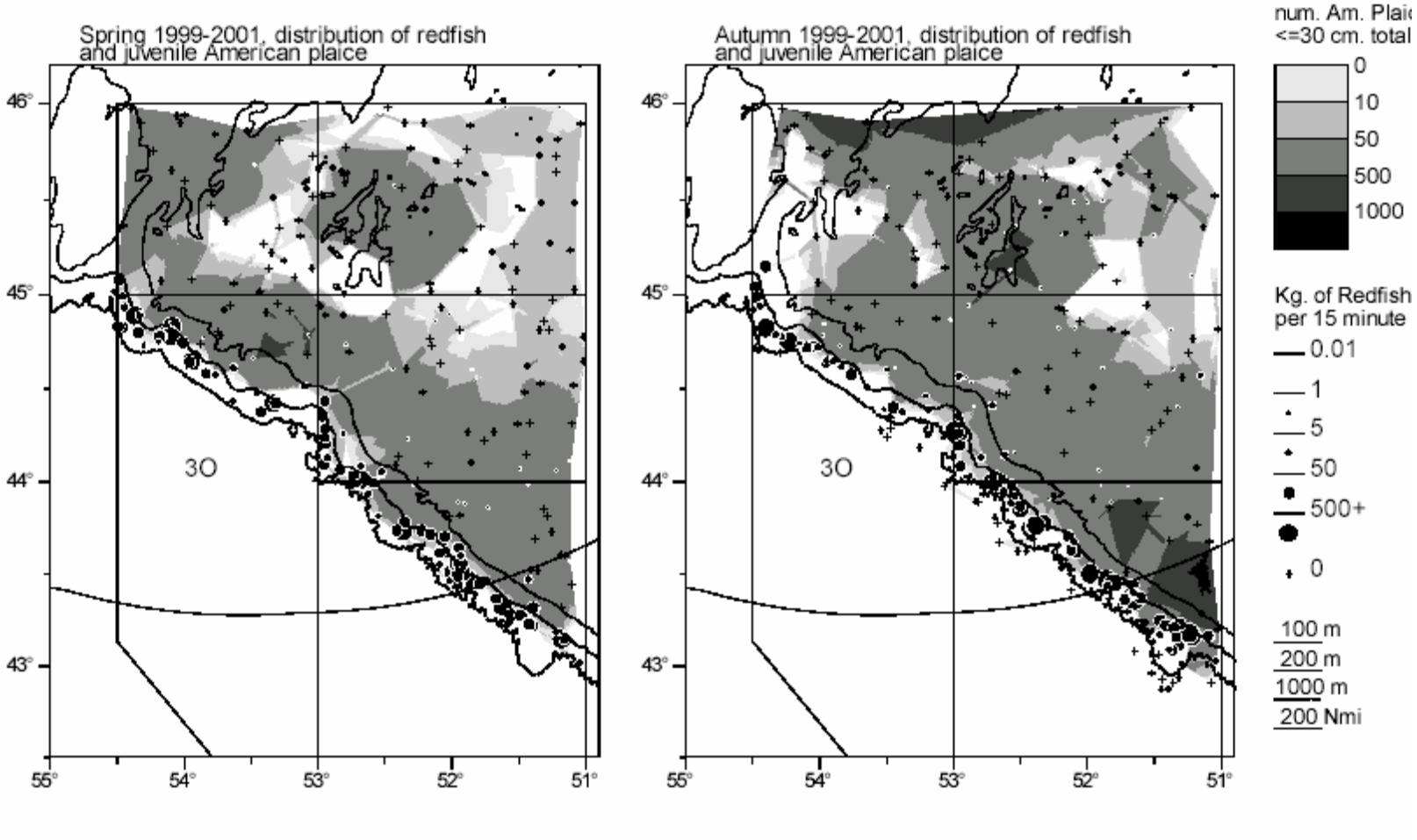

Fig. 12. Distribution of redfish catch (filled circles) in relation to catch of juvenile American plaice (contours of numbers <=30 cm caught) for Div. 3O aggregated from 1999-2001.

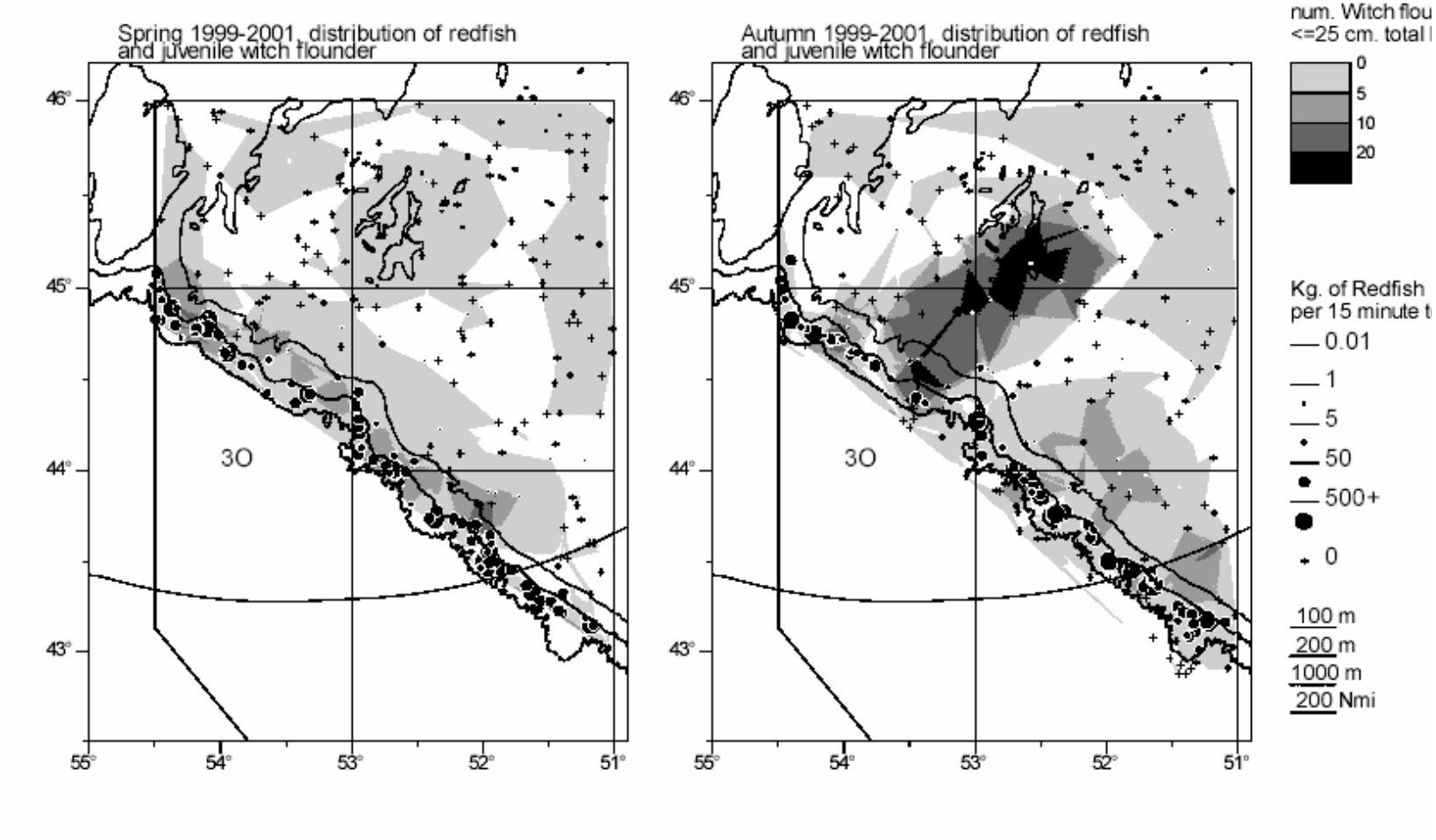

Fig. 13. Distribution of redfish catch (filled circles) in relation to catch of juvenile witch flounder (contours of numbers <=25 cm caught) for Div. 3O aggregated from 1999-2001.

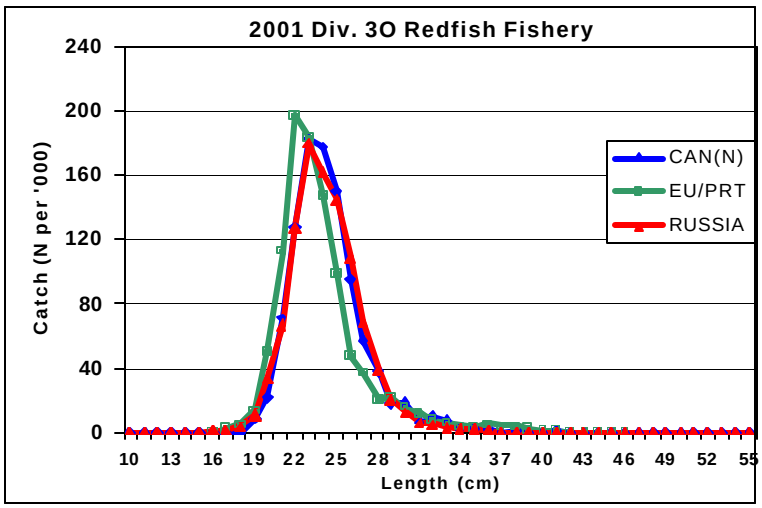

Fig 14. Size distribution of the commercial catch of Can(N), EU/Portugal and Russia for 2001.