Northwest Atlantic Fisheries Organization

Serial No. N5009 **NAFO SCR Doc. 04/56**

SCIENTIFIC COUNCIL MEETING – JUNE 2004

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

by

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Abstract

This paper contains information to address a request by Canada to the NAFO Scientific Council with respect to the redfish stock in Division 3O. Responses were requested for two items regarding the impact of certain catch levels and two items regarding recruitment.

Introduction

Four questions were posed by Canada to the NAFO Scientific Council at its June 2004 meeting with respect to redfish in Division 3O (see Provisional Agenda to the June 2004 Scientific Council in (Anon 2004)). Responses were requested for two items regarding the impact of certain catch levels and two items regarding recruitment. This paper contains information from commercial fisheries and research surveys to prepare responses to these requests.

Catch History

Nominal catches have ranged between 3,000 tons and 35,000 tons since 1960 (Table 1, Fig. 1). Up to 1986 catches averaged 13,000 tons, increased to 27,000 tons in 1987 with a further increase to 35,000 tons in 1988, exceeding TACs (set within the Canadian 200-mile limit) by 7,000 tons and 21,000 tons respectively. Catches declined to 13,000 tons in 1989, increased gradually to about 16,000 tons in 1993 and declined further to about 3,000 tons in 1995, partly due to reductions in foreign allocations within the Canadian zone since 1993. Catches increased to 14,000 tons by 1998 and declined to 10,000 tons by 2000. Catch increased dramatically to 20,000 in 2001 then declined to 17,000 tons in 2002. The catch for 2003 is estimated to be within the range of 16 100 tons and 18 400 tons.

Catch Sampling

Catch sampling was available from observer sampling of the Russian fleet from 1999-2003 (Fig. 2) (Vaskov 2004), the Spanish fleet for 2003 (Fig. 3 left panel) (González et al, MS 2004) and the Portuguese fleet for 2003 (Fig. 3 right panel) (Vargas et al, MS 2004). The predominant size group from the Russian and Portuguese 2003 fisheries was between 21-26cm. Spanish fisheries were comprised of a smaller overall size range, dominated by fish between 18-22 cm.

Relative Recruitment Based On Research Surveys

Stratified-random Canadian bottom trawl surveys have been conducted in Div. 3O in spring since 1973 and in autumn since 1990. In the spring surveys, coverage was to 367 m from 1973 to 1990 and to 732 m from 1991 onwards. In the autumn surveys, coverage was to 550 m in 1990 and to 732 m from 1991 onwards. The vessels and survey gear utilized

were as follows: *A. T. Cameron* from 1973 to 1982 with a Yankee 41-5 otter trawl (1.75 n. mi. standard tow), *Wilfred Templeman* from 1984 to spring 1995 with an Engel 145 otter trawl (1.75 n. mi. standard tow) and *Wilfred Templeman* from autumn 1995 onwards using a Campelen 1800 shrimp trawl (0.75 n. mi. standard tow). All Engel 145 surveys from 1991 to spring 1995, essentially the surveys to 732 m, 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 1998). Although there were comparative fishing trials between the Engel 145 and the Yankee 41-5, there was insufficient redfish data to enable a conversion into Engel 145 units. Only the spring series were considered for determining relative year-class strengths as it is the longest between the seasonal series.

Stratified-random Russian surveys were conducted in Div. 3O from 1983 to 1993 in the spring-summer period covering depths to 730m. Details of the gear and vessel used and number of sets were most recently provided by Vaskov (2003).

Stratified mean number per tow at length from the Canadian survey series were scaled to the highest observed value over the series to examine relative year-class strength. Length composition from the Russian survey series was available as within year percent frequency distributions. Mean length at age (Fig. 4) was estimated from the pooled Canadian survey data to provide a means of identifying the year-class from the length distributions. Based on the mean length at age and the sizes caught in the current fisheries, it would take between about six years before recruitment first enters the fishery and about eight years to become fully recruited to the fishery.

Survey estimates demonstrate very high variability and sometimes exhibit large fluctuations from year to year (Fig. 5). However, information from the Canadian Survey series from 1973-2003 suggest above average year-classes occurred in 1973, 1978, 1980, 1985 and 1988 (Fig. 6-7). These correspond very well with above average year-classes (1978-1979, 1984 and 1988) as estimated from the Russian survey series from 1983-1993 (Fig. 8). There is no indication of any above average recruitment from the Canadian surveys since the 1988 year-class. It is difficult to determine exactly what the Canadian surveys are monitoring. Length sampling from the commercial fisheries in the mid-1990s reveals a higher proportion of fish greater than 25 cm compared to the size distribution of the survey catches (Power 2003). Therefore, it appears that fish sizes outside this range, especially fish greater than 25 cm, are generally unavailable to the Canadian survey gear in this area. The reasons for this are unknown but may be related to availability or distribution relative to trawlable bottom.

Determining impacts of various catch levels

An analytical population model has not been developed to estimate the absolute sizes of year-classes in the commercial fishery due to a variety of reasons including sampling deficiencies and a lack of aged commercial samples. A non-equilibrium general production model (ASPIC, see Prager 1994 and 2000) was attempted on this resource but the diagnostics from the model suggest the results were not consistent with a long lived species like redfish (ANON, 2003). Therefore, there is a lack of information to determine the impact of removals on the stock and establishment of reference levels of sustainable yield potential of this stock.

A relative fishing mortality index (proxy) derived from the ratio of catch (in year n) to biomass averaged between the Canadian autumn (in year n-1) and spring (in year n) surveys suggests that fishing mortality has increased five fold between 1998 and 2001 and has remained at or above this value to 2003 (Fig. 9). CPUE data from Russian scientific observers onboard commercial trawlers targeting redfish suggest a relative stable catch rate (tons/hour) during 2000-2003 (Vaskov, 2004). Catches increased from about 14 000 tons in 1998 to about 20 000 tons in 2001 then decreased to between 16 000 tons to 18 000 tons in 2002 and 2003. Over the 44 year period from 1960-2003, catches only exceeded 20,000 tons in 1987, 1988 and 2001.

The most recent above average year-class (1988) is estimated to be larger than 30cm in 2003 assuming that these fish have experienced the normal growth pattern for redfish in this area. The bulk of the 2003 catch was from year-classes younger than the 1988 year-class. These year-classes are average to weak based on the results from surveys. The 1988 year-class was reduced to very low levels since it began to be exploited by the fishery in the mid-1990s, as indicated by low representation in catch sampling of recent catches. It was also noted that historically there were cycles of increases followed by decreases and that these correspond reasonably well with entry into the fishery of what is considered to be above average year-classes based on results from survey data.

Although there are difficulties with the interpretation of the indices from this stock, it is apparent that existing fisheries are now harvesting year-classes considered to be average to weak as compared to the 1988 year-class. Catches have declined from about 20 000 tons in 2001 to about 16 000 tons to 18 000 tons over the past two years, and are primarily taken in the NRA which currently has no catch restriction.

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Table 1. Nominal catches (t) and TACs (within the Canadian 200 mile limit) of redfish in Div. 3O.

Year	Canada	Others	Total [a]	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	7,133	7,340	20,000
1984	167	9,861	16,978	20,000
1985	104	8,106	12,860	20,000
1986	141	10,314	11,055	20,000
1987	183	12,837	27,170	20,000
1988	181	11,111	34,792	14,000
1989	27	11,029	13,256	14,000
1990	155	8,887	14,242	14,000
1991	28	7,533	8,461	14,000
1992	1,219	12,149	15,268	14,000
1993	698	12,522	15,720	14,000
1994	1,624	3,004	5,428	10,000
1995	177	2,637	3,214	10,000
1996	7,255	2,390	9,845	10,000
1997	2,554	2,558	5,112	10,000
1998	8,972	4,380	14,052	10,000
1999	2,344	10,249	12,593	10,200
2000	2,206	10,584	10,003	10,000
2001	4,893	17,203	20,307	10,000
2002	3,000	16,452	17,234	10,000
2003	3,111	12,401	16,073-18,419	10,000

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

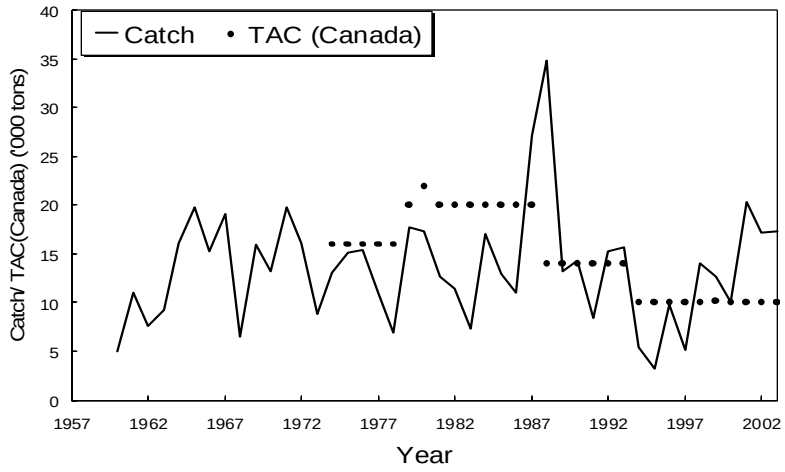

Fig. 1. Catch and Canadian TACs for redfish in Div. 3O.

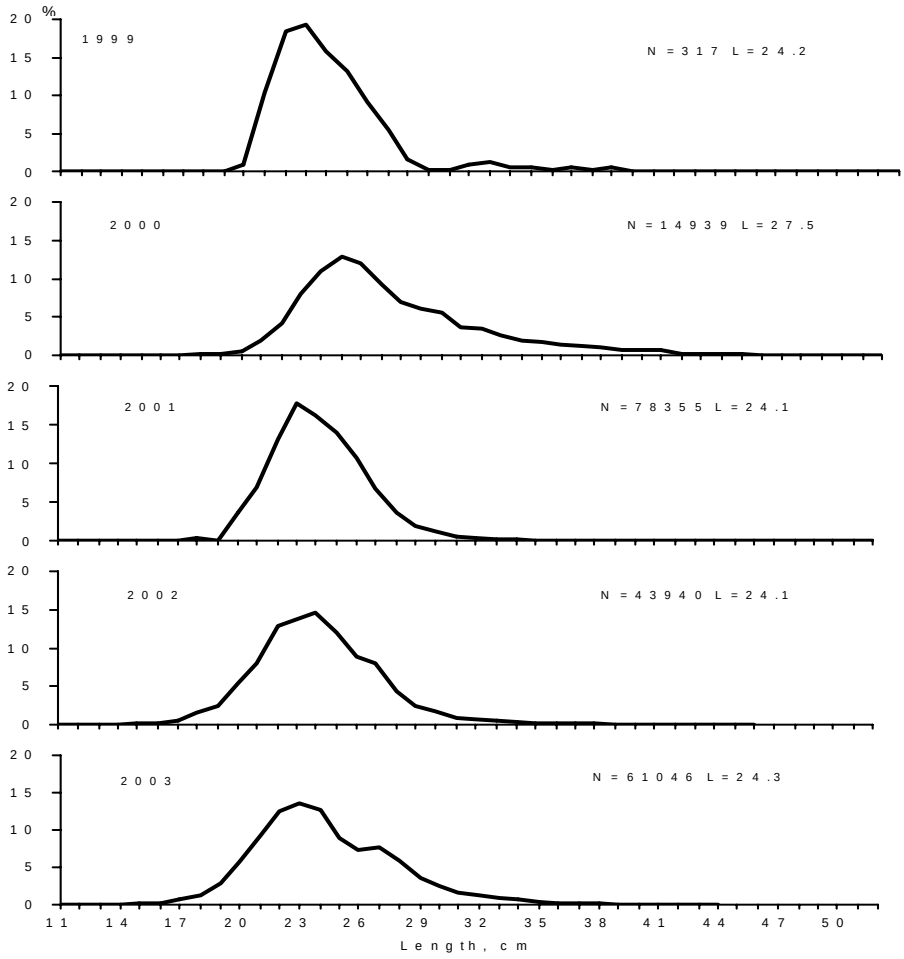

Fig. 2. Length frequencies (percent at length) from Russian observers collected in Div. 3O.

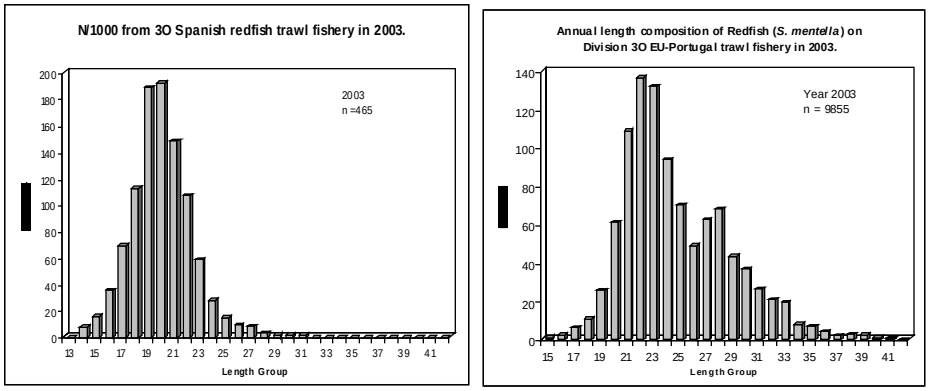

Fig. 3. Redfish length distributions sampled by observers from EU-Spain (left panel) and EU-Portugal catches (right panel) in 2003 fisheries.

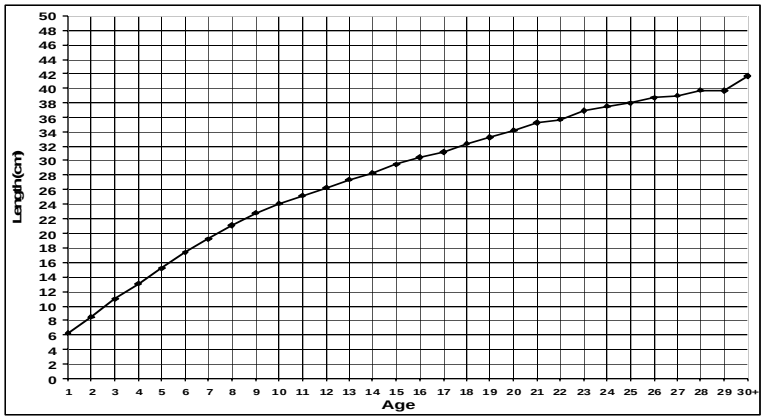

Fig. 4. Mean length at age for redfish in Div. 3O based on Canadian survey data pooled from 1973-2000.

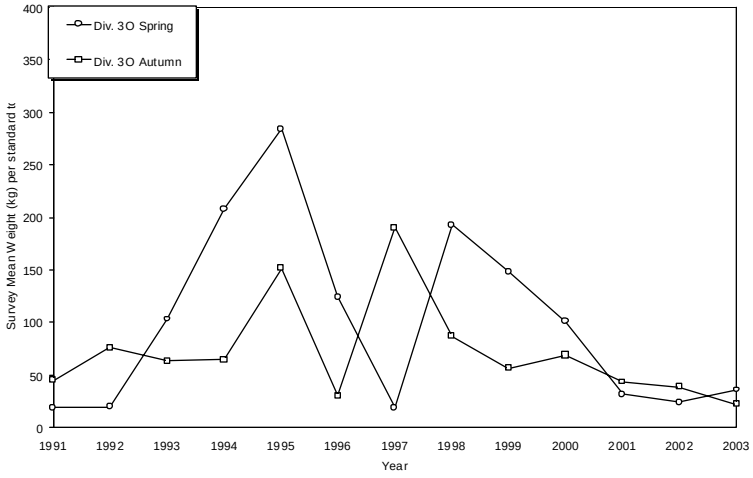

Fig. 5. CanadianSurvey biomass indices from 1991-2003 in Div. 3O in Campelen equivalent units for surveys prior to autumn 1995. Each series cover strata to the 732 m.

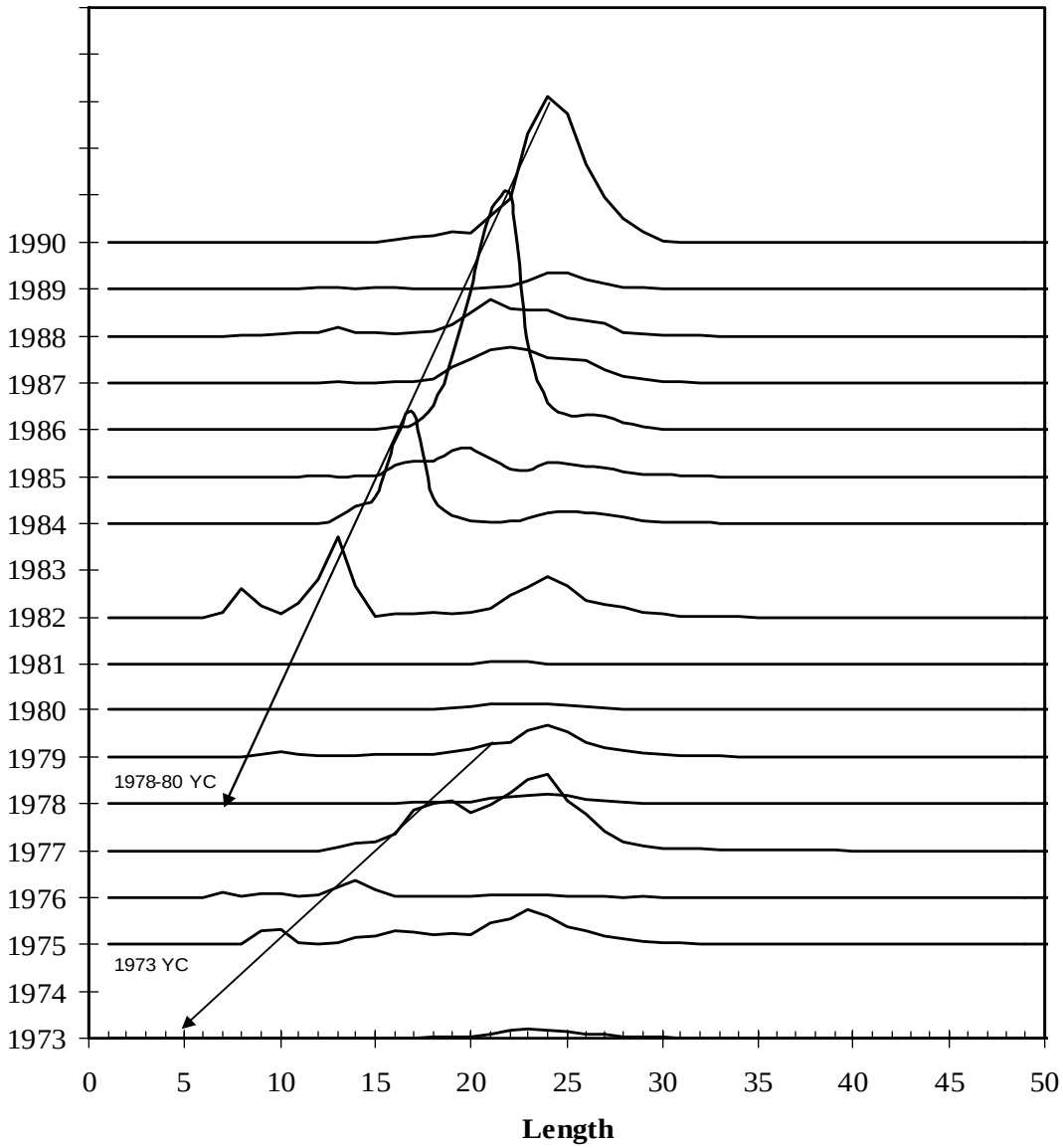

Fig. 6. Length frequency distribution from Canadian Spring RV surveys in Div. 3O from 1973-1990 for STRATA LESS THAN 200 FATHOMS. Units represent estimates of stratified mean per tow per length scaled to the highest value estimated in the series.

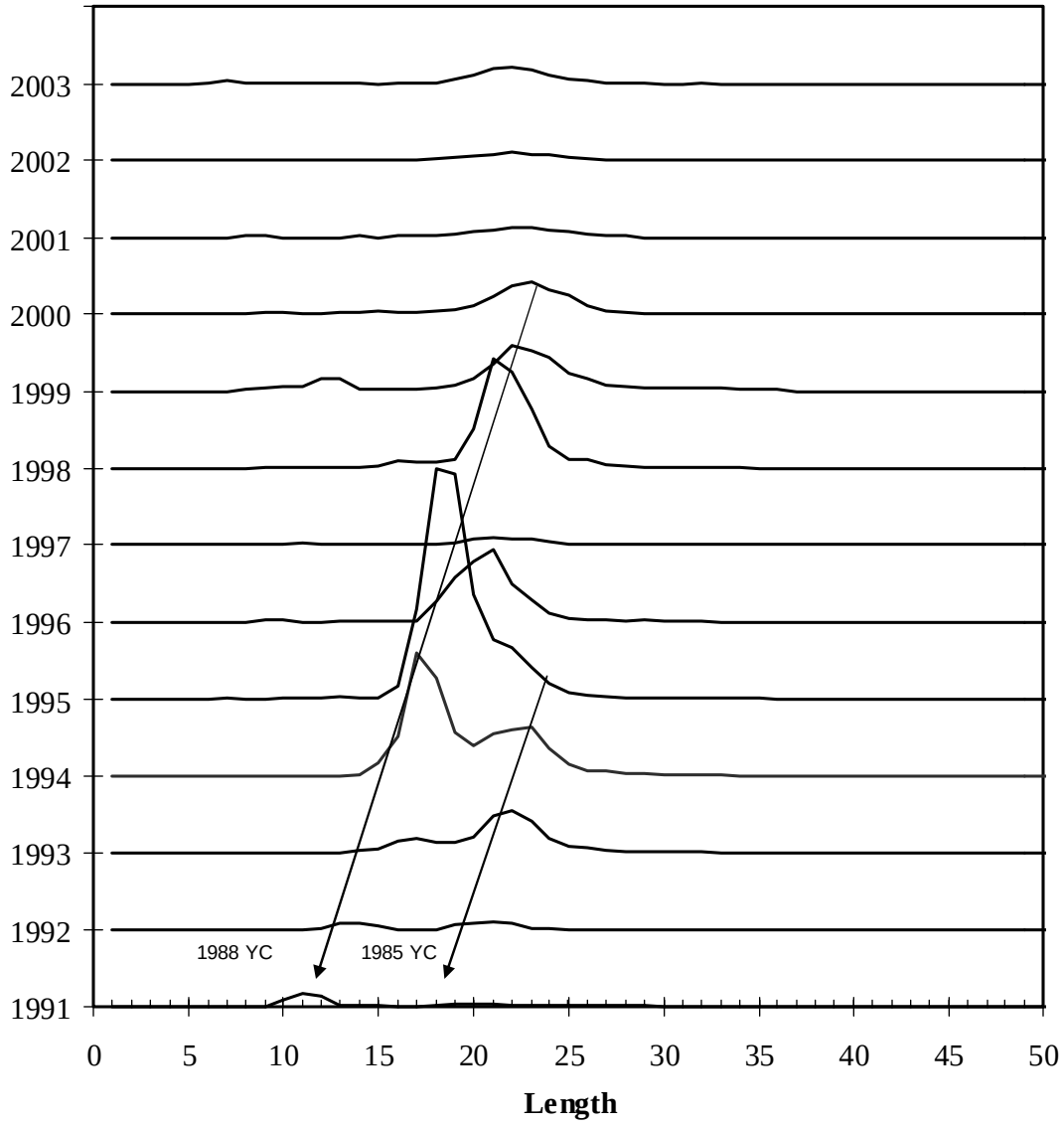

Fig. 7. Length frequency distribution from Canadian Spring RV surveys in Div. 3O from 1973-1990 for STRATA TO 732 METERS. Units represent estimates of stratified mean per tow per length scaled to the highest value estimated in the series.

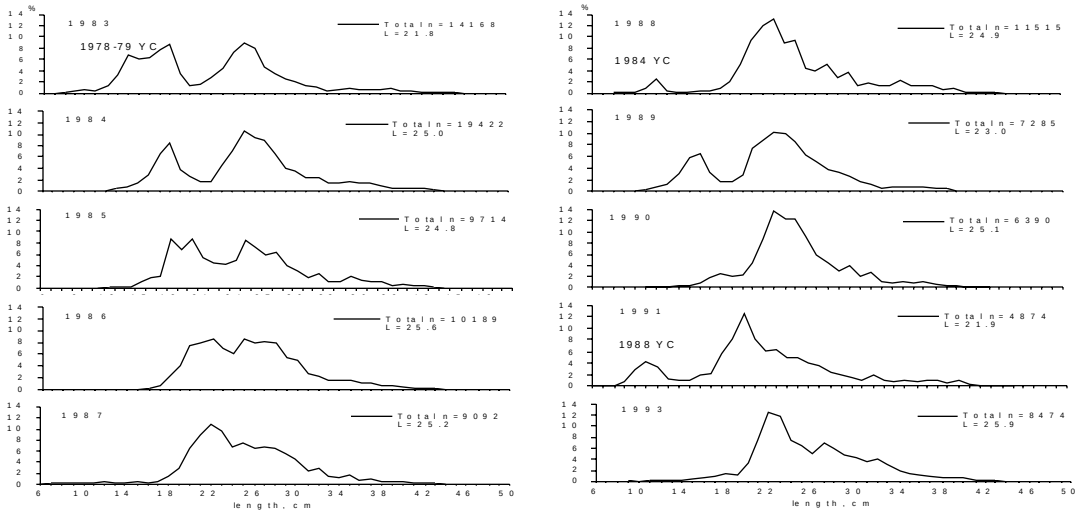

Fig. 8. Length frequency distribution from Russian Spring-Summer RV surveys in Div. 3O from 1983-1991 for STRATA TO 400 FATHOMS. Plotted are percent at length within each year.

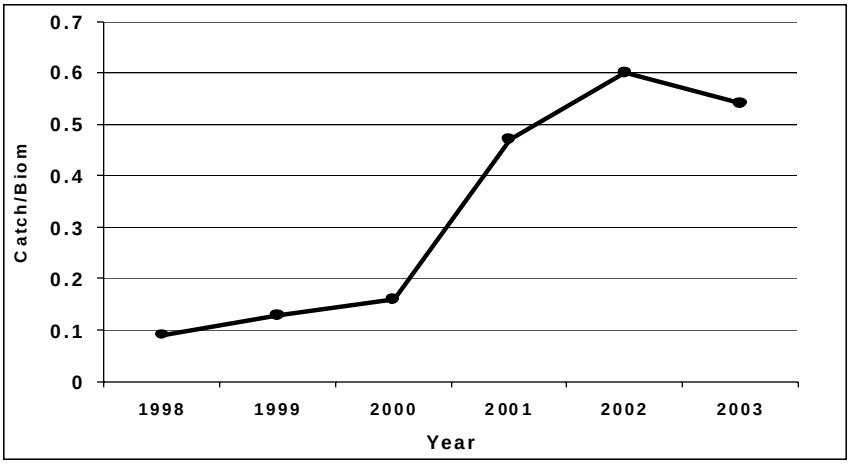

Fig. 9. Catch/biomass ratios as a relative index of fishing mortality (proxy) from 1998-2003 (see text).