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Northern (2J+3KL) Cod Stock Status Update

by

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Abstract

The annual full regional stock assessment of the Northern (NAFO Divs. 2J+3KL) Cod stock was not conducted in 2002. Alternatively, a stock status update was completed. A stock update has been defined to be the updating of the basic catch, tagging, and abundance index data, but not carrying out quantitative analysis of these data. Continued decline in the sentinel catch rate and the commercial catch rate, together with the concentration of commercial and recreational fishing effort in a small portion of the stock area is of considerable concern. Total exploitation rates calculated from tagging experiments in the stock area are variable, and while some are low, there is concern that a number of experiments resulted in exploitation rates that were calculated to be greater than 10% with one as high as 30% in 2001. The new information considered in this update substantially increases the concerns noted in the 2001 assessment regarding the sustainability of current levels of fishing.

Introduction

The Northern (2J+3KL, figure 1) stock has supported a commercial fishery since the 16th century. For the century prior to 1960 the catches were generally less than 300,000 t. With high catches in the late 1960s, mainly by non-Canadian fleets, the stock declined until the mid-1970s. After the extension of jurisdiction in 1977, the stock increased until the mid 1980s but then collapsed in late 1980s and early 1990s. A moratorium on commercial fishing was declared in July 1992. A TAC was reintroduced in 1998, but restricted to the inshore and to vessels less than 65 feet in length. Historically many northern cod migrated from overwintering areas offshore to feeding areas inshore. From the 1960s until the moratorium, the fishery was prosecuted with large trawlers in the offshore, mainly in the winter and spring, and a fleet of smaller vessels in the inshore that deployed traps, gillnets and hook and line from late spring to autumn. There have always been some fish that have overwintered inshore. Following the collapse, a substantial portion of the remaining fish in the stock area appear to be inshore throughout the year. Cod from this stock grow more slowly than those in warmer areas. An age 5 cod is presently about 50 cm (about 20 inches) long. Females mature at about age 5. Cod in 2J3KL (Figure 1) feed on a wide variety of food items. Capelin has historically been the major prey of adults.

The information in this update is based upon the Canadian 2002 Stock Status report (DFO, 2002) for this stock.

The Fishery

The catch history for northern cod is given in Figure 2. A moratorium on directed commercial fishing was imposed in July 1992. A joint DFO-industry sentinel survey commenced in 1995. Reported catches in 1993-1997 came from

by-catch, sentinel surveys (1995-1997) and rough estimates of catches during recreational/food fisheries (1994, 1996).

In 1998 sentinel and recreational/food fisheries took place and a TAC was reintroduced at a level of 4,000 t for commercial vessels under 65 feet in the inshore. In 1999 the TAC was increased to 9,000 t, including 300 t for sentinel and 100 t for by-catch. In addition, a food/recreational fishery was allowed.

In 2000/2001 a new fishing season was put in place (1 April to 31 March) and a TAC of 7,000 t was set which included the sentinel survey. A food/recreational fishery was permitted in addition to the TAC.

A 5,600 t TAC was put in place for 2001/2002 with the intention that it be retained for a 3-year period. The TAC included projected sentinel survey catches, but not catches from the recreational fishery.

In 2001 the recreational fishery was regulated by license and individuals were limited to 30 fish controlled by possession of tags. License holders were required to complete and return catch logs.

Reported landings in 2001/2002 were 4,795 t from the commercial fishery (including by-catch), 118 t from the sentinel survey and 1,975 t from the recreational fishery, giving a total of 6,887 t. It is known that in recent years there have been removals in excess of reported landings, the magnitude of which is unknown. Dock-side monitoring was reported to be particularly problematic in some areas in the 2001/2002 fishery.

By-catches of 2J3KL cod occur in ongoing Canadian and non-Canadian fisheries, but accurate estimates are not available and it is not known what impact by-catches may be having on the recovery of the stock.

No sampling of the recreational catch was carried out. Sampling of the commercial catch was insufficient in some cases and had to be augmented by sentinel survey data. The total catch at age was comprised mostly of 4, 5 and 6 year olds. The 1992 year class is still present as 9 year olds. Few fish older than age 11 were caught. Ages 6 to 9 predominated in the gillnet landings and ages 4 and 5 in the linetrawl and handline landings.

The distribution of commercial and recreational fishery catches by unit area (see Figure 3) is shown for 2001 in Figure 4. The highest catches in both fisheries occurred in 3La and 3Lb (Bonavista Bay and Trinity Bay). Commercial catch from 3Ki (from Cape Freels to central Notre Dame Bay) was also relatively high. Recreational catches were higher than commercial catches from White Bay (3Kd) north.

Resource Status

The biomass index values from the autumn research bottom-trawl surveys in 2J3KL (which excludes the new inshore strata) have been very low for the last 10 years with the 2001 survey at about 2% of the average in the 1980s (Figure 5). Survey biomass doubled from 1998 to 1999 and has since remained more or less constant at a level that is less than 20% of that which was measured in the year in which the moratorium was declared. Slightly elevated presence of fish has been noted since 1999 in the offshore near the 3K/3L boundary, particularly in the Tobin's Point area. In the 2001 autumn survey, fish in this area were mainly age 2 and 3. Extension of the survey into the inshore since 1996 (with the exception of 1999) has resulted in some moderate catches in some years, particularly in the Trinity Bay to Bonavista Bay area. The biomass index in the spring survey in 3L in 2001 is very low, less than 1% of the average in the 1980s (Figure 6).

Age specific mortality estimates were calculated for the autumn 2J3KL bottom-trawl survey – for illustration the estimates for ages 4-6 are given in Figure 7. Total mortality rates of fish in the offshore are estimated to be as high as levels in the 1980s when substantial commercial fisheries existed. A total mortality estimate of 1.5 corresponds to 22% survival of a cohort in one year.

Acoustic studies have been conducted in Smith Sound in western Trinity Bay (3L) at various times since spring 1995. Surveys in January provided average indices of biomass of about 15,000 t in 1999, 22,000 t in 2000, 31,000 t in 2001

and 25,000 t in 2002. Age 5 fish dominated the samples in 2002, but the distribution included fish up to age 13.

Acoustic studies were also conducted in Hawke Channel in 2J and on Tobin's Point (close to the 3K/3L line) in recent years. Acoustic densities in the Tobin's Point area in January 2002 were reported to be higher than observations in previous years.

The sentinel surveys in 2J3KL were initiated in 1995 to provide catch rates and biological samples of cod in inshore waters. Catch rates have been relatively low since the start of the survey in 2J and in 3K north of White Bay. However, fish have existed in sufficient density to enable moderate to high catch rates in some times and places from White Bay to the southern boundary of the stock.

Annual median sentinel catch rate values by unit area for gillnets (Figure 7) show that 2001 values are similar to those for 1995, the first year of the survey, and are generally lower than all other years throughout the stock area. With the exception of 3Lq (St. Mary's Bay), where the fish are thought to be predominantly from 3Ps, values were highest in Trinity Bay (3Lb) and Bonavista Bay (3La) and low to the north and south. There are less data for linetrawls and the pattern is not as clear. Values for 2001 are, however, the lowest in the time series for Trinity Bay and Bonavista Bay.

Commercial catch rates were calculated from catch and effort data recorded in logbooks maintained by commercial fishermen following reintroduction of a TAC in 1998. The overall spatial pattern for the predominant gear, gillnets, has been similar among years (Figure 8).

With the exception of statistical areas 13 and 14 (Cape Bonavista area) the medians in 2001 are at or near the lowest observed in the four years. There is further evidence of the trend noted in the 2001 assessment for the remaining fish to be concentrated in a decreasing portion of the stock area. Areas 15 and 16 (western Trinity Bay) are much lower than previous years. Catch rates in the southern portion of the stock area (areas 23 to 28) are much reduced in recent years with the exception of area 28 (St. Mary's Bay) which reflects a decreased presence of 3Ps fish migrating seasonally into southern 3L. There are less data for linetrawls. The overall pattern is similar to that shown by the gillnet data but there is more variability.

Tagging studies have been intensified in recent years and a total of 18,200 cod have been tagged in 2J3KL between 1999 and 2001 spread across 72 separate experiments with a median of 157 fish per experiment. There have been a total of 2,391 recaptures up to the end of 2001.

Accounting for reporting rate, tag loss, tagging mortality and natural mortality allows total exploitation rates to be calculated by experiment from all recaptures (including those from outside the stock area).

Total exploitation rates calculated from tagging experiments in the stock area are variable, and while some are low, there is concern that a number of experiments resulted in exploitation rates that were calculated to be greater than 10%. Several of the experiments with high exploitation rates were in Bonavista Bay and Trinity Bay. One large experiment in Bonavista Bay in 2001 gave a very high exploitation rate of 30%.

Mean exploitation rates (Table 2), weighted by experiment size, were calculated by unit area (see Figure 3) for the three years. Values ranged from 4% to 56%. The latter value is based on a single experiment comprising only 21 fish. In 2001 exploitation rate was highest among cod tagged in 3La (Bonavista Bay) and among cod tagged in 3Lj/3Lq (southern shore, St. Mary's Bay). A large proportion of the 3Lj/3Lq recaptures came from Placentia Bay in 3Ps.

Exploitation rates for 3Ki in 2000 and 2001 are based almost entirely on tagging prior to 2000. No cod concentrations sufficiently large for tagging could be located in 3Ki prior to the 2000 and 2001 fisheries.

Inshore surveys of young fish have been carried out using beach seines over the period 1992-97 and again in 2001. These surveys record the density of fish age 0-2. The inshore is thought to be the prime nursery area for northern cod. The numbers of age 0 fish in 2001 were among the lowest observed since the surveys began in 1992.

Outlook

This report provides an update of information that has become available since the last full assessment carried out in March 2001. The continued decline in the sentinel index and the commercial catch rate index during 2001, together with the concentration of commercial and recreational fishing effort in a small portion of the stock area, is of considerable concern. Total exploitation rates calculated from tagging experiments in the stock area are variable, and while some are low, there is concern that a number of experiments resulted in exploitation rates that were calculated to be greater than 10%, with one as high as 30%.

In the 2001 assessment, the status of this stock was assessed under two hypotheses regarding stock structure. The same approach is adopted in this update. Under the hypothesis of a single functional population, the 2001 assessment of this stock found that there was no evidence of a recovery and considered that any fishery on the remnant in the inshore would delay recovery. A tentative spawner biomass limit reference point of 200,000 t was suggested and it was noted that the stock was well below this limit. It was pointed out that an approach of no directed fishing was generally accepted as being consistent with a precautionary approach for a stock at this level. The new information considered in this update is consistent with the conclusions drawn under the single functional population hypothesis in the 2001 assessment.

Under the hypothesis that the inshore constitutes a subpopulation that is functionally separate from the offshore, the 2001 assessment of this stock concluded that it was unclear whether the spawning stock was being sustained by recent levels of recruitment, at the current levels of natural and fishing mortality, given the declining trends in some indices. The new information considered in this update substantially increases the concerns noted in the 2001 assessment regarding the sustainability of current levels of fishing. Given the increasing evidence that the current levels of fishing are not sustainable, a reduction in removals would be consistent with a precautionary approach.

For scientific monitoring purposes, no more than 200 t for a sentinel survey is required under current stock conditions.

References

DFO, 2002. Northern (2J+3KL) cod Stock Status Update. DFO Science Stock Status Report A2-01(2002).

Lilly, G.R., P.A. Shelton, J. Brattey, N.G. Cadigan, B.P. Healey, E.F. Murphy, and D.E. Stansbury. 2001. An assessment of the cod stock in NAFO Divisions 2J+3KL. DFO Can. Stock Assess. Sec. Res. Doc. 2001/044.

Table 1 - Landings (thousand metric tons).

Year	62-76 Avg.	77-91 Avg.	1996	1997	1998 ¹	1999 ¹	00/01 ¹	01/02 ¹
TAC	N/A	N/A	0	0	4	9	7	6
Can. Fixed	88	90	2	1	5	8	5	7
Can. Mobile	9	84	+	+	+	0	+	+
Others	405	38	0	0	0	+	+	+
Totals	502	212	2	1	5	8	5	7

¹ Provisional.

+ Catch less than 500 t.

Table 2 - Mean Exploitation Rates by unit area from 1999-2001.

Area tagged	Exploitation rate		
	1999	2000	2001
3Ki	0.36	0.08	0.04
3La	0.13	0.11	0.16
3Lb	0.06	0.09	0.08
3Lf	0.10	0.06	0.04
3Lj	0.56	0.05	0.16
3Lq	0.21	0.22	0.24

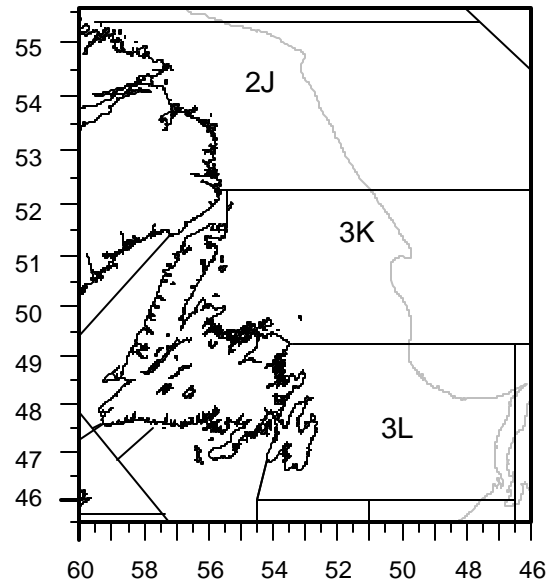


Figure 1 - 2J3KL NAFO Convention Area.

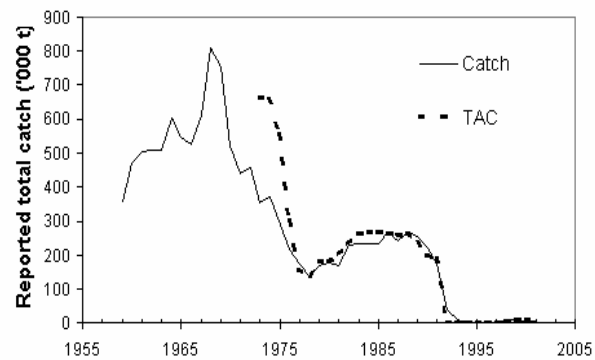


Figure 2 - Reported catch and TAC (thousands of tons).

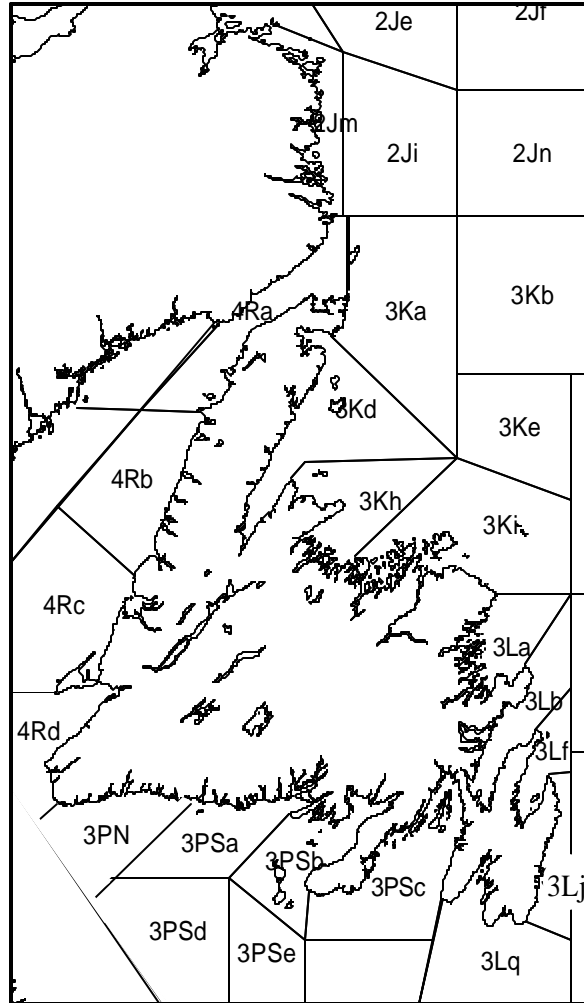


Figure 3 - Unit areas within the northern cod stock area used for summarizing catch data.

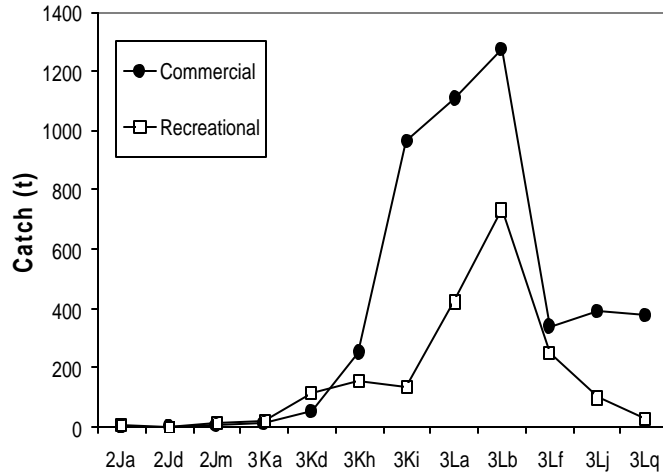


Figure 4 - Distribution of inshore commercial and recreational fishery catches by unit area in 2001.

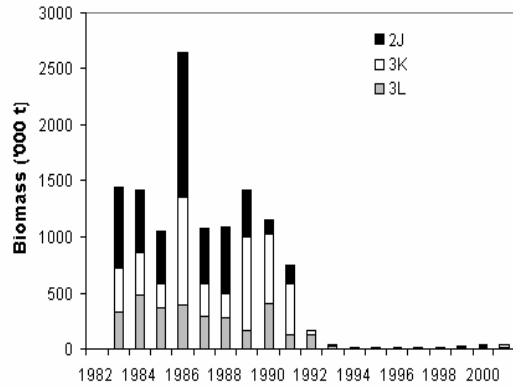


Figure 5 - Biomass index from autumn bottom-trawl surveys in 1983-2001.

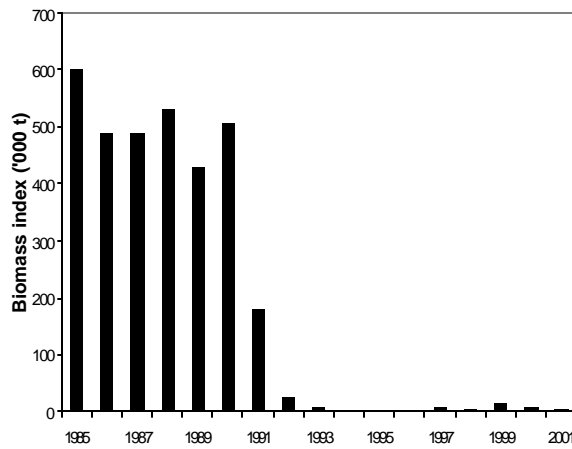


Figure 6 - Biomass index from spring bottom-trawl surveys in 3L during 1985-2001.

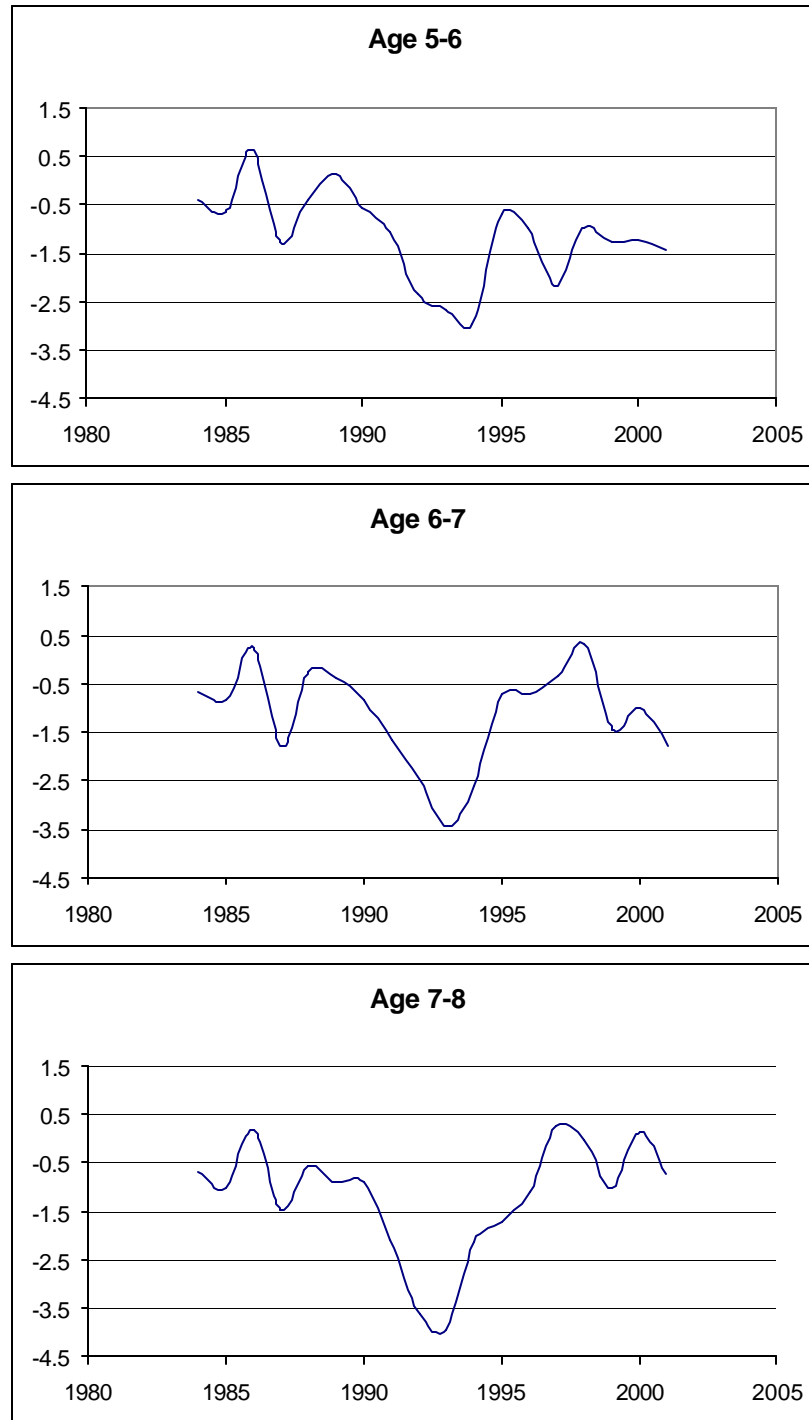


Figure 7 - Age Specific mortality estimates from Fall bottom-trawl survey. Panel title indicates estimate for age a in previous year to age $a+1$ in current year.

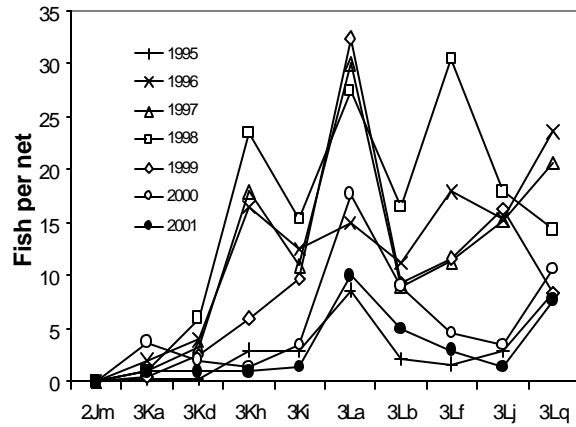


Figure 8. Median sentinel gillnet catch rates for 1995-2001 by unit area. Refer to SCR 01/33, figure 1.b. for definition of unit areas.

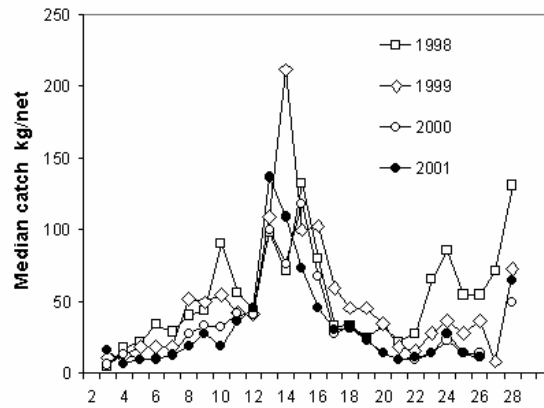


Figure 9. Median gillnet catch rates from the commercial fishery by statistical fishing area, for the years 1998-2001. Refer to SCR 01/33, fig 1.c. for definition of statistical fishing areas.