

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

Background

The biomass of the northern (2J+3KL) cod stock off southern Labrador and eastern Newfoundland was about 3 million t in the early 1960s. Fishing intensity increased greatly in the 1960s as non-Canadian fleets exploited the dense offshore overwintering aggregations. The stock declined to about 0.5 million t in the mid-1970s. After the extension of jurisdiction in 1977, the stock increased to just over 1 million t in the mid-1980s, but then collapsed to an extremely low level in the late 1980s and early 1990s. A moratorium on commercial fishing was declared in July 1992.

Historically, many cod migrated from overwintering areas offshore to feeding areas inshore, where they were exploited by the traditional inshore fishery. By the mid-1990s it was apparent that these offshore populations were barely detectable. At the same time, it was recognized that there were aggregations of cod in the inshore in Div. 3L and southern Div. 3K. These inshore populations appeared to be more productive during the 1990s than populations in the offshore. A small fishery directed at these inshore populations was reintroduced in 1998. Catch rates declined and the fishery was closed indefinitely in April 2003. A food/recreational fishery, which had been open in several recent years, was also closed.

An age 5 cod is presently about 50 cm (about 20 inches) long. Females mature at about age 5.

Capelin has historically been the major prey of adults. Harp seals are important predators.

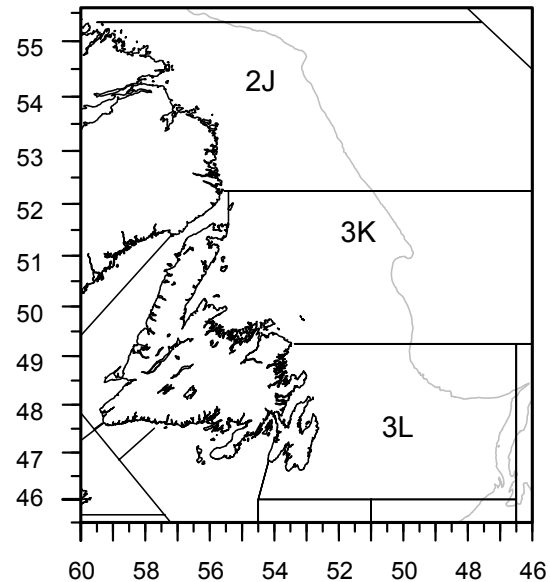


Figure 1: Map of the stock area of northern (2J+3KL) cod.

Summary

- The most recent full assessment of the status of the northern (2J+3KL) cod stock was conducted in February 2003. The present update provides information on commercial catches in 2003, the results of research bottom-trawl surveys, sentinel surveys and an acoustic survey, and the perspective of fish harvesters.
- The 2003 research bottom-trawl surveys during both autumn and spring indicate that the biomass of cod in the offshore remains extremely low (1% or less of the average during the 1980s.)
- Indices from inshore fixed-gear sentinel surveys increased from the start of the surveys in 1995 to a peak in 1997-1998, and then declined to below their 1995 levels. The indices were higher in 2003 than in 2002, but remained at or below the 1995 values.

- Hydroacoustic surveys in Smith Sound (Trinity Bay) during the winters of 1999-2004 provided average indices of biomass that peaked at 26,000 t in 2001 and then declined to 18,000 t in 2004.
- Catch rates in sentinel surveys and by-catches in fisheries directed at other species continue to illustrate that the summer-autumn distribution of cod in the inshore is mainly from White Bay in southwestern 3K to Cape St. Mary's at the southernmost limit of the stock. The highest catch rates in sentinel surveys occur mainly in southern Bonavista Bay and Trinity Bay in northern 3L and in St. Mary's Bay in southern 3L adjacent to 3Ps.
- There is evidence from the sentinel surveys and the observations of fish harvesters that recruitment has improved in the inshore in recent years.

The Fishery

Catches of northern cod increased during the 1960s to a peak of over 800,000 t in 1968, declined steadily to a low of 140,000 t in 1978, recovered to about 240,000 t through much of the 1980s, and then declined rapidly in the early 1990s in advance of a moratorium on directed fishing in 1992 (Fig. 2).

Catches during 1993-1997 came from by-catches, food/recreational fisheries, and DFO-industry sentinel surveys that started in 1995. A small index/commercial fishery limited to fixed gear deployed from small (<65 feet) vessels commenced in 1998. Catches from 1998 to 2002 came from directed cod fisheries, by-catches, sentinel surveys and food/recreational fisheries. The directed commercial and recreational fisheries were closed indefinitely in April 2003.

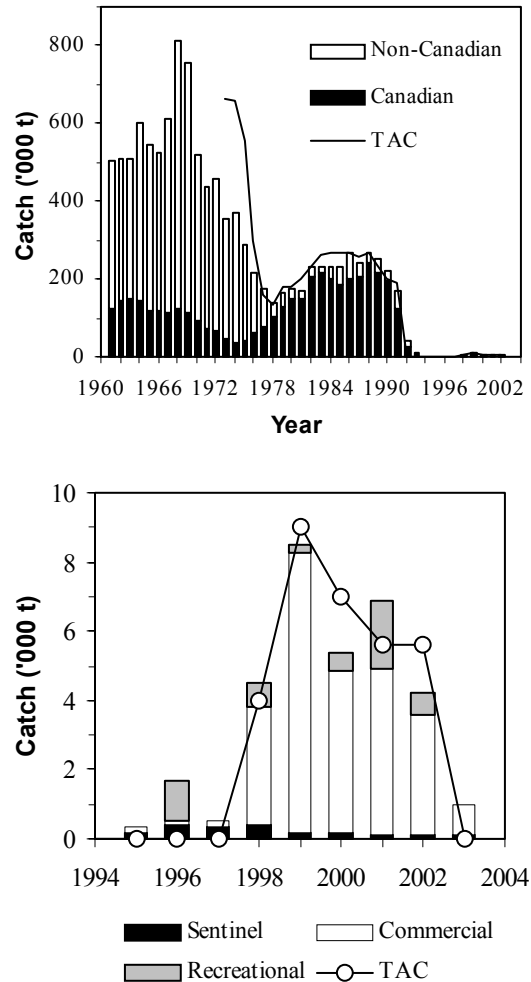


Figure 2: Reported catch and total allowable catch (TAC) (thousands of tons) in 1961-2003. The upper panel illustrates the full series, with the catch subdivided into Canadian and non-Canadian fleets. The lower panel shows 1995-2003 in more detail, with the catch subdivided into food/recreational, index/commercial (including by-catch) and sentinel.

Table 1: Catch (thousand metric tons)

Year	62-76	77-91	1998	1999	00/01	01/02	02/03	03/04
	Avg. Avg.							
TAC	N/A	N/A	4	9	7	6	6	0
Can. Fixed	88	90	5	8	5	7	4	1
Can. Mobile	9	84	+	0	+	+	+	+
Others	405	38	+	+	+	+	+	
Totals	502	212	5	8	5	7	4	1

Reported landings during 2003 were approximately 880 t from the commercial fishery and 90 t from the sentinel surveys, for a total of 970 t.

Most (780 t) of the commercial catch came from a mass mortality of cod in Smith Sound, Trinity Bay, during April 2003. The exact cause of the event remains uncertain, but it was clearly associated with unusually cold water within the Sound (Colbourne et al. 2003). The cod were collected from the surface of the water by gaff and dipnet. Many of these fish were frozen, whereas others were torpid but still alive. The fish were generally large, with a high proportion in the range 55-85 cm.

The rest of the reported catch was by-catch in fisheries directed at other species. Most (84 t) of this came from gillnets set for winter (blackback) flounder. The bulk of this catch came from Bonavista Bay and Trinity Bay in July.

The by-catch from Canadian trawlers was 3 t.

An estimate is not yet available for the 2003 catch by non-Canadian trawlers outside the 200 nautical mile limit on the Nose of the Bank (Div. 3L). The Scientific Council of the Northwest Atlantic Fisheries Organization (NAFO) determined that catches during 2000-2002 were 50-80 t annually.

Industry perspective

A perspective on the status of northern cod was gathered during winter 2004 in meetings between fish harvesters and scientists and through responses to a questionnaire sent to Fish Harvester Committees by the Fisheries, Food and Allied Workers (FFAW) Union. A report on these two exercises is not yet available. It was generally agreed that the overall biomass of northern cod is significantly less than it was historically, but that cod abundance is high in some areas of the inshore. There are good signs of recruitment in almost all inshore areas.

Resource Status

The most recent full assessment of this stock was conducted during February 2003. Readers are referred to the status report from that assessment (DFO 2003) for a summary of trends in population indices and biological characteristics, an analysis of population dynamics and stock status, a discussion of the impacts of predators (seals) and prey (capelin), and a consideration of major sources of uncertainty. The present report provides updated information on the major population indices.

Stock structure

Since the mid-1990s, there has been a dichotomy between the inshore and the offshore. Cod in the offshore have been small and at very low density, whereas cod in the inshore have included larger sizes and have been found in relatively high densities in some times and places. Various observations, both historic and recent, are consistent with the hypothesis that there are populations in the inshore that are functionally distinct from those in the offshore. It is thought that these inshore populations have historically been small relative to the populations that migrated into the inshore from the offshore during spring/summer.

Tagging studies, conducted during the post-moratorium period while the overall stock size remains extremely low, indicate that the inshore of 3KL is currently inhabited by at least two groups of cod: (1) a northern resident coastal group that inhabits an area from western Trinity Bay northward to western Notre Dame Bay and (2) a migrant group that overwinters in inshore and offshore areas of 3Ps, moves into 3L during late spring and summer and returns to 3Ps during the autumn. The tagging also indicates considerable movement of cod among Trinity, Bonavista and Notre Dame Bays. It is not known if there is currently movement between the inshore and the offshore in 2J3KL.

Population Indices

The offshore biomass index values from the autumn **research bottom-trawl surveys** in 2J3KL have been very low for the past decade (Fig. 3). The slight improvement toward the end of the 1990s has not been sustained. The biomass index in 2003 was about 1% of the average in the 1980s.

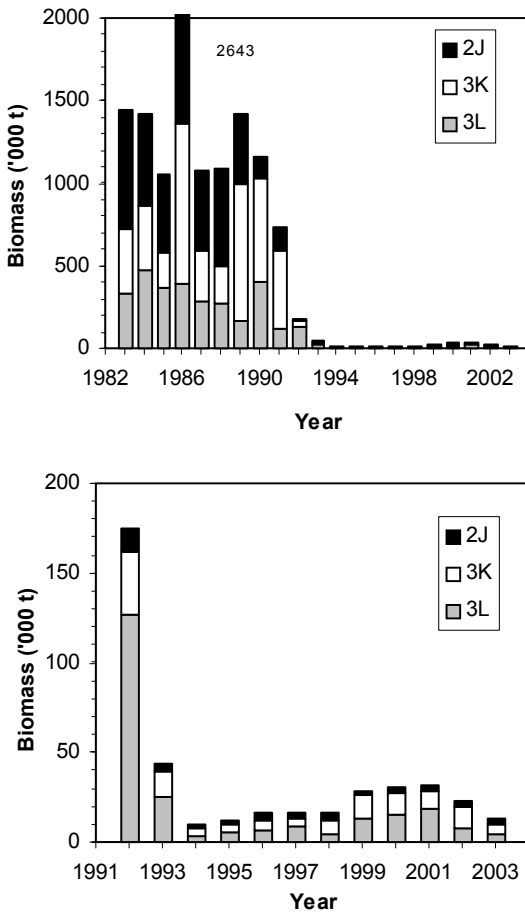


Figure 3: Biomass index from autumn bottom-trawl surveys in 1983-2003. The upper panel shows the full series. The lower panel shows 1992-2003 on a finer scale.

The biomass index from the spring research bottom-trawl survey in 3L continues to be less than 1% of the average in the 1980s (Fig. 4).

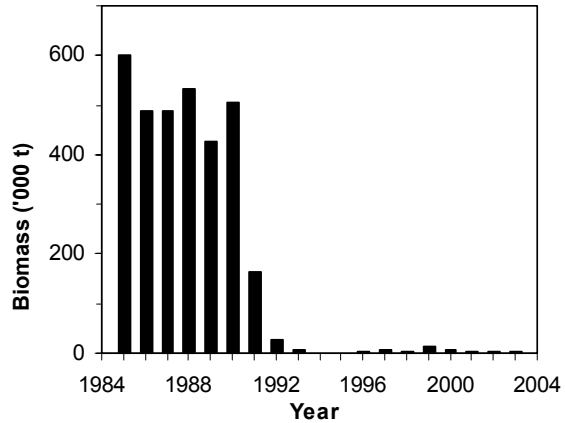


Figure 4: Biomass index from spring bottom-trawl surveys in 3L during 1985-2003. Values in 1994 - 1995 are too small to be distinguishable from the axis.

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. Catch rates have declined almost everywhere since 1998. In 2003, the highest catch rates generally occurred in southern Bonavista Bay and Trinity Bay in northern 3L and in St. Mary's Bay in southern 3L adjacent to 3Ps.

The sentinel survey data were standardized to remove site and seasonal effects and to produce annual indices of total catch rate for 3K and 3L combined. Gillnets and linetrawls were treated separately (Fig. 5). Gillnet catch rates increased from 1995 to 1998, declined to 2002 and increased a little in 2003. Linetrawl catch rates showed relatively little change from 1995 to 1996, increased in 1997, and then declined to a low in 2000. There has been variability in the past few years, with the 2003 value being similar to the 1998 value. However, the linetrawl catch comprised a higher proportion of small fish in 2003 than in 1998.

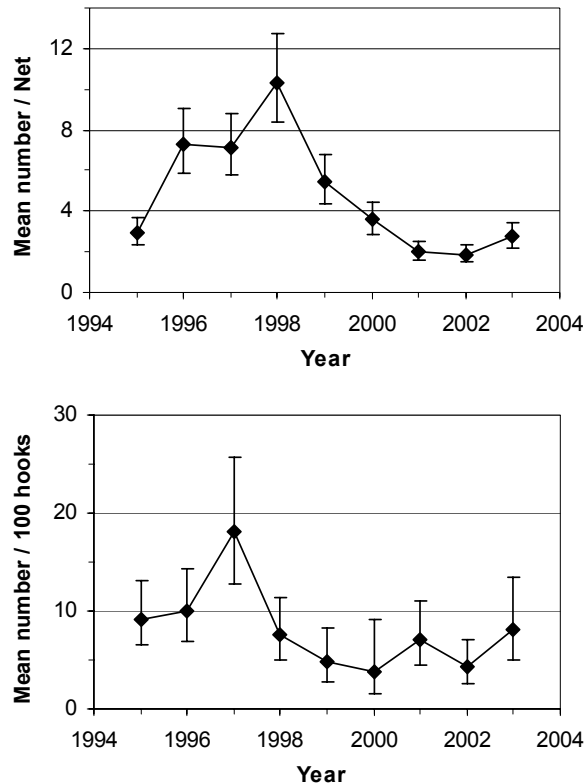


Figure 5: Standardized catch rates from sentinel surveys in 3KL; gillnets above and linetrawls below.

The sentinel surveys have also deployed small mesh (3 ¼ inch) gillnets at many sites since 1996. For sites in 2J3KL combined, the catch rates of small fish (roughly 34-44 cm) were highest in 1996 and 1997, declined to a low in 1999 or 2000, and then increased to a level in 2003 that was approximately equal to that in 1996-1997.

Hydroacoustic studies have been conducted in Smith Sound in western Trinity Bay (3L) at various times since spring 1995. Winter (January-February) surveys have been conducted in a standard manner by the Fisheries Conservation Chair at Memorial University of Newfoundland since 1999. Average indices of biomass increased to a peak of about 26,000 t in 2001 and then declined to 23,000 t in 2002, 20,000 t in 2003, and 18,000 t in 2004. The fish sampled during the 2004 survey were of a wide size range (35-120 cm).

Sources of uncertainty

The bottom-trawl surveys conducted during the autumns of 2002 and 2003 were not completed until January of the following year. It is not known if this delay in completion affected the biomass estimates from each of these surveys.

Similarly, the hydroacoustic survey of Smith Sound in 2004 was delayed until February, whereas surveys in 1999-2003 were completed in January. It is not known if this change in timing had an influence on the biomass estimate.

Outlook

The outlook for the northern (2J+3KL) cod stock remains essentially unchanged from that determined during the most recent full assessment in February 2003 (DFO 2003).

The biomass of cod in the offshore remains at an extremely low level.

There are aggregations of cod in the inshore, most notably in western Trinity Bay and southern Bonavista Bay. The 2003 assessment determined that the spawner biomass of these populations increased from the mid-1990s to 1998, and then decreased as a consequence of increased fishing mortality in 1998-2002 and weaker recruitment during the mid-1990's. Recruitment improved during the late 1990's and very early 2000's, and in February 2003 it was projected that the spawner biomass would increase during the next few years. The increased catch rates in the small-mesh sentinel surveys during 2003 and the observations of fish harvesters provide additional evidence that these year-classes are strong relative to those produced during the mid-1990s. The extent to which these year-classes survive and contribute to an increase in the inshore spawner biomass remains to be seen.

The 2003 Stock Status Report (DFO 2003) stated: "Under a precautionary approach,

conservation limit reference points need to be defined to demarcate when the stock is considered to have impaired productivity and is thus in a situation in which serious harm has occurred. Northern cod productivity is impaired and serious harm has occurred.” It has not yet been possible to identify a conservation limit for the spawner stock biomass (Rivard and Rice 2003). “When the spawner biomass of the 2J3KL cod stock as a whole approaches 150,000 t, the available data will be reviewed with the objective of determining appropriate spawner biomass limit reference points in keeping with a precautionary approach. Based on historic data, it is anticipated that appropriate conservation limit reference levels will be set at levels greater than 300,000 t for the stock as a whole. Recovery of spawner biomass to this level is expected to take many years.”

Management Considerations

A major challenge currently facing management of fisheries in inshore waters of 2J3KL is the limitation of cod by-catch in fisheries directed at other species.

Although the northern cod stock as a whole is at a very low level, aggregations do occur in various areas of the inshore in 3KL. The largest and most dense of these aggregations occurs in Smith Sound, Trinity Bay, in winter. During other seasons, aggregations should be expected to occur mainly from southern Bonavista Bay to western Trinity Bay, but they could occur as far north as White Bay and as far south as St. Mary's Bay.

These cod may be caught in gillnets set for winter (blackback) flounder, lumpfish and even herring, and may occur in capelin traps. The biggest challenge may be to fish for winter flounder without a large by-catch of cod, and this problem will be most acute in western Trinity Bay and southern Bonavista Bay.

The challenge of avoiding excessive by-catch of cod in fisheries directed at other species may intensify in the next few years if there is good survival of the small cod that are

presently seen throughout much of the inshore.

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References

- Colbourne, E.B., Bratley, J., Lilly, G., and Rose, G.A. 2003. The AZMP program contributes to the scientific investigation of the Smith Sound mass fish kill of April 2003. DFO Atlantic Zone Monitoring Program Bulletin 3: 45-48. <http://www.meds-sdmm.dfo-mpo.gc.ca/zmp/Documents/AZMP-No3.pdf>
- DFO, 2003. Northern (2J+3KL) cod. DFO Can. Sci. Advis. Sec. Stock Status Rep. 2003/018.
- Lilly, G.R., Murphy, E.F., Healey, B.P., Maddock Parsons, D., and Stead, R. 2004. An update of the status of the cod (*Gadus morhua*) stock in NAFO Divisions 2J+3KL in March 2004. DFO Can. Sci. Advis. Sec. Res. Doc. 2004/023.
- Lilly, G.R., P.A. Shelton, J. Bratley, N.G. Cadigan, B.P. Healey, E.F. Murphy, D.E. Stansbury and N. Chen. 2003. An assessment of the cod stock in NAFO Divisions 2J+3KL in February 2003. DFO Can. Sci. Adv. Sec. Res. Doc. 2003/023.
- Rivard, D., and Rice, J. 2003. National workshop on reference points for Gadoids. Ottawa, November 5-8, 2002. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2002/033.

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