



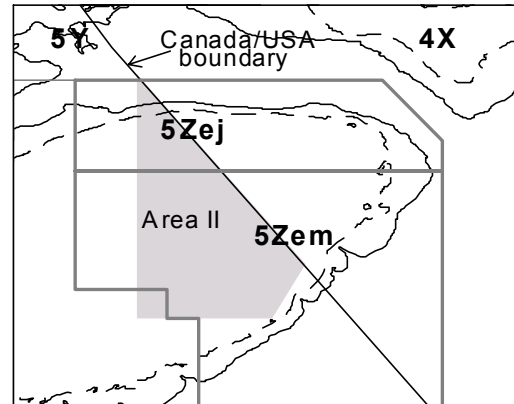
Eastern Georges Bank Cod

Background

The cod fishery on Georges Bank has been in operation since the late 1700s. Since 1977, only Canada and the USA have had directed fisheries and, with the establishment of the Canada/USA boundary in 1984, each country has been limited to their respective sides. Canadian catches of cod are taken primarily between June and October. Management of the Canadian fishery has been by seasonal closures to all gears and by EA's for vessels >65', ITQ for <65' mobile gear since June 1992 and by individual or community quotas for fixed gear. The USA fishery in the management area has been constrained by spatial expansion of closed Area II in 1994 and by extension to year-round closure in 1995.

In recent years, most of the biomass has been found on the Canadian side of the international boundary, although substantial seasonal movements relative to the boundary occur.

Georges Bank cod prey heavily on fish, but crustaceans and molluscs are also included in their diet. Cod in this area have a very fast growth rate, reach 50 cm (20 in) and begin to spawn for the first time by age 2, and by age 3 almost all are sexually mature.



Summary

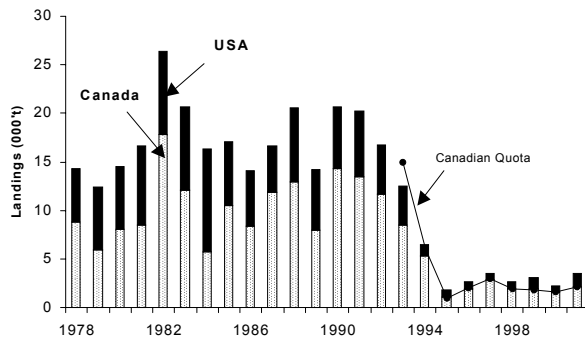
- Combined Canada and USA catches in 2001 were 3,500t, a 57% increase over 2000.
- Adult biomass increased from 8,900t in 1995 to about 21,100t in 2001 but has since decreased to about 17,300t in 2002. Almost all of this increase has been the result of growth and survival to ages 5+ of the 1992, 1995 and 1996 year-classes.
- Recruitment has been below the 1978-98 average of 7.5 million since the 1990 year-class and particularly poor since the 1996 year-class.
- The exploitation rate for ages 4-6 increased rapidly between 1989 and 1993 to over 50%. The 1999 and 2000 exploitation rates were less than $F_{0.1}$ but increased to above $F_{0.1}$ in 2001.
- Projection at $F_{0.1}$ for 2002 indicates a combined Canada/USA yield of about 1,900t. At the $F_{0.1}$ yield in 2002, adult biomass in 2003 is expected to remain at about the 2002 level.
- With the current poor recruitment and exploitation rates near the present levels, improvement in stock status is not expected in the near term.

The Fishery

Catches (thousands of tonnes)

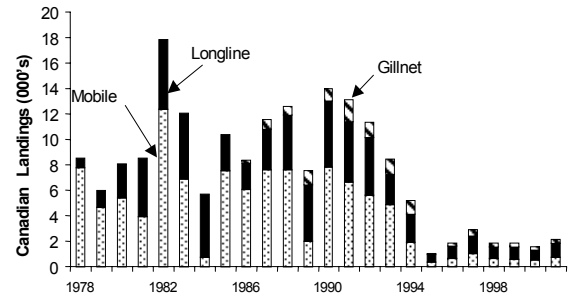
Year	1978-90 Avg.	1991-97 Avg.	1998	1999	2000	2001
Cdn. Quota	-	10.1	1.9	1.8	1.6	2.1
Canada	10.2	6.4	1.9	1.8	1.6	2.1
USA	7.0	2.7	0.8	1.2	0.7	1.4
TOTAL	17.2	9.2	2.7	3.0	2.3	3.6

Combined Canada/USA catches peaked at 26,000t in 1982, averaged about 17,900t between 1978-92 and declined to 1,800t in 1995, the lowest observed. Landings since 1998 have been about 3,000t. Catches in 2001 increased by 57% from 2000 and were the highest since 1994. Canada has accounted for over 65% of the total 5Zej and 5Zem landings.



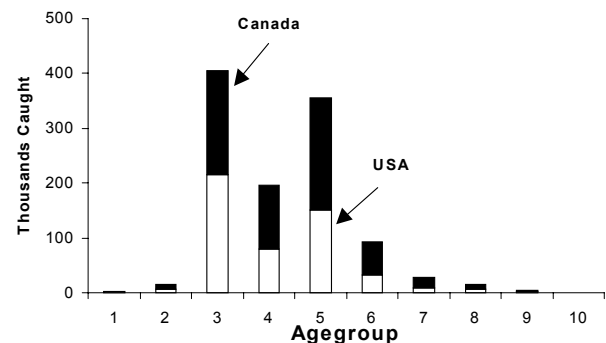
Canadian catches are now dominated by landings from fixed gear components. Since 1995 and with reduction in allowable yields, the Georges Bank fishery has become more of a mixed species fishery with reduced targeting for cod and in 1995 fishing was restricted to bycatch only. Since 1995, industry also imposed self-regulation to avoid overrunning allocations, including directing for haddock in early June and late fall when cod bycatch was low. A high proportion of trips include observers and landings have been subject to 100% dockside monitoring. In 2001, most gear sectors reached their allocation. The Canadian groundfish fishery in 5Zj,m has been closed to all vessels from January to June since 1994. Landings

increased by 34% from 1,600t in 2000 to 2,100t in 2001.



USA catches for 1995-98 ranged from 557t to 795t. Since December of 1994, a year-round closed area (Area II) in part of the 5Zej and 5Zem area has been in effect. Minimum mesh sizes limits were increased in 1994 and again in 1999. Limits on sea days were also used as an additional measure for effort reduction. USA catches increased from 795t in 1998 to 1,150t in 1999 and declined to 660t in 2000 and again increased in 2001 to 1,360t.

The 1998 year-class at age 3 dominated the 2001 fishery and comprised over 36% of the total catch in numbers, more than twice the forecast from the yield projection of 2001, reflecting an under-estimate of this year-class in the 2001 assessment. Contribution of age 6+ cod was lower than expected from the yield projection of 2001 as a result of a change in partial recruitment.

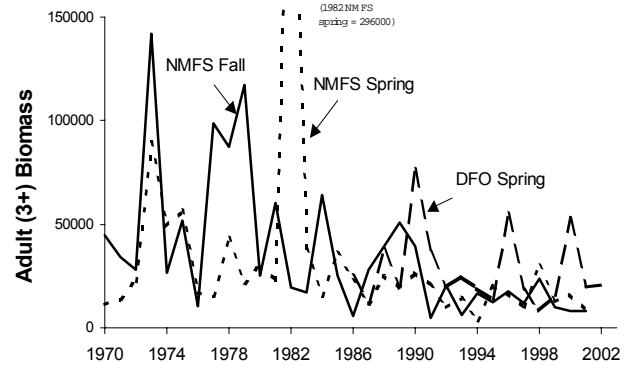


Environmental Conditions

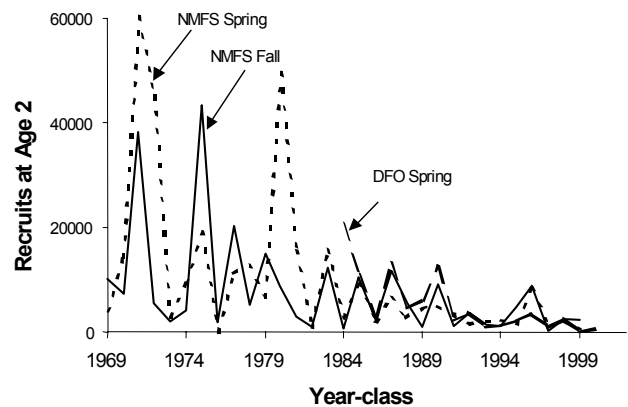
In recent years (1998-2001), water temperatures on Georges Bank have generally been about 1°C above normal. This is in contrast to the Scotian Shelf where temperatures in 2001 were colder than normal and lower than in 2000. Vertical mixing on Georges Bank, as indicated by the annual mean difference in water density between 0 and 50m, has remained relatively constant as it has been for the past 20 years. Both the shelf/slope front and Gulf Stream were further offshore in 2001 compared to 2000. While the shelf/slope front had moved seaward of its long-term (1971-2000) mean position, the Gulf Stream remained landward of its long-term mean. Although not covering Georges Bank, information from the July groundfish surveys (July) and satellite ocean colour data (full year), suggest the chlorophyll levels in surface waters were similar in 2001 to 2000 and similar to the long-term mean. Connections between the oceanographic conditions and the status of assessed fish stocks within 5Z are still elusive and remain under investigation.

Resource Status

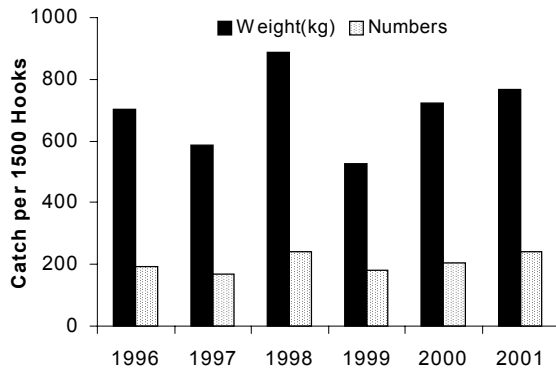
The DFO and NMFS research surveys appear to demonstrate similar trends with a consistent spatial distribution by season. Adult (ages 3+) biomass declined between 1990-92 and showed some modest recovery since 1995. The 2000 DFO spring survey shows a substantial increase over 1999 but declined to lower levels in 2001 and 2002. The most recent NMFS spring and fall surveys remain at low biomass levels.



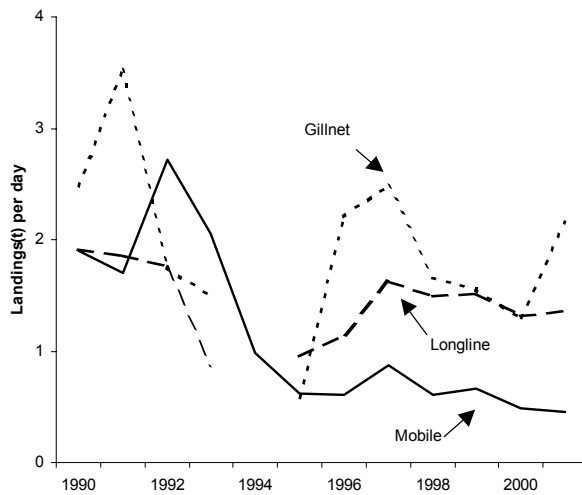
The age two index of year-class strength has been well below the long-term average since the 1990 year-class and the 1997-1999 year-classes appear to be very low. The 1996 year-class was the highest since 1990.



A fixed-station **commercial vessel longline survey** has been conducted by five vessels using standardised fishing practices since 1996. Results have been variable with a modest increasing trend since 1999. This survey covers only the Canadian zone in 5Zj,m and is not considered to be representative of overall stock abundance. It may provide supplemental information on stock density in the Canadian zone.



Commercial fishery catch rates (CPUE) for longline and mobile gear has remained stable between 1998 and 2001 while gillnet CPUE increased between 2000 and 2001. However, fishers have indicated that their recent catch rates are not reflective of cod abundance and that changes in fishing practices have been required to avoid areas of higher cod abundance. CPUE is not considered to be representative of stock abundance and is not used in the assessment.



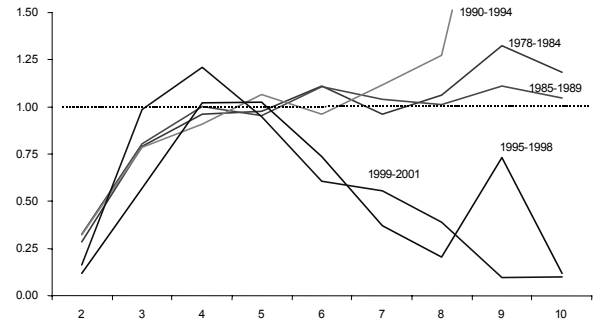
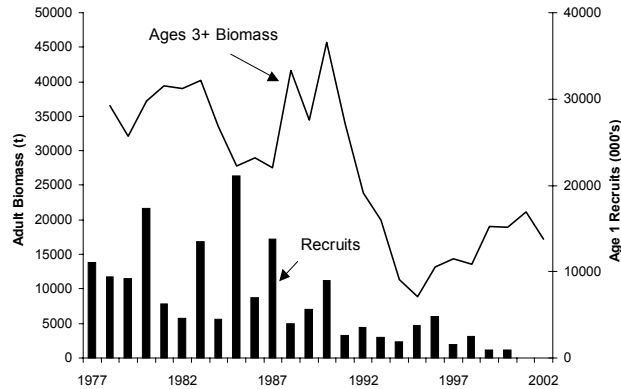
The DFO survey **weight-at-age** was used to calculate population biomass at the beginning of the year, while fishery weight-at-age was used to forecast fishery yield. Survey weights-at-age show a declining trend and some of the 2002 weights-at-age are the lowest observed.

Stock status evaluations were based on an assessment using landings statistics, age

composition of the commercial catch and trends in abundance from three bottom trawl research surveys. The current assessment model used to estimate stock abundance is a change from 2001 (TRAC, 2002). Some survey indices at age were excluded as being unrepresentative and the method used for calculating stock size at the oldest age was modified. The most notable consequences of the new model are a decreased retrospective pattern and an apparent change in partial recruitment at age. Consequently, yields and stock trends reported in previous assessments are not directly comparable with those reported here.



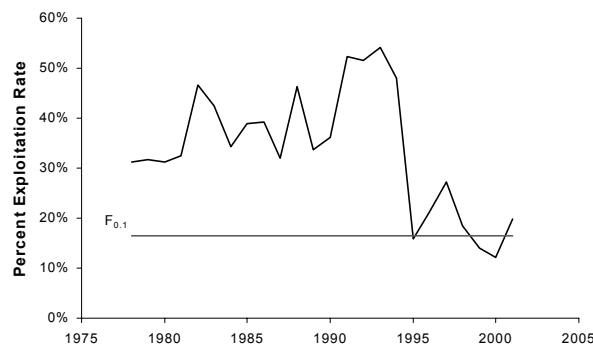
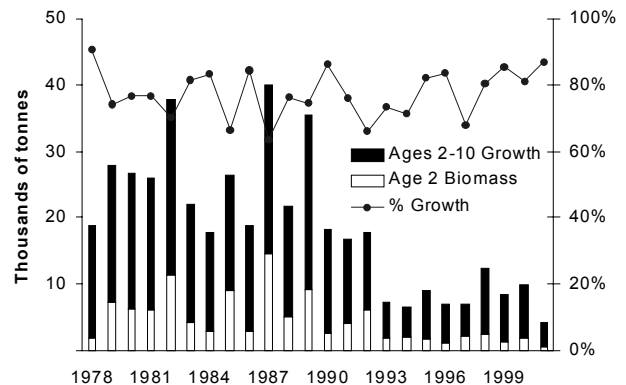
There has been a substantial decline in **adult stock biomass** from about 43,000t in 1990 to about 8,900t in 1995, the lowest observed. The biomass has since increased and was 21,100t in 2001 but declined to 17,300t in 2002. Almost all of the increase in the late 1990's has been the result of growth and survival to ages 5+ of the 1992, 1995 and 1996 year-classes. Much of the decline between 2001 and 2002 is due to the low weights-at-age observed in the 2002 DFO survey.



Recruitment has been below the 1978-98 average of 7.5 million since the 1990 year-class. The 1996 year-class appears to be the strongest since the 1990 year-class. While the 1998 year-class is somewhat stronger than previous estimates, recruitment since the 1996 year-class has been particularly poor.

Most (60-90%) of the cod stock **production** has been derived from growth of ages 2-10 with the rest coming from recruitment. In recent years, due to weak recruitment, the amount due to growth has increased and now is about 90% of the total.

The **exploitation rate for ages 4-6** increased rapidly between 1989 and 1993 to over 50%, greater than twice the $F_{0.1}$ reference level. In 1995, it declined to near $F_{0.1}$ due to restrictive management measures. The 1999 and 2000 exploitation rates were less than $F_{0.1}$ but increased to above $F_{0.1}$ in 2001.



Retrospective analysis indicates a pattern of inconsistencies with a tendency to over or underestimate fishing mortality, biomass and abundance at age 1 relative to the terminal year estimate. The extent of this pattern is substantially less in the current assessment compared to that observed in 2001.

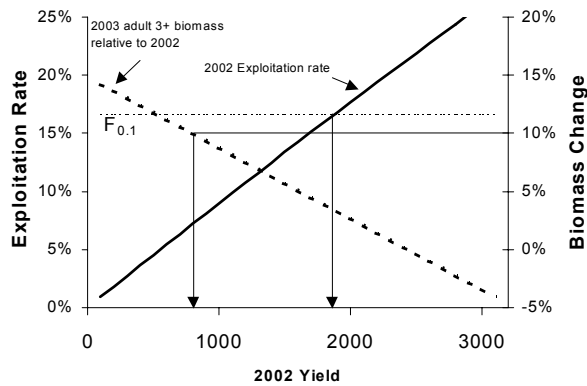
Partial recruitment to the fishery has changed since 1994 as a result of seasonal and spatial area closures and the bycatch nature of the fishery due to reduced allocations. Catchability of ages 5+ cod has been reduced and the exploitation pattern has a substantial declining trend. This pattern may not persist for the long term changes but is expected to remain for the short term.

Outlook

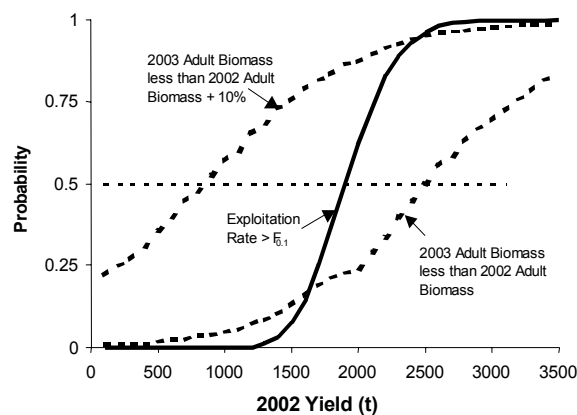
Projection at $F_{0.1}$ for 2002 indicates a combined Canada/USA yield of about 1,900t. This is a substantial decrease from the yield projected in 2001 due to several factors including poor recruitment since 1996, lower weights-at-age in 2002 and lower partial recruitment to the fishery of older age groups since 1995. At the $F_{0.1}$

yield, adult biomass is not expected to change significantly from the beginning of year 2002 to the beginning of year 2003.

Uncertainty associated with results of the assessment can be related to the probability that the exploitation rate in 2002 will exceed $F_{0.1}$ or how the 2003 biomass will change relative to 2002 biomass. These calculations do not include uncertainty due to variations in weight-at-age, partial recruitment, variations in natural mortality, systematic errors in data reporting or model mis-specifications.

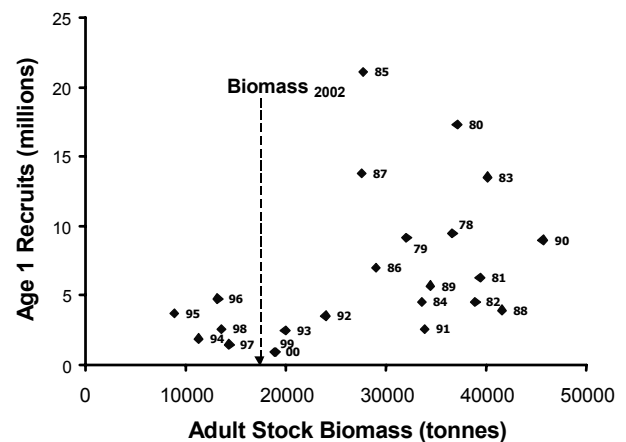


For example, at a combined 2002 Canada/USA yield of about 1,500t, there is a low probability of exceeding $F_{0.1}$ and of a decrease in adult biomass. However, at that 2002 yield, the probability of a 10% increase in adult biomass is only about 25%. There is virtually no chance of a 20% increase in biomass in 2003.



Management Considerations

Comparison of adult biomass and resultant recruitment indicates that the relatively weak post-1992 year-classes have been produced at biomass levels of 25,000t or less. The chance of poor recruitment (less than 5 million) is higher when the adult biomass is less than a 25,000t threshold. Subsequent poor recruitment will lead to reduced prospects for an increase in biomass towards a 25,000t threshold.



With the current poor recruitment and exploitation rates near the present levels, improvement in stock status is not expected in the near term.

Cod and haddock are often caught together in the Canadian groundfish fisheries. However, their catchabilities to the fisheries differ and they are not necessarily caught in proportion to their relative abundance. Exploitation of haddock at $F_{0.1}$ with current fishing practices may compromise the achievement of rebuilding objectives for this cod stock.

Anecdotal information from the 2001 fishery and prosecution of suspected violators suggests an increasing probability of cod discards and catch misreporting. There is a potential for this practice to

increase in the 2002 fishery if the allowable cod catch is lowered while the haddock catch increases.

References

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