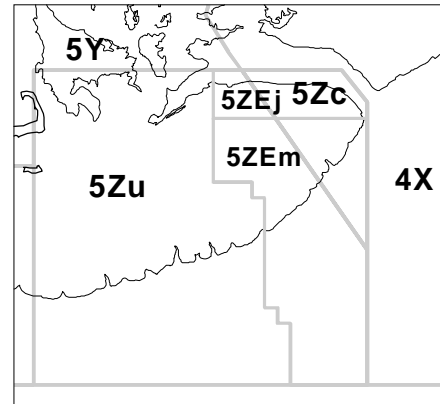


Eastern Georges Bank Cod



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 1985, 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 and by ITQ for <65' mobile gear since June 1992, Enterprise Allocations for offshore boats since 1984 and by competitive quota for fixed gear. The USA fishery has been greatly constrained by establishment of a closed area between January and June in 1994 and by expansion of the area and 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

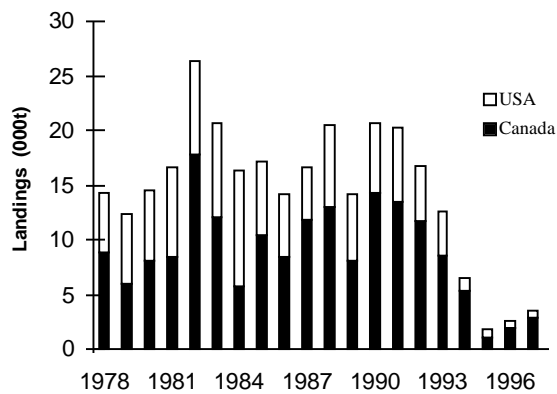
- Combined Canada and USA landings in 1995, 1996 and 1997 are the lowest since 1978.
- Growth of the 1992 year-class and recruitment of the 1995 year-class has sustained the biomass at about 15,000t since 1996.
- Recruitment has been below average since the 1990 year-class, and the 1997 year-class is the lowest observed. Chances for improved recruitment are greater at adult biomass levels greater than 25,000t.
- Exploitation rate declined from 55% in 1993 to less than the $F_{0.1}$ level in 1995; it has since increased to 19%, just over $F_{0.1}$.
- Yield projection at $F_{0.1}$ for 1998 indicates a **combined** Canada/USA yield of about 3,600t. The $F_{0.1}$ yield will be even lower if the declining trend in weights-at-age continues.
- At a combined Canada/USA quota of 3,000t, for example, there is a 12% risk of exceeding $F_{0.1}$, and an almost negligible risk of not achieving a 10% increase in biomass. There is a 53% risk of not achieving a 20% increase in biomass, unless the combined quota is below 3,000t.

The Fishery

Landings (thousands of tonnes)

Year	78-89 Avg.	90-93 Avg.	1994	1995	1996	1997
Cdn. Quota	-	15	6	1.0	2.0	3.0
Canada	9.9	12.0	5.3	1.1	1.9	2.9
USA	7.1	5.6	1.2	0.7	0.8	0.6
TOTAL	17.0	17.6	6.5	1.8	2.7	3.5

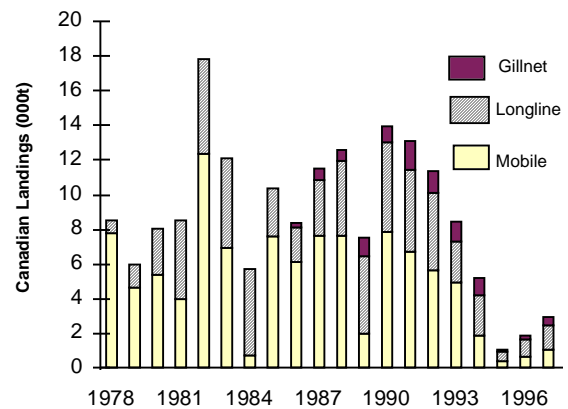
Combined Canada/USA landings peaked at 26,000t in 1982, averaged about 17,900t between 1978-92 and declined to 1,800t in 1995. Due to the Canadian bycatch limitations and introduction of a USA closed area, the 1995 landings were the lowest observed. Landings in 1996 increased to about 2,700t, and to 3,500t in 1997. Since 1985, Canada has taken about 63% of the total 5Zj,m landings.



Canadian landings had been dominated by otter trawlers, except in 1984 and 1989, but the proportion of total landings taken by fixed gears (longline and gillnet) has increased in recent years, and the longline fishery now dominates. Since 1994, the Georges Bank fishery has become more of a mixed species fishery with reduced targeting for cod. In 1997, most gear sectors reached their allocation. A high proportion of trips included observers and landings were subject to 100% dockside monitoring. Industry also imposed self-regulation to avoid overrunning allocations, including directing for haddock in early June and late fall when cod bycatch was low. Discarding in the 1997 fishery was not apparent

from commercial fishery samples, but industry reported some regulatory discards from the scallop fishery. The Canadian groundfish fishery in 5Zj,m was closed to all vessels from 1 January to early June 1997.

In 1997, the 1992 and 1993 year-classes comprised 30% and 35% respectively of the total Canadian catch both in numbers and in weight.



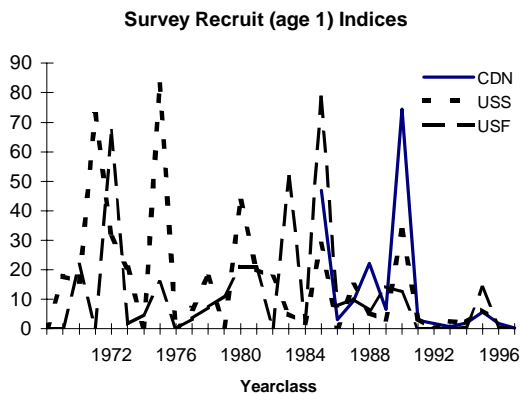
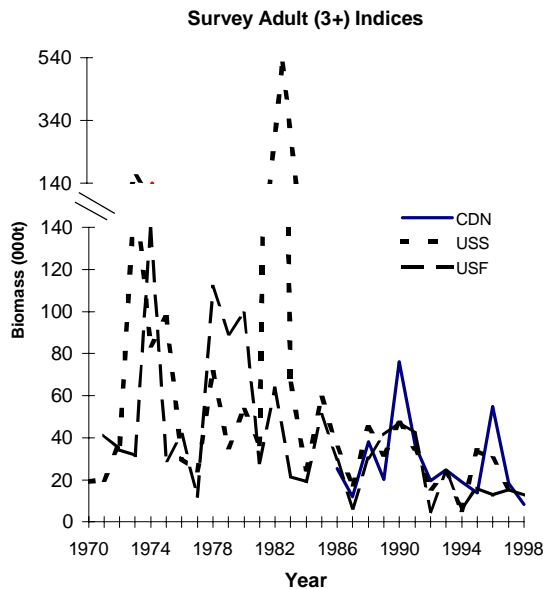
USA landings for 1995-97 were 665t, 773t and 557t respectively. The USA imposed a year-round closed area in December, 1994 and also increased minimum mesh sizes. Limits on days at sea were used as an additional measure for effort reduction.

Resource Status

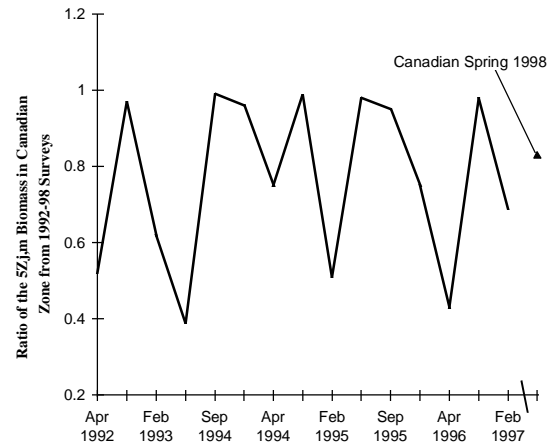
Stock status evaluations were based on an assessment using landings statistics, age composition of the commercial catch and trends in abundance from three bottom trawl research surveys. The USA fall survey is lagged by one year for comparison of indices (ie. fall 1977 age one vs. spring 1978 age two) with the USA and Canadian spring surveys.

All three surveys appear to demonstrate similar relative year-class strengths with a decline in total numbers between 1990-92 and have remained at low levels since 1992. The 1998 Canadian spring 3+ indices continue to

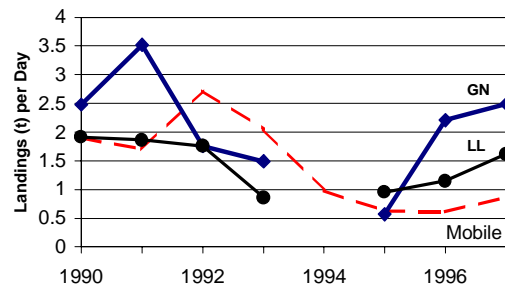
decrease. The USA spring and fall indices remain low. The 1990 age 1 index was above average while those since 1990 are well below average.



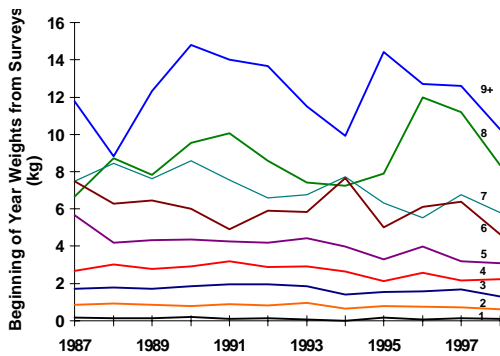
An analysis of **biomass distribution** relative to the international boundary from research surveys shows a seasonal pattern. Virtually all cod of ages 2 and older were found on the Canadian side during the NMFS fall survey, while the proportion found during the DFO and NMFS spring surveys ranged between 40% and 85%.



Commercial fishery catch rate for longline increased from 1994-97, consistent with reports from the fishery. Mobile gear and gillnet fishermen indicated that their recent catch rates are not reflective of cod abundance because of management restrictions.

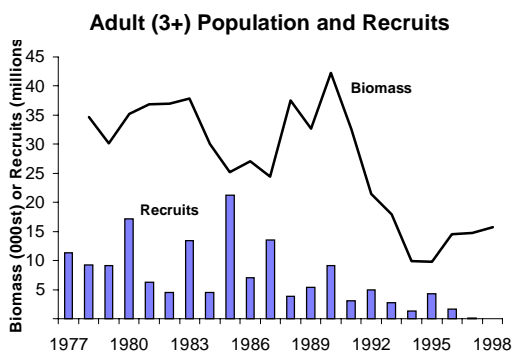


Survey **weight-at-age** was used to calculate population biomass at the beginning of the year, while fishery weight-at-age was used to forecast fishery yield. At younger ages, fishery weight-at-age tends to be larger because the fishery selects larger fish. At older ages, survey and fishery weights-at-age correspond when adjusted for time of year. In this instance, there are indications of substantial reduction in survey weight-at-age between 1997 and 1998. Confirmation of this decline will have to wait until observations from the fishery are available. If the decline occurs, F in 1998 will be higher for the same quota. If the decline is not confirmed, population biomass increase may be greater than forecast.

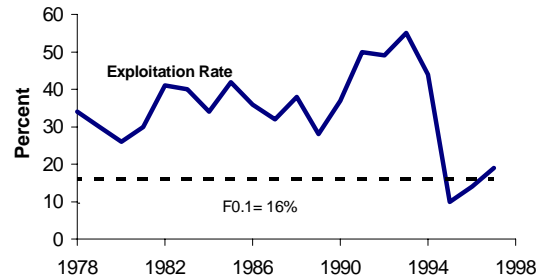


There has been a substantial decline in age 3+ biomass from 42,000t in 1990 to 10,000t in 1995, the lowest observed. The biomass increased to about 15,000t in 1996 due to recruitment of the 1992 year-class. Subsequent growth of this year-class and recruitment of the 1995 year-class has sustained the biomass at about the same level until 1998. Population biomass in 1998 is much lower than projected in the 1997 assessment. About half of this difference is due to the decline in survey weights at age. The remaining difference is due to more pessimistic survey catch rates.

Recruitment has been below average since the 1990 year-class, and the 1997 year-class is the lowest observed. The 1995 year-class appears to be similar in size to the 1992 year-class.



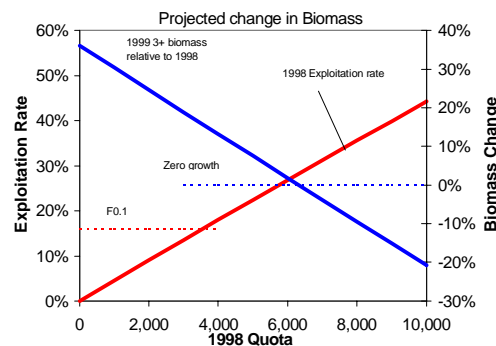
The **exploitation rate** increased rapidly between 1989 and 1993 to 55%, three and a half times the $F_{0.1}$ reference level. In 1995, it declined to 10%, less than the $F_{0.1}$ level, and has since increased to 19%, just over $F_{0.1}$.



Retrospective patterns were not looked at this year, but last year's investigations showed no pattern.

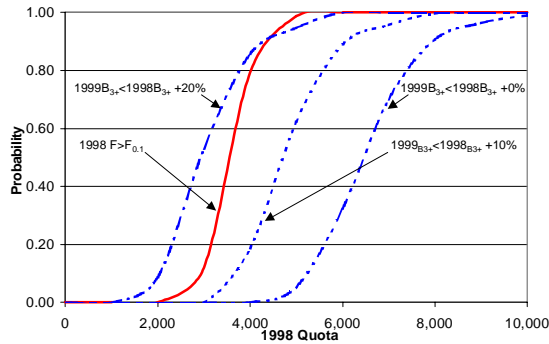
Outlook

Yield projection at $F_{0.1}$ for 1998 indicates a **combined** Canada/USA yield of about 3,600t. The $F_{0.1}$ yield will be even lower if the declining trend in weights at age continues. Adult biomass may increase by 15% through 1998 at the projected $F_{0.1}$ yield of 3600t. The exploitation rates and the resultant impact on the adult biomass in 1999 are shown below for a range of quotas in 1998:



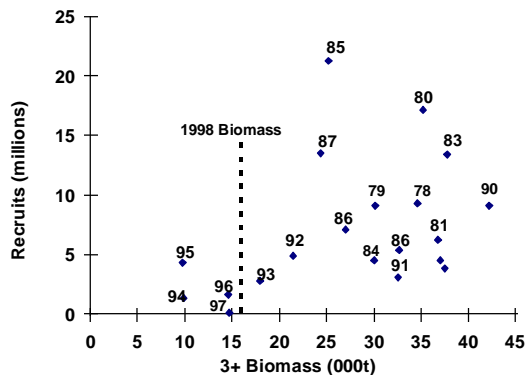
Uncertainty associated with results of the assessment can be related to the probability that the exploitation rate in 1998 will exceed the $F_{0.1}$ reference or that the 1999 biomass will be less than the 1998 biomass. These uncertainty calculations do not include variations in weight at age, partial recruitment, variations in natural mortality, systematic errors in data reporting or model misspecifications.

At a combined 1998 Canada/USA quota of about 3,000t, for example, there is a 12% risk of exceeding $F_{0.1}$ and an almost negligible risk of not achieving a 10% increase in biomass. However, there is a 53% risk of not achieving a 20% increase in biomass, unless the combined Canada/USA quota is below 3,000t.



Management Considerations

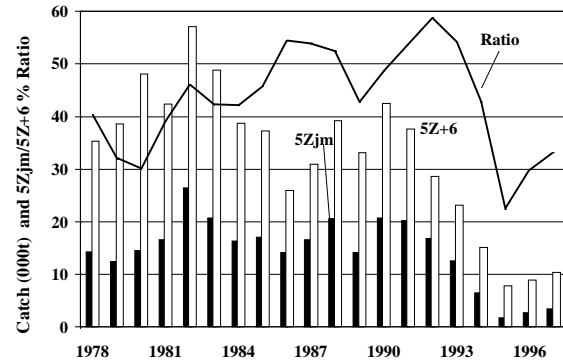
Comparison of adult biomass and resultant recruitment indicates that the relatively small 1992-97 year-classes have been produced at biomass levels of 25,000t or less. The chance of **improved recruitment** is greater for biomass above 25,000 t.



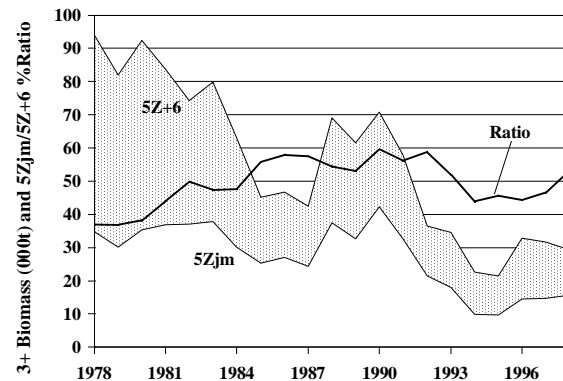
It is projected that 22% by weight and 40% by numbers of the 1998 yield at $F_{0.1}$ would be comprised of the 1995 year class. Enhancing survivorship of this year class would benefit stock rebuilding.

Comparison of Results for the 5Z+6 (USA) and 5Zj,m (Canadian) Management Area Assessments

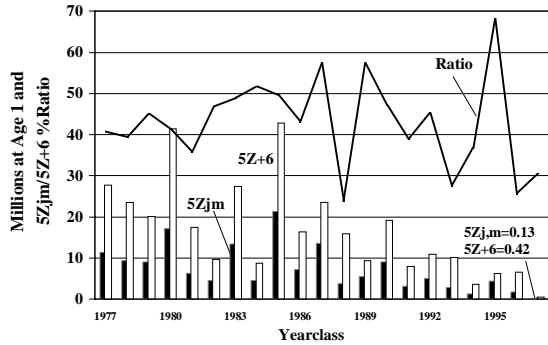
Catches in 1978-97 from 5Zj,m averaged 43% of the total 5Z+6 landings, ranging from 59-23%.



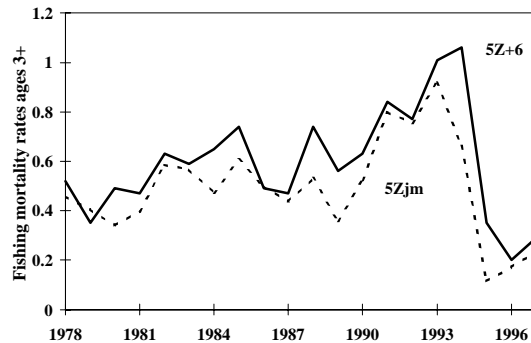
The adult biomass in 5Z+6 declined from 90,000t in the late 1970's to 21,000 t in 1995 but has since increased to 29,000 t in 1998. Adult biomass in the 5Zj,m area ranged between 42,000 t and 10,000 t and is 15,000 t in 1998. The 5Zj,m area averages 50% of the total 5Z+6 adult biomass.



Recruitment patterns in the two areas have been similar. The 1985 and 1980 year-classes were the most abundant followed by the 1983 and 1987 cohorts. Since 1990, recruitment has been below average in both areas.



Fishing mortality rate showed a similar trend of increase between the late 1970s and was above 1.0 in 1993. Substantial reductions in the Canadian TAC for the 5Zj,m area and reduced effort by the USA lowered exploitation to below the $F_{0.1}$ level in 1996. Exploitation increased in 1997 to slightly above $F_{0.1}$.



Population trends in the 5Zj,m and 5Z+6 areas have remained relatively consistent between 1978 and 1997. This implies some measure of stability in the geographic distribution of the stock.

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Hunt, J.J. and M-I. Buzeta. 1998. Status of the Georges Bank cod stock in 5Zj,m. DFO Can. Stock Assmt. Secretariat Doc. 98/65.

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