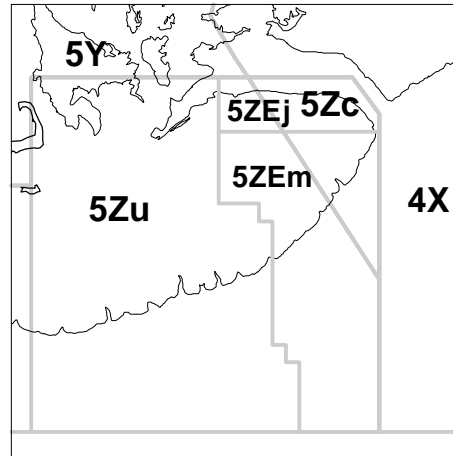


Georges Bank Cod In 5Zj,m



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 less than 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.

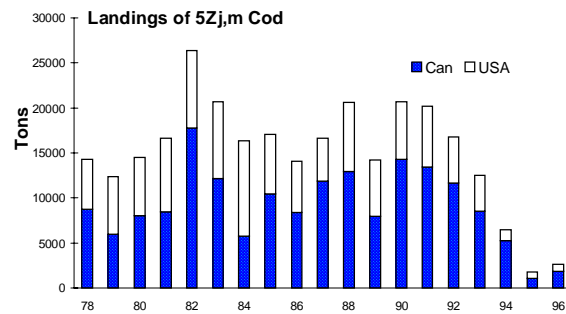
In recent years, most of the biomass has been found on the Canadian side of the international boundary, although substantial seasonal movements relative to the boundary occur.

Georges Bank cod prey heavily on fish followed by crustaceans and molluscs. 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.

The Fishery

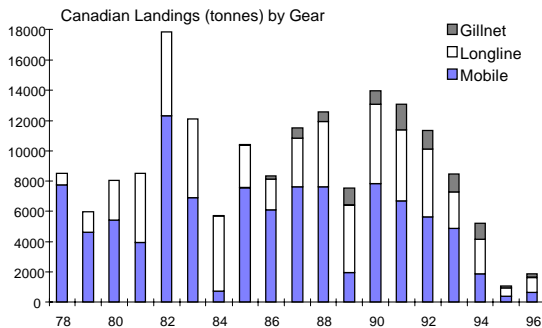
Landings (thousands of tonnes)

Year	78-79		80-89		1992	1993	1994	1995	1996
	Avg.	Avg.	Avg.	Avg.					
TAC	-	-	-	-	15.0	6.0	1.0	2.0	
Canada	7.4	10.4	11.7	8.5	5.3	1.1	1.9		
USA	6.0	7.3	5.1	4.0	1.2	0.7	0.8		
TOTAL	13.4	17.7	16.8	12.5	6.5	1.8	2.7		



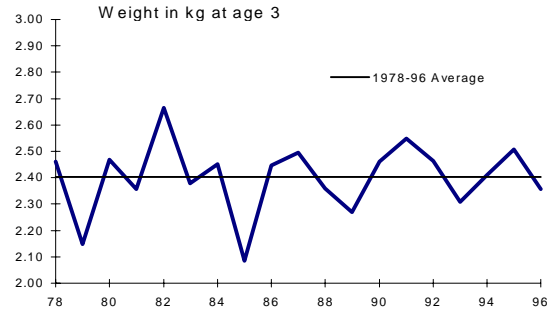
Combined Canada/USA landings peaked at 26,000t in 1982, averaged about 17,700t between 1980-89 and declined to 1,800t in 1995. Due to the Canadian bycatch limitations and a USA closed area, the 1995 landings were the lowest observed. Landings in 1996 increased to about 2,700t. Since 1985, Canada has taken about 65% of the total landings.

Canadian landings have 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. Since 1994, the Georges Bank fishery has become more of a mixed species fishery with reduced targeting for cod. Canadian landings in 1996 were 1,900t and 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 1996 fishery was not apparent from commercial fishery samples, but industry reported some discards when cod bycatch became excessive. The Canadian groundfish fishery in 5Zj,m was closed to all vessels from 1 January to June 6, 1996.

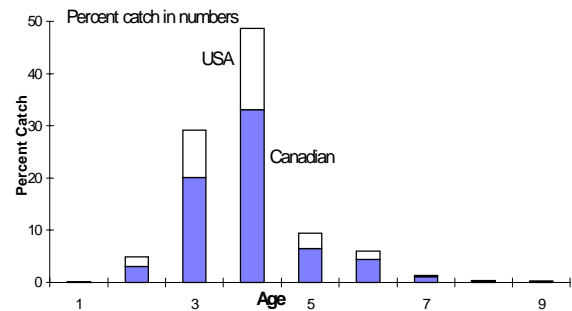


USA landings for 1994-95 have been revised from earlier estimates and updated with 1996 landings. Reported landings for 1994-96 were 1,229t, 665t and 773t, respectively. The USA imposed a year-round closed area in December, 1994 and also increased minimum mesh sizes. Limits on days at sea were used as an additional measure for effort reduction.

Mean weight at age has been variable without trend between 1978 and 1996. Weight at age three is shown as an example.

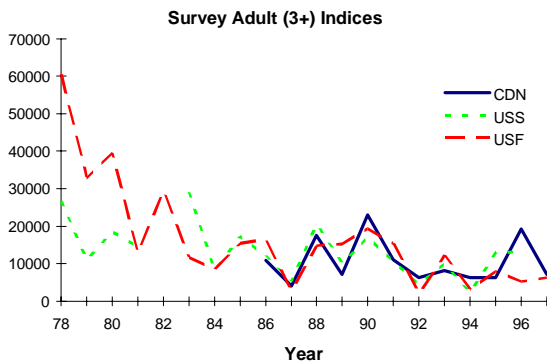


Catch at age for 1994-96 was estimated from Canadian and USA sampling data. In 1996, the 1992 year-class comprised about 49% of the total catch in numbers and in weight.

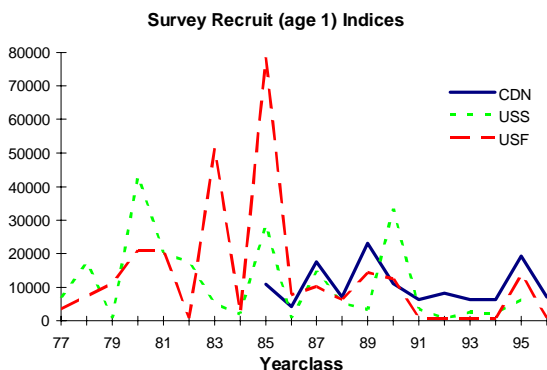


Resource Status

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.

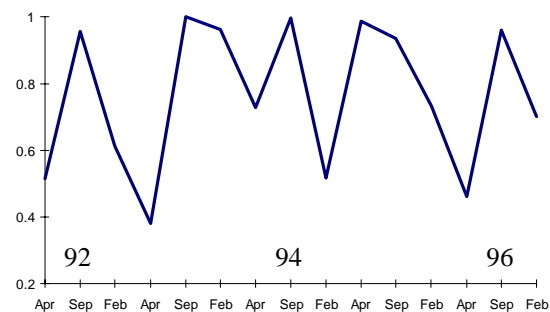


All three surveys appear to demonstrate similar relative year-class strengths with a decline in total numbers between 1990-92 and have remained at low levels since 1992. The 1997 Canadian spring 3+ indices decreased from the previous year. The USA spring and fall indices remained constant between 1995 and 1996. The 1990 year-class was above average while those since 1990 are well below average.



An analysis of **biomass distribution** relative to the international boundary from research surveys show a seasonal pattern. Most of the 5Zj,m cod biomass is found in the Canadian zone during the winter/spring period with more widespread distribution in the summer/fall time period.

Ratio of the 5Zj,m Biomass in Canadian Zone from 1992-97 surveys



Commercial fishery catch rate declined during 1987-94 but estimates of catch rates since 1994 are inappropriate as indices of stock abundance because of management restrictions. However, fishermen reported that during the 1995 and 1996 commercial fisheries, abundance of cod was higher than that observed in 1994.

A research longline survey by industry is in development but additional years of data are required before trends can be evaluated.

Although population trends are similar to last year, the estimates for 1995 and 1996 are lower than those reported last year. Reasons for these differences include:

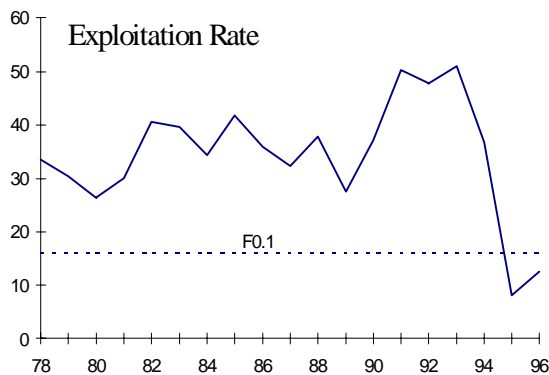
- lower Canadian survey index in 1997
- increased exploitation in 1996
- revision of USA landings and catch at age from estimates used in the last assessment.

Investigation of retrospective patterns did not identify a strong trend, but year-class abundance and fishing mortality estimates appeared to increase as additional data were included in the model.

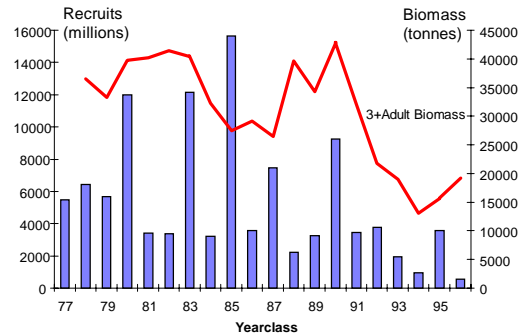
Abundance estimates indicate that there has been a substantial decline in 3+ biomass from 43,000t in 1990 to 13,000t in 1994, the lowest observed, but has increased since then to about 21,000t at the beginning of 1997.

However, a large part of this increase is due to growth and the contribution of the 1992 year-class at age 5 in 1997. The contribution of the 1992 year-class will diminish in 1998 as mortality offsets production from growth.

The **exploitation rate** increased rapidly between 1989 and 1991 to almost four times the $F_{0.1}$ reference level. In 1995, it was reduced to less than $F_{0.1}$ and remained below this level in 1996. The exploitation rate exceeded 40% between 1991 and 1993, was 37% in 1994, decreased to 8% in 1995, and was about 13% in 1996.



Recruitment has been below average since the 1990 year-class, and the 1994 year-class was the lowest observed. The 1995 year-class appears to be of moderate strength and similar in size to the 1992 year-class. Preliminary estimates for the 1996 year-class indicate that it may be of very low abundance and therefore abundance in 1998 will be very dependant on the contribution of the 1995 year-class at age 3.

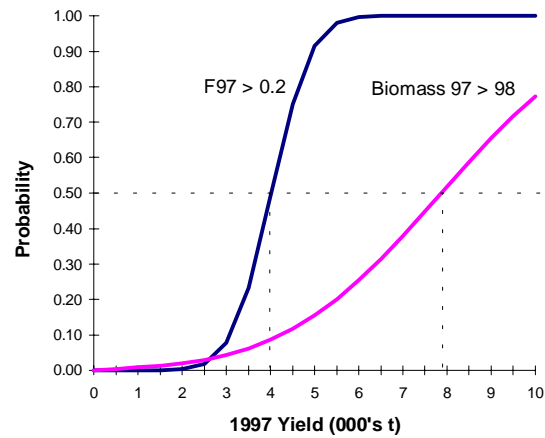
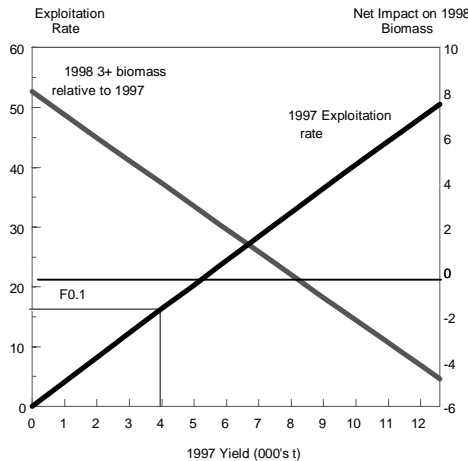


Outlook

The 1994-96 mean weights and partial recruitment from the fishery were used for catch projection. Yield projection at $F_{0.1}$ for 1997 indicates a **combined** Canada/USA yield of about 4,000t. Fishing at that level will result in an increase in 3+ stock biomass between 1997 and 1998 of 4,000t to about 24,500t, but still well below the 30,000 to 40,000t seen between 1978 and 1990. About 27% of the projected 1998 biomass will come from the 1992 year-class at age 6. Yields in 1997 and projected 1998 adult biomass for $F_{0.1}$ and the status quo exploitation rate are summarized below:

1997 Exploitation	1997 Yield	3+ Biomass in 1998
$F_{0.1}$	4,033t	24,430t
$F_{97}=F_{96}$	2,704t	25,789t

Yields in 1997 for a range of exploitation rates and the resultant impact on the adult biomass in 1998 are shown below:

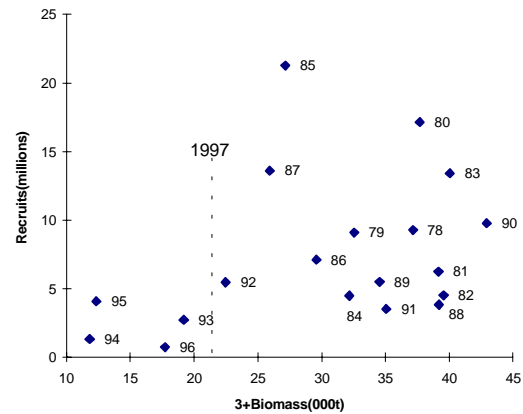


Adult biomass in 1998 would increase by about 8,000t with no fishing in 1997 and by about 4,000t at the F_{0.1} yield.

Uncertainty associated with results of the assessment can be related to the probability that exploitation rate in 1997 will exceed the F_{0.1} reference or that the 1998 biomass will be less than the 1997 biomass. These uncertainty calculations are based on approximations and do not include variations in weight at age, partial recruitment, variations in natural mortality, systematic errors in data reporting or model mis-specifications but should provide useful guidelines. The probability that the exploitation rate in 1997 will exceed F_{0.1} is very sensitive to changes in yield. For example, a combined Canada/USA catch of 3,000t, about what was caught in 1996, reduces the probability from 50% to about 10% that exploitation will exceed the F_{0.1} reference level.

Management Considerations

Comparison of adult biomass and resultant recruitment indicates that the relatively small 1992-96 year-classes have been produced at biomass levels of 25,000 t or less.



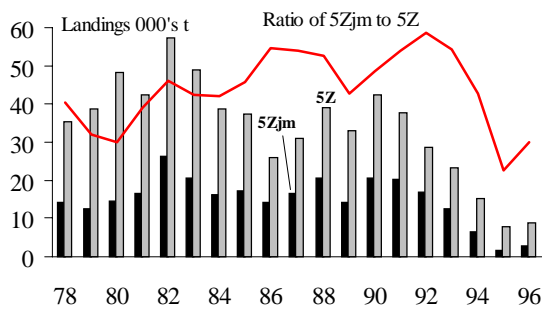
Measures to increase the biomass above the 1997 level of 21,000t would therefore enhance the prospects of improved recruitment.

The expected small size of the 1993, 1994 and 1996 year-classes increases the importance of the contribution of the moderate 1995 year-class. Limiting exploitation on this year-class to ensure production from growth would benefit stock rebuilding.

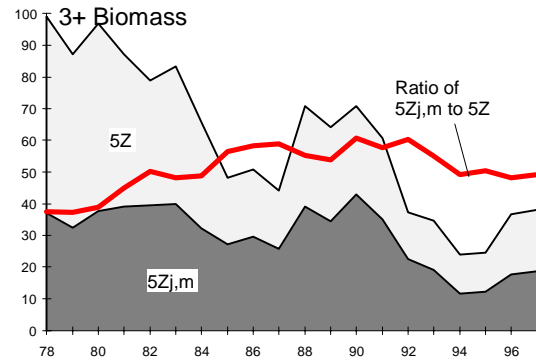
Comparison of Results for the 5Z (USA) and 5Zj,m (Canadian) Management Units

Substantial management actions, including area and seasonal closures, increased mesh size regulation, lower quotas, trip and days at sea limits to reduce effort have been implemented in both the 5Z and 5Zj,m areas. Stock status evaluation of the 5Z area was recently completed and comparison of trends in population with those in the 5Zj,m area is now possible.

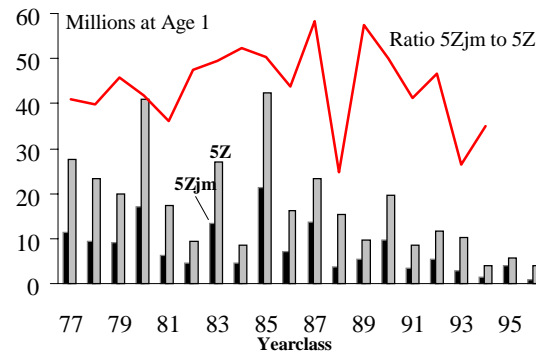
Catches in 1978-96 from 5Zj,m averaged about 44% of the total catches from 5Z, ranging between 59% and 22%.



The adult biomass in 5Z declined from about 100,000t in the late 1970s to 26,000t in 1994 but has since increased to 44,000t in 1997. Adult biomass in the 5Zj,m area ranged between 43,000t and 13,000t and was 21,000t in 1997. The 5Zj,m area accounts for 40-60% of the total 5Z adult biomass.

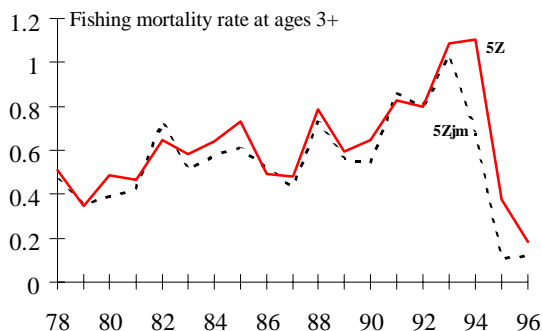


Recruitment patterns in the two areas have been similar. The 1980 and 1985 year-classes were the most abundant followed by the 1983 and 1987 cohorts.



Since 1990, recruitment has been below average in both areas. The 1995 year-class appears to be more abundant in 5Zj,m compared to the total 5Z area but the reverse is true for the 1996 year-class.

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 have lowered exploitation to below the $F_{0.1}$ level in 1996.



Population trends in the 5Zj,m and 5Z areas have remained relatively consistent over the 1978 to present time. This implies some measure of stability in the geographic distribution of the stock and both areas have shown an increase in biomass following the effort reductions implemented in 1994 and later.

For more Information

Contact: Joseph Hunt
Biological Station
St. Andrews, N.B.
E0G 2X0

Tel: (506) 529-8854
Fax: (506) 529-5862
E-mail: hunt@sta.dfo.ca

References

- Anon. 1997. Report of the 24th Stock assessment Workshop/Stock Assessment Review Committee. NEFSC Ref. Doc. 97/ (in preparation).
- Hunt, J.J., and M-I. Buzeta. 1997. Status of the Georges Bank cod stock in 5Zj,m. DFO Canadian Stock Assessment Secretariat Res. Doc. 97/53.

This report is available from the:

Maritimes Regional Advisory Process
Department of Fisheries and Oceans
P.O. Box 1006, Stn. B105
Dartmouth, Nova Scotia
Canada B2Y 4A2
Phone number: 902-426-7070
e-mail address: v_myra@bionet.bio.dfo.ca

Internet address: <http://csas.meds.dfo.ca>

La version française est disponible à l'adresse ci-dessus.

