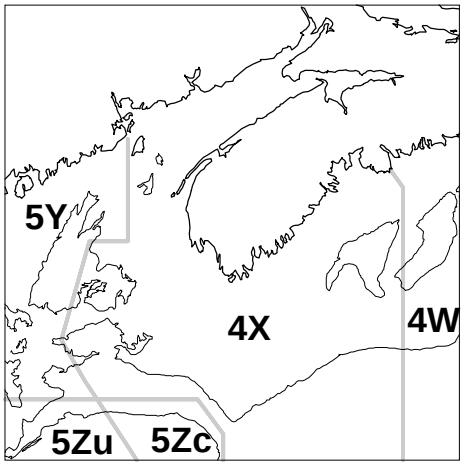
Southern Scotian Shelf And Bay Of Fundy Cod



Background

Atlantic cod is a bottom dwelling fish occurring on both sides of the North Atlantic. In the Canadian Atlantic, cod range from northern Georges Bank to northern Labrador. There are several concentrations of cod within this range, one of which occurs in the southern Scotian Shelf and Bay of Fundy (NAFO Division 4X).

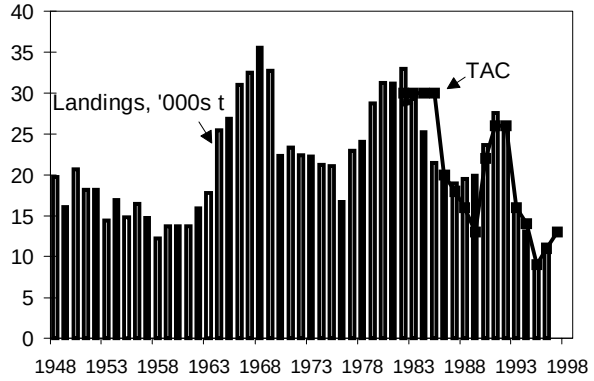
Juvenile cod in Division 4X feed on a wide variety of invertebrates and as they grow include fish in their diet. Seasonal movements associated with spawning occur and a number of spawning areas exist in Division 4X with the largest occurring during winter on Browns Bank. Growth rates vary among cod in Division 4X with more rapid growth noted in the Bay of Fundy. Cod in Division 4X reach on average 53 cm (21 inches) by age 3 years and increase to 72 cm (29 inches) by age 5 and 110 cm (43 inches) by age 10. Age at first reproduction generally occurs at 3 years and individuals tend to spawn several batches of eggs during a single spawning period.

Cod in Division 4X has supported a commercial fishery since the 1700s and until the 1960s was primarily an inshore fishery. Following extension of jurisdiction to 200 miles by coastal states in 1977, only Canada has made substantial landings of cod from this area. Minimum mesh size and hook size regulations have been enacted to reduce the catch of juvenile cod. Spawning area/seasonal closure of Browns Bank is in place from 1 February-15 June. Scientific advice is presented on the basis of a target capture rate of roughly 16% of the population and maintaining a large spawning stock biomass to enhance the probability of good recruitment.

The Fishery

Landings (thousands of tonnes)

Year	71-80 Avg	81-90 Avg	1992	1993	1994	1995	1996	1997
TAC	-	-	26	15	13	9	11	13
Total	23	24	26	16	13	9	11	



Landings increased through the 1960s from 14,000t to 36,000t as large offshore trawlers became active in the fishery. Since 1970, landings have varied between 16,000t and 33,000t, reaching their lowest level of 9,000t in 1995. These landings are a reflection of the Total Allowable Catch, which declined from 26,000t in 1992 to 9,000t in 1995. The TAC

Canada

increased to 13,000t for 1997, a harvest level which was projected to entail a 50% risk of a reduction in age 4+ biomass. Landings to the end of June in 1997 were 3,600t.

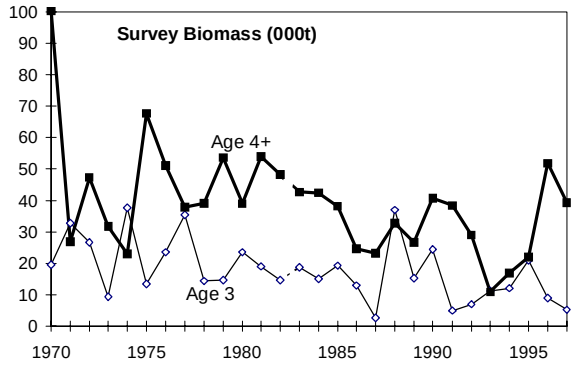
The fishery takes place year round, with catches peaking in June and July, and is prosecuted predominantly by tonnage classes 1 and 2 longliners and handliners (45% of landings), and tonnage class 2 and 3 otter trawlers (37% of landings), along with gillnetters and large otter trawl vessels. The distribution of landings in 4X has shifted west in recent years, with both the gillnet and otter trawl fleets concentrating more in the Bay of Fundy.

Effort by all gear sectors has declined from a peak in 1991 or 92. For 1996, effort appears to have increased for some, though not all, sectors of the fishery, but remains much lower than the levels seen in the early 1990's.

In the first half of 1997, landings were dominated by the 1992 year-class (age 5, 25-32in) which accounted for 47% of the landed weight. This was lower than expected, with the shortfall made up by age 3 and 4 fish. Although the population abundance of age 6+ cod is low, recent declines in the proportion of older cod in the landings are likely due in part to reduced fishing effort during the winter-spring fishery when the proportion of large cod in the catch is generally highest. These changes in fishing patterns are resulting in increased exploitation of age 3 and 4 cod, which previously were only partly recruited to the fishery.

Resource Status

Stock status evaluation was based on an analytical assessment using commercial landing statistics, samples for size and age composition of the commercial catch, and trends in abundance from the July research survey. While analyses have been conducted using commercial catch at age data prior to 1980 in previous assessments, commercial sampling for this period was sparse. Due to uncertainties in the reliability of catch at age prior to 1980 for some areas, it has not been considered in recent assessments.

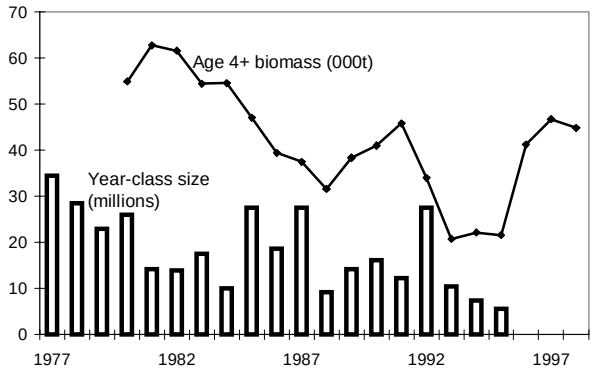


The 1997 **research vessel (RV) survey** biomass (adjusted for differences in survey vessel catchability before and after 1983) for ages 4 and older combined decreased from 1996, but is still about average due to high catches of the strong 1992 year-class. Survey biomass estimates for ages 2 and 3 (1994 and 1995 year-classes) are quite low.

Length at age on the Scotian Shelf has been fairly consistent, but has been higher than average in the last 5 years in the Bay of Fundy.

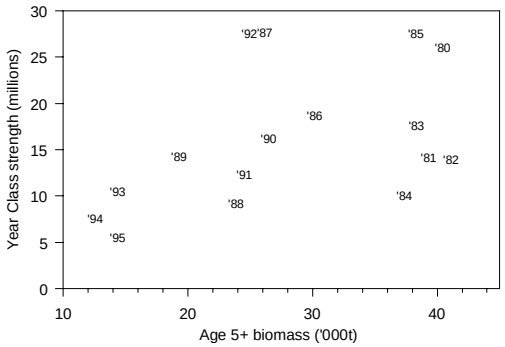
A joint industry/DFO Science resource survey (**ITQ survey**) has been conducted by the ITQ fleet in 4X for three years, concurrent with the RV survey. The ITQ survey covered most of the 4X area, including much of the inshore area from St. Marys Bay to Cape Sable which is not covered by the RV survey. The geographic pattern of cod catches in the ITQ survey was similar to those from the RV survey; the highest catches were in the Bay of Fundy, while catches of cod were predominantly null in deep water south of Browns and German banks, and on LaHave Bank and farther east. The results of this survey suggest there has been little change in cod biomass in the Bay of Fundy, but a decline in biomass in other areas.

Population abundance estimates indicate that the stock will decline during 1997. The beginning of year population biomass for ages 4+ peaked in 1991, then dropped to the lowest levels in the time series in 1993. The increase since 1995 is primarily due to recruitment of the very strong 1992 cohort. Assuming that the 1997 TAC of 13,000t is caught, the beginning of 1998 age 4+ biomass will drop to 45,000t, down 2,000t from 1997.

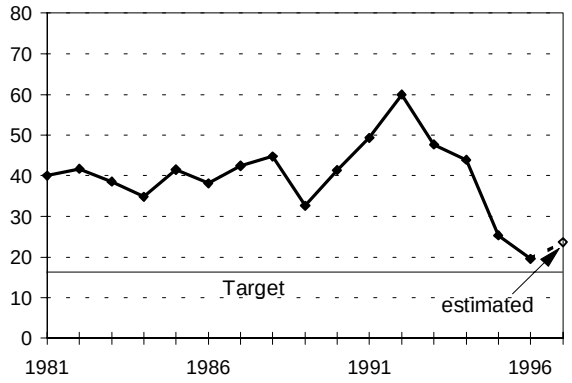


Spawning occurs in 4X both in fall (Oct. - Nov.), and spring (Feb. - May), and is quite widespread geographically. In fall, cod spawn along the coast from Halifax around into the Bay of Fundy. Until about 1984, cod concentrating off Halifax harbour and St. Margarets Bay were the subject of a substantial seasonal gillnet fishery. In recent years, however, this has all but disappeared. In spring, cod spawn primarily on Browns Bank, but also near the mouth of, and in the Bay of Fundy.

Recruitment following the 1992 year-class looks quite poor. All three cohorts are below average, with the 1994 and 1995 year-classes estimated as the lowest in the time series. The low number of small fish (20 - 30cm) caught in the 1997 ITQ survey suggests that recruitment of the 1996 year-class may also be poor. Given the low 5+ biomass in 1996 (18,000t), the stock recruitment relationship also suggests that poor recruitment for this year-class can be anticipated. The 5+ biomass for 1997 and projected for 1998 is 38,000t, suggesting that there is currently a higher probability of average or better recruitment.



The exploitation rate throughout most of the recent past has consistently been well over twice the target of 16%, reaching a high of 60% in 1992. Exploitation rate has declined markedly since then, to 19% in 1996.

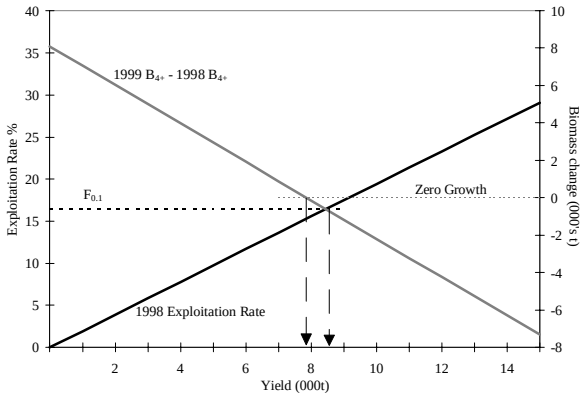


The assessment for this stock shows no strong retrospective pattern. There is a slight tendency to initially under-estimate year-class strength, however for most year-classes there is little or no change in estimated size with additional years of information.

Outlook

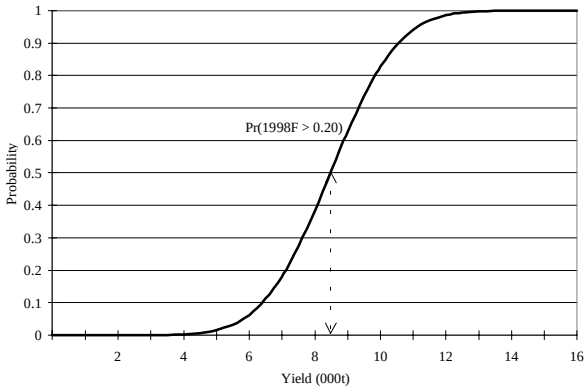
The expected catch of about 13,000t in 1997 will result in an exploitation rate of 24%, an increase from 1996. The projected yield at the target exploitation rate for 1998 would be about 8500t, 40% of which is expected to come from the 1992 year-class. At this fishing level, the age 4+

biomass is projected to decrease by 1,000t in 1998 to about 44,000t at the beginning of 1999.



Though all uncertainties and biases cannot be incorporated, the statistical precision of the abundance estimate was approximated, and used to evaluate the risk that specific catch levels in 1998 would exceed $F_{0.1}$, or result in a decline in age 4+ biomass from 1998 to 1999. At a yield of 8,500t which corresponds to a 50% risk of exceeding $F_{0.1}$, the 4+ population biomass has a 58% probability of decreasing for 1998; this probability declines to 50% at a yield of about 7,900t. The probability of exceeding $F_{0.1}$ declines below 20% for harvests of 7,100t or lower.

The fishery at present is concentrating on younger fish than in past years. Continuing with fishing patterns which result in higher exploitation rates on ages 3 and 4 cod will reduce the potential yield from these fish.



Given that poor recruitment is anticipated for the 1996 year-class, it is unlikely that average or better recruitment to the fishery (age 3) will be seen until at least 2000. If the harvest level in 1998 results in a reduction in stock size, the $F_{0.1}$ projected yield for 1999 will be lower than for 1998. To ensure a higher probability of average or better recruitment it is important to ensure that the spawning stock remains high. Given the poor recruitment of recent year-classes, this will require reducing exploitation below the levels at which it has been set in recent years.

For More Information

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References

Clark, D. S. 1997. Assessment of cod in Division 4X in 1997. Can. Stock Assess. Secr. Res. Doc. 97/110.

This report is available from the:

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