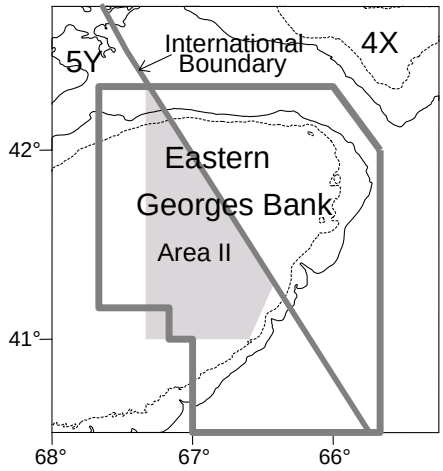
EASTERN

GEORGES BANK

COD

[5Zjm; 551,552,561,562]



Summary

- Combined Canada/USA catches were 1,796 mt, including 472 mt of discards.
- Adult population biomass (ages 3+) declined from 19,400 mt in 2001 to 13,200 mt in 2005, but increased again to 19,300 mt at the beginning of 2008.
- Fishing mortality fluctuated between 0.19 and 0.50 from 1995 to 2004, declined to 0.12 in 2005, and has subsequently been at or below the F_{ref} level of 0.18. Fishing mortality in 2007 was 0.13.
- Recruitment at age 1 of the 2003 year class, at 7.1 million, is the only above average cohort since the 1990 year class. The 2002, 2004 and 2006 year classes are the lowest on record and the 2005 year class is also below average. Current biomass is less than 25,000 mt (the level below which recruitment tends to be lower than average).
- Resource productivity is currently poor due to low recent recruitment and low weights-at-age.
- Assuming a 2008 catch equal to the 2,300 mt total quota, a combined Canada/USA catch of about 2,100 mt in 2009 would result in a neutral risk (50%) that the fishing mortality rate in 2009 would exceed F_{ref}, whereas a catch of 1,300mt would result in a neutral risk (50%) that the 2010 adult biomass would be lower than the 2009 adult biomass. A 10% biomass increase is unlikely even with no catch. The 2003 year class is projected to contribute over 50% of the fishery catch biomass in 2008 and 2009.
- There is uncertainty about the benchmark model formulation that is not captured in the risk calculations. Some alternative formulations that were investigated produced results that were similar, but the most pessimistic estimated about half the 3+ biomass and projected catch of the benchmark formulation results. The benchmark formulation was used as the basis for management advice.

Catches, Biomass (thousands mt); Recruits (millions)

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Avg[1]	Min[1]	Max[1]
Canada	**Quota**	1.8	1.6	2.1	1.2	1.3	1.0	0.7	1.3	1.4	1.6			
	Landed	1.8	1.6	2.1	1.3	1.3	1.1	0.6	1.1	1.1		6.4	0.6	17.8
	Discard	0.3	0.1	0.1	0.1	0.2	0.1	0.2	0.4	0.1		0.1	0.0	0.5
USA	**Quota[3]**						0.3	0.3	0.4	0.5	0.7			
	Landed	1.2	0.7	1.4	1.4	1.8	1.0	0.1	0.1	0.2		4.0	0.1	10.6
	Discard	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.3		0.1	0.0	0.3
Total	**Quota**						1.3	1.0	1.7	1.9	2.3			
	Catch	3.3	2.3	3.7	2.8	3.4	2.3	1.1	1.6	1.8		10.5	1.1	26.5
Adult Biomass[4]		15.4	15.9	19.4	18.4	15.4	18.3	13.2	16.1	18.9	19.3	24.6[2]	8.5[2]	43.8[2]
Age 1 Recruits		4.4	2.6	2.2	2.9	0.9	7.1	0.9	2.6	0.9		6.1	0.9	21.1
Fishing mortality[5]		0.29	0.18	0.30	0.23	0.33	0.19	0.12	0.18	0.12		0.45	0.12	1.00
Exploitation Rate		23%	15%	24%	18%	26%	16%	10%	15%	11%		32%	10%	58%

[1]1978 – 2007
[2]1978 – 2008
[3]for fishing year from May 1 – April 30
[4]Jan 1 ages 3+
[5]ages 4-6

Fishery

Combined Canada/USA catches, which averaged 17,500 mt between 1978 and 1992, peaked at 26,460 mt in 1982, declined to 1,804 mt in 1995, fluctuated around 3,000 mt until 2003, and subsequently declined again. Catches in 2007 were 1,796 mt, including 472 mt of discards (Figure 1).

Canadian catches decreased to 1,232 mt in 2007 from 1,450 mt in 2006. Since 1995, with reduction in cod quotas, the fishery has reduced targeting for cod through changes in fishing practices. All 2007 landings were subject to dockside monitoring and at sea observers monitored close to 99% by weight of the mobile gear fleet landings and 6% by weight of the fixed gear landings. No discards were attributed to the Canadian mobile gear groundfish fishery due to the high observer coverage. Discards from the Canadian fixed gear fleet could not be estimated because of low observer coverage, but they were assumed to be negligible, consistent with the observations from the 2006 fishery. Since 1996 the Canadian scallop fishery has not been permitted to land cod. Estimated discards of cod by the Canadian scallop fishery were 124 mt in 2007.

USA catches increased to 564 mt in 2007 from 166 mt in 2006. Since December 1994, a year-round closure of Area II has been in effect, with the exception of a Special Access Program for yellowtail flounder in 2004. Minimum mesh size limits were increased in 1994, 1999 and 2002. Limits on sea days and trip limits have also been implemented. Quotas were introduced in May 2004. Estimated discards of cod in the groundfish fishery for 2007 were 348 mt.

The combined Canada/USA 2007 **fishery age composition** was dominated by the 2003 year class at age 4 (57% by number) whilst the 2001 year class at age 6 made the second highest contribution (12% by number). The fully recruited 2002 year class at age 5 contributed only 4% to the catch by number. Where applicable, discards at age from the

USA groundfish fishery (1989 to 2007), the Canadian groundfish fishery (1995 to 2007) and the Canadian scallop fishery (1978 to 2007) were included in the assessment.

Harvest Strategy and Reference Points

The Transboundary Management Guidance Committee has adopted a strategy to maintain a low to neutral risk of exceeding the fishing mortality limit reference, $F_{ref} = 0.18$. When stock conditions are poor, fishing mortality rates should be further reduced to promote rebuilding.

State of Resource

Evaluation of the state of the resource was based on results from an age structured analytical assessment (Virtual Population Analysis, VPA), which used fishery catch statistics and sampling for size and age composition of the catch for 1978 to 2007 (including discards). The VPA was calibrated to trends in abundance from three bottom trawl survey series: NMFS spring, NMFS fall and DFO. Retrospective analyses were conducted to detect any tendency to consistently overestimate or underestimate fishing mortality, biomass or recruitment relative to the terminal year estimates. The extent of the retrospective pattern for this assessment was similar to that seen in the past and was not of concern, although there was a general tendency to initially underestimate recent weak year-classes as recruits at age 1.

There are some concerns regarding the currently accepted benchmark model formulation. The benchmark formulation displayed a desirable feature, a flat pattern for survey catchability at older ages. However, this formulation now shows a domed catchability for older ages in both the DFO and NMFS spring surveys. In combination with the domed fishery partial recruitment for older ages, this generates 'cryptic' biomass that is not observed in either the fishery or the surveys. This can lead to an overestimation of fish at older ages. A preliminary examination was made of a number of other model formulations. However, there were also issues with these alternative formulations that were not fully resolved, and all generated lower biomass and lower projected catches than the current benchmark formulation. Some of the alternative formulation results were similar, but the most pessimistic (splitting the survey indices in 1994) were about half the 3+ biomass and projected catch of the benchmark formulation results. The benchmark formulation was used as the basis for management advice.

Adult population biomass (ages 3+) declined substantially from 43,800 mt in 1990 to 8,500 mt in 1995, the lowest observed (Figure 2). The biomass subsequently increased to 19,400 mt in 2001, declined to 13,200 mt in 2005 but increased again to 19,300 mt at the beginning of 2008 (80% Confidence Interval: 16,300 mt – 23,600 mt). Much of the increase in the late 1990s was the result of growth and survival to ages 5+ of the 1992, 1995 and 1996 year classes. The increase in 2006 was due largely to recruitment of the 2003 year class, and the increases in 2007 and 2008 were due to growth of the 2003 year class. All subsequent year classes have been below the 1978 to 2007 average. Lower weights-at-age in the population in recent years and generally poor recruitment (see below) have contributed to the lack of sustained rebuilding.

Recruitment at age 1 of the 2003 year class, at 7.1 million, is the only above average (6.1 million for 1978-2007) cohort since the 1990 year class (Figure 2). The 2002, 2004 and 2006 year classes, at less than 1 million each, are the lowest on record. Although the 2005 year class (2.6 million fish at age 1) is stronger than any of these cohorts, it too is below average. Current biomass is less than 25,000 mt, the level below which recruitment tends to be lower than average (Figure 3).

Fishing mortality (population weighted average of age groups 4-6) increased sharply between 1989 and 1993 from 0.46 to 1.00 (Figure 1). Due to restrictive management measures, fishing mortality fluctuated between 0.19 and 0.50 during 1995 to 2004, declined to 0.12 in 2005, and has subsequently been at or below the F_{ref} level of 0.18. Fishing mortality in 2007 was 0.13 (80% Confidence Interval: 0.10 – 0.18).

Productivity

Recruitment, as well as age structure, fish growth, and spatial distribution, reflect changes in the productive potential. In both absolute numbers and percent composition, the **population age structure** displays a higher abundance at older age groups compared to the mid 1990s. However, the abundance for older ages may not be well determined. Average weight at length, used to reflect **condition**, has been stable, but declines in **length at age**, and hence **weight at age,** have hampered biomass rebuilding. The **spatial distribution** patterns for ages 3+ observed during the most recent bottom trawl surveys were similar to those observed over the past decade. Resource productivity is currently poor due to low recent recruitment and low weights-at-age.

Outlook

This outlook is provided in terms of consequences with respect to the harvest reference points for alternative catch quotas in 2009. Uncertainty about standing stock generates uncertainty in forecast results, which is expressed here as the risk of exceeding F_{ref} =0.18. The risk calculations assist in evaluating the consequences of alternative catch quotas by providing a general measure of the uncertainties. However, they are dependent on the data and model assumptions and do not include uncertainty due to variations in weight at age, partial recruitment to the fishery, natural mortality, systematic errors in data reporting or the possibility that the model may not reflect stock dynamics closely enough.

For **projections**, the 2005-2007 average values for the fishery weight at age and the 2003-2007 average values for partial recruitment pattern were assumed for 2008-2009 and the 2006-2008 survey average values were assumed for beginning of year population weight at age in 2009-2010. Assuming a 2008 catch equal to the 2,300 mt total quota, a combined Canada/USA catch of about 2,100 mt in 2009 would result in a neutral risk (50%) that the fishing mortality rate in 2009 would exceed F_{ref}, whereas a catch of 1,300 mt would result in a neutral risk (50%) that the 2010 adult biomass would be lower than the 2009 adult biomass. A 10% biomass increase is unlikely even with no catch.

While management measures have resulted in decreased exploitation rate since 1995, adult biomass has fluctuated between 15,000 and 19,000 mt since 1999 without any

persistent rebuilding. The recent lower size at age of cod has contributed to the lack of recovery. However, the continuing poor recruitment since the early 1990s is an important factor for this lower productivity. The 2003 year class (7.1 million) is the only one since the 1990 year class that has approached the average for 1978-1990 (9.8 million) and is projected to contribute over 50% of the fishery catch biomass in 2008 and 2009. Furthermore, the 2002, 2004 and 2006 year classes are the lowest since 1978 at less than one million recruits. Without improved recruitment, rebuilding will not occur at current harvest levels. Notably, appreciable rebuilding will not occur even without fishing in 2009.

Special Considerations

If the eastern Georges Bank and Georges Bank management units are assessed using different model formulations, results may be difficult to reconcile. Potential inconsistencies in stock status and reference points between these assessments may have implications for the management of the fisheries in these units, which need to be explored fully in a benchmark assessment. For example, the difference in biomass between Georges Bank and eastern Georges Bank assessment results may not reflect the status of western Georges Bank. However, it was considered premature to revise the reference points for eastern Georges Bank at this time.

Cod and haddock are often caught together in groundfish fisheries, although they are not necessarily caught in proportion to their relative abundance because their catchabilities to the fisheries differ. Due to the higher haddock quota, discarding of cod may be high and should be monitored. Modifications to fishing gear and practices, with enhanced monitoring, may mitigate these concerns.

Source Documents

Clark K, O'Brien L, Wang Y, Gavaris S, Hatt B. 2008. Assessment of eastern Georges Bank Atlantic cod for 2008. TRAC Reference Document 2008/01.

TRAC. 2008. Proceedings of the Transboundary Resources Assessment Committee (TRAC); 23–26 June 2008. TRAC Proceedings 2008/01.

Correct Citation

TRAC. 2008. Eastern Georges Bank Cod. TRAC Status Report 2008/01.

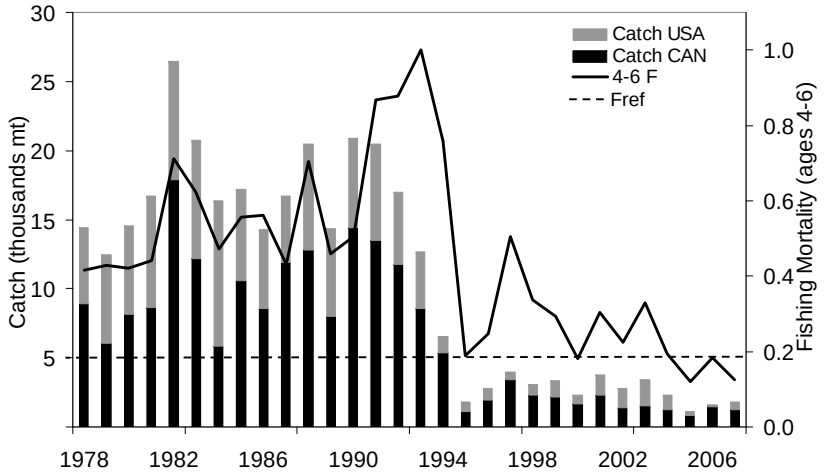


Figure 1. Catches and fishing mortality.

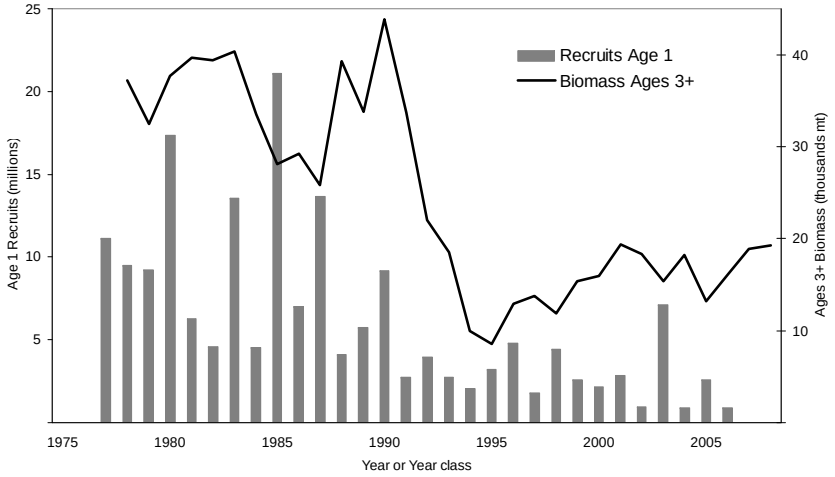


Figure 2. Biomass and recruitment.

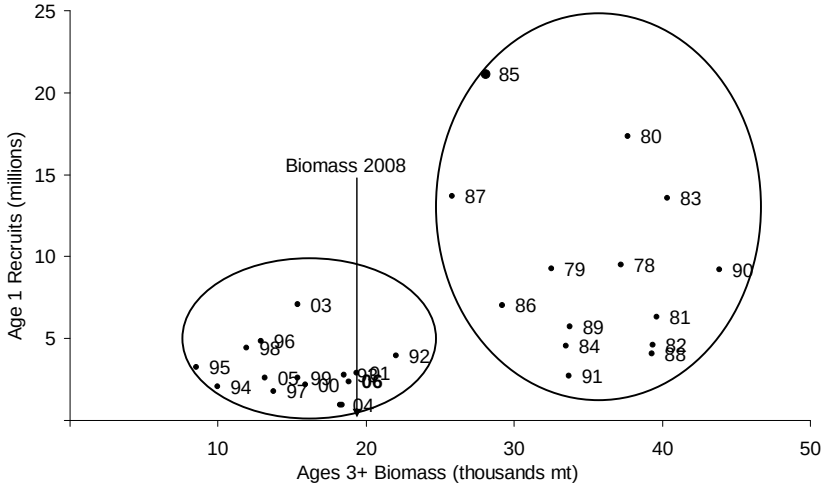


Figure 3. Stock recruitment patterns.

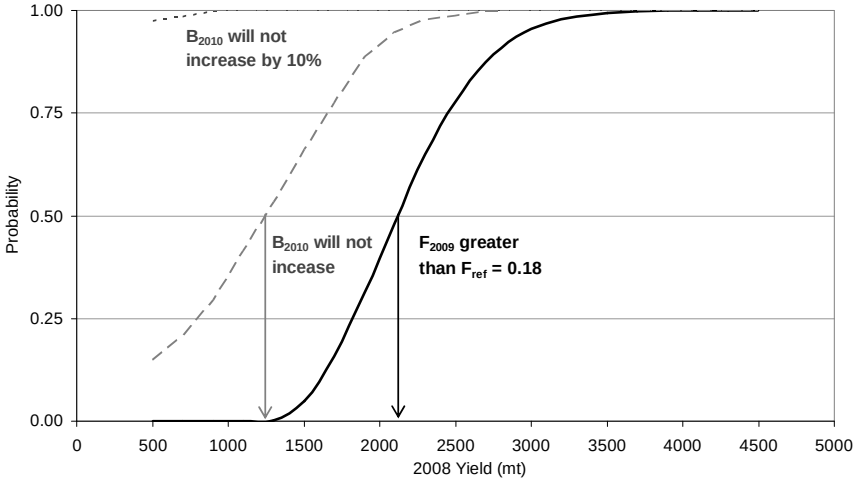


Figure 4. Projection risks.