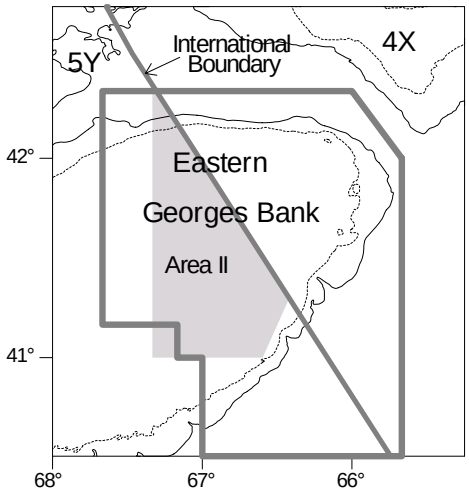
EASTERN GEORGES BANK COD

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



Summary

- Combined Canada and USA catches in 2004 were about 2,300 mt, a decrease of about 1,100 mt from 2003.

- Adult biomass increased from 8,700 mt in 1995 to about 18,800 mt in 2001 but has since declined to about 14,300 mt at the beginning of 2005. Most of the post-1995 increase has been the result of growth and survival to ages 5+ of the 1992, 1995 and 1996 year classes.

- Recruitment of the 2002 year class, at less than 1 million is the lowest on record. The 2003 year class shows a substantial increase over recent years to about 9.3 million, but has high uncertainty.

- In 1995, fishing mortality declined to near F_{ref} =0.18 due to restrictive management measures. Since 1995, fishing mortalities have been greater than F_{ref} but the F_{2004}=0.16 was below F_{ref}.

- Age structure continues to expand, but overall productivity for this stock is currently poor, largely due to declines in weight at age and, with the exception of the 2003 year class, low recruits per spawner.

- Assuming a 2005 catch equal to the 1,000 mt quota, a combined Canada/USA yield of about 2,200 mt in 2006 has a neutral risk, about 50%, of exceeding F_{ref} = 0.18 and a low risk, about 25%, of not achieving a 10% increase in biomass from the beginning of year 2006 to the beginning of year 2007. A 2006 yield of about 1,900 mt would reduce the risk of exceeding F_{ref} to 20% and enhance stock rebuilding prospects.

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

		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Avg[1]	Min[1]	Max[1]
Canada	**Quota**	2.0	3.0	1.9	1.8	1.6	2.1	1.2	1.3	1.0	0.7	3.4	1.0	15
	Landed	1.9	2.9	1.9	1.8	1.6	2.1	1.3	1.3	1.1		7.2	1.1	17.8
	Discard	0.1	0.5	0.4	0.4	0.1	0.1	0.1	0.2	0.1		0.1	0	0.5
USA	**Quota**[5]									0.3	0.3			
	Landed	0.8	0.6	0.8	1.2	0.7	1.4	1.4	1.8	1.0		4.5	0.6	10.6
	Discard	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.1	0.1		<0.1	<0.1	0.2
Total	**Quota**									1.3	1.0			
	Catch	2.8	4.0	3.1	3.3	2.3	3.7	2.8	3.4	2.3		11.9	1.8	26.5
	Adult Biomass[2]	12.7	13.5	12.1	16.3	15.7	18.8	17.1	15.3	16.5	14.3	25.6[4]	8.7[4]	45.4[4]
	Age 1 Recruits	2.9	4.6	1.7	4.5	3.1	2.5	1.8	0.6	9.3		6.5	0.6	21.1
	Fishing mortality[3]	0.25	0.42	0.32	0.30	0.20	0.30	0.23	0.29	0.16		0.48	0.20	0.95
	Exploitation Rate[3]	20%	31%	25%	23%	16%	24%	19%	23%	13%		34%	16%	57%

[1]1978 – 2003
[2]ages 3+
[3]ages 4-6
[4]1978-2004
[5]for fishing year from May 1 – April 30

Fishery

Combined Canada/USA catches, which averaged about 17,900 mt between 1978 and 1992, peaked at 26,600 mt in 1982 and declined to 1,800 mt in 1995. Catches in 2004 were 2,300 mt (Figure 1). Canada accounted for about 60-70% of historical total landings but this has declined to about 50% since 2002.

Canadian catches declined to 1,200 mt in 2004 from about 1,500 mt in 2003. Landings from fixed gear components have been dominant in recent years. In 1995, cod fishing was restricted to bycatch only. Since 1995, with reduction in quotas, the fishery has become more of a mixed species fishery with reduced targeting for cod. Also, since 1995, industry imposed self-regulation to avoid overrunning allocations, including directing for haddock in early June and late fall when cod bycatch was low. The Canadian groundfish fishery on eastern Georges Bank has been closed to all vessels from January to May inclusive, since 1994. About 10% of landed weight was observed and all landings have been subject to 100% dockside monitoring. Since 1996 the Canadian scallop fishery has not been permitted to land cod. Landings until 1995 include those catches reported by the scallop fishery. Discards of cod by the Canadian scallop fishery since 1978 were estimated from scallop effort data and observed catches and ranged up to 200 mt. Analysis of discarding in the groundfish fishery for 1995-2004 indicated discards of 200 to 400 mt in 1997-1999. Age composition of all discard catches were derived and added to the annual catch at age for 1978-2004 for this assessment. Estimates of cod less than 43 cm taken in the Canadian groundfish fishery have been less than 1% of the total in recent years.

USA catches for 1995-98 were less than 1,000 mt but have been increasing since 1998 to 1,900 mt in 2003 and declined to 1,100 mt in 2004. Since December of 1994, a year-round closure of Area II has been in effect. Minimum mesh sizes limits were increased in

1994, 1999 and again in 2002. Limits on sea days as well as trip limits were also used as additional management measures. Most of the 2004 catch was taken in the first and second quarters, prior to implementation of a reduced quota allocation for the 2004 fishing year (May 2004-April 2005). Preliminary analysis of cod discards and associated catch at age in the groundfish fishery for 1989-2004 were derived and were generally less than 100 mt. The estimated discard catch at age for 1989-2004 was included in the assessment.

The 2000 year class at age 4 dominated (24%) the **combined Canada/USA 2004 fishery**. The proportional catch at age in 2004 differed from that forecast in the 2004 yield projection of the previous assessment, with age 3 (the 2001 year-class) contributing more than 20% compared to a projected value of 10%.

Harvest Strategy & 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

The state of the resource was based on results from an age structured analytical assessment (VPA) that used fishery catch statistics and sampling for size and age composition of the catch for 1978 to 2004, including discards. The VPA was calibrated to trends in abundance from three bottom trawl research surveys, NMFS spring, NMFS fall and DFO. Retrospective analysis is used to detect any pattern of inconsistency with a tendency to over or underestimate fishing mortality, biomass and recruitment relative to the terminal year estimate. The extent of the pattern for this assessment was similar to that seen in the past and was not of concern.

There was a substantial decline in **adult (3+) stock biomass** from about 45,400 mt in 1990 to about 8,700 mt in 1995, the lowest observed (Figure 2). The biomass subsequently increased to 18,800 mt in 2001 but declined to 14,300 mt at the beginning of 2005 (80% Confidence Interval: 12,200 t – 17,500 t). 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. Lower weights-at-age in the population in recent years and the continuing low recruitment have contributed to the recent decline.

Recruitment at age 1 has been below the average of 6.5 million since 1990. The 1996 and 1998 year classes, at about 4 million, appear to be the strongest since the 1990 year class (Figure 2). Recruitment of the 2002 year class, at less than 1 million is the lowest on record. The 2003 year class shows a substantial increase over recent years to about 9.3 million. This year class will make a large contribution to the fishery over the next several years.

The **fishing mortality for ages 4-6** increased rapidly between 1989 and 1993 to over 0.9, much greater than the fishing mortality reference, $F_{ref} = 0.18$ (Figure 1). In 1995, it declined to near F_{ref} due to restrictive management measures. Since 1995, fishing mortalities have been greater than the F_{ref} but the F_{2004}=0.16 (80% Confidence Interval: 0.13 – 0.20) was below F_{ref}.

Productivity

Recruits per spawner, age structure, spatial distribution and fish growth reflect changes in the productive potential. Recruit per spawner has been generally lower than that seen prior to 1990. In both absolute numbers and percent composition, the **population age structure** displays an increasing representation of age groups, reflecting lower exploitation, particularly at younger ages, since 1995. The **spatial distribution** patterns observed during the most recent bottom trawl surveys were similar to the average patterns over the previous five years. Observed declines in **weight at age** are a factor in limiting improvements to the population biomass. Largely due to low recruits per spawner, with the exception of the 2003 year class, and declines in weight at age, overall productivity for this stock is currently poor.

Outlook

The outlook is provided in terms of the possible consequences for alternative catch quotas in 2006 with respect to the harvest reference points. Uncertainty about standing stock generates uncertainty in forecast results. This uncertainty is expressed in the outlook as the risk of exceeding $F_{ref} = 0.18$, the risk of not achieving a stable biomass and the risk that the biomass will not increase by 10% or more between 2006 and 2007. The risk calculations provide a general sense of the uncertainties and assist with evaluating the consequences of alternative catch quotas. These calculations 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 the stock dynamics closely enough. Also, the risk calculations are dependent on the model assumptions and data used in the analyses. Though the assumptions used were deemed most suitable, there may be other plausible assumptions.

Assuming a 2005 catch equal to the 1,000 mt quota, the projection indicates that a combined Canada/USA yield of about 2,200 mt in 2006 has a neutral risk, about 50%, of exceeding F_{ref}. (Figure 4). At a yield of 2,200 mt in 2006, there is a low risk of a decrease in biomass and about a 25% risk of not achieving a 10% increase in biomass from the beginning of year 2006 to the beginning of year 2007. A 2006 yield of about 1,900 mt would reduce the risk of exceeding F_{ref} to about 20% and enhance stock rebuilding prospects (low risk of not achieving 10% biomass increase). The 2003 year class at age 3 in 2006 is projected to contribute about 1,000 mt to the catch.

Medium term projections assumed that the stock is exploited at a constant fishing mortality rate of 0.18 and that recruitment was average. The previous 10-year average recruitment, with the 2003 year class included, is 4.0 million. However, the 2003 year

class is not well estimated and has considerable uncertainty and an average (2.3 million) with this year class excluded may be more consistent with recent recruitment trends.

Biomass, Yield (thousands mt)

	2.3 Million Recruits			4.0 Million Recruits		
	Total Biomass	Adult Biomass	Yield	Total Biomass	Adult Biomass	Yield
2005	20	14	1.0[1]	20	14	1.0[1]
2006	23	22	2.2	24	22	2.2
2007	25	23	2.8	24	25	3.0
2008	26	25	2.9	30	28	3.5
2009	26	25	2.5	32	30	3.4
2010	24	23		32	30	

[1] Total Allowable Catch in 2005

Special Considerations

Consistent management by Canada and the USA is required to ensure that conservation objectives are not compromised.

The 2003 year class will dominate the catch in 2006 and continue to dominate it to 2009, the last year of the forecast. These increasing catches are highly dependent on the magnitude of this year class, which has high uncertainty. Measures should be taken to avoid wastage of this year class due to discarding. This year class represents an opportunity to initiate rebuilding of the stock by pursuing a risk averse harvest strategy.
Cod and haddock are often caught together in groundfish fisheries, although their catchabilities to the fisheries differ and they are not necessarily caught in proportion to their relative abundance. With current fishing practices and catch ratios, the achievement of rebuilding objectives for cod may constrain the harvesting of haddock. Additional efforts to protect the 2003 cod year class which, from first indications, is estimated to be larger than has been seen in recent years are warranted. Modifications to fishing gear and practices, with enhanced monitoring, may mitigate these concerns.

Source Documents

Hunt, J.J., L. O'Brien, and B. Hatt. 2005. Population status of eastern Georges Bank cod for 1978-2006. TRAC Reference Document 2005/01.

TRAC, 2005. R. O'Boyle, and W. Overholtz [eds]. Proceedings of the Transboundary Resources Assessment Committee (TRAC); 14–16 June 2005. TRAC Proceedings 2005/02.

Correct citation:

TRAC. 2005. Eastern Georges Bank cod. TRAC Status Report 2005/01.

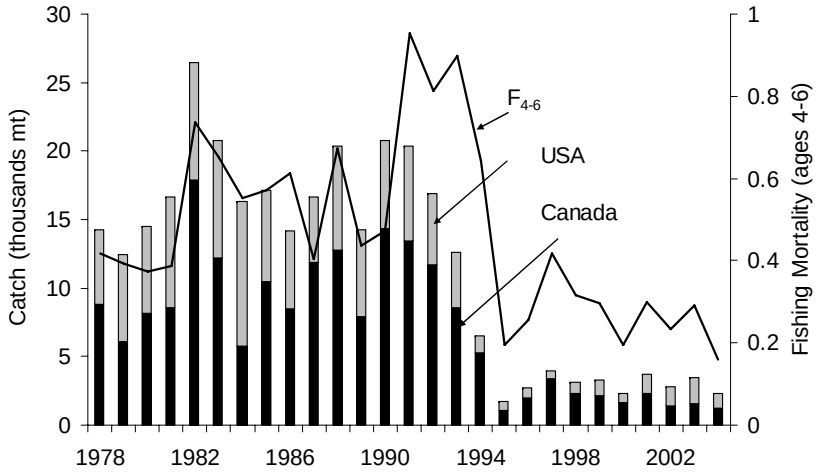


Figure 1. Catches and fishing mortality.

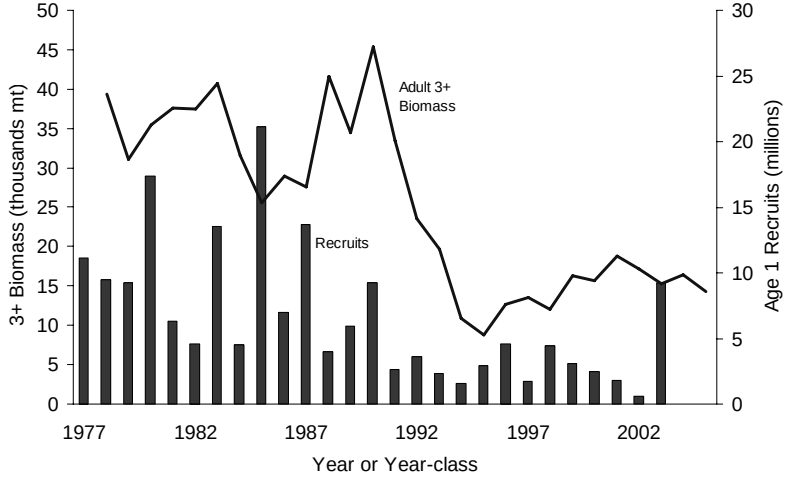


Figure 2. Biomass and recruitment.

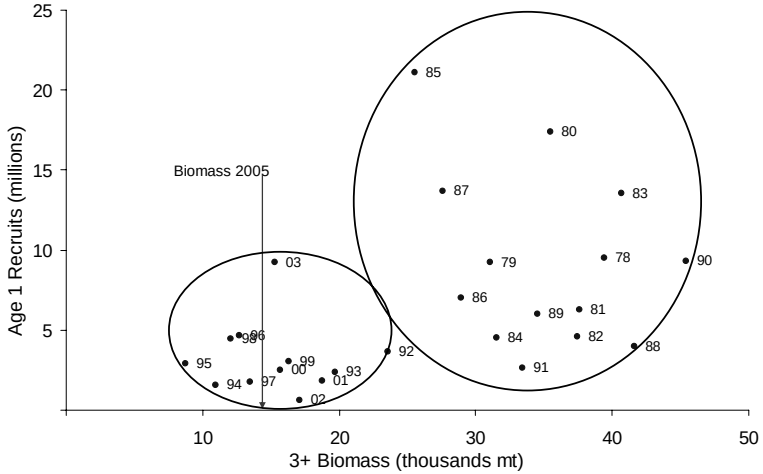


Figure 3. Stock recruitment patterns.

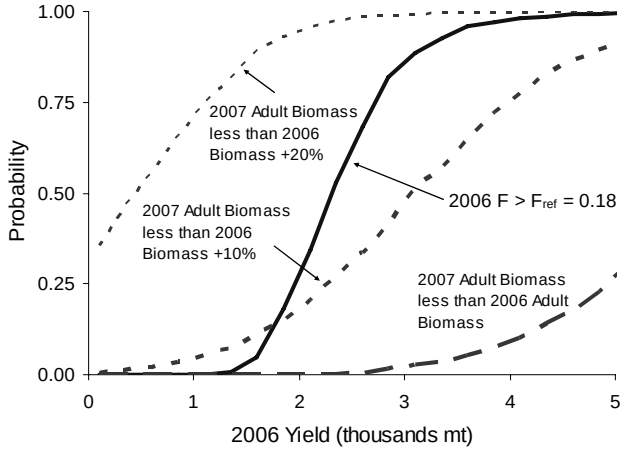


Figure 4. Projection risks.