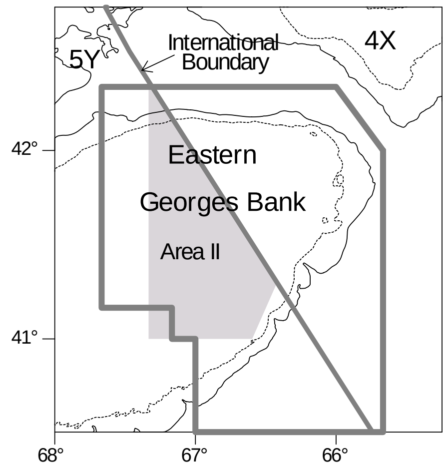
Fisheries and Oceans Canada   Pêches et Océans Canada   NOAA FISHERIES NATIONAL MARINE FISHERIES SERVICE

Transboundary Resource Assessment Committee

Status Report 2006/02

EASTERN GEORGES BANK HADDOCK

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



Summary

- Combined Canada and USA catches in 2005 were 15,100 mt.

- Adult biomass (ages 3+) increased from 8,600 mt in 1993 to 73,800 mt in 2003. Adult biomass subsequently decreased to 51,000 mt in 2005 but increased in 2006 to 123,000 mt, higher than the 1931-1955 maximum biomass of about 90,000 mt.

- The exceptional 2003 year class, estimated at 338 million age-1 fish, is the largest observed in the assessment time series (1931-1955 and 1969-2005). The 2001, 2002 and 2004 year classes are weak (< 9 million). Initial estimates of the 2005 year class (28 million) suggest that it is about average.

- Fishing mortality (ages 4+) was below F_{ref} = 0.26 during 1995 to 2004. The failure of the 2003 year class to contribute as expected to the 2005 fishery resulted in fishing mortality in 2005 slightly above F_{ref} (F=0.29).

- Resource productivity has severely diminished in recent years due to reductions in fish size at age.

- Assuming a 2006 catch equal to the 22,000 mt total quota, a combined Canada/USA catch of 19,000 mt in 2007 would result in a neutral risk (50%) that the fishing mortality rate in 2007 will exceed F_{ref} = 0.26. A catch of 16,000 mt would result in a low risk (25%) that the fishing mortality rate in 2007 will exceed F_{ref}.

- Slow growth of the 2003 cohort will continue to impact the fishery. If the TAC in 2006 is caught, fishing mortality will be higher than F_{ref} on the fully recruited ages (F_{5+}=0.5).

Ce document est disponible sur l'Internet à :   This document is available on the Internet at :
http://www.mar.dfo-mpo.gc.ca/science/TRAC/trac.html

Canada   July 2006

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

		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Avg[1]	Min[1]	Max[1]
Canada	**Quota**	3.2	3.9	3.9	5.4	7.0	6.7	6.9	9.9	15.4	14.5			
	Landed	2.7	3.4	3.7	5.4	6.8	6.5	6.8	9.7	14.5		4.3	0.5	14.5
	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
USA	**Quota[6]**								5.1	7.6	7.5			
	Landed	<0.1	0.3	0.4	0.2	0.6	0.9	1.6	1.8	0.5		2.2	<0.1	9.1
	Discard[2]	0.1	<0.1	0	0	<0.1	<0.1	0.1	0.2	0.1		0.4	<0.1	7.6
Total	**Quota**								15.0	23.0	22.0			
	Catch	2.9	3.8	4.1	5.6	7.5	7.5	8.5	11.8	15.1		7.0	2.2	23.3
	Adult Biomass[4]	22.0	24.3	29.7	34.4	46.5	40.5	73.8	68.7	50.6	122.7	41.8[3]	6.8[3]	122.7[3]
	Age 1 Recruits	17.0	7.2	26.0	10.9	72.2	4.3	1.8	338.4	8.6	27.9	28.3[3]	0.5[3]	338.4[3]
	Fishing mortality[5]	0.12	0.15	0.14	0.16	0.19	0.19	0.18	0.17	0.29		0.29	0.08	0.59
	Exploitation Rate[5]	11%	13%	12%	14%	16%	16%	15%	14%	23%		22%	7%	41%

[1]1969 - 2005
[2] discards not estimated in 1999-2000 but assumed negligible
[3]1931 - 1955, 1969 – 2005
[4]Jan 1 ages 3+
[5]ages 4+
[6]for fishing year from May 1 – April 30

Fishery

Under restrictive management measures, **combined Canada/USA catches** declined from over 6,400 mt in 1991 to a low of about 2,100 mt in 1995, fluctuated between about 3,000 mt and 4,000 mt until 1999 and have since increased to about 15,100 mt (Figure 1). Greater catches were recorded in the late 1970s and early 1980s, ranging up to about 23,000 mt, but catches subsequently declined and fluctuated around 5,000 mt during the mid to late 1980s.

The **Canadian catch** in 2005 increased to 14,490 mt from 9,900 mt in 2004. Weight of all Canadian landings was monitored at dockside. At-sea observers monitored 16% of the total haddock landed in 2005, by weight. Discarding and misreporting by the groundfish fishery have been negligible since 1992. Discards of haddock by the Canadian scallop fishery ranged between 29 and 186 mt since 1969 and were 52 mt in 2005. The size composition of the catch in the 2005 Canadian fisheries had a mode at 52.5 cm for otter trawlers and longliners. Gill-netters caught few haddock.

USA catches in 2005 declined to 569 mt from 1,800 mt in 2004. Catches were less than the 7,590 mt quota because the groundfish fishery on eastern Georges Bank was closed in August when the USA cod quota of 300 mt was reached. Landings were 512 mt and discards were estimated to be 57 mt.

For the **combined Canada/USA fishery catch in 2005**, the 2000 year class (age 5) and the 1998 year class (age 7) dominated by weight. Due to the reduced growth rate of the 2003 year class, it did not contribute substantially to the catch in 2005 as previously expected.

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, $F_{ref} = 0.26$. 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 2005 (including discards). The VPA was calibrated to trends in abundance from three bottom trawl surveys series; NMFS spring, NMFS fall and DFO. Data to approximate the age composition of the catch during 1931 to 1955 were used to reconstruct a population analysis of eastern Georges Bank haddock that was suitable for comparison of productivity. Retrospective analyses were used to detect any patterns to consistently overestimate or underestimate fishing mortality, biomass and recruitment relative to the terminal year estimates. This stock assessment does not display a retrospective pattern.

Population biomass (ages 3+) increased to 39,000 mt during the late 1970s and early 1980s due to **recruitment** of the strong 1975 and 1978 year classes whose abundances were estimated to be above 50 million age-1 fish each (Figure 2). However, biomass declined rapidly in the early 1980s as subsequent recruitment was poor and these two cohorts were fished intensely at young ages. Improved recruitment in the 1990s and the strong 2000 year class, lower exploitation, and reduced capture of small fish in the fisheries allowed the biomass to increase from near an historical low of 8,600 mt in 1993 to 73,800 mt in 2003. Adult biomass subsequently decreased to 51,000 mt in 2005 but increased in 2006 to 123,000 mt (80% Confidence Interval: 93,300 mt – 167,300 mt) in 2006, higher than the 1931-1955 maximum biomass of about 90,000 mt. The marked increase in 2006 is due to the exceptional 2003 year class, estimated at 338 million age-1 fish, the largest in the assessment time series (1931-1955 and 1969-2005). In contrast, the 2001, 2002 and 2004 year classes are weak (< 9 million age-1 fish). Initial estimates of the 2005 year class (28 million age-1 fish) suggest that it is about average. Older ages sustained the fishery in 2005 and the strong 2000 year class is expected to continue to contribute substantially to the catch weight in 2006.

Fishing mortality for ages 4+ fluctuated between 0.2 and 0.4 during the 1980s and showed a marked increase between 1989 and 1993 to about 0.6, the highest observed. Since 1995, fishing mortality has been below the reference, $F_{ref} = 0.26$, but increased in 2005 to slightly above F_{ref} ($F_{2005} = 0.$ 29; 80% Confidence Interval: 0.23 – 0.37) (Figure 1).

Productivity

Recruits per spawner, age structure, spatial distribution and fish growth reflect changes in the productive potential. The recruits per adult biomass ratio was generally low during the 1980s but higher during the 1990s, comparable to that of the 1931 to 1955 period, suggesting that higher recruitment might occur when the biomass is above 40,000 mt. However, in the early 2000's, excepting 2003, recruits per spawner were again low. In both absolute numbers and percent composition, the **population age structure** displays a broad representation of age groups, reflecting improving recruitment and 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 ten years. However, consistent with the pattern observed for previous large year classes, the exceptional 2003 year class, the main component of the 3+ age group, was widely distributed throughout the survey area. Both **length and weight at age** have declined since about 2000 and are currently at or near the lowest observed in the DFO survey time series. The size at age for the 2003 year class is lower than previous year classes. DFO survey average weights at length, used to reflect fish **condition,** declined during 2000 to 2006 for most lengths. Resource productivity has severely diminished in recent years due to reductions in fish size at age.

Outlook

This outlook is provided in terms of consequences with respect to the harvest reference points for alternative catch quotas in 2007. Uncertainty about standing stock generates uncertainty in forecast results which is expressed here as the risk of exceeding F_{ref}=0.26. 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.

The weights at age for the 2003 and subsequent year classes in 2006 and 2007 were estimated by applying the average growth rate from recent year classes to the last observed size at age of the 2003 year class. This accounts for the slower growth of these cohorts and results in lower weights at age than have been observed. This also reduces the fishery partial recruitment pattern which was derived to be consistent with the size at age.

Assuming a 2006 catch equal to the 22,000 mt total quota, a combined Canada/USA catch of 19,000 mt in 2007 would result in a neutral risk (50%) that the fishing mortality rate in 2007 will exceed F_{ref} = 0.26 (Figure 4). A catch of 16,000 mt would result in a low risk (25%) that the fishing mortality rate in 2007 will exceed F_{ref}. Adult biomass is projected to be 149,000 mt in 2007 and will increase by less than 10% in 2008.

Due to uncertainties in future growth trends of the 2003 year class and this cohort's overwhelming influence, medium term projections were not conducted.

Special Considerations

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

The outstanding 2003 year class was expected to contribute substantially (32%) to the 2005 catch. However, the contribution was negligible (1%) due to a failure to recruit to the fishery because of slow growth. The failure of this year class to contribute as expected to the fishery resulted in fishing mortality above F_{ref} on the older ages in 2005. This has been exacerbated by the two weak year classes preceding the 2003 year class. Slow growth of the 2003 cohort will continue to impact the fishery. If the TAC in 2006 is caught, fishing mortality will be higher than F_{ref} on the fully recruited ages (F_{5+}=0.5). Due to the high abundance of the 2003 cohort and its slow growth, discards of this year class may be high and should be monitored.

While best judgement was used to determine the weights at age and fishery partial recruitments for the projections, the risk analysis does not capture the extent of uncertainty of the consequences for various catch levels, which are important in this instance; and should be used in a precautionary manner.

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 are warranted to protect the 2003 cod year class, which is the first above average cod year class since the 1990 year class. Modifications to fishing gear and practices, with enhanced monitoring, may mitigate these concerns.

Source Documents

TRAC. 2006. R. O'Boyle and W. Overholtz [eds]. Proceedings of the Transboundary Resource Assessment Committee (TRAC); 13–16 June 2006. TRAC Proceedings 2006/(in prep.).

Van Eeckhaute, L., and J. Brodziak. 2006. Assessment of Haddock on Eastern Georges Bank. TRAC Reference Document 2006/(in prep.).

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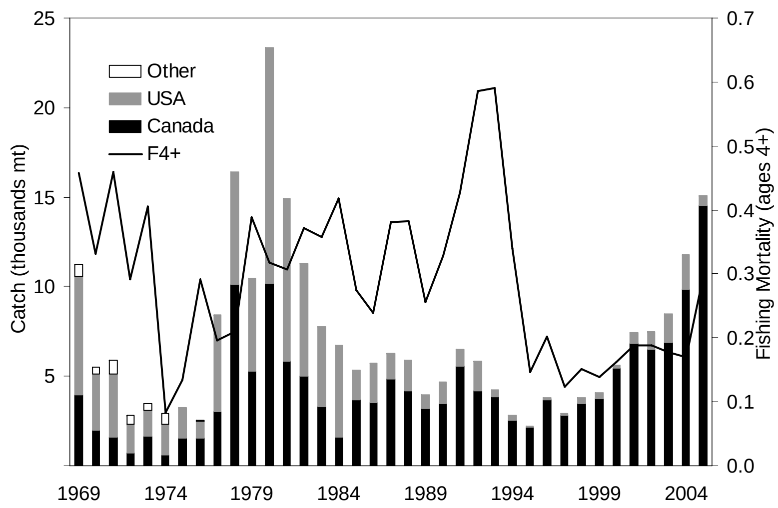

Figure 1. Catches and fishing mortality.

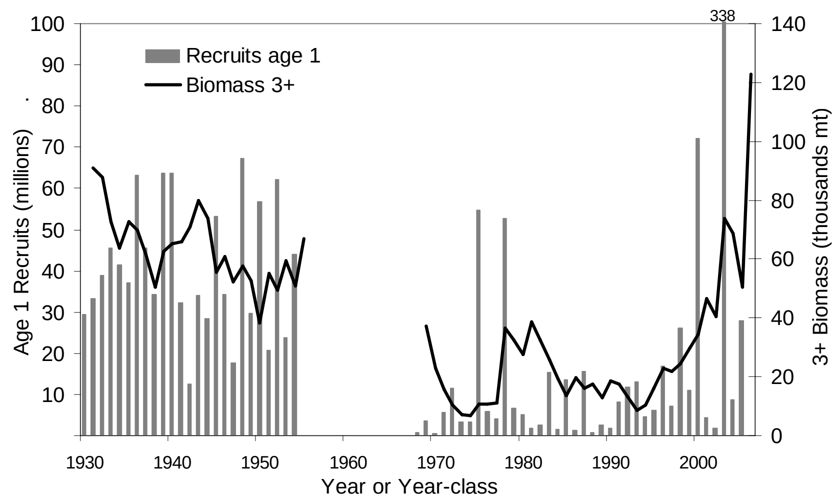

Figure 2. Biomass and recruitment.

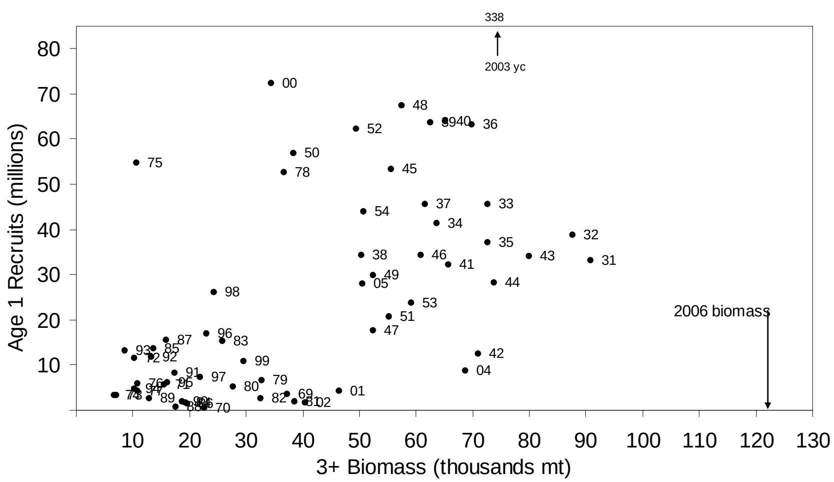

Figure 3. Stock recruitment patterns.

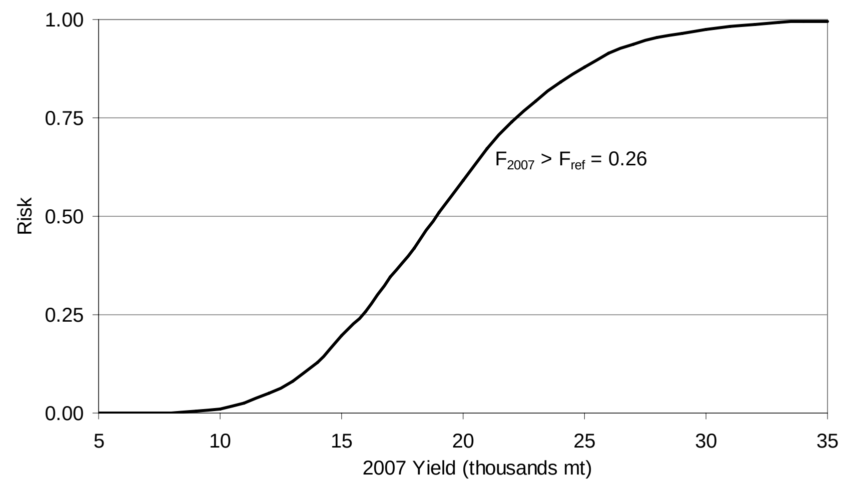

Figure 4. Projection risks.