

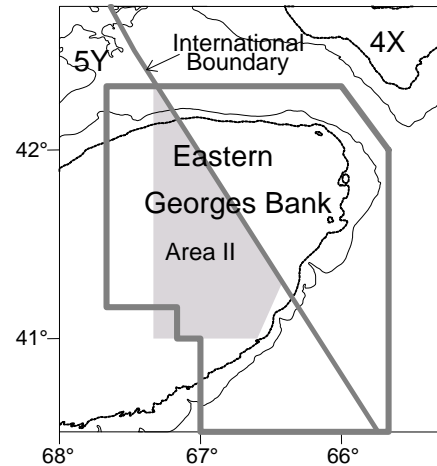


Transboundary Resources Assessment Committee

Status Report 2009/02

**EASTERN
GEORGES BANK
HADDOCK**

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

**Summary**

- Combined Canada and USA catches in 2008 were 15,995 mt.
- Adult biomass (ages 3+) increased from 9,100 mt in 1993 to 81,800 mt in 2003, declined to 57,800 mt in 2005, and subsequently tripled to a record-high 155,600 mt in 2009.
- The exceptional 2003 year class, currently estimated at 291 million fish at Age 1, is the largest in the assessment time series. Except for the strong 2000 year class and the exceptional 2003 year class, recruitment has fluctuated without trend about an average of 11 million since 1990. The preliminary estimate for the 2008 year class is below-average at 9 million fish at Age 1.
- Fishing mortality was below $F_{ref} = 0.26$ during 1995 to 2003, fluctuated around F_{ref} during 2004 to 2006, but in 2007 and 2008 declined to 0.13 and 0.09 respectively
- With expanded age structure, broad spatial distribution and improved recruitment, current resource productivity is high, hindered only by recent reductions in fish weight at age.
- Assuming a 2009 catch equal to the 30,000 mt total quota, a combined Canada/USA catch of 29,600 mt in 2010 results in a neutral risk (50%) that the fishing mortality rate in 2010 will exceed $F_{ref} = 0.26$. A catch of 25,900 mt in 2010 results in a low risk (25%) that the 2010 fishing mortality rate will exceed F_{ref} .



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

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Avg ¹	Min ¹	Max ¹
Canada	Quota	5.4	7.0	6.7	6.9	9.9	15.4	14.5	12.7	15.0	18.9			
	Landed	5.4	6.8	6.5	6.8	9.7	14.5	12.0	11.9	14.8		4.9	0.5	14.8
	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	Quota²					5.1	7.6	7.5	6.3	8.1	11.1			
	Catch²					1.1	0.6	0.7	0.3	2.3				
	Landed	0.3	0.8	1.1	1.7	1.8	0.6	0.3	0.2	1.1		2.1	<0.1	9.1
	Discard	<0.1	<0.1	<0.1	0.1	0.2	0.1	0.3	0.3	<0.1		0.9	0.0	7.6
Total	Quota³					15.0	23.0	22.0	19.0	23.0	30.0			
	Catch^{3,4}					10.9	15.1	12.7	12.3	17.1				
	Catch	5.8	7.6	7.6	8.6	11.9	15.3	12.6	12.5	16.0		7.6	2.1	23.3
	Adult Biomass⁵	35.9	49.8	42.7	81.8	76.4	57.8	117.3	142.5	146.0	155.6	45.0 ⁶	4.9 ⁶	155.6 ⁶
	Age 1 Recruits	9.3	82.1	3.3	2.7	291.0	6.0	24.6	6.6	11.8	8.8	26.8 ⁶	0.2 ⁶	291.0 ⁶
	Fishing mortality⁷	0.16	0.17	0.17	0.19	0.27	0.25	0.26	0.13	0.09		0.29	0.09	0.58
	Exploitation Rate⁷	13%	14%	14%	16%	22%	20%	21%	11%	8%		23%	8%	40%

¹1969 - 2008

²for fishing year from May 1 – April 30

³for Canadian calendar year and USA fishing year May 1 – April 30

⁴sum of Canadian Landed, Canadian discard, and USA Catch (includes discards)

⁵Jan 1 ages 3+

⁶1931 - 1955, 1969 – 2009

⁷ages 4+ for 1969 - 2007; ages 5+ for 2003 - 2008

Fishery

Under restrictive management measures, **combined Canada/USA catches** declined from 6,504 mt in 1991 to a low of 2,150 mt in 1995, varied between about 3,000 mt and 4,000 mt until 1999, and increased to 15,256 mt in 2005 (Figure 1). Combined catches in 2006, 2007 and 2008 were 12,634 mt, 12,488 mt, and 15,995 mt, respectively.

The **Canadian catch** in 2008 increased to 14,814 mt from 11,946 mt in 2007. The weight of all Canadian landings was monitored at dockside. At-sea observers monitored 38% of the total haddock landed, by weight, in 2008. 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 33 mt in 2008.

USA catches in 2008 increased to 1,181 mt from 541 mt in 2007. Landings were 1,136 mt and discards were estimated to be 44 mt, primarily from the otter trawl fishery, but discards also occurred in the longline fleet.

For the **combined Canada/USA fishery catch in 2008**, the 2003 year class (Age 5) dominated by numbers and weight. Discards at age from the USA groundfish fishery (1989-2008) and the Canadian scallop fishery (1978-2008) were included in the assessment when identified.

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

Evaluation of the state of the resource was based on results from an age structured analytical assessment (Virtual Population Analysis, VPA) that used fishery catch statistics and sampling for size and age composition of the catch for 1969 to 2008 (including discards). The VPA was calibrated to trends in abundance from three bottom trawl survey 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 suitable for comparison of productivity to recent years. Retrospective analyses were conducted to detect any tendency to consistently overestimate or underestimate fishing mortality, biomass and recruitment relative to the terminal year estimates. The current stock assessment does not display a retrospective pattern.

Improved **recruitment** since 1990, lower exploitation, and reduced capture of small fish in the fisheries allowed the **adult population biomass** (ages 3+) to increase from near an historical low of 9,100 mt in 1993 to 81,800 mt in 2003 (Figure 2). Adult biomass decreased to 57,800 mt in 2005 and subsequently increased to 155,600 mt (80% Confidence Interval: 124,200 mt – 186,600 mt) in 2009, higher than the 1931-1955 maximum biomass of about 90,000 mt. The tripling of the biomass after 2005 was due to the exceptional 2003 year class, currently estimated at 291 million Age 1 fish (largest in the assessment time series: 1931-1955 and 1969-2008). Except for the strong 2000 year class and the exceptional 2003 year class, recruitment has fluctuated without trend about an average of 11 million since 1990. The preliminary estimate for the 2008 year class is below-average at 9 million fish at Age 1.

Fishing mortality (population weighted average of fully recruited ages) fluctuated between 0.2 and 0.4 during the 1980s, and markedly increased in 1992 and 1993 to about 0.6, the highest observed. From 2003 to the present, the age at full recruitment to the fishery has been at Age 5 (rather than Age 4, previously) due to a decline in size at age of haddock. Fishing mortality (ages 4+ prior to 2003 and ages 5+ for 2003-2008) was below $F_{ref} = 0.26$ during 1995 to 2003, fluctuated around F_{ref} during 2004 to 2006, but in 2007 and 2008 declined to 0.13 and 0.09, (80% Confidence Interval: 0.07 – 0.11), respectively (Figure 1). The determination of F_{ref} was based on analyses that assumed full recruitment to the fishery for ages 4 and older.

Productivity

Recruitment, as well as age structure, spatial distribution and fish growth reflect changes in the productive potential. Recruitment, while highly variable, has generally been higher when adult biomass has been above 40,000 mt (Figure 3). The **population age structure** displays a broad representation of age groups, reflecting improving recruitment and lower exploitation 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. Both **length and weight at age** have generally declined since about 2000. While size at age increased in 2008 for the younger age groups, weights remained below the 1986 to 2000 average, except for Age 1. The size at age for the 2003 year class is smaller than previous year classes, but its rate of growth at length is similar to previous year classes. DFO survey average weights at length, used to reflect fish **condition**, exhibit a declining trend since the late 1990s but were at or near the series average in

2009. With expanded age structure, broad spatial distribution and improved recruitment, current resource productivity is high, hindered only by the recent 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 2010. Uncertainty about current biomass 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.

For projections, the 2009 survey and 2008 fishery weights at age were used for inputs, except for a few older ages where the values were poorly estimated, in which case the last 3 year average was used. Fishery partial recruitment was based on the most recent five years. Inputs for the 2003 and 2005 year classes were derived by accounting for recent trends in reduced growth rate. Assuming a 2009 catch equal to the 30,000 mt total quota, a combined Canada/USA catch of 29,600 mt in 2010 results in a neutral risk (50%) that the 2010 fishing mortality rate would exceed $F_{ref} = 0.26$ (Figure 4). The 2003 year class is expected to constitute 80% of the 2010 catch biomass. A catch of 25,900 mt in 2010 results in a low risk (25%) that the 2010 fishing mortality rate will exceed F_{ref} . Adult biomass is projected to be 94,700 mt at the beginning of 2011, a decline from 126,300 mt in 2010 as expected with the passing of the 2003 year class through the population.

Special Considerations

Catches for several years into the future will be dependent on the 2003 year class. The size at age for the 2003 year class is smaller than previous year classes, but its rate of growth at length is similar. Consequently, current indications suggest that the 2003 cohort could eventually achieve a typical adult size. Size at Age 1 of the 2007 and 2008 year classes is similar to year classes before 2000.

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. Modifications to fishing gear and practices, with enhanced monitoring, may mitigate these concerns.

Source Documents

TRAC. 2009. L. O'Brien and T. Worcester, editors. 2009. Proceedings of the Transboundary Resources Assessment Committee (TRAC); 8-12 June 2009. TRAC Proceedings 2009/01.

Van Eeckhaute, L., L. Brooks, and M. Traver. 2009. Assessment of Haddock on Eastern Georges Bank for 2009. TRAC Reference Document 2009/02.

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TRAC. 2009. Eastern Georges Bank Haddock. TRAC Status Report 2009/02.

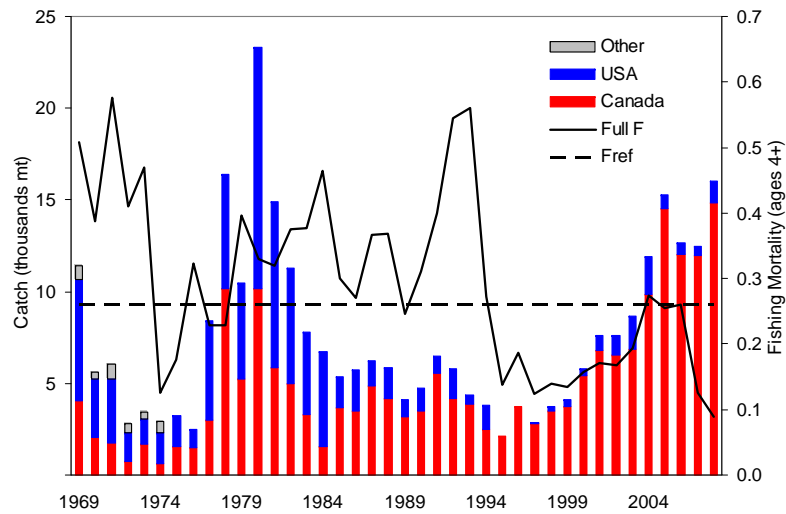


Figure 1. Catches (bars) and fishing mortality (line). (Full F=4+ for 1969-2002 and 5+ for 2003-2008.)

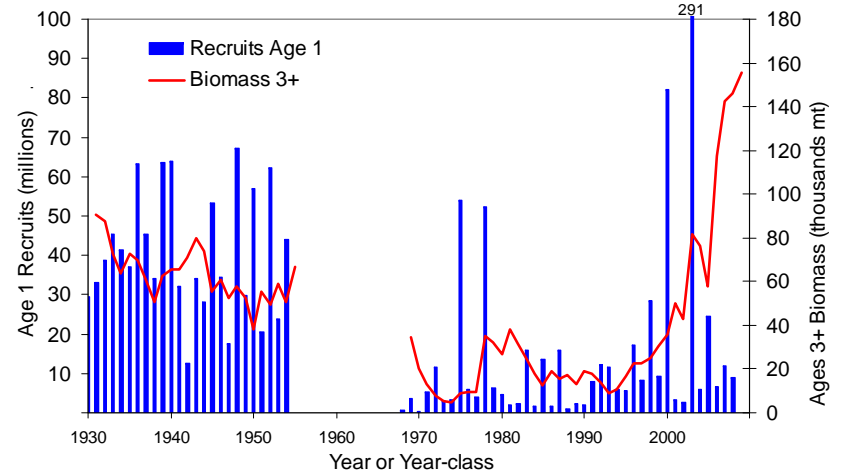


Figure 2. Biomass (line) and recruitment (bars).

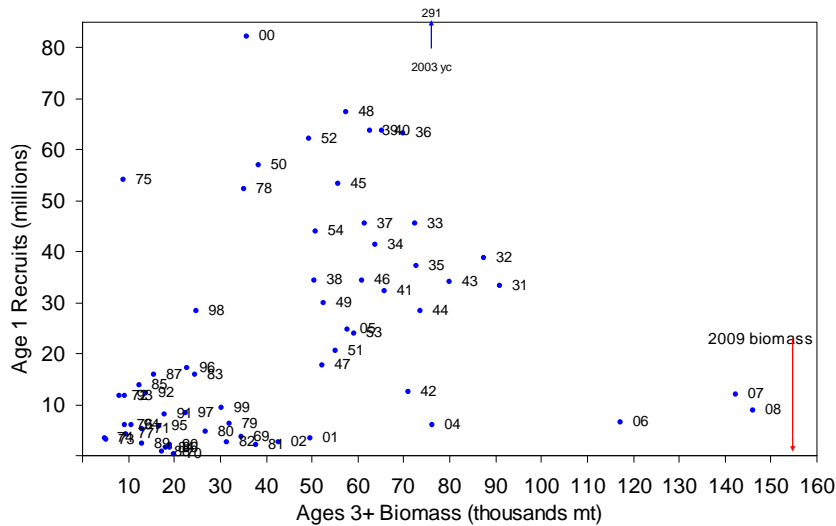


Figure 3. Stock recruitment patterns.

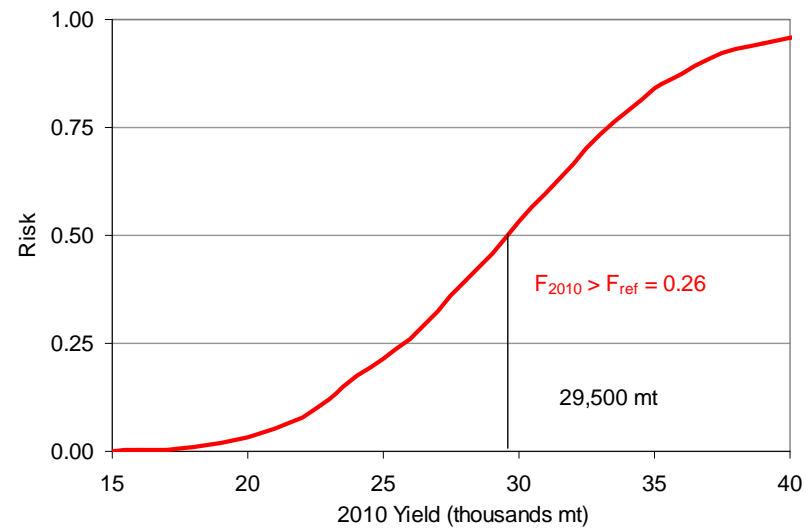


Figure 4. Projection risks.