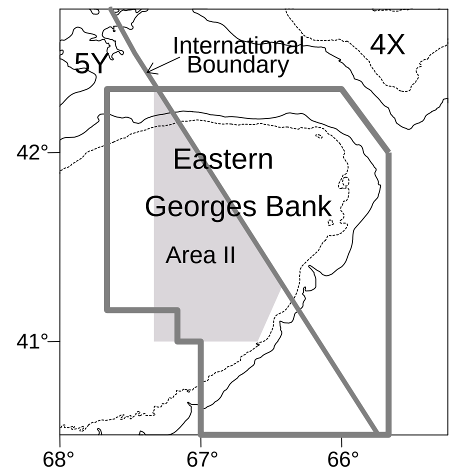
EASTERN GEORGES BANK HADDOCK

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



Summary

- Combined Canada and USA catches in 2010 were 18,794 mt.
- Adult biomass decreased to 59,700 mt in 2005 and subsequently increased to 162,800 mt in 2009. In 2011 the adult biomass decreased to 93,400 mt.
- The preliminary estimate for the 2010 year class is outstanding at 557 million age 1 fish which would make it the largest in the assessment time series. Except for the strong 2000 year class and the exceptional 2003 and 2010 year classes, recruitment has fluctuated around an average of 9 million since 1990.
- Fishing mortality was below F_{ref} = 0.26 during 1995 to 2003, above or near F_{ref} in 2004 to 2006, but declined since then and was 0.15 in 2010.
- This stock exhibits some positive features such as an expanding age structure, broad spatial distribution and has produced 2 exceptional year classes in the last 8 years.
- Assuming a 2010 catch equal to the 22,000 mt total quota, a combined Canada/USA catch of 16,000 mt in 2012 results in a neutral risk (50%) that the 2012 fishing mortality rate would exceed F_{ref} = 0.26. Due to the 2010 year class' entry into the 3+ group in 2013, the estimated probability that the adult biomass will decline from 2012 to 2013 is virtually 0%. Adult biomass is projected to be 124,600 mt at the beginning of 2013.

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http://www.mar.dfo-mpo.gc.ca/science/TRAC/trac.html

June 2011
Revised: March 2012

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

		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Avg[1*]	Min[1*]	Max[1*]
Canada	**Quota**	6.7	6.9	9.9	15.4	14.5	12.7	15.0	18.9	17.6	12.5			
	Landed	6.5	6.8	9.7	14.5	12.0	11.9	14.8	17.6	16.6		5.5	0.5	17.6
	Discard	<0.1	0.1	0.1	<0.1	0.1	0.1	<0.1	0.1	<0.1		0.1	<0.1	<0.1
USA	**Quota**[2]			5.1	7.6	7.5	6.3	8.1	11.1	12.0	9.5			
	Catch[2]			1.1	0.6	0.7	0.3	1.6	1.6	1.8				
	Landed	1.1	1.7	1.8	0.6	0.3	0.3	1.1	2.2	2.2		2.1	<0.1	9.1
	Discard	<0.1	0.1	0.2	0.1	0.3	0.3	0.1	0.1	<0.1		0.6	<0.1	7.6
Total	**Quota**[3]			15.0	23.0	22.0	19.0	23.0	30.0	29.6	22.0			
	Catch[3,4]			10.9	15.1	12.7	12.3	17.1	17.6	18.4				
	Catch	7.6	8.6	11.9	15.3	12.6	12.5	16.0	19.9	18.8		8.2	2.1	23.3
	Adult Biomass[5]	43.6	83.6	78.7	59.7	122.5	149.5	152.6	162.8	129.4	93.4	49.2[6]	4.9[6]	162.8[6]
	Age 1 Recruits	4.1	2.6	304.4	6.1	23.6	6.4	9.8	5.1	5.9	557.1	34.5[6]	0.2[6]	557.1[6]
	Fishing mortality[7]	0.16	0.19	0.27	0.25	0.25	0.12	0.09	0.13	0.15		0.28	0.09	0.58
	Exploitation Rate[7]	14%	16%	21%	20%	20%	10%	7%	11%	13%		22%	7%	40%

[1]1969 - 2010
[2]for fishing year from May 1st – April 30th
[3]for Canadian calendar year and USA fishing year May 1st – April 30th
[4]sum of Canadian Landed, Canadian discard, and USA Catch (includes discards)
[5]January 1st ages 3+
[6]1931 - 1955, 1969 – 2011
[7]ages 4+ for 1969 - 2002; ages 5+ for 2003 - 2010

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 then decreased to 12,508 mt in 2007 but increased to 19,856 in 2009 and then decreased to 18,794 mt in 2010.

The **Canadian catch** in 2010 decreased to 16,592 mt from 17,648 mt in 2009. The weight of all Canadian landings was monitored at dockside. At-sea observers monitored 12% of the total haddock landed, by weight, in 2010. Discarding and misreporting by the groundfish fishery have been negligible since 1992. Discards of haddock by the Canadian sea scallop fishery ranged between 29 mt and 186 mt since 1969 and were 14 mt in 2010.

USA catches in 2010 decreased to 2,201 mt from 2,208 mt in 2009. Landings were 2,167 mt and discards were estimated to be 34 mt, primarily from the otter trawl fishery, but discards also occurred in the longline fleet. Landings are reported by dealers and discards are estimated from at-sea observer data.

The **combined Canada/USA fishery catch** (landings + discards) in 2010 was dominated by the 2003 year class (age 7) by numbers and weight.

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 reference, F_{ref} = 0.26 (established in 2002 by the

[*] Superscript 1 added.

TMGC). 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 2010 (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 10,300 mt in 1993 to 83,600 mt in 2003 (Figure 2). Adult biomass decreased to 59,700 mt in 2005 and subsequently increased to 162,800 mt in 2009, higher than the 1931-1955 maximum biomass of about 90,000 mt. In 2011 the adult biomass decreased to 93,400 mt (80% confidence interval: 74,300 mt – 111,300 mt). The tripling of the adult biomass after 2005 was due to the exceptional 2003 year class, currently estimated at 304 million age 1 fish. The preliminary estimate for the 2010 year class is outstanding at 557 million age 1 fish which would make it the largest in the assessment time series: 1931-1955 and 1969-2010. Except for the strong 2000 year class and the exceptional 2003 and 2010 year classes, recruitment has fluctuated around an average of 9 million since 1990.

Fishing mortality (population weighted for ages 4+) fluctuated between 0.2 and 0.4 during the 1980s, and markedly increased in 1992 and 1993 to about 0.5, 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 (population weighted for ages 4+ prior to 2003 and ages 5+ for 2003-2010) was below $F_{ref} = 0.26$ during 1995 to 2003, above or near F_{ref} in 2004 to 2006, but declined since then and was 0.15 in 2010 (80% confidence interval: 0.13 – 0.19, Figure 1).

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. There has been a general decline in weights at age since the late 1990s. The size at age for the 2003 year class is smaller than previous year classes, but its rate of growth at length has been similar to previous year classes. Growth of the 2003 year class now appears to have slowed substantially. DFO survey average weights at length, used to reflect fish **condition,** exhibit a declining trend since about 2001 and declined in 2011 to well below each length's average and are at the lowest level for most lengths examined.

Outlook

This outlook is provided in terms of consequences with respect to the harvest reference points for alternative catch quotas in 2011. Uncertainty about current biomass generates uncertainty in forecast results, which is expressed here as the probability 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 2011 survey and 2010 fishery weights at age were used for inputs, unless it was considered appropriate to use the 3-year averages, i.e., to avoid using the lower weights at age of the 2003 year class and when weights at age had dropped within a cohort. Fishery partial recruitment was based on the most recent five years, however, a value of 1 was used for ages 9+ partial recruitment, higher than the assessment results indicated (0.5) but consistent with F_{ref}. Inputs for the 2003, 2005 and 2010 year classes were derived by accounting for recent trends in reduced size at age. Assuming a 2010 catch equal to the 22,000 mt total quota, a combined Canada/USA catch of 16,000 mt in 2012 results in a neutral risk (50%) that the 2012 fishing mortality rate would exceed F_{ref} = 0.26 (Figure 4). The 9+ age group, of which the 2003 year class is the main component, is expected to constitute 72% of the 2012 catch biomass. A catch of 13,900 mt in 2012 results in a low risk (25%) that the 2012 fishing mortality rate will exceed F_{ref}. A catch of 17,800 mt in 2012 results in a high risk (75%) that the 2012 fishing mortality rate will exceed F_{ref}. Due to the 2010 year class' entry into the 3+ group in 2013, the estimated probability that the adult biomass will decline from 2012 to 2013 is virtually 0%. Adult biomass is projected to be 124,600 mt at the beginning of 2013.

Probability of exceeding F_{ref}	**25%**	**50%**	**75%**
2012 catch	13,900 mt	16,000 mt	17,800 mt
2013 catch	13,700 mt	15,700 mt	18,100 mt

Special Considerations

The 2003 year class will enter the 9+ group in 2012. The reference catch will be highly influenced by the partial recruitment that is used for the 9+ age group in the projections.

The medium term outlook for stock biomass is strongly influenced by the outstanding 2003 and 2010 year classes. As the importance of the 2003 year class diminishes, the 3+ stock biomass will decline in 2012 even for relatively low catch, and it will then increase beginning in 2013 as the 2010 year class recruits. While the assessment indicates that the 2012 TAC should be less than the 2011 TAC to prevent the fishing mortality rate from exceeding the F_{ref}, the adult biomass would be expected to increase in 2013 and 2014 compared to the current level (2011), even if the current TAC was maintained. However, if the 2010 year class turns out to be much smaller than currently estimated (i.e., half the size), a catch equal to the current TAC is likely to result in some decrease in adult biomass in 2014 compared to 2011.

Source Documents

Porter JM, O'Brien L, editors. 2011. Proceedings of the Transboundary Resources Assessment Committee (TRAC): Eastern Georges Bank Cod and Haddock, and Georges Bank Yellowtail Flounder: Report of Meeting held 21-24 June 2011. TRAC Proceedings 2011/01.

Van Eeckhaute L, Brooks E. 2011. Assessment of Haddock on Eastern Georges Bank for 2011. TRAC Reference Document 2011/03.

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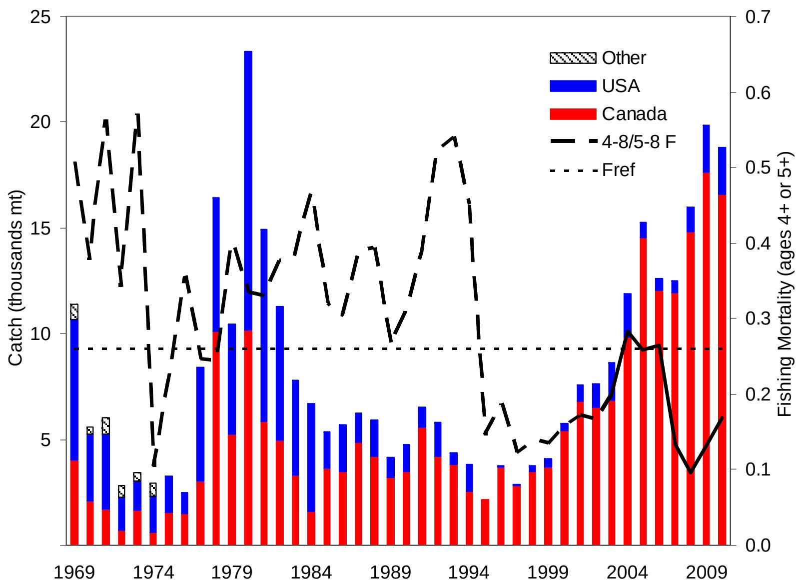

Figure 1. Catches (bars) and fishing mortality (line); (F=4-8 for 1969-2002 and 5-8 for 2003-2010).

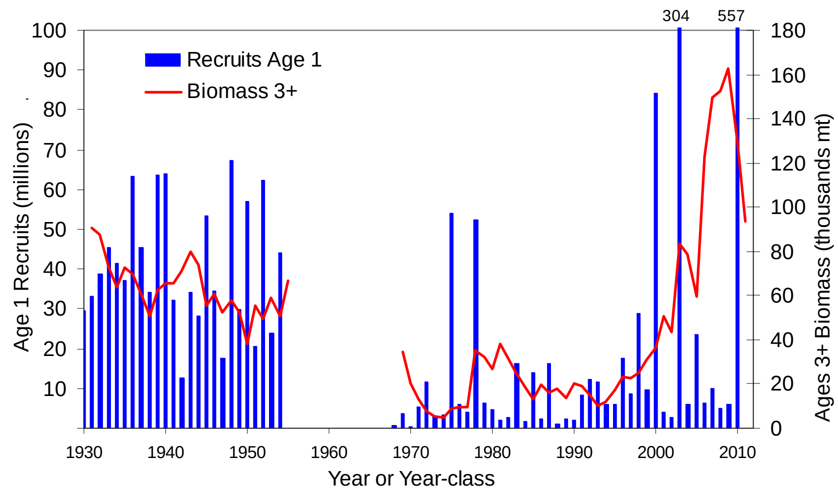

Figure 2. Biomass (line) and recruitment (bars).

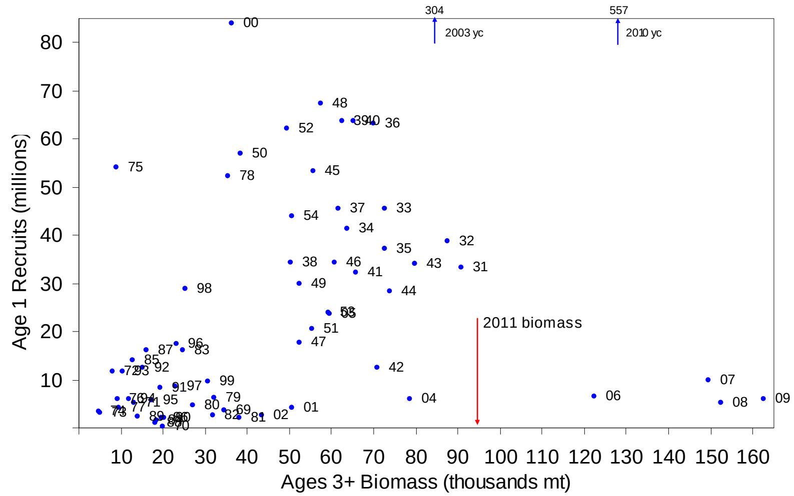

Figure 3. Stock recruitment patterns.

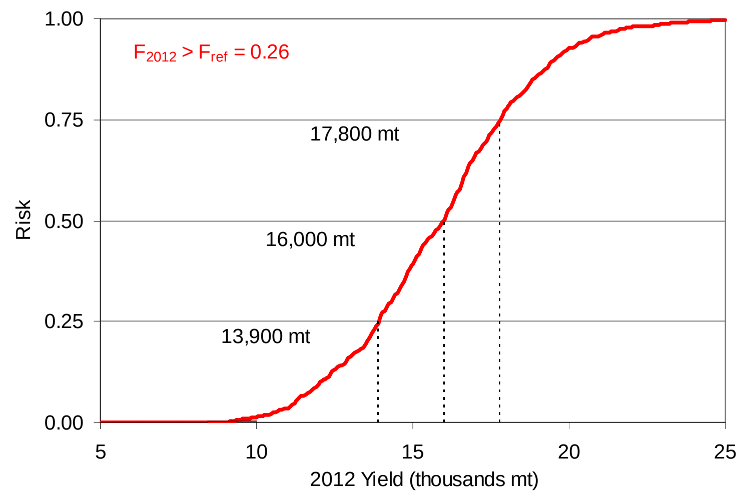

Figure 4. Projection risks.