

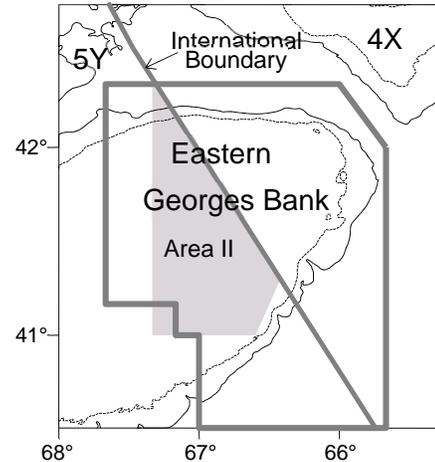


Transboundary Resources Assessment Committee

Status Report 2013/03

**EASTERN
GEORGES BANK
HADDOCK**

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



Summary

- Combined Canada and USA catches in 2012 were 5,631 mt.
- At the beginning of 2013, the adult biomass increased to 183,600 mt. The 2014 3+ biomass is projected to be the largest in the time series at 245,500 mt, due to the contribution from the outstanding 2010 and strong 2011 year classes.
- The current estimate for the 2010 year class is 474 million age 1 fish, which would make it the largest cohort in the assessment time series. The preliminary estimate for the 2012 year class is 15 million age 1 fish. Except for the strong 2000 and 2011 year classes and the exceptionally large 2003 and 2010 year classes, recruitment has fluctuated between 2.1 and 28.8 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 has subsequently been below F_{ref} and was 0.16 in 2012.
- This stock exhibits positive features such as an expanding age structure, broad spatial distribution, and has produced two exceptionally strong and two strong year classes in the last 13 years. Fish condition has generally been below the time series average since 2000.
- Assuming a 2013 catch equal to the 10,400 mt total quota, a combined Canada/USA catch of 31,500 mt in 2014 results in a neutral risk (50%) that the 2014 fishing mortality rate would exceed $F_{ref} = 0.26$. The probability that the 2015 biomass will not increase is greater than 75% at the F_{ref} catch level and there is almost no chance that it will increase by 10% at any of the catch scenarios considered. Biomass at the beginning of 2015 is projected to be 240,000 mt fishing at F_{ref} .

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

This document is available on the Internet at :



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

		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Avg ¹	Min ¹	Max ¹
Canada⁸	Quota	9.9	15.4	14.5	12.7	15.0	18.9	17.6	12.5	9.1	6.4			
	Landed	9.7	14.5	12.0	11.9	14.8	17.6	16.6	11.2	5.0		5.6	0.5	17.6
	Discard	0.1	<0.0	0.1	0.1	<0.0	0.1	<0.0	<0.0	<0.0	<0.0	0.1	<0.0	0.2
USA⁸	Quota²	5.1	7.6	7.5	6.3	8.1	11.1	12.0	9.5	6.9	4.0			
	Catch²	1.1	0.6	0.7	0.3	1.6	1.6	1.8	1.1	0.4				
	Landed	1.8	0.6	0.3	0.3	1.1	2.2	2.2	1.3	0.4		2.0	<0.0	9.1
	Discard	0.2	0.1	0.3	0.3	0.1	0.1	0.0	0.1	0.1		0.6	0.0	7.6
Total⁸	Quota³	15.0	23.0	22.0	19.0	23.0	30.0	29.6	22.0	16.0	10.4			
	Catch^{3,4}	10.9	15.1	12.7	12.3	17.1	17.6	18.4	12.3	5.1				
	Catch	11.9	15.3	12.6	12.5	16.0	19.9	18.8	12.7	5.6		8.2	2.1	23.3
	Adult Biomass⁵	79.0	59.9	123.3	150.9	151.3	159.9	124.9	89.1	62.7	183.6	51.2 ⁶	4.9 ⁶	183.6 ⁶
	Age 1 Recruits	306.7	7.1	16.2	5.4	6.4	3.5	4.7	474.3	73.9	15.3	33.4 ⁶	0.2 ⁶	474.3 ⁶
	Fishing mortality⁷	0.28	0.26	0.26	0.14	0.09	0.13	0.17	0.15	0.16		0.29	0.09	0.57
	Exploitation Rate⁷	22%	21%	21%	12%	8%	11%	14%	13%	13%		22%	8%	40%

¹1969 – 2012²for fishing year from May 1st – April 30th³for Canadian calendar year and USA fishing year May 1st – April 30th⁴sum of Canadian Landed, Canadian Discard, and USA Catch (includes discards)⁵January 1st ages 3+⁶1931 – 1955, 1969 – 2013⁷ages 4-8 for 1969 – 2002; ages 5-8 for 2003 – 2012⁸ unless otherwise noted, all values reported are for calendar year***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 decreased the following two years and were 5,631 mt in 2012.

The **Canadian catch** in 2012 decreased to 5,062 mt from 11,247 mt in 2011. The weight of all Canadian landings was monitored at dockside. Discards in the groundfish fishery are considered to be negligible. Discards of haddock by the Canadian sea scallop fishery ranged between 29 mt and 186 mt since 1969 and were 28 mt in 2012.

USA catches decreased from 1,409 mt in 2011 to 569 mt in 2012. Landings were 443 mt and discards were estimated to be 126 mt, primarily from the large mesh otter trawl fishery. Landings are reported by dealers and discards are estimated from at-sea observer data.

The **combined Canada/USA fishery catch** (landings + discards) in 2012 was dominated by the 2003 year class (age 9) by numbers and weight. Both the Canadian and the USA fisheries were adequately sampled to determine length composition of the catch.

Harvest Strategy and Reference Points

The Transboundary Management Guidance Committee (TMGC) 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 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 2012 (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 and recruitment relative to the terminal year estimates. The current stock assessment does not display a retrospective bias.

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 a historical low of 10,300 mt in 1993 to 83,900 mt in 2003 (Figure 2). Adult biomass decreased to 59,900 mt in 2005 and subsequently increased to 159,900 mt in 2009, higher than the 1931-1955 maximum biomass of about 90,000 mt. At the beginning of 2013, the adult biomass increased to 183,600 mt (80% confidence interval: 146,700 mt – 249,300 mt). The tripling of the adult biomass after 2005 was due to the exceptionally strong 2003 year class, currently estimated at 307 million age 1 fish. The current estimate for the 2010 year class is 474 million age 1 fish, which would make it the largest cohort in the assessment time series: 1931-1955 and 1969-2012. The preliminary estimate for the 2012 year class is 15 million age 1 fish. Except for the strong 2000 and 2011 year classes and the exceptionally strong 2003 and 2010 year classes, recruitment has fluctuated between 2.1 and 28.8 million since 1990.

Fishing mortality (population weighted for ages 4-8) fluctuated between 0.26 and 0.47 during the 1980s, and increased in 1992 and 1993 to about 0.5, the highest observed. After 2002, the age at full recruitment to the fishery has been age 5 (rather than age 4 previously) due to a decline in size at age of haddock. Fishing mortality (population weighted for ages 4-8 prior to 2003 and ages 5-8 for 2003-2012) was below $F_{ref} = 0.26$ during 1995 to 2003, above or near F_{ref} in 2004 to 2006, but has subsequently been below F_{ref} and was 0.16 in 2012 (80% confidence interval: 0.14 – 0.20, 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, which has been the case since 2001 (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 2003 year class appears to have reached its maximum growth potential. Fish condition as measured by Fulton's K derived from the DFO survey and the NMFS fall survey has generally been below the time series average since 2000.

Outlook

This outlook is provided in terms of consequences with respect to the harvest reference points for alternative catch quotas in 2014. Uncertainty about current biomass generates uncertainty in forecast results, which is expressed here as the probability of exceeding $F_{ref}=0.26$ and change in adult biomass from 2014 to 2015. The risk calculations assist in evaluating the consequences of alternative catch quotas by providing a general measure of the uncertainties. However, the risk calculations 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, the possibility that the model may not reflect stock dynamics closely enough and retrospective bias.

For projections, the most recent 3-year survey and fishery average weights at age were used as inputs. Fishery partial recruitment (PR) was based on the 2003 to 2012 population weighted average. The PR on the age 9+ group was 0.3 which is consistent with the model. No growth was assumed for the 2003 year class from ages 10 to 12. The 2003 year class values were used for the 2010 year class for weights and partial recruitment due to similarity in growth.

Assuming a 2013 catch equal to the 10,400 mt total quota, a combined Canada/USA catch of 31,500 mt in 2014 results in a neutral risk (50%) that the 2014 fishing mortality rate would exceed $F_{ref} = 0.26$ (Figure 4). The 2014 3+ biomass is projected to be the largest in the time series at 245,500 mt, due to the contribution from the outstanding 2010 and strong 2011 year classes. The 9+ age group (9%), of which the 2003 year class is the main component, and the 2010 year class (83%) are expected to constitute the majority of the 2014 catch biomass. A catch of 27,000 mt in 2014 results in a low risk (25%) that the 2014 fishing mortality rate will exceed F_{ref} . A catch of 37,500 mt in 2014 results in a high risk (75%) that the 2014 fishing mortality rate will exceed F_{ref} . The probability that the 2015 biomass will not increase is greater than 75% at the F_{ref} catch level and there is almost no chance that it will increase by 10% at any of the catch scenarios considered. Biomass at the beginning of 2015 is projected to be 240,000 mt fishing at F_{ref} . Biomass increase is expected to be offset by fishery catch and natural mortality.

Probability of exceeding F_{ref}	25%	50%	75%
2014 catch	27,000 mt	31,500 mt	37,500 mt

Special Considerations

Although the fishing mortality reference is based on a PR of 1 for older ages, the benchmark model indicates a PR of 0.3 for the 9+ age group. Several corroborating factors influenced the decision to use the lower PR produced by the model, e.g. the predicted versus observed 2011 catch at age supports the use of the lower PR.

Although currently the 2013 haddock quota is projected to be above F_{ref} , it is unlikely that the 2013 quota will be caught due to restrictive quotas on other species.

In July 2013 there will be a reduction in minimum size from 18 inches to 16 inches for the US fishery which is expected to result in reduced discards and a possible change in PR for the youngest ages.

Source Documents

Clark, K.J., and L. O'Brien, editors. 2013. Proceedings of the Transboundary Resources Assessment Committee (TRAC): Eastern Georges Bank Cod and Haddock, and Georges Bank Yellowtail Flounder: Report of Meeting held 25-27 June 2013. TRAC Proceedings 2013/02.

Van Eeckhaute, L. and E.N. Brooks. 2013. Assessment of Haddock on Eastern Georges Bank for 2013. TRAC Reference Document 2013/03.

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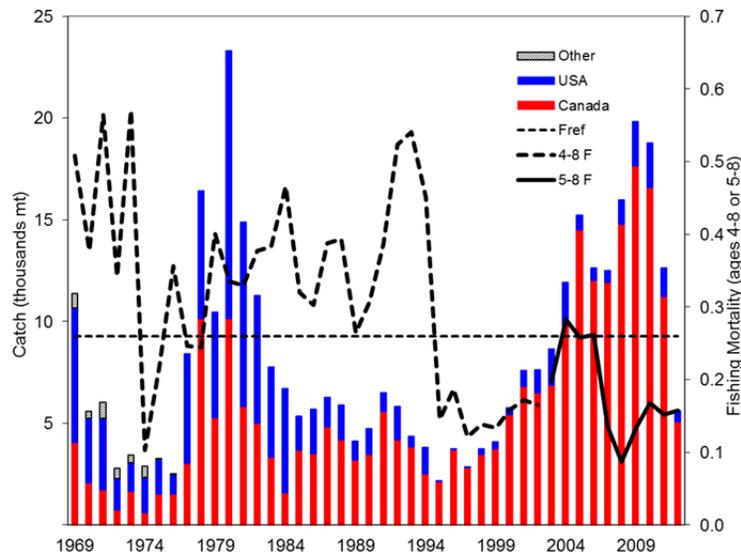


Figure 1. Catches (bars) and fishing mortality (line); (F for ages 4-8 for 1969-2002 and ages 5-8 for 2003-2012).

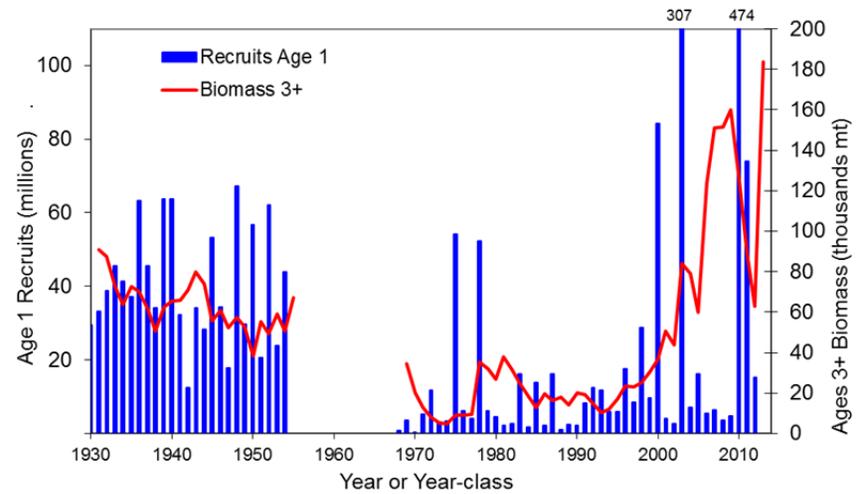


Figure 2. Biomass (line) and recruitment (bars).

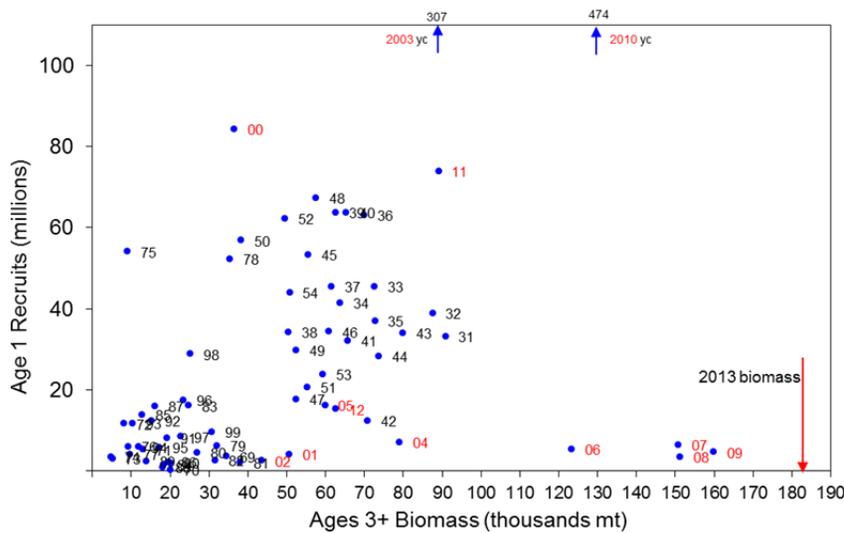


Figure 3. Stock recruitment patterns.

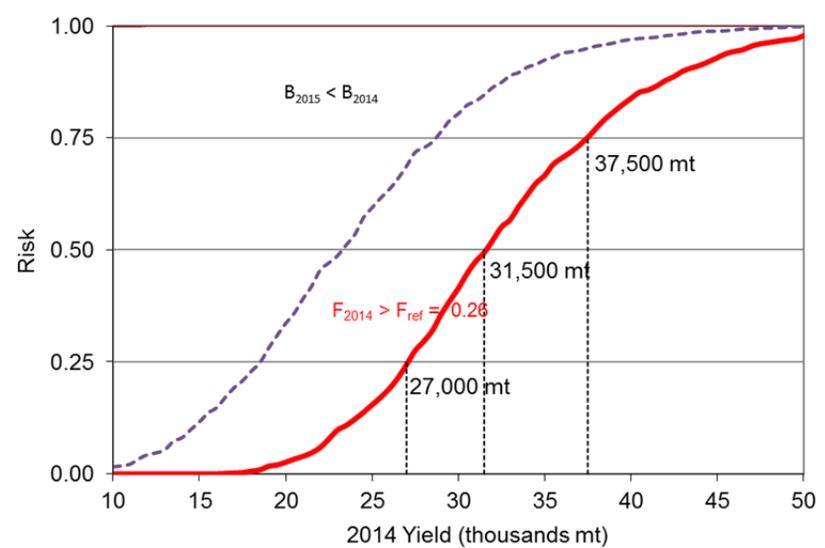


Figure 4. Projection risks.