Fisheries and Oceans Canada Pêches et Océans Canada

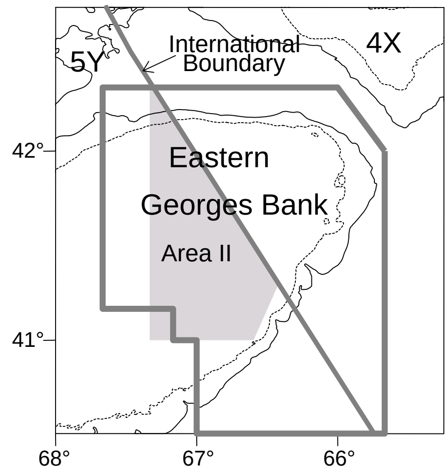
NOAA FISHERIES
NATIONAL MARINE FISHERIES SERVICE

Transboundary Resources Assessment Committee

Status Report 2014/02

EASTERN GEORGES BANK HADDOCK

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



Summary

- Combined Canada and USA catches in 2013 were 5,066 mt.
- At the beginning of 2014, adult biomass was 160,300 mt.
- The current estimate for the 2010 year class is 334 million age 1 fish, which would make it the largest cohort in the assessment time series. The preliminary estimate for the 2013 year class is 1,546 million age 1 fish, the largest in the time series. Except for the strong 2000 and 2011 year classes and the exceptionally strong 2003, 2010 and 2013 year classes, recruitment has fluctuated between 2.1 and 27.3 million since 1990.
- Fishing mortality was below F_{ref} = 0.26 during 1995 to 2003, above F_{ref} in 2004 to 2006, but has subsequently been below F_{ref} and was 0.16 in 2013.
- This stock exhibits positive features such as an expanding age structure, broad spatial distribution, and has produced three 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 2014 catch equal to the 27,000 mt total quota and downsizing the 2013 year class to the 2010 year class abundance at age 1, a combined Canada/USA catch of 44,000 mt in 2015 results in a neutral risk (50%) that the 2015 fishing mortality rate would exceed F_{ref} = 0.26. The probability that the 2016 biomass will not increase by 20% is negligible. Biomass at the beginning of 2016 is projected to be 234,300 mt fishing at F_{ref}.

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

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Avg[1]	Min[1]	Max[1]
Canada[2]	**Quota**	15.4	14.5	12.7	15.0	18.9	17.6	12.5	9.1	6.4	16.5			
	Landed	14.5	12.0	11.9	14.8	17.6	16.6	11.2	5.0	4.6		5.6	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	0.2
USA[2]	**Quota[3]**	7.6	7.5	6.3	8.1	11.1	12.0	9.5	6.9	4.0	10.5			
	Catch[3]	0.6	0.7	0.3	1.6	1.6	1.8	1.1	0.4	0.6[4]				
	Landed	0.6	0.3	0.3	1.1	2.2	2.2	1.3	0.4	0.3		2.0	<0.1	9.1
	Discard	0.1	0.3	0.3	0.1	0.1	<0.1	0.1	0.1	0.1		0.5	0.0	7.6
Total[2]	**Quota[3]**	23.0	22.0	19.0	23.0	30.0	29.6	22.0	16.0	10.4	27.0			
	Catch[5,6]	15.1	12.7	12.3	16.5	19.2	18.4	12.3	5.5	5.2				
	Catch	15.3	12.6	12.5	16.0	19.9	18.8	12.7	5.6	5.1		8.2	2.1	23.3
Adult Biomass[7]		53.0	100.5	120.1	117.5	121.5	91.4	61.5	40.6	125.2	160.3	48.5[8]	4.9[8]	160.3[8]
Age 1 Recruits		5.8	10.6	5.5	5.4	2.8	4.1	334.3	50.5	14.7	1,546.2	51.2[8]	0.2[8]	1,546.2[8]
Fishing mortality[9]		0.30	0.32	0.17	0.11	0.18	0.25	0.24	0.25	0.16		0.30	0.10	0.57
Exploitation Rate[9]		23%	25%	14%	10%	15%	20%	19%	20%	13%		23%	9%	40%

[1] 1969 – 2013
[2] unless otherwise noted, all values reported are for calendar year
[3] for fishing year from May 1st – April 30th
[4] preliminary estimate
[5] for Canadian calendar year and USA fishing year May 1st – April 30th
[6] sum of Canadian landed, Canadian discard, and USA catch (includes discards)
[7] January 1st ages 3+
[8] 1931 – 1955, 1969 – 2014
[9] ages 4-8 for 1969 – 2002; ages 5-8 for 2003 – 2013

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 15,257 mt in 2005 (Figure 1). Combined catches then decreased to 12,510 mt in 2007 but increased to 19,855 mt in 2009, decreased the following years, and were 5,066 mt in 2013.

The **Canadian catch** decreased from 5,064 mt in 2012 to 4,631 mt in 2013. 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 15 mt and 186 mt since 1969 and were 10 mt in 2013.

USA catches decreased from 569 mt in 2012 to 435 mt in 2013. Landings were 344 mt and discards were estimated to be 91 mt, primarily from the otter trawl fishery with a small amount from mid-water trawlers (6 mt). Landings are reported by dealers, and discards are estimated from at-sea observer data.

The **combined Canada/USA fishery catch** (landings + discards) in 2013 was dominated by the 2010 year class (age 3) 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 2013 (including discards). The VPA was calibrated to trends in abundance from three bottom trawl survey series: NMFS spring, NMFS fall and DFO winter. Retrospective analyses were conducted to detect any tendency to consistently overestimate or underestimate fishing mortality, biomass, and recruitment relative to the terminal year estimates. Retrospective analysis shows lower biomass, higher F, and lower recruitment for several years of the analysis; however, differences were not considered sufficient to warrant a rho adjustment this year.

Several large **recruitment** events 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 a historical high of 160,300 mt (80% confidence interval: 123,500 mt – 206,400 mt) at the beginning of 2014 (Figure 2). The more than doubling of the adult biomass after 2005 was due to the exceptionally strong 2003 year class, currently estimated at 243 million age 1 fish. The current estimate for the 2010 year class is 334 million age 1 fish, which would make it the largest cohort in the assessment time series: 1931-1955 and 1969-2013. The preliminary estimate for the 2013 year class is 1,546 million age 1 fish, the largest in the time series. Except for the strong 2000 and 2011 year classes and the exceptionally strong 2003, 2010 and 2013 year classes, recruitment has fluctuated between 2.1 and 27.3 million since 1990 (Figure 2).

Fishing mortality (population weighted for ages 4-8) fluctuated between 0.27 and 0.47 during the 1980s, and increased in 1992-1994 to about 0.5, the highest observed since 1971. After 2002, the age at full recruitment to the fishery has been at age 5 (previously age 4) 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 2003-2013) was below $F_{ref} = 0.26$ during 1995 to 2003, fluctuated around 0.3 in 2003 to 2006, but has subsequently been below F_{ref} and was 0.16 in 2013 (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 reached its maximum growth potential at a smaller average size than year classes from the 1990s. The 2010 year class is showing similar growth to the 2003 year class. 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 2015. 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 2015 to 2016. 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, or the possibility that the model may not reflect stock dynamics closely enough.

For projections, the most recent 3-year survey and fishery average weights at age were used for beginning year population and fishery weights at age except as indicated below. Fishery partial recruitment (PR) was based on the 2003 to 2013 population weighted average except for age 4 where the 2003 year class value was used. The PR on the age 9+ group was 0.3, which is consistent with the model. The 2003 year class values were used for the 2010 year class for weights and partial recruitment due to similarity in growth. The 2010 year class values were used for 2013 year class weights. The weights at age of the 2005 and 2009 year classes were averaged for the 2011 year class weights.

Although the preliminary estimate of the 2013 year class is outstanding, its magnitude is highly uncertain. Given this uncertainty and the effect it will have on the 2016 biomass in the projection, this year class was downsized to the size of the 2010 year class. Assuming a 2014 catch equal to the 27,000 mt total quota, a combined Canada/USA catch of 44,000 mt in 2015 results in a neutral risk (50%) that the 2015 fishing mortality rate would exceed $F_{ref} = 0.26$ (Figure 4). The 2010 year class is expected to constitute the majority (88%) of the 2015 catch biomass. A catch of 37,000 mt in 2015 results in a low risk (25%) that the 2015 fishing mortality rate will exceed F_{ref}. A catch of 52,000 mt in 2015 results in a high risk (75%) that the 2015 fishing mortality rate will exceed F_{ref}. The probability that the 2016 biomass will not increase by 20% is negligible. Biomass at the beginning of 2016 is projected to be 234,300 mt fishing at F_{ref}.

Probability of exceeding F_{ref}	**25%**	**50%**	**75%**
2015 catch	37,000 mt	44,000 mt	52,000 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 values support the use of the lower PR.

If the 2014 quota is caught, the 2014 F will be above F_{ref} due to the revision of the size of the 2010 year class in the 2014 assessment. In July 2013, there was a reduction in minimum size for the US fishery from 18 inches to 16 inches.

Source Documents

O'Brien, L., and T. Worcester, editors. 2014. Proceedings of the Transboundary Resources Assessment Committee (TRAC): Eastern Georges Bank Cod and Haddock, and Georges Bank Yellowtail Flounder: Report of Meeting held 23-26 June 2014. TRAC Proceedings 2014/02.

Van Eeckhaute, L. and E.N. Brooks. 2014. Assessment of Haddock on Eastern Georges Bank for 2014. TRAC Reference Document 2014/02.

Correct Citation

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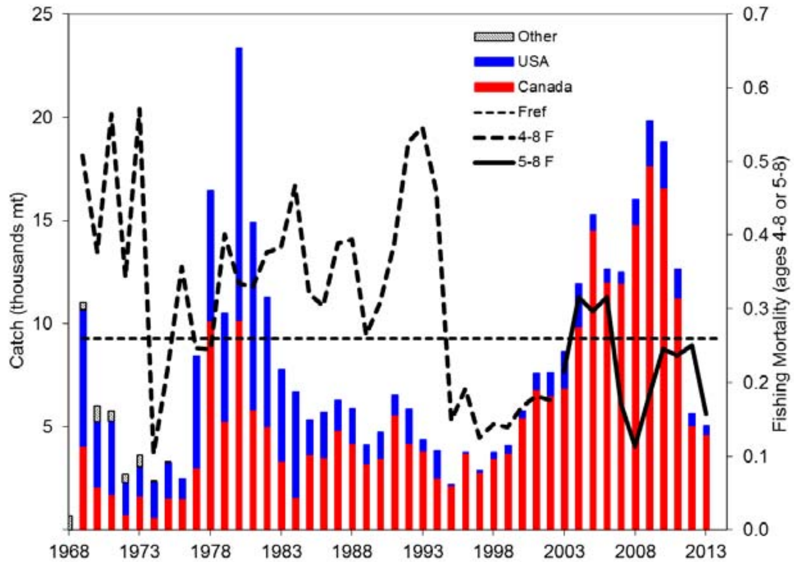

Figure 1. Catches (bars) and fishing mortality (line); (F for ages 4-8 for 1969-2002 and ages 5-8 for 2003-2013) for Eastern Georges Bank (EGB) haddock.

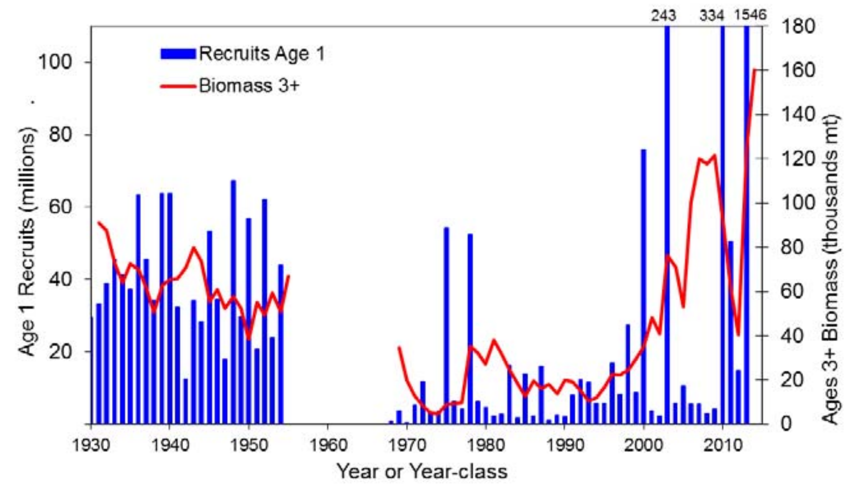

Figure 2. Biomass (line) and recruitment (bars) for EGB haddock.

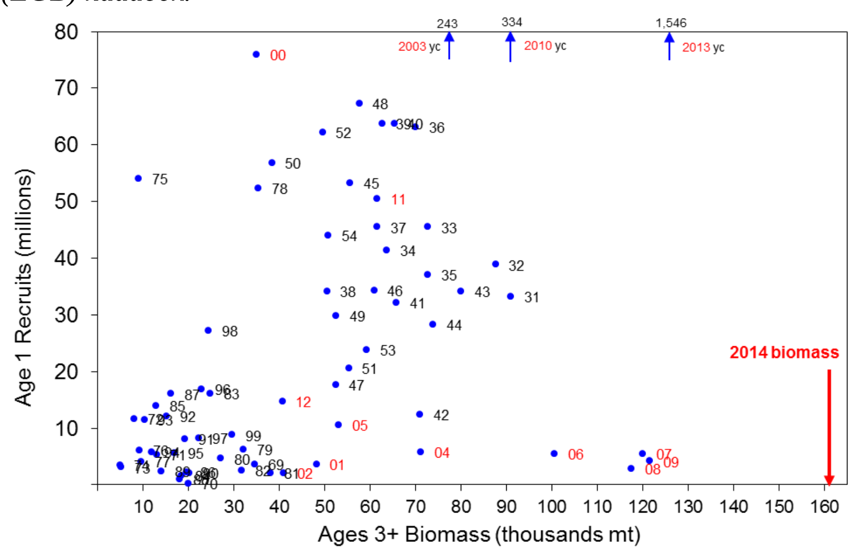

Figure 3. Stock recruitment patterns for EGB haddock.

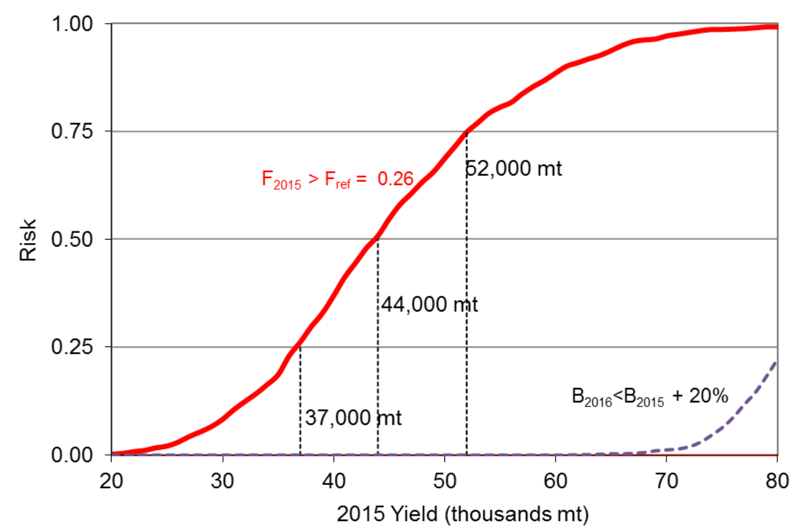

Figure 4. Projection risks for EGB haddock.