Transboundary Management Guidance Committee

Guidance Document 2012/01

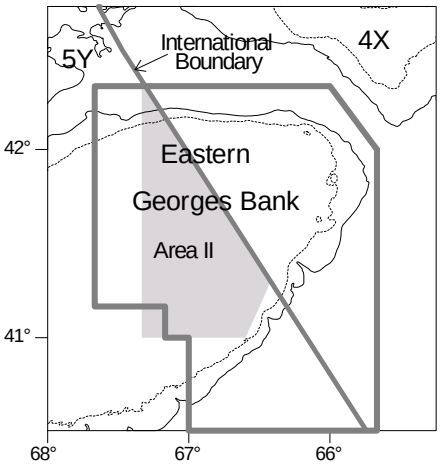
The Transboundary Management Guidance Committee (TMGC), established in 2000, is a government – industry committee composed of representatives from Canada and the United States. The Committee's purpose is to develop guidance in the form of harvest strategies, resource sharing and management processes for Canadian and US management authorities for the cod, haddock and yellowtail flounder transboundary resources on Georges Bank. This document is a summary of the basis of the TMGC's guidance to both countries for the 2013 fishing year (calendar year for Canada; May 1, 2013 to April 30, 2014 for the USA). Pertinent reference documents and consultations used in the TMGC deliberations are listed at the end of this document.

Since inception, the TMGC has successfully coordinated management of three trans-boundary groundfish resources. Annual harvest levels have been established, consistent with the legal and policy requirements of both countries. The benefits of this approach are worth noting: fishing mortality rates for the three management units considered by the TMGC have been reduced and Eastern Georges Bank haddock has been at record high abundance.

In January of 2011, the International Fisheries Clarification Act (Act) was signed into law in the U.S. The Act recognizes the U.S./Canada Transboundary Resources Sharing Understanding, and provides the US with flexibility in the rebuilding period and catch level requirements for Georges Bank yellowtail flounder under the Magnuson-Stevens Fishery Conservation and Management Act.

Eastern Georges Bank Cod [5Zjm; 551, 552, 561, 562]

Guidance



The TMGC concluded, after considering both models, that the most appropriate combined Canada/USA TAC for Eastern Georges Bank cod for the 2013 fishing year is 600 mt. In keeping with the harvest strategy for this stock, TMGC sought to decrease fishing mortality and promote stock rebuilding. TMGC considered only the rho adjusted projection advice to account for the retrospective bias in both model formulations. A 2013 TAC of 600 mt corresponds approximately to the average of the neutral risk of exceeding F_{ref} of 0.18. Under both model formulations a catch at this level is expected to result in a biomass increase of more than 10%. The annual allocation shares between countries for 2013 are based on a combination of historical catches (10% weighting) and resource distribution based on trawl surveys (90% weighting). Combining these factors entitles the USA to 16% and Canada to 84% of the TAC, resulting in a national quota of 96 mt for the USA and 504 mt for Canada.

Harvest Strategy & Reference Points

The strategy is to maintain a low to neutral risk of exceeding the fishing mortality limit reference, F_{ref}=0.18. When stock conditions are poor, fishing mortality rates should be further reduced to promote rebuilding.

Fishery Exploitation

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

		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Avg[1]	Min[1]	Max[1]
Canada[9]	Quota	1.3	1.0	0.7	1.3	1.4	1.6	1.2	1.0	0.9	0.5			
	Catch	1.5	1.3	0.9	1.4	1.2	1.5	1.2	0.8	0.7		5.9	0.7	17.9
	Landed	1.3	1.1	0.6	1.1	1.1	1.4	1.0	0.7	0.7		5.8	0.6	17.8
	Discard	0.2	0.1	0.2	0.3	0.1	0.1	0.2	0.1	<0.1		0.1	<0.1	0.5
USA[9]	Quota[2]		0.3	0.3	0.4	0.5	0.7	0.5	0.3	0.2	0.2			
	Catch[2]		0.2	0.2	0.3	0.3	0.5	0.5	0.3	0.2				
	Landed	1.9	1.0	0.2	0.1	0.2	0.2	0.4	0.4	0.3		3.5	0.1	10.6
	Discard	0.1	0.1	0.3	0.1	0.4	<0.1	0.2	0.1	<0.1		<0.1	<0.1	0.4
Total[9]	Quota		1.3	1.0	1.7	1.9	2.3	1.7	1.3	1.1	0.7			
	Catch	3.5	2.3	1.3	1.7	1.8	1.8	1.9	1.3	1.0		9.5	1.0	26
	Catch[3,4]		1.5	1.1	1.7	1.5	2.0	1.7	1.1	0.9				
"split M 0.2" model														
	Adult Biomass[5]	5.9	5.1	3.0	4.2	3.9	3.4	3.7	3.3	2.7	2.8	22.3	2.7	59.6
	Age 1 Recruits	0.4	2.8	0.5	0.9	1.4	0.9	0.9	1.0	4.0		5.1	0.4	23.6
	Fishing mortality[6]	0.80	0.86	0.43	0.74	0.50	0.55	0.65	0.58	0.49		0.6	0.33	1.29
	Exploitation Rate[6]	50%	53%	32%	48%	36%	38%	44%	40%	35%		40%	26%	67%
"split M 0.5" model														
	Adult Biomass[5]	7.3	6.6	4.0	6.1	6.2	5.7	6.4	5.2	4.2	4.2	23.6	4.0	59.6
	Age 1 Recruits	0.5	4.4	0.6	1.0	1.7	1.0	1.0	1.2	4.8		5.3	0.5	23.7
	Fishing mortality[6]	0.60	0.61	0.31	0.50	0.27	0.25	0.31	0.33	0.28		0.48	0.24	1.05
	Exploitation Rate[7]	41%	42%	24%	36%	22%	20%	25%	26%	22%		34%	20%	60%
	Exploitation Rate[8]	36%	37%	21%	31%	19%	18%	21%	22%	19%		31%	14%	53%

[1]1978 – 2011
[2]for fishing year from May 1 – April 30
[3]for Canadian calendar year and USA fishing year May 1-April 30
[4]sum of Canadian landed, Canadian Discard, and USA Catch (includes discards)
[5]Jan 1 ages 3+
[6]ages 4-9
[7]ages 4-5
[8]ages 6-9
[9] unless otherwise noted, all values reported are for calendar year

Combined Canada/USA catches averaged 17,208 mt between 1978 and 1992, peaking at 26,464 mt in 1982. Catches declined to 1,683 mt in 1995, then fluctuated at about 3,000 mt until 2004, subsequently declining. Catches in 2011 were 1,037 mt, including 69 mt of discards.

State of Resource

Evaluation of the resource was based on two VPA model formulations which were established during the benchmark assessment meeting in 2009. These model formulations will be referred to as the "split M 0.2" and "split M 0.5" model. The survey abundance

indices were split in 1993-1994 for both model formulations. Natural mortality (M) was fixed at 0.2 for all the ages in all years for the "split M 0.2" model and was fixed at 0.5 for ages 6+ in years after 1994 for the "split M 0.5" model. It was recommended at the 2009 benchmark meeting to consider both model formulations.

Retrospective analyses were conducted to detect any tendency to consistently overestimate or underestimate fishing mortality (F), biomass (B), and recruitment relative to the terminal year estimates. The current stock assessments exhibit retrospective bias in B and F, which results in decreases in B and increases in F compared to the results of last year's assessment. The adult biomass, recruitment, and fishing mortality estimates presented below are from the unadjusted benchmark model formulations.

Fishing mortality (F; population weighted average of ages 4-9) was high prior to 1994. F declined in 1995 to 0.36 for the "split M 0.2" model and to 0.24 for the "split M 0.5" model due to restrictive management measures. F in 2011 was estimated to be 0.49 (80% confidence interval: 0.40-0.65) from the "split M 0.2" model and 0.28 (80% confidence interval: 0.24-0.38) from the "split M 0.5" model. Both models show reductions in F since the early 2000s, but fishing mortality has been consistently above $F_{ref} = 0.18$.

Since 1995 adult population biomass (ages 3+) from the "split M 0.2" model has fluctuated between 2,700 mt and 10,100 mt. Biomass was 2,845 mt (80% confidence interval: 2,409 mt – 3,705 mt) at the beginning of 2012. Since 1995 adult population biomass from the "split M 0.5" model has fluctuated between 4,000 mt and 12,600 mt. Biomass was 4,192 mt (80% confidence interval: 3,586 mt – 5,474 mt) at the beginning of 2012. Lower weights at age in the population in recent years and generally poor recruitment have contributed to the lack of sustained rebuilding. Survey biomass indices have been lower since the mid-1990s. Survey biomasses for the spring 2012 NEFSC surveys and for the 2012 DFO survey were among the lowest in their time series. The estimated adult population biomass at the beginning of 2012 from the VPA was only 5.5% ("split M 0.2" model) and 8% ("split M 0.5" model) of the 1978 biomass (beginning of time series). The 2012 adult population biomass estimates are the second lowest in the time series according to both models.

Recruitment at age 1 has been low in recent years. Since 2000, the 2003 year class (2.8 million fish from the "split M 0.2" model and 4.4 million fish from the "split M 0.5" model) is the highest recruitment estimated by either model (excluding 2010). The initial estimates of the 2010 year class at 4.0 million from the "split M 0.2" model and 4.8 million from the "split M 0.5" model are stronger than the 2003 year class based on the 2012 assessment. However, the uncertainties on the 2010 year class are high, with a 46% relative standard error on age 2 from both models. Both the 2003 and 2010 year classes are less than half of the average (about 10 million) during 1978-1990, when the productivity was considered to be higher. Recruitment for the 2002 and 2004 year classes was the lowest on record in both models. The 2006 year class at age 1 was 1.4 million from the "split M 0.2" model and at 1.7 million from the "split M 0.5" model. The 2007, 2008, and 2009 year classes were similar in strength to the 2000 year class, which was only about 10% of the 1978-1990 average recruitment in both models. Recruitment indices for the 2011 year class from the bottom trawl surveys are low.

Productivity

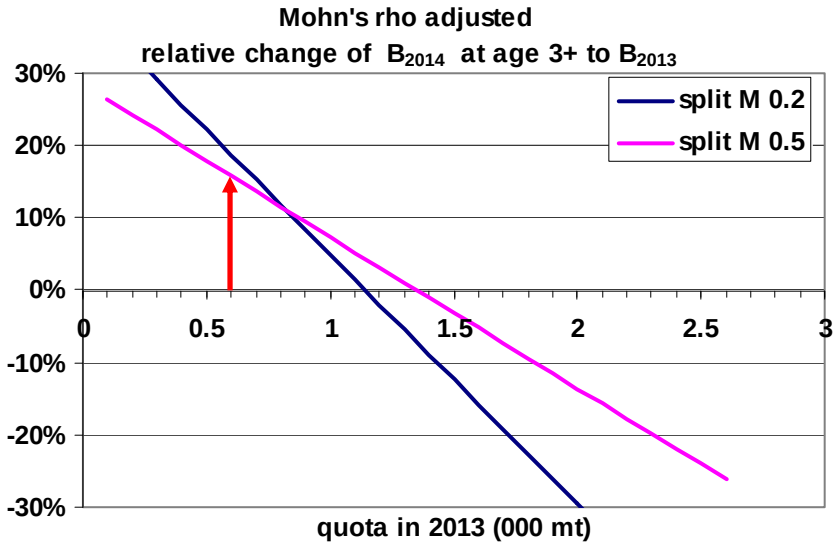
The population age structure displays a very low proportion of ages 7+ compared to the 1980s. Condition has been stable in the past but has started to decline in recent years. Resource productivity is currently very poor due to low recent recruitment and low size at age compared to the 1980s. The current biomass is at a level where only low recruitment has been observed.

2013 Catch Risk Assessment

In recent years, catches based on the "split M 0.2" and "split M 0.5" unadjusted formulations have not reduced fishing mortality below F_{ref} and have not had the expected effect on SSB. TRAC recommends not basing 2013 catches on these unadjusted model projection results (shown in grey font in table), but rather on the rho adjusted projection results.

Probability of exceeding F_{ref} in 2013:	**0.25**	**0.5**	**0.75**
"Split M 0.2"	750 mt	875 mt	1,025mt
"Split M 0.5"	1,175 mt	1,400 mt	1,625 mt
"Split M 0.2": Rho adjusted	325 mt	400 mt	475 mt
"Split M 0.5": Rho adjusted	625 mt	775 mt	875 mt

Neutral risk (50%) that biomass will not increase by:	**0%**	**10%**	**20%**
"Split M 0.2"	2,475 mt	1,775 mt	1,050 mt
"Split M 0.5"	2,475 mt	1,525 mt	575 mt
"Split M 0.2": Rho adjusted	1,175 mt	900 mt	575 mt
"Split M 0.5": Rho adjusted	1,450 mt	900 mt	400 mt



Considering both models, under the rho adjusted "split M 0.2" assumption, a 50% probability of not exceeding F_{ref} implies catches less than 400 mt, and of less than 775 mt under the rho adjusted "split M 0.5" assumption. Given the extremely low SSB, TRAC considers that management should try to harness the growth potential from the 2010 year class to rebuild the spawning stock biomass.

Special Considerations

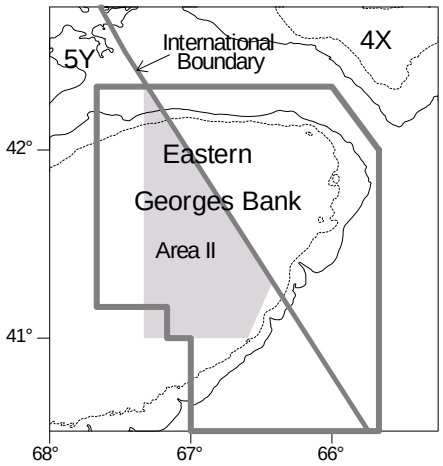
At the 2009 benchmark it was recommended to use the two model formulations to develop management advice until a preferred model could be determined. The 2003 year class has now progressed through the fishery providing information on natural mortality at ages 6 and older. A benchmark assessment has been scheduled for spring of 2013 to review the model formulation.

Current stock status is based on the unadjusted models. If the retrospective bias observed in this assessment was considered when determining stock status, biomass would be significantly lower and fishing mortality significantly higher than reported here. In order to address the retrospective bias, catch advice for 2013 was based on rho adjusted biomass values.

While management measures have resulted in decreased exploitation rate since 1995, fishing mortality has remained above F_{ref} and adult biomass has fluctuated at a low level. The continuing poor recruitment since the early 1990s is an important factor for this lower productivity. The initial estimate of the 2010 year class is higher than adjacent year classes, but is still well below the average of 1978-1990, when the productivity was higher. Rebuilding will not occur without improved recruitment.

Eastern Georges Bank Haddock [5Zjm; 551, 552, 561, 562]

Guidance



The TMGC concluded that the most appropriate combined Canada/USA TAC for Eastern Georges Bank haddock for the 2013 fishing year is 10,400 mt, representing a neutral risk (50%) of exceeding F_{ref} of 0.26. This is a reduction from the previous TAC to account for the expected decrease in stock size as the exceptional 2003 year class moves through the fishery. The stock size is expected to again increase beginning in 2013 as the 2010 year class recruits and is projected to be 306,200 mt (a record-high) at the beginning of 2014. The annual allocation shares between countries for 2012 are based on a combination of historical catches (10% weighting) and resource distribution based on trawl surveys (90% weighting). Combining these factors entitles the USA to 38% and Canada to 62% of the TAC, resulting in a national quota of 3,952 mt for the USA and 6,448 mt for Canada.

Harvest Strategy & Reference Points

The strategy is 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.

Fishery Exploitation

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

		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Avg[1]	Min[1]	Max[1]
Canada[8]	**Quota**	6.9	9.9	15.4	14.5	12.7	15.0	18.9	17.6	12.5	9.1			
	Landed	6.8	9.7	14.5	12.0	11.9	14.8	17.6	16.6	11.2		5.7	0.5	17.6
	Discard	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.0		0.1	0.0	0.2
USA[8]	**Quota**[2]		5.1	7.6	7.5	6.3	8.1	11.1	12.0	9.5	6.9			
	Catch[2]		1.1	0.6	0.7	0.3	1.6	1.6	1.8	1.1				
	Landed	1.7	1.8	0.6	0.3	0.3	1.1	2.2	2.2	1.3		2.1	0.0	9.1
	Discard	0.1	0.2	0.1	0.3	0.3	0.1	0.1	0.0	0.1		0.6	0.0	7.6
Total[8]	**Quota**[3]		15.0	23.0	22.0	19.0	23.0	30.0	29.6	22.0	16.0			
	Catch[3,4]		10.9	15.1	12.7	12.3	17.1	17.6	18.4	12.3				
	Catch	8.6	11.9	15.3	12.6	12.5	16.0	19.9	18.8	12.7		8.3	2.1	23.3
Adult Biomass[5]		86.4	81.6	62.2	130.9	160.7	162.2	172.7	136.6	99.0	70.7	50.5[6]	4.9[6]	172.7[6]
Age 1 Recruits		2.7	328.0	5.9	18.8	5.8	7.8	4.3	4.9	588.9	104.9	36.3[6]	0.2[6]	588.9[6]
Fishing mortality[7]		0.19	0.27	0.25	0.25	0.13	0.08	0.12	0.15	0.14		0.29	0.08	0.57
Exploitation Rate[7]		16%	22%	20%	20%	11%	7%	11%	13%	12%		22%	7%	40%

[1]1969 – 2011
[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 – 2012

[7] ages 4-8 for 1969 – 2002; ages 5-8 for 2003 – 2011
[8] unless otherwise noted, all values reported are for calendar year

Combined Canada/USA catches declined from 6,504 mt in 1991 to a low of 2,150 mt in 1995, fluctuated at about 3,000 mt to 4,000 mt until 1999, and increased to 19,856 mt in 2009, the highest since 1981. Combined catches were 12,655 mt in 2011.

State of Resource

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.

Fishing mortality for fully recruited ages fluctuated between 0.26 and 0.47 during the 1980s, and markedly increased in 1992 and 1993 to about 0.5, the highest observed. Fishing mortality was below $F_{ref} = 0.26$ during 1995 to 2003, fluctuated around F_{ref} during 2004 to 2006, but declined since then and was 0.14 in 2011.

Adult population biomass (ages 3+) increased from near an historical low of 10,400 mt in 1993 to 86,400 mt in 2003. Adult biomass subsequently decreased to 62,200 mt in 2005, but increased to 172,700 mt in 2009, the highest in the assessment time series (1931-1955 and 1969-2011). The tripling of the biomass after 2005 was due to recruitment and growth of the exceptional 2003 year class. At the beginning of 2012 the adult biomass decreased to 70,700 mt (80% confidence interval: 60,000 mt – 83,700 mt) commensurate with the 2003 year class reaching its highest biomass in 2009.

The current estimate for the outstanding 2010 year class is 589 million age 1 fish, which would make it the largest cohort in the assessment time series. The preliminary estimate for the 2011 year class is 105 million age 1 fish. Except for the strong 2000 and 2011 year classes and the exceptional 2003 and 2010 year classes, recruitment has fluctuated between 2.1 and 29.4 million since 1990.

Productivity

The probability of higher recruitment is increased at larger stock size. Stock size has been high since 2001. The population age structure displays a broad representation of age groups, reflecting improving recruitment and lower exploitation since 1995. There has been a general decline in weights at age since the late 1990s. Fish condition exhibits a declining trend since about 2001 and declined to its lowest value in 2011. Except in 2009, the condition factor of haddock has been below the series average since 2003.

2013 Catch Risk Assessment

Risk of exceeding F_{ref}	25% (risk averse)	50% (risk neutral)	75% (risk prone)
2013 Catch (mt)	9,300 mt	10,400 mt	11,900 mt

A combined Canada/USA catch of 10,400 mt in 2013 results in a neutral risk (50%) that the 2013 fishing mortality rate would exceed $F_{ref} = 0.26$. The 9+ age group (34%), of which the 2003 year class is the main component, and the 2010 year class (44%) are

expected to constitute the majority of the 2013 catch biomass. Due to the entry of the 2010 year class into the 3+ group in 2013 and its subsequent increase in weight, the estimated probability that the adult biomass will decline from 2013 to 2014 is virtually 0% at any of the catch scenarios considered. Adult biomass is projected to be 306,200 mt (a record-high) at the beginning of 2014.

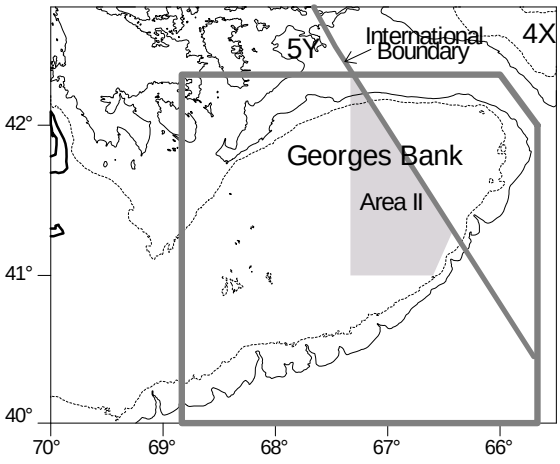
Special Considerations

Last year, the partial recruitment (PR) on ages 9+ was set equal to 1.0 for projections. This year, it has been set at 0.3 to match the VPA estimated PR. If this reduced PR for ages 9+ occurs in 2012 and the quota is caught, then the fishing mortality rate would be expected to be above $F_{ref} = 0.26$.

In 2013, the 2010 year class will be mostly below the current minimum size regulation used by the US, which could lead to significant discarding. This is not expected to be an issue in the Canadian fishery due to the different gear types and management measures.

Georges Bank Yellowtail Flounder [5Zhjmn; 522,525, 551, 552, 561, 562]

Guidance



The TMGC concluded that the most appropriate combined Canada/USA TAC for Georges Bank yellowtail for the 2013 fishing year is 500 mt. The re-emergence of the retrospective pattern led the TMGC to consider five sensitivity analyses consistent with the TRAC advice. Recent experience has shown that the catch advice based on the approved benchmark model has not met the harvest strategy. This is due to the retrospective bias that exists in the assessment model, the specific cause of which is unknown. The proposed quota is estimated to have a one percent chance of exceeding F_{ref} under the approved benchmark model used to determine stock status, but it may not fully account for the magnitude of the retrospective bias. However, it is lower than the catch associated with a neutral risk of exceeding F_{ref} based on the unadjusted projection results. This catch level is expected to result in an increase in stock size and falls within the range of the sensitivity analyses provided by the TRAC. The annual allocation shares between countries for 2013 are based on a combination of historical catches (10% weighting) and resource distribution based on trawl surveys (90% weighting). Combining these factors entitles the USA to 43% and Canada to 57% of the TAC, resulting in a national quota of 215 mt for the USA and 285 mt for Canada.

Harvest Strategy & Reference Points

The strategy is to maintain a low to neutral risk of exceeding the fishing mortality limit reference, F_{ref}=0.25. When stock conditions are poor, fishing mortality rates should be further reduced to promote rebuilding.

Fishery Exploitation

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

		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Avg[1]	Min[1]	Max[1]
Canada[9]	**Quota**	2.3	1.9	1.7	0.9	0.4	0.6	0.5	0.8[8]	1.2	0.6			
	Landed	2.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		0.5	<0.1	2.9
	Discard	0.8	0.4	0.2	0.5	0.1	0.1	0.1	0.2	<0.1		0.5	0.1	0.8
USA[9]	**Quota**[2]		6.0	4.3	2.1	0.9	1.9	1.6	1.2[8]	1.5	0.6			
	Catch[2]		5.9	3.8	1.9	1.0	1.6	1.8	1.1	1.1				
	Landed	3.2	5.8	3.2	1.2	1.1	0.7	1.0	0.7	0.9		4.4	0.4	15.9
	Discard	0.4	0.5	0.4	0.4	0.5	0.4	0.7	0.3	0.2		0.6	<0.1	3.0
Total[9]	**Quota**[3]		7.9	6.0	3.0	1.3	2.5	2.1	2.0[8]	2.7	1.2			
	Catch[3,4]		6.4	4.1	2.5	1.1	1.7	1.9	1.3	1.1				
	Catch	6.6	6.8	3.9	2.1	1.7	1.3	1.8	1.2	1.2		6.0	1.1	17.2

Adult Biomass[5]	10.9	8.5	4.0	2.5	2.5	3.4	3.9	4.2	4.5	4.3	6.9[6]	2.0[6]	26.2[6]
SSB	10.0	5.4	3.2	2.4	2.9	3.7	4.2	4.4	4.6		6.8	2.2	22.2
Age 1 Recruits	10.6	6.9	8.8	10.8	7.4	8.2	6.9	3.1	3.0		19.5	3.0	70.6
Fishing mortality[7]	0.61	1.94	1.39	1.52	1.00	0.51	0.67	0.49	0.31		1.02	0.31	1.94
Exploitation Rate[7]	42%	80%	70%	73%	58%	37%	45%	35%	24%		59%	24%	80%

[1]1973 – 2011
[2]for fishing year May 1 – April 30
[3]for Canadian calendar year and USA fishing year May 1 – April 30
[4]sum of Canadian Landed, Canadian Discard, and USA Catch (includes discards)
[5]January 1st ages 3+
[6]1973 – 2012
[7]ages 4+ for calendar year
[8]quotas not jointly determined; established individually by each country
[9] unless otherwise noted, all values reported are for calendar year

Total catches of Georges Bank yellowtail flounder peaked at about 21,000 mt in both 1969 and 1970. The combined Canada/USA catch increased from 1995 through 2001, averaged 6,300 mt during 2002-2004, but declined to 1,169 mt in 2011 due to restrictive management measures.

State of Resource

The VPA formulation down-weights the DFO surveys in 2008 and 2009 to account for the higher uncertainty in these years due to large tows, as previously recommended by TRAC. This formulation is denoted Split Series and is most similar to the Major Change model of the benchmark assessment. The current stock assessment exhibits a retrospective bias in spawning stock biomass (SSB) and F which results in decreases in SSB and increases in F compared to the results of last year's assessment. The estimate of stock biomass has changed from last year to this year primarily due to the retrospective bias. All the results presented for adult biomass, recruitment, and fishing mortality rate below are for the Split Series VPA.

Fishing mortality for fully recruited ages 4+ was close to or above 1.0 between 1973 and 1995, fluctuated between 0.51 and 0.97 during 1996-2003, increased in 2004 to 1.94, and then declined to 0.31 in 2011. Although quotas had been set to bring F below F_{ref}, the retrospective bias re-emergence resulted in F estimates above F_{ref}.

Adult population biomass (age 3+) increased from a low of 2,100 mt in 1995 to 10,900 mt in 2003, declined to about 2,500 mt in 2006 and 2007, increased to 4,500 mt in 2011, and was 4,300 mt at the beginning of 2012. Spawning stock biomass in 2011 was estimated to be 4,600 mt.

During 1973-2011 recruitment averaged 19.5 million fish at age 1; however, it has been below this average since 2002. The 2009 and 2010 year classes are estimated at 3.1 million and 3.0 million, respectively, the lowest values in the time series.

Productivity

Truncated age structure, poor recent recruitment and lower condition factor (weights at length) indicate current resource productivity is lower than historical levels.

2013 Catch Risk Assessment

In order to meet the harvest strategy ($F<F_{ref}$ and reduce F when stock condition is poor to promote rebuilding) and given the increased magnitude of the retrospective bias in the Split Series VPA, TRAC recommended not basing 2013 catches on the unadjusted model projection results. Five sensitivity analyses were performed to address the retrospective bias in characterizing the uncertainty and risk to determine the appropriate catch advice:

1. Split Series rho adjusted (adjSp)
2. Single Series rho adjusted (adjSi)
3. Catch multiplied by 5 for years 2005-2011 (Cmults)
4. Natural mortality multiplied by 4.5 for years 2005-2011 (Mmults)
5. Catch multiplied by 3.5 and natural mortality multiplied by 2.5 for years 2005-2011 (M&C)

The first two sensitivity analyses account for the retrospective bias by making adjustments to the catch projections. The latter three sensitivity analyses address retrospective bias by modifying assessment inputs. It was agreed that the magnitude of the changes in the latter three scenarios were too great to be regarded as plausible explanations for the patterns in the data. The changes were therefore assumed to alias unknown mechanisms in a similar manner to the Split Series change in survey catchability. If the adjustments adequately alias the currently unknown mechanism(s), the broadly consistent results across the approaches all support the proposed catch advice.

The results from the five different sensitivity analyses are therefore used as the basis for the catch advice:

	Split	adjSp	Single	adjSi	Cmults	Mmults	M&C
200 mt quota							
$P(F>F_{ref})$	0.00	0.56	0.00	0.00	0.03	0.02	0.25
F2013	0.05	0.27	0.01	0.06	0.15	0.15	0.21
deltaB	36%	55%	9%	10%	70%	91%	72%
B2013	4163	881	14900	3441	7497	1931	4270
P(B inc)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(B inc 10%)	1.00	1.00	0.47	0.55	1.00	1.00	1.00
500 mt quota							
$P(F>F_{ref})$	0.01	1.00	0.00	0.04	0.98	0.98	1.00
F2013	0.14	0.80	0.04	0.16	0.42	0.39	0.61
deltaB	29%	22%	7%	1%	50%	81%	51%
B2013	4163	881	14900	3441	7497	1931	4270
P(B inc)	1.00	1.00	1.00	0.76	1.00	1.00	1.00
P(B inc 10%)	1.00	1.00	0.20	0.00	1.00	1.00	1.00

Under the five sensitivity analyses, to achieve both a high probability that F in 2013 will be less than F_{ref} and that adult biomass will increase, a 2013 quota of approximately 200 mt would be required. A quota of 400-500 mt implies that either F will be below F_{ref} in 2013 in only one (Single Series rho adjusted) of the five sensitivity analyses or the adult biomass will increase from 2013 to 2014 for the other four (but not Single Series rho adjusted).

Special Considerations

The Split Series formulation was approved at the last benchmark assessment and is used to estimate current stock size and fishing mortality. In recent years, catches based on the rho unadjusted Split and Single Series models have not reduced fishing mortality below F_{ref} and have not had the expected effect on age 3+ biomass or SSB. If the retrospective bias observed in this assessment was considered when determining stock status, biomass would be lower (from 4,600 mt to 1,700 mt) and fishing mortality higher (from 0.31 to 0.62) than reported here.

Due to the assumption used for the 2011 year class in the projections (10 year geometric mean), the increase in adult biomass will be optimistic if the 2011 year class is as poor as the recent year classes.

In the USA, there is a requirement to provide rebuilding projections when stocks are overfished. The current rebuilding scenario for Georges Bank yellowtail flounder requires solving for a value of F (F_{reb50}) that, when applied in years 2013 onwards, results in a 50% probability that SSB is greater than SSB_{msy} (43,200 mt) in year 2032. Due to the length of the rebuilding program, projections were not considered.

Source Documents

Legault, C.M., L. Alade, H.H. Stone, and W.E. Gross. 2012. Stock Assessment of Georges Bank Yellowtail Flounder for 2012. TRAC Reference Document - 2012/02; 133p.

Stone, H.H., L. O'Brien, and L. Van Eeckhaute. 2012. Update of allocation shares for Canada and the USA of the transboundary resources of Atlantic cod, haddock and yellowtail flounder on Georges Bank through fishing year 2013. TRAC Reference Document 2012/xx.

TRAC. 2012. Georges Bank yellowtail flounder. TRAC Status Report 2012/01.

TRAC. 2012. Eastern Georges Bank cod. TRAC Status Report 2012/02.

TRAC. 2012. Eastern Georges Bank haddock. TRAC Status Report 2012/03.

Consultations

TRAC Pre-Assessment Industry/Science meeting in Canada, Yarmouth, Nova Scotia, June 11, 2012.

Transboundary Resources Assessment Committee (TRAC) meeting, Woods Hole, Massachusetts, 26-29 June 2012.

Transboundary Management Guidance Committee public consultation in Canada, Yarmouth, Nova Scotia, 9 Aug 2012.