Transboundary Management Guidance Committee

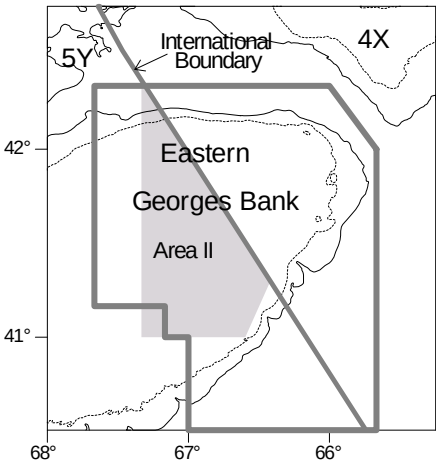
Guidance Document 2010/01

The Transboundary Management Guidance Committee (TMGC), established in 2000, is a government – industry committee comprised 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 2011 fishing year. 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 to low levels, Eastern Georges Bank haddock went through record high abundance, Georges Bank yellowtail flounder is growing, and declines in Eastern Georges Bank cod have been arrested.

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

Guidance



The TMGC concluded that the most appropriate combined Canada/USA TAC for Eastern Georges Bank cod for the 2011 fishing year is 1,050 mt. The TMGC considered the two model formulations with their retrospective patterns and the risk consequences provided by the TRAC when developing management guidance. In keeping with the harvest strategy for this stock, TMGC sought to decrease fishing mortality and promote stock rebuilding. A 2011 TAC of 1,050 mt corresponds to the average of the two models for a low (25%) risk of exceeding F_{ref} of 0.18. Under both model formulations a catch at this level is expected to result in greater than neutral probability of biomass growth of up to 10%. The recommended low catch level was intended to both reduce risk of exceeding F_{ref} and consider the retrospective pattern. The annual allocation shares between countries for 2011 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 19% and Canada to 81% of the TAC, resulting in a national quota of 200 mt for the USA and 850 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)

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg[1]	Min[1]	Max[1]
Canada	Quota	2.1	1.2	1.3	1.0	0.7	1.3	1.4	1.6	1.2	1.0			
	Landed	2.1	1.3	1.3	1.1	0.6	1.1	1.1	1.4	1.0		6.1	0.6	17.8
	Discard	0.1	0.1	0.2	0.1	0.2	0.3	0.1	0.1	0.2		0.1	0.0	0.5
USA	Quota[2]				0.3	0.3	0.4	0.5	0.7	0.5	0.3			
	Catch[2]				0.2	0.2	0.3	0.3	0.7	0.5				
	Landed	1.5	1.7	1.9	1.0	0.2	0.1	0.2	0.2	0.4		3.8	0.1	10.6
	Discard	0.2	0.0	0.1	0.1	0.2	0.1	0.3	0.0	0.2		0.1	0.0	0.3
Total	Quota				1.3	1.0	1.7	1.9	2.3	1.7	1.3			
	Catch	4.0	3.1	3.5	2.3	1.3	1.7	1.8	1.8	1.9		10.0	1.3	26.5
From "split M 0.2" model														
	Adult Biomass[3]	10.1	7.9	6.0	5.3	3.2	5.0	5.0	5.2	6.3	6.4	24.1[4]	3. 2[4]	60.4[4]
	Age 1 Recruits	1.0	1.7	0.5	3.6	0.6	1.4	2.0	1.3	1.2		5.6	0.5	23.6
	Fishing mortality[5]	0.65	0.47	0.79	0.84	0.40	0.63	0.35	0.35	0.33		0.57	0.32	1.29
	Exploitation Rate[5]	44%	34%	50%	52%	30%	43%	27%	27%	26%		38%	25%	67%
From "split M 0.5" model														
	Adult Biomass[3]	12.8	10.4	7.8	7.7	5.1	7.8	8.3	8.4	9.9	9.2	25.5[4]	5.1[4]	60.4[4]
	Age 1 Recruits	1.2	2.5	0.7	5.0	0.8	1.7	2.4	1.5	1.5		5.8	0.7	23.7
	Fishing mortality[5]	0.46	0.35	0.55	0.52	0.23	0.32	0.21	0.20	0.20		0.47	0.20	1.06
	Exploitation Rate[6]	32%	25%	37%	37%	19%	23%	15%	17%	18%		33%	15%	60%
	Exploitation Rate[7]	34%	27%	36%	37%	26%	26%	20%	15%	13%		30%	13%	53%

[1]1978 – 2009
[2]for fishing year from May 1 – April 30
[3]Jan 1 ages 3+
[4]1978 – 2010
[5]ages 4-9
[6]ages 4-5
[7]ages 6-9

Combined Canada/USA catches, which averaged 17,508 mt between 1978 and 1992, peaked at 26,463 mt in 1982, and declined to 1,684 mt in 1995. Catches fluctuated around 3,000 mt until 2004, and subsequently declined again. Catches in 2009 were 1,858 mt, including 425 mt of discards.

Two model formulations were used for development of management advice. It is anticipated that this practice will continue until the progression of the 2003 year class through older ages has been documented, providing information on natural mortality at ages 6 and older. These model formulations are 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.

Fishing mortality was high prior to 1994. Fishing mortality 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 and then fluctuated. Fishing mortality in 2009 was 0.33 from the "split M 0.2" model and 0.20 from the "split M 0.5" model. While both models show recent reductions in fishing mortality, the model formulations adopted after the benchmark review indicate that F has been above F_{ref}.

Both assessment models exhibit a retrospective pattern in which estimates of fishing mortality were revised upward. The retrospective inconsistency in the fishing mortality was approximately 20% for the split M 0.2 model and approximately 10% for the split M 0.5 model.

State of Resource

Since 1995 adult population biomass (ages 3+) from the "split M 0.2" model has fluctuated between 3,200 mt and 10,100 mt. Biomass was 6,334 mt in 2009 and 6,394 mt at the beginning of 2010. Since 1995, adult population biomass from the "split M 0.5" model has fluctuated between 5,084 mt and 10,824 mt. Biomass was 9,856 mt in 2009 and 9,260 mt at the beginning of 2010. In both models, the increase in biomass in 2006 was largely due to recruitment of the 2003 year class, and the increases in 2007, 2008 and 2009 were due to growth of the 2003 year class.

Both assessment models exhibit a retrospective pattern in which estimates of stock size were revised downward. The retrospective inconsistency in the 3+ biomass was approximately 50% for the "split M 0.2" model and approximately 30% for the "split M 0.5" model.

Productivity

The 2003 year class, (3.6 million from "split M 0.2" model and 5.0 million from "split M 0.5" model), is the highest since the 1990 year class but is still lower than the pre-1990 average. The 2002 and 2004 year classes are the lowest on record. The 2005 and 2007 year classes are below the post-1990 average while the 2006 year class is about half the size of the 2003 year class. Initial indications are that the 2008 year class is also below the recent average. The population age structure displays a very low proportion of ages 7+ compared to the 1980s. Lower weights-at-age in the population in recent years and generally poor recruitment have contributed to the lack of sustained rebuilding, although improvement in size at some ages has been seen in the 2009 fishery and 2010 DFO survey. Total population biomass (age 1+) has shown a slight decrease for both models since 1994, whilst survey biomass indices have fluctuated without clear trend.

2011 Catch Risk Assessment

Model	"split M 0.2"			"split M 0.5"		
Risk Level	25% (risk averse)	50% (risk neutral)	75% (risk prone)	25% (risk averse)	50% (risk neutral)	75% (risk prone)
Risk Factor:	Catch (mt) in 2011 for the indicated risk factors					
F_{ref} in 2011 will be exceeded	850	1,000	1,150	1,250	1,400	1,600
4+ biomass in 2012 will	1,525	1,850	2,250	750	1,350	1,850

be lower than the 2011 biomass						
4+ biomass in 2012 will not increase by 10%	750	1,100	1,550	-	450	1,100
4+ biomass in 2012 will not increase by 20%	350	750	1,250	-	-	350

Note: In some cases, no level of catch will result in the indicated increase in biomass.

As indicated in the above table, for the "split M 0.2" model a combined Canada/USA catch of about 1,000 mt in 2011 will result in a neutral risk (50%) that the fishing mortality rate in 2011 will exceed F_{ref} whereas a catch of 1,850 mt will result in a neutral risk (50%) that the 2012 biomass (ages 4+) will be lower than the 2011 biomass.

For the "split M 0.5" model a combined Canada/USA catch of about 1,400 mt in 2011 will result in a neutral risk (50%) that the fishing mortality rate in 2011 will exceed F_{ref} whereas a catch of 1,350 mt will result in a neutral risk (50%) that the 2012 biomass (ages 4+) will be lower than the 2011 biomass.

Special Considerations

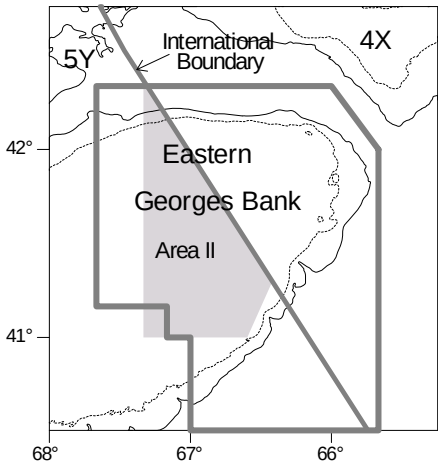
There is no strong evidence to determine which of the two benchmark methods provides a better scientific basis for fishery management. The range of stock status estimates and projections from the two models reflects the substantial uncertainty in the assessment.

While management measures have resulted in decreased exploitation rate since 1995, fishing mortality has remained above F_{ref} and adult biomass has fluctuated without any appreciable rebuilding. The recommended low catch level was intended to both reduce risk of exceeding F_{ref} and consider the retrospective pattern. With the passing of the 2003 year class through the population, rebuilding will not occur without improved recruitment.

Cod and haddock are often caught together in groundfish fisheries, although they are not necessarily caught in proportion to their relative abundance because their catchabilities to the fisheries differ. Due to the higher haddock quota, discarding of cod may be high and should be monitored. Modifications to fishing gear and fishing practices, with enhanced monitoring, have mitigated this issue to some extent but concerns remain.

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 2011 fishing year is 22,000 mt, representing a neutral risk (50%) of exceeding F_{ref} of 0.26. This is a reduction from recent TACs due to the normal decrease from a record high stock size as the exceptional 2003 year class moves through the fishery. Adult biomass peaked at 157,300 mt in 2009, reflecting the recruitment and growth of the exceptional 2003 year class, and declined to 125,100 mt in 2010. The 2003 year class has reached maximum biomass and, as a consequence, 3+ stock biomass is expected to decrease to 68,000 mt in 2012, based on fishing at F_{ref}. The annual allocation shares between countries for 2011 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 9,460 mt for the USA and 12,540 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)

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg	Min	Max
Canada	Quota	7.0	6.7	6.9	9.9	15.4	14.5	12.7	15.0	18.9	17.6			
	Landed	6.8	6.5	6.8	9.7	14.5	12.0	11.9	14.8	17.6		5.2	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	Quota2				5.1	7.6	7.5	6.3	8.1	11.1	12.0			
	Catch2				1.1	0.6	0.7	0.3	2.3	2.9				
	Landed	0.8	1.1	1.7	1.8	0.6	0.3	0.2	1.1	2.0		2.1	<0.1	9.1
	Discard	<0.1	<0.1	0.1	0.2	0.1	0.3	0.3	<0.1	<0.1		0.6	0	7.6
Total	Quota3				15.0	23.0	22.0	19.0	23.0	30.0	29.6			
	Catch3,4				10.9	15.1	12.7	12.3	17.1	17.6				
	Catch	7.6	7.6	8.6	11.9	15.3	12.6	12.5	16.0	19.7		7.9	2.1	23.3
Adult Biomass[5]		50.2	43.1	82.4	77.3	58.6	118.5	144.2	147.5	157.3	125.1	48.1[6]	4.9[6]	157.3[6]
Age 1 Recruits		82.5	4.0	2.9	292.7	6.3	24.3	6.8	10.3	5.6	5.0	26.5[6]	0.2[6]	292.7[6]
Fishing mortality[7]		0.17	0.17	0.19	0.27	0.25	0.25	0.12	0.09	0.13		0.29	0.09	0.58
Exploitation Rate[7]		14%	14%	16%	22%	20%	20%	11%	8%	11%		22%	8%	40%

[1]1969 - 2009
[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]1931 - 1955, 1969 – 2010
[7]ages 4+ for 1969 - 2002; ages 5+ for 2003 - 2009

Combined Canada/USA catches declined from 6,504 mt in 1991 to a low of 2,150 mt in 1995, fluctuated about 3,000 mt to 4,000 mt until 1999, and since increased to 15,256 mt in 2005. Combined catches then decreased to 12,488 mt in 2007 but increased to 19,707 mt in 2009.

Fishing mortality for fully recruited ages fluctuated between 0.2 and 0.4 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 0.13 in 2009.

State of Resource

Adult population biomass (ages 3+) increased from near an historical low of 10,300 mt in 1993 to 82,400 mt in 2003. Adult biomass subsequently decreased to 58,600 mt in 2005, but increased to 157,300 mt in 2009, the highest in the assessment time series (1931-1955 and 1969-2008). The tripling of the biomass after 2005 was due to recruitment and growth of the exceptional 2003 year class. In 2010 the adult biomass decreased to 125,100 mt commensurate with the 2003 year class reaching its highest biomass in 2009.

Productivity

Recruitment improved in the 1990s and the 2003 year class, estimated at 293 million, 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 9 million since 1990. The 2005 year class is near the time series average of 26.5 million. The preliminary estimate for the 2009 year class is below-average at 5 million fish at age 1. Both length and weight at age have generally declined since about 2000, but, the decline appears to have halted or reversed for most ages. This stock exhibits some positive features such as an expanding age structure, improvements in size at age for the younger ages and broad spatial distribution.

2011 Catch Risk Assessment

Risk of exceeding F_{ref}	25% (risk averse)	50% (risk neutral)	75% (risk prone)
2011 Catch (mt)	19,000 mt	22,000 mt	25,150 mt

A combined Canada/USA catch of 22,000 mt results in a neutral risk (50%) of exceeding F_{ref}=0.26. The 2003 year class is expected to constitute 75% of the 2011 catch biomass. The risk of biomass decline is not pertinent because biomass is currently at a very high level.

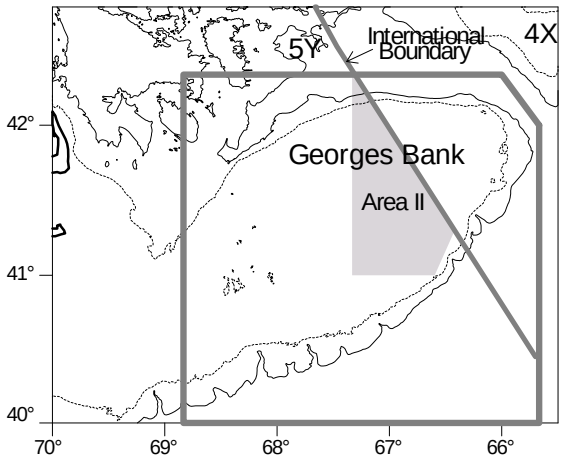
Special Considerations

The 2003 year class has reached maximum biomass. As a consequence, 3+ stock biomass has declined from a peak of 157,000 mt in 2009 and is expected to be 68,000 mt in 2012 based on fishing at F_{ref}.

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 fishing practices, with enhanced monitoring, have mitigated this issue to some extent but concerns remain.

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 2011 fishing year is 1,900 mt. A 2011 TAC of 1,900 mt corresponds to a low probability of exceeding F ref (< 25 %) and an expected 10% increase in median biomass from 2011 to 2012. The TMGC noted that the biomass is increasing and is at its highest level since 1974. Despite the recent re-emergence of a retrospective pattern, which is of concern, the fishing mortality in 2008 and 2009 was 0.15, below the F ref value of 0.25. The annual allocation shares between countries for 2010 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 55% and Canada to 45% of the TAC, resulting in a national quota of 1,045 mt for the USA and 855 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)

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg[1]	Min[1]	Max[1]
Canada	**Quota**	3.4	2.9	2.3	1.9	1.7	0.9	0.4	0.6	0.5	0.8[8]			
	Landed	2.9	2.6	2.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1		0.5	<0.1	2.9
	Discard	0.8	0.5	0.8	0.4	0.2	0.5	0.1	0.1	0.1		0.5	0.1	0.8
USA	**Quota**[2]				6.0	4.3	2.1	0.9	1.9	1.6	1.2[8]			
	Catch[2]				5.9	3.8	1.9	1.0	1.6	1.8				
	Landed	3.6	2.5	3.2	5.8	3.2	1.2	1.1	0.7	1.0		4.5	0.4	15.9
	Discard	0.1	0.1	0.4	0.5	0.4	0.4	0.5	0.4	0.7		0.6	<0.1	3.0
Total	**Quota**[3]				7.9	6.0	3.0	1.3	2.5	2.1	2.0[8]			
	Catch[3,4]				6.4	4.1	2.5	1.1	1.7	1.9				
	Catch	7.4	5.7	6.6	6.8	3.9	2.1	1.7	1.3	1.8		6.2	1.1	17.2
Adult Biomass[5]		10.3	9.1	10.9	8.6	4.2	2.9	4.4	8.3	13.1	14.6	7.7[6]	2.0[6]	26.2[6]
SSB		9.3	10.1	10.1	5.5	3.5	3.5	6.2	10.6	14.0		7.5	2.2	22.2
Age 1 Recruits		22.2	15.3	10.9	8.0	14.9	23.9	22.2	8.2	6.1		21.4	6.1	70.6
Fishing mortality[7]		0.97	0.65	0.61	1.91	1.30	1.18	0.53	0.15	0.15		1.01	0.15	1.91
Exploitation Rate[7]		57%	44%	42%	80%	67%	64%	38%	13%	13%		58%	13%	80%

[1]1973 – 2009

[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]Jan-1 age 3+
[6]1973 - 2010
[7]age 4+ for calendar year
[8]quotas not jointly determined; established individually by each country

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 1,778 mt in 2009 due to restrictive management measures.

The two VPA formulations presented in TRAC 2009 have been replaced by a single formulation which down-weights the DFO surveys in 2008 and 2009 to account for the higher uncertainty in these years due to large tows, as recommended by the TRAC last year.

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 1.91, and then declined to 0.53 in 2007 and 0.15 in both 2008 and 2009, below the reference point of $F_{ref} = 0.25$.

State of Resource

Adult population biomass (age 3+) increased from a low of 2,100 mt in 1995 to 10,900 mt in 2003, declined to about 2,900 mt in 2006, and increased to 14,600 mt at the beginning of 2010, the highest adult biomass since 1974. Spawning stock biomass in 2009 was estimated to be 14,000 mt.

Productivity

During 1998-2001 recruitment averaged 22.2 million fish at age 1 but has since been below 20 million fish, with the exception of the 2005 and 2006 year classes, estimated at 23.9 million and 22.2 million, respectively. The 2007 and 2008 year classes are among the poorest in the time series (6-8 million age-1 fish). The 2005 year class had been estimated as strong in the previous three assessments, but is now estimated as only average. Truncated age structure in the bottom trawl surveys and changes in distribution indicate current resource productivity is lower than historical levels.

2011 Catch Risk Assessment

Risk of exceeding F_{ref}	25% (risk averse)	50% (risk neutral)	75% (risk prone)
2011 Catch (mt)	3,100 mt	3,400 mt	3,800 mt

A combined Canada/USA catch of about 3,400 mt in 2011 would result in a neutral risk (~50%) that the fishing mortality rate will exceed F_{ref}, while catches of 3,100 mt and 3,800 mt in 2011 would result in 25% and 75% risk that fishing mortality rate will exceed F_{ref}, respectively. A TAC of 1,900 will result in less than 25% risk of exceeding F_{ref}.

Sensitivity analyses conducted at TRAC adjusted the population abundance at age in 2010 to account for the retrospective pattern in two different ways. These two approaches

produced similarly reduced 2011 catch advice relative to the Split Series VPA and resulted in F_{ref} catches of about 2,200 mt for a 50% probability of exceeding F_{ref}. The recommended TAC of 1,900 mt has less than a 50% probability of exceeding F_{ref} relative to these sensitivity analyses.

Anticipated Biomass Changes

Fishing at F_{ref} in 2011 will generate no change in age 3+ biomass from 2011 to 2012 (15,200 mt). A catch in 2011 of 3,400 mt will result in no change in median biomass from 2011 to 2012, while catches in 2011 of 1,900 mt and 400 mt will result in 10% and 20% increases in median biomass from 2011 to 2012, respectively.

Special Considerations

The current stock assessment exhibits retrospective patterns in SSB and F which results in decreases in SSB and increases in F compared to the results of last year's assessment. Although the intention of the split series VPA was to eliminate the retrospective pattern, the pattern has re-emerged but at a lower magnitude primarily due to change in perception of the 2005 year class. This year class was originally estimated to be approximately 60 million in the 2007-2009 assessments, the strongest year class since the 1980 cohort. The 2005 year class is now estimated as only average (24 million) because it did not appear in any of the 2009-2010 surveys or the 2009 catch at the expected magnitude of a strong year class.

Source Documents

Van Eeckhaute L and O'Brien L . 2010. 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 2011. TRAC Reference Document 2010/07.

TRAC. 2010. Eastern Georges Bank cod. TRAC Status Report 2010/03.

TRAC. 2010. Eastern Georges Bank haddock. TRAC Status Report 2010/04.

TRAC. 2010. Georges Bank yellowtail flounder. TRAC Status Report 2010/05.

Consultations

Transboundary Resources Assessment Committee (TRAC), Woods Hole, Massachusetts, 20-23 July 2010.

Transboundary Management Guidance Committee public consultation in Canada, Yarmouth, Nova Scotia, 4 Aug 2010.