Transboundary Resources Assessment Committee

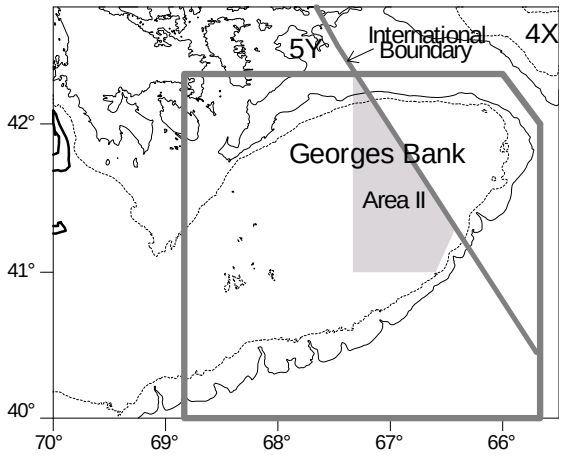
Status Report 2011/01

GEORGES BANK

YELLOWTAIL

FLOUNDER

[5Zhjmn; 522,525,551,552,561,562]



Summary

- Combined Canada and USA catches in 2010 were 1,160 mt.
- Adult population biomass (age 3+) increased from a low of 2,100 mt in 1995 to 10,900 mt in 2003, declined to about 2,700 mt in 2006, and increased to 9,300 mt at the beginning of 2011. Spawning stock biomass in 2010 was estimated to be 8,800 mt.
- During 1998-2001, recruitment averaged 22.2 million fish at age 1 but has since been below 20 million fish, including the 2005 and 2006 year classes estimated at 16.8 million and 17.2 million, respectively. The 2007 and 2008 year classes are well below average, and the 2009 year class is estimated to be the lowest in the time series at 0.9 million age-1 fish. The 2005 year class had been estimated as strong in previous assessments, but is now estimated as slightly below average.
- 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 1.93, and then declined to about 0.27 in both 2008 and 2009, and 0.13 in 2010, below the reference point of $F_{ref} = 0.25$.
- Assuming a catch in 2011 equal to the quota of 2,650 mt, a combined Canada/USA catch of about 1,700 mt in 2012 would result in a neutral risk (~50%) that the fishing mortality rate will exceed F_{ref}. A catch in 2012 of 2,300 mt will result in no change in median adult biomass from 2012 to 2013.

- With the reemergence of a retrospective pattern, despite using a split survey series formulation, alternative projection assumptions were explored to examine the sensitivity of this uncertainty on catch advice and stock rebuilding.

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

		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Avg[1]	Min[1]	Max[1]
Canada	**Quota**	2.9	2.3	1.9	1.7	0.9	0.4	0.6	0.5	0.8[8]	1.2			
	Landed	2.6	2.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		0.5	<0.1	2.9
	Discard	0.5	0.8	0.4	0.2	0.5	0.1	0.1	0.1	0.2		0.5	0.1	0.8
USA	**Quota**[2]			6.0	4.3	2.1	0.9	1.9	1.6	1.2[8]	1.5			
	Catch[2]			5.9	3.8	1.9	1.0	1.6	1.8	1.1				
	Landed	2.5	3.2	5.8	3.2	1.2	1.1	1.0	1.0	0.7		4.4	0.4	15.9
	Discard	0.1	0.4	0.5	0.4	0.4	0.5	0.4	0.8	0.3		0.6	<0.1	3.0
Total	**Quota**[3]			7.9	6.0	3.0	1.3	2.5	2.1	2.0[8]	2.7			
	Catch[3,4]			6.4	4.1	2.5	1.1	1.7	1.9	1.3				
	Catch	5.7	6.6	6.8	3.9	2.1	1.7	1.5	1.8	1.2		6.1	1.1	17.2
Adult Biomass[5]		9.1	10.9	8.6	4.1	2.7	3.3	5.6	8.7	8.7	9.3	7.4[6]	2.0[6]	26.2[6]
SSB		10.1	10.1	5.5	3.3	2.9	4.4	7.1	9.3	8.8		7.2	2.2	22.2
Age 1 Recruits		15.2	10.7	7.4	11.6	16.8	17.2	8.0	4.7	0.9		20.3	0.9	70.6
Fishing mortality[7]		0.65	0.61	1.93	1.35	1.35	0.72	0.28	0.27	0.13		1.00	0.13	1.93
Exploitation Rate[7]		44%	42%	80%	69%	69%	47%	22%	22%	11%		58%	11%	80%

[1]1973 – 2010
[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 - 2011
[7]age 4+ for calendar year
[8]quotas not jointly determined; established individually by each country

Fishery

Total catches of Georges Bank yellowtail flounder peaked at about 21,000 mt in both 1969 and 1970 (Figure 1). Prior to the mid-1990s, the USA fishery accounted for most of the annual catches. The combined Canada/USA catch increased from 1995 through 2001, averaged 6,300 mt during 2002-2004, but declined to 1,160 mt in 2010 due to restrictive management measures.

The 2010 **Canadian catch** of 217 mt was well below the Canadian quota of 756 mt, with landings of only 17 mt and estimated discards of 200 mt. Since there was no directed Canadian fishery for yellowtail in 2010, landings were incidental to cod and haddock fishing. Discards were due to the sea scallop dredge fishery.

USA catches in 2010 were 943 mt, with landings of 654 mt and discards of 289 mt. The USA landings in 2010 were predominantly from the trawl fishery while discards came from both the trawl and sea scallop dredge fisheries. Preliminary estimates of the USA catches for fishing year 2010-2011 were 93% of the 1,200 mt quota.

Ages 3-5 accounted for most of the **combined Canada/USA fishery** catch in 2010 by number. Both the Canadian and the USA fisheries were well sampled to determine length composition of the catch.

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 limit reference, $F_{ref} = 0.25$ (established during the 2005 TRAC benchmark). 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 1973 to 2010. The VPA was calibrated to trends in abundance from three bottom trawl survey series (NMFS spring, NMFS fall and DFO) and a recruitment index from the NMFS summer sea scallop survey. 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 recommended by the TRAC previously. This formulation is denoted Split Series and is most similar to the Major Change model of the benchmark assessment. 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 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.

In light of the re-emergence of the retrospective pattern in the Split Series VPA, two additional approaches were considered to address the retrospective pattern. Firstly, since the Split Series VPA no longer eliminates the retrospective, a rho adjustment was applied to this model. Secondly, a rho adjustment was applied to the Single Series VPA (formerly known as the Base Case formulation during the 2005 benchmark assessment, but not used in recent years). The Split Series with the rho adjustment applies two approaches in combination (splitting the survey time series and applying a rho adjustment) to address the retrospective pattern, whereas the Single Series with the rho adjustment applies a single adjustment with a larger rho.

The perception of the stock has changed from last year to this year primarily due to the retrospective pattern. If the retrospective pattern persists the state of the resource will be more pessimistic than described below.

Adult population biomass (age 3+) increased from a low of 2,100 mt in 1995 to 10,900 mt in 2003, declined to about 2,700 mt in 2006, and increased to 9,300 mt at the beginning of 2011. Total population biomass (age 1+) has generally tracked the three groundfish surveys, although splitting the series implies high catchability of the surveys in recent years (Figure 2). Spawning stock biomass in 2010 was estimated to be 8,800 mt (80% confidence interval: 7,300-10,800 mt) (Figure 3).

During 1973-2010 **recruitment** averaged 20.3 million fish at age 1 but has been below this average since 2002 (Figure 3). The 2005 and 2006 year classes are estimated at 16.8 million and 17.2 million, respectively. The 2007 and 2008 year classes are well below average, and the 2009 year class is estimated to be 0.9 million age-1 fish, which although estimated with high

uncertainty is by far the lowest in the time series. The 2005 year class had been estimated as strong in previous assessments, but is now estimated as below average.

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 1.93, and then declined to about 0.27 in both 2008 and 2009, and 0.13 in 2010 (80% confidence interval: 0.10-0.17), below the reference point of $F_{ref} = 0.25$ (Figure 1).

Productivity

Age structure, spatial distribution, and fish growth typically reflect changes in the productive potential. In both absolute numbers and percent composition, the **population age structure** estimated by the VPA displays a truncated pattern with few old fish. **Spatial distribution patterns** from the three groundfish surveys generally follow historical averages. **Growth** has been variable without strong trends, but weights at age in recent years have trended down. Truncated age structure and lower weights at age indicate current resource productivity is lower than historical levels.

Outlook

This outlook is provided in terms of consequences with respect to the harvest reference points for alternative catch quotas in 2012. Uncertainty about current biomass generates uncertainty in forecast results, which is expressed here as the probability of exceeding $F_{ref} = 0.25$. 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, the possibility that the model may not reflect stock dynamics closely enough, and/or the reemergence of a retrospective pattern.

Projections were made using 2008-2010 average fishery partial recruitment and survey and fishery weights at age for the Split Series benchmark model, Single Series rho adjusted model, and the Split Series rho adjusted model. Results from all three models are given in the tables below.

For the Split Series model, assuming a catch in 2011 equal to the quota of 2,650 mt, a combined Canada/USA catch of about 1,700 mt in 2012 would result in a neutral risk (~50%) that the fishing mortality rate will exceed F_{ref}. Catches of 1,400 mt and 1,900 mt in 2012 would result in 25% and 75% risk that fishing mortality rate will exceed F_{ref}, respectively (Figure 4). A catch in 2012 of 2,300 mt will result in no change in median biomass from 2012 to 2013, while catches in 2012 of 1,500 mt and 700 mt will result in 10% and 20% increases in median biomass from 2012 to 2013, respectively (Figure 4).

2012 Catch (mt)

Probability of exceeding F_{ref}	25%	50%	75%
Split Series	1,400	1,700	1,900
Split Series rho adjusted	600	750	900
Single Series rho adjusted	1,400	1,700	1,900

Relative Change in Median Biomass 2012 to 2013

2012 Catch (mt)	Split Series	Split Series rho adjusted	Single Series rho adjusted
600	+22%	+25%	0%
750	+20%	+20%	-2%
900	+18%	+16%	-3%
1,400	+12%	+1%	-9%
1,700	+8%	-8%	-13%
1,900	+5%	-14%	-15%

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 2012 onwards, results in a 50% probability that SSB is greater than SSB_{msy} (43,200 mt). Using the same starting conditions as the projection described above, the rebuilding target cannot be achieved by 2016 even under no fishing. There is a 50% probability that the rebuilding target will be achieved in 2017 at a fishing mortality rate of 0.08, which has an associated median 2012 catch of 600 mt.

Alternative projection assumptions were explored to examine the sensitivity of catch advice. The population abundance at age in 2011 was adjusted to account for the retrospective pattern by adjusting all ages by the same amount based on the SSB retrospective rho. This Split Series rho adjusted projection formulation resulted in much lower 2012 catch advice for a given probability of exceeding F_{ref} than the unadjusted Split Series projections (Figure 4). Another alternative projection used the Single Series VPA formulation (which was most similar to the benchmark Base Case formulation) and adjusted that population abundance at age in 2011 to account for the much larger retrospective pattern in SSB. This Single Series rho adjusted projection formulation resulted in nearly identical 2012 catch advice for a given probability of exceeding F_{ref} as the unadjusted Split Series projections. However, the Single Series rho adjusted projection formulation predicts decreases in median adult biomass from 2012 to 2013 under catches that are predicted to produce increases in this median biomass under the Split Series projections (Figure 4).

In light of the implications of the alternative models, if managers wish to base the 2012 catch on consideration of both F_{ref} and a desire to maintain stock biomass, a catch in the range of 900-1,400 mt is indicated.

Special Considerations

Although the Split Series VPA is used for management advice, the mechanisms for the large changes in survey catchability are not easily explained. These changes in survey catchability are

most appropriately thought of as aliasing an unknown mechanism that produces a better fitting model. The inability to plausibly explain these survey catchability changes causes increased uncertainty in this assessment relative to other assessments. Although the intention of the Split Series VPA was to eliminate the retrospective pattern, the pattern has re-emerged but at a lower magnitude. This additional source of uncertainty should be considered when setting the 2012 quota and indicates lower catch advice than the projections from the Split Series VPA.

In 2001 the US extended the Georges Bank yellowtail flounder rebuilding period to 2016. This assessment suggests the probability of rebuilding by that date is less than 50%. The rebuilding strategy may be revised again by May 2012 as authorized by the International Fisheries Agreement Clarification Act.

Source Documents

Gavaris S, O'Boyle R, Overholtz W, editors. 2005. Proceedings of the Transboundary Resources Assessment Committee (TRAC): Benchmark Review of Stock Assessment Models for the Georges Bank Yellowtail Flounder Stock; 25 – 26 January 2005 and 26 – 29 April 2005. TRAC Proceedings 2005/01.

Legault CM, Alade L, Stone HH. 2011. Assessment of Georges Bank Yellowtail Flounder for 2011. TRAC Reference Document 2011/01.

Legault C, Alade L, Stone H, Gavaris S, Waters C. 2008. Georges Bank Yellowtail Flounder. *In* Northeast Fisheries Science Center. 2008. Assessment of 19th Northeast groundfish stocks through 2007: a report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. Northeast Fish Sci Cent Ref Doc. 08-15. [available at http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0815/]

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 20-24 June 2011. TRAC Proceedings 2011/01.

Correct Citation

TRAC. 2011. Georges Bank Yellowtail Flounder. TRAC Status Report 2011/01.

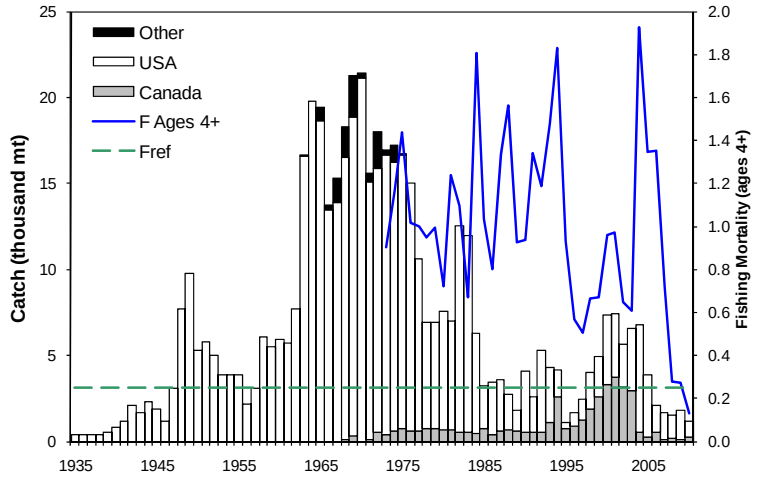


Figure 1. Catches and fishing mortality (F).

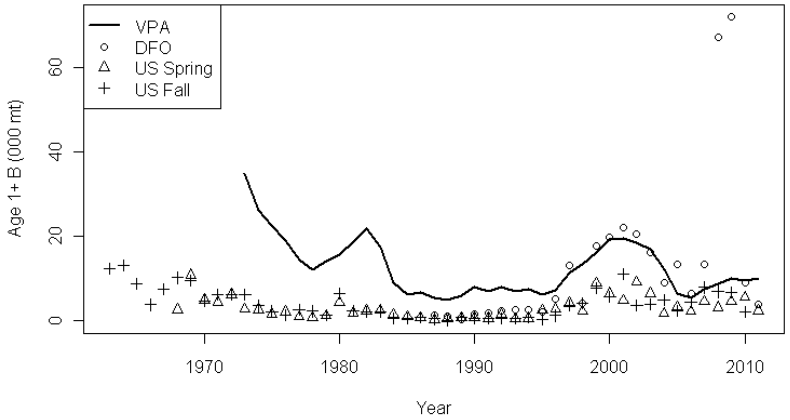


Figure 2. Ages 1+ biomasses (B).

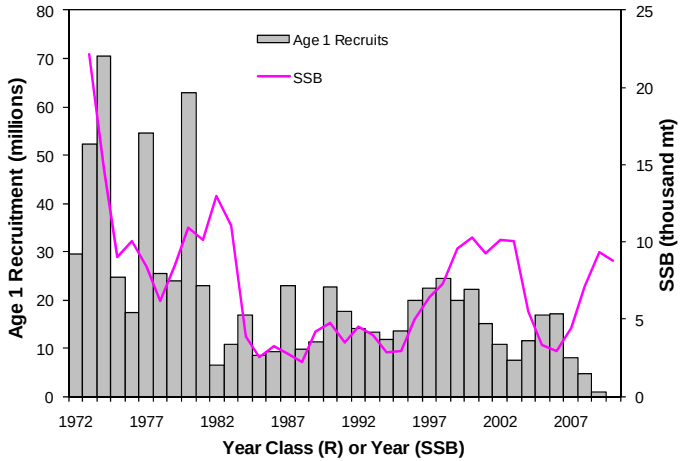


Figure 3. Recruitment and spawning stock biomass (SSB).

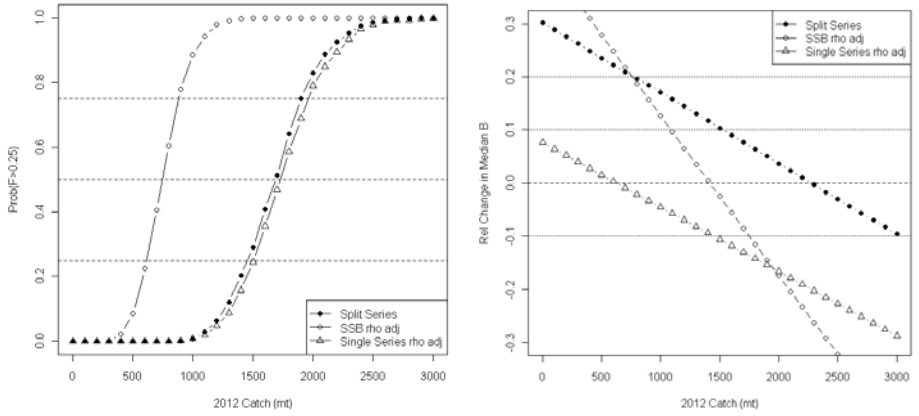


Figure 4. Risk of exceeding F_{ref}=0.25 and relative change in median biomass.