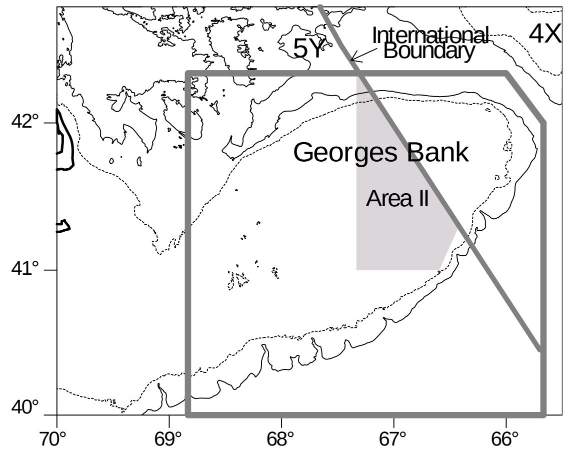
Fisheries and Oceans Canada Pêches et Océans Canada
NOAA FISHERIES NATIONAL MARINE FISHERIES SERVICE

Transboundary Resources Assessment Committee

Status Report 2010/03

GEORGES BANK YELLOWTAIL FLOUNDER

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



Summary

- Combined Canada and USA catches in 2009 were 1,778 mt.

- The two VPA formulations presented in TRAC 2009 have been replaced by a single formulation.

- Adult biomass (age 3+) increased from a low of 2,100 mt in 1995 to 11,000 mt in 2003, declined to 2,900 mt in 2006, and increased to 13,000 mt in 2009 and 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. The perception of the stock has changed since last year primarily due to a reduction in the estimated strength of the 2005 year class. Stock biomass is now estimated to be markedly lower than estimated last year (e.g. 2009 age 3+ biomass was 28,000 mt "Including" or 20,600 mt "Excluding" previously).

- 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. The 2007 and 2008 year classes are among the poorest in the time series (6-8 million age-1 fish).

- 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 $F_{ref} = 0.25$.

- Assuming a catch in 2010 equal to 1,956 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

in 2011 will exceed F_{ref}. Fishing at F_{ref} in 2011 will generate no change in age 3+ biomass from 2011 to 2012 (15,200 mt).

- This assessment has a new source of uncertainty compared to recent assessments due to the re-emergence of a moderate retrospective pattern despite splitting the survey series. Alternative projection assumptions were explored to examine the sensitivity of this uncertainty on catch advice and stock rebuilding.

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

Fishery

Total catches of Georges Bank yellowtail flounder peaked at about 21,000 mt in both 1969 and 1970. 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 1,778 mt in 2009 (Figure 1) due to restrictive management measures.

The 2009 **Canadian catch** of 89 mt was well below the Canadian quota of 483 mt, with landings of only 5 mt and estimated discards of 84 mt. Since there was no directed Canadian fishery for yellowtail in 2009, landings were incidental to cod and haddock fishing. Discards were due to the sea scallop dredge fishery.

USA catches in 2009 were 1,689 mt, with landings of 975 mt and discards of 715 mt. The USA landings in 2009 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 2009-2010 were 109% of the 1,617 mt quota.

Ages 3-4 accounted for most of the **combined Canada/USA fishery** catch in 2009 by number, with few age 1 fish caught due to mesh regulations. 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, $F_{ref} = 0.25$. 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 2009. 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 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. 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.

The perception of the stock has changed from last year to this year primarily due to a change in the estimated strength 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. Thus, stock biomass is now estimated to be markedly lower than estimated last year resulting in lower projected catches.

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. 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 2009 was estimated to be 14,000 mt (80% Confidence Interval: 11,700-17,100 mt) (Figure 3).

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 (Figure 3). 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.

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 (80% Confidence Interval for 2009: 0.12-0.19), 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** in recent surveys are confounded by the influence of large tows, but show more concentration in recent years than has been observed previously in surveys. **Growth** has been variable without strong trends. Truncated age structure in the bottom trawl surveys and changes in distribution 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 2011. Uncertainty about current biomass generates uncertainty in forecast results, which is expressed here as the risk 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 or the possibility that the model may not reflect stock dynamics closely enough.

Due to changes in fishery partial recruitment patterns and both survey and fishery weights at age over time, average values from 2007-2009 were used in the projections. Assuming a catch in 2010 equal to 1,956 mt (the sum of the individually determined quotas for Canada and USA), 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 (Figure 4). 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 (Figure 4).

Probability of exceeding F_{ref}	25%	50%	75%
2011 quota	3,100 mt	3,400 mt	3,800 mt

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_{reb75}) that, when applied in years 2011-2014, results in a 75% probability that SSB in 2014 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 2014 even under no fishing. Alternative rebuilding strategies (different rebuilding timeframes and probabilities) were explored that resulted in fishing mortality rates ranging from 0.04 to 0.14 and associated median 2011 catches of 600 to 2,000 mt.

Alternative projection assumptions were explored to examine the sensitivity of catch advice. The population abundance at age in 2010 was adjusted to account for the retrospective pattern in two different ways; adjust all ages by the same amount based on the SSB retrospective rho or adjust each age according to its own retrospective rho. These two approaches produced similarly reduced 2011 catch advice relative to the Split Series VPA (Figure 4).

A second set of sensitivity projections sampled recruitments for the stochastic projections from a distribution of estimated age 1 abundance for years 1983 to 2009. This set of recruitments had a median of 14.0 million in contrast to the standard rebuilding projections which had a median of 24.7 million, which uses recruitment estimates from 1963 to 2009. Although catch advice for 2011 was unchanged, the probability of achieving US rebuilding targets was reduced, e.g. under no fishing there is less than a 5% probability of SSB_{2020}>43,200 mt (note that SSBmsy assumes a median recruitment of 24.7 million). Median catch in projected years diverged from the standard F_{ref} projections beginning in 2014 and were less than half the standard projections by 2020.

Special Considerations

Although the Split Series VPA is used for management decisions, 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 primarily due to change in perception of the 2005 year class.

Surveys conducted by the FSV Henry B. Bigelow in the spring and fall of 2009 and spring of 2010, calibrated to the RV Albatross IV units, were included in this assessment.

Source Documents

Legault, C.M., L. Alade, and H.H. Stone. 2010. Stock Assessment of Georges Bank Yellowtail Flounder for 2010. TRAC Working Paper 2010/18: 86 p.

Legault C, Alade L, Stone H, Gavaris S, Waters C. 2008. C. Georges Bank Yellowtail Flounder. *In* Northeast Fisheries Science Center. 2008. Assessment of 19 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/]

TRAC. 2005. Gavaris S, O'Boyle R, Overholtz W, editors. 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: 65p.

TRAC. 2009. O'Brien L, Worcester T, editors. Proceedings of the Transboundary Resources Assessment Committee (TRAC); Gulf of Maine/Georges Bank Herring, Eastern Georges Bank Cod and Haddock, Georges Bank Yellowtail Flounder. Report of Meeting held 8 - 11 June 2009. TRAC Proceedings 2009/01.

Correct Citation

TRAC. 2010. Georges Bank Yellowtail Flounder. TRAC Status Report 2010/03.

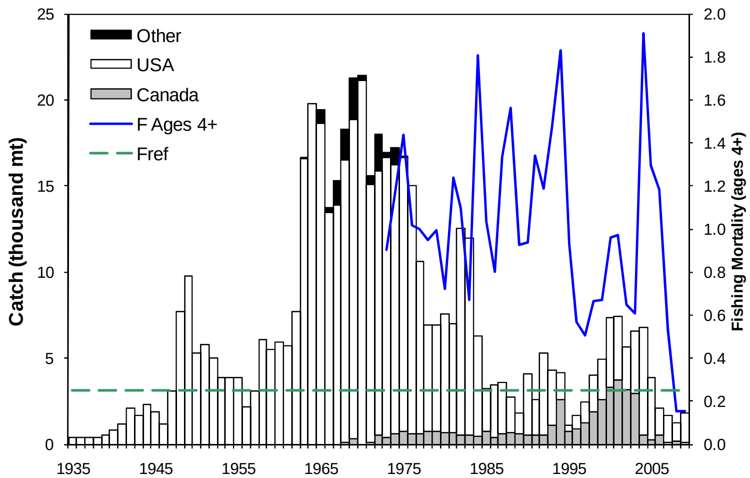


Figure 1. Catches and fishing mortality.

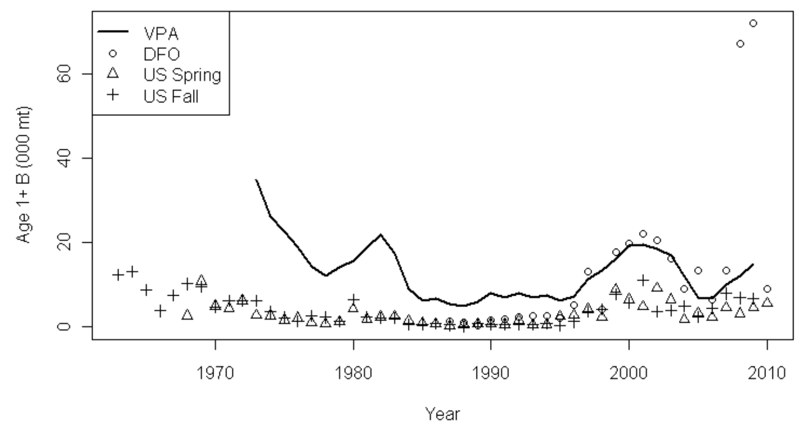


Figure 2. Ages 1+ biomasses

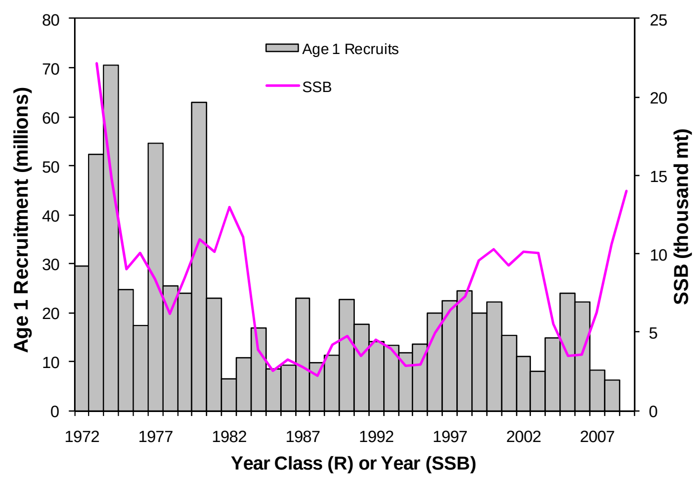


Figure 3. Recruitment and spawning stock biomass.

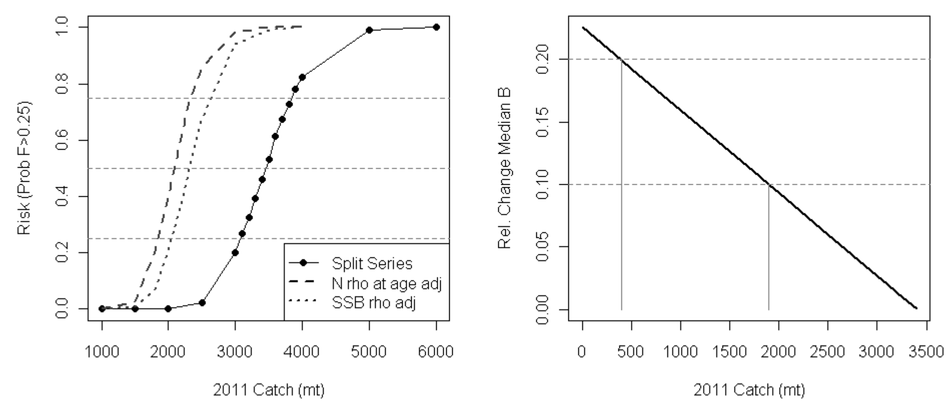


Figure 4. Risk of exceeding F_{ref}=0.25 and relative change in median biomass.