Transboundary Resources Assessment Committee

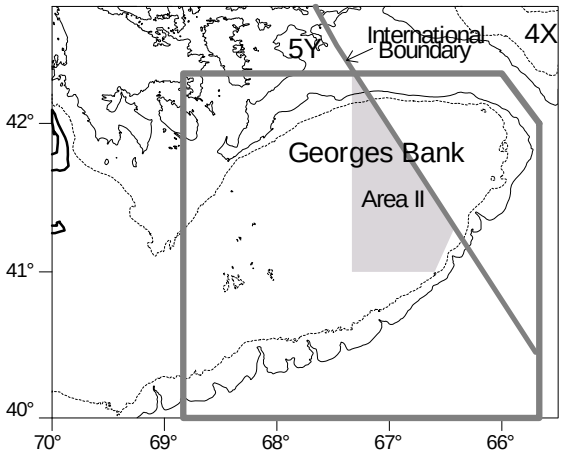
Status Report 2014/03 (Revised)

GEORGES BANK

YELLOWTAIL

FLOUNDER

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



Summary

- Combined Canada and USA catches in 2013 were 218 mt. This is the lowest value in the time series beginning in 1935.
- All three bottom trawl surveys declined from already low values and catch curve analyses indicate high total mortality rates (Z>1).
- Recent catch is low relative to the biomass estimated from the surveys.
- The declining trend in survey biomass in recent years to low levels, despite reductions in catch to low amounts, indicates a poor state of the resource.
- Due to a number of issues, the Transboundary Resources Assessment Committee (TRAC) agreed to no longer use a Virtual Population Analysis (VPA) assessment model to evaluate stock status or provide catch advice. The lack of a stock assessment model framework means no fishing mortality rate can be calculated for this stock.
- An empirical approach based on survey catches developed during the 2014 Diagnostic and Empirical Approach Benchmark[1] for Georges Bank yellowtail flounder was applied to generate catch advice. Using a constant exploitation rate of 2% to 16% results in 2015 catch advice of 44 mt to 354 mt. Alternatively, a constant quota approach could be used, resulting in 2015 catch advice of 400 mt or less. The TRAC recommends the Transboundary Management Guidance Committee (TMGC) implement one approach (one exploitation rate

[1] Throughout the report the original meeting title 'Diagnostic Benchmark" has been corrected to "Diagnostic and Empirical Approach Benchmark".

if that approach is selected, or one quota if that approach is selected) and maintain that approach over three years to see if the stock responds.

Table 1. Catches (thousands mt)

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Avg[1]	Min[1]	Max[1]
Canada[2]	**Quota**	1.7	0.9	0.4	0.6	0.5	0.8[3]	1.2	0.6	0.3	<0.1			
	Landed	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		0.5	<0.1	2.9
	Discard	0.2	0.5	0.1	0.1	0.1	0.2	<0.1	<0.1	<0.1		0.5	<0.1	0.8
USA[2]	**Quota[4]**	4.3	2.1	0.9	1.9	1.6	1.2[3]	1.5	0.6	0.2	0.3			
	Catch[4]	3.8	1.9	1.0	1.6	1.8	1.1	1.1	0.5	0.1[5]				
	Landed	3.2	1.2	1.1	0.7	1.0	0.7	0.9	0.4	0.1		4.2	0.1	15.9
	Discard	0.4	0.4	0.5	0.4	0.7	0.3	0.2	0.2	<0.1		0.6	<0.1	3.0
Total[2]	**Quota[6]**	6.0	3.0	1.3	2.5	2.1	2.0[3]	2.7	1.2	0.5	0.4			
	Catch[6]	4.1	2.5	1.1	1.7	1.9	1.3	1.1	0.6	0.1[5]				
	Catch[7]	3.9	2.1	1.7	1.5	1.8	1.2	1.2	0.7	0.2		5.7	0.2	17.2

[1] 1973 – 2013
[2] unless otherwise noted, all values reported are for calendar year
[3] quotas not jointly determined; established individually by each country
[4] for fishing year May 1 – April 30
[5] preliminary estimate
[6] for Canadian calendar year and USA fishing year May 1 – April 30
[7] sum of Canadian landed, Canadian discard, and USA catch (includes discards)

Fishery

Total catches of Georges Bank yellowtail flounder peaked at about 21,000 mt in both 1969 and 1970 (Figure 1). The combined Canada/USA catch increased from 1995 through 2001, averaged 6,300 mt during 2002-2004, but declined to 218 mt in 2013 due to restrictive management measures (Table 1). The 2013 value was the lowest catch in the time series beginning in 1935.

The 2013 **Canadian catch** of 39 mt was well below the Canadian quota of 285 mt, with landings of <1 mt and estimated discards of 39 mt from the sea scallop dredge fishery.

USA catches in 2013 were 179 mt, with landings of 130 mt and discards of 49 mt. The USA landings in 2013 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 2013 were 47% of the 215 mt quota.

Harvest Strategy and Reference Points

The TMGC has adopted a strategy to maintain a low to neutral risk of exceeding the fishing mortality limit reference, $F_{ref} = 0.25$ (established in 2002 by the TMGC). When stock conditions are poor, fishing mortality rates should be further reduced to promote rebuilding.

State of Resource

The TRAC agreed to no longer use a VPA assessment model to evaluate stock status or provide catch advice. The reasons for this decision are:

- the re-emergence of a strong retrospective pattern in the yellowtail VPA assessment benchmark models since 2011,

- evaluations conducted at the April 2014 Diagnostic and Empirical Approach Benchmark,
- inconsistencies between relative fishing mortality trends and trends in total mortality from the surveys that are difficult to reconcile within the VPA, and
- VPA estimates for the whole of Georges Bank that were lower than independent biomass estimates for only portions of the Bank.

The declining trend in survey biomass in recent years to low levels, despite reductions in catch to low amounts, indicates a poor state of the resource.

Productivity

Recruitment, spatial distribution, and fish growth typically reflect changes in the productive potential. Recent **recruitment** has generally been below average. **Spatial distribution patterns** from the three groundfish surveys generally follow historical averages. **Growth** has recently been variable without trend, and condition (weight at length) has improved from last year, although it is still below the long term average. Stock biomass is low and productivity is poor.

Outlook

This outlook is provided in terms of an empirical approach from the 2014 Diagnostic and Empirical Approach Benchmark. The lack of a stock assessment model framework means no fishing mortality rate can be calculated for this stock. The empirical approach averages estimates of biomass from the 2014 DFO winter, 2014 NMFS spring, and 2013 NMFS fall surveys (Figure 2), and applies an exploitation rate (ratio of yield per recruit to total stock biomass per recruit under the presumed F and M) to this average to generate catch advice for 2015. The exploitation rate recommended during the Diagnostic and Empirical Approach Benchmark was found to be less stable under varying M scenarios. (*NOTE: After the TRAC meeting a calculation error was discovered in this stability analysis which demonstrated the exploitation rate was stable but at a slightly lower level. However, as discussed during the TRAC, there were three reasons why the exploitation rate derived from the Diagnostic and Empirical Approach Benchmark is too high:*

1. *the fishing mortality rate increased when M increased, which contradicted the approach used for Eastern Georges Bank cod,*
2. *catch advice would be higher than some of the survey swept area estimates, and*
3. *surveys have continued to decline despite low catches, which are lower than the unrealized quota under the Diagnostic and Empirical Approach Benchmark.*)

An exploitation range of 2% to 16% was suggested by the TRAC as an appropriate scientific basis for calculating the catch advice. This range came from the following considerations:

1. current total mortality rates are high (Z>1.0) but uncertain based on catch curve analyses from all three surveys,
2. recent catch is low relative to the biomass estimated by the surveys,
3. the survey indices remain low despite low catches,
4. given 1 and 2 above, the natural mortality rate may have increased above its new value of 0.4 in recent years, and

5. the expected number of spawnings in yield per recruit analysis can be used as a relative measure of risk to the population's ability to recover (lower values have higher risk).

Using these considerations, a table was constructed for a number of combinations of fishing mortality rate and natural mortality rate using results of a yield per recruit analysis (Table 2). There are a number of combinations of M and F that generate a given exploitation rate (mu). This table should not be used to pick an F_{ref} proxy. The F=0 rows (rows 1 and 5) are included to allow comparison of the expected number of spawnings. The three rows with Z<1 and F>0 (rows 2, 3, and 4) are not consistent with recent estimates of high total mortality from the survey. Rows 5, 6, and 7 are consistent with recent estimates of high total mortality.

Table 2. Total mortality rate (Z), natural mortality rate (M), fishing mortality rate (F), expected number of spawnings (E(Sp)), and resulting exploitation rate (mu) from yield per recruit analysis.

Row	Z	M	F	E(Sp)	Mu
1	0.40	0.40	0.00	1.403	0%
2	0.50	0.40	0.10	1.196	5%
3	0.65	0.40	0.25	1.000	11%
4	0.80	0.40	0.40	0.872	16%
5	1.00	1.00	0.00	0.250	0%
6	1.10	1.00	0.10	0.238	2%
7	1.50	1.00	0.50	0.204	7%

There are two approaches to management that could be considered: constant exploitation rate and constant quota. The constant exploitation rate approach varies the catch as the survey biomass changes, imposing greater variability in the catch. The constant quota approach imposes greater variability in the population. The TRAC recommends the TMGC implement one approach (one exploitation rate if that approach is selected, or one quota if that approach is selected) and maintain that approach over three years to see if the stock responds.

Given the range of exploitation rates (mu) of 2% to 16%, the catch advice for 2015 ranges from 44 mt to 354 mt. An advantage of this approach is that it responds to changes in the population as measured by the surveys. It does not account for uncertainty in the catch advice due to uncertainty in the survey catch per tow, survey catchability assumption, or the uncertainty associated with the appropriate exploitation rate. The variability in the surveys will translate directly into variability in the catch advice using this approach.

Table 3. Survey biomass from the three bottom trawl surveys, an arithmetic average of these biomasses, and catch advice from two exploitation rates (mu).

					mu = 2%	16%
Year	DFO	Spring	Fall (year-1)	Avg (mt)	Catch Advice (mt)	Catch Advice (mt)
2010	8,233	22,181	26,936	19,117	382	3,059
2011	3,450	9,557	8,976	7,328	147	1,172
2012	5,063	14,908	9,793	9,921	198	1,587
2013	629	4,119	10,065	4,938	99	790
2014	462	2,684	3,493	2,213	44	354

Alternatively, the TMGC could consider a constant quota approach. If this approach is selected, the TRAC recommends a quota of 400 mt or lower (based on not increasing the quota relative to the 2014 quota due to concerns about stock declines and comparisons to output from the constant exploitation rate table above) until signals are observed that the stock condition has improved over three years (based on life history traits). The risks of a constant quota approach are that if the constant quota is set too high it will lead to stock declines, while if the constant quota is set too low it will lead to forgone yield. This approach has the advantage of fixing the quota to reduce one source of variability in the system, but has the difficulty of determining when to change from the constant quota.

Special Considerations

Because a stock assessment model framework is lacking for this stock, no historical estimates of biomass, fishing mortality rate, or recruitment can be calculated. As well, status determination relative to reference points is not possible because reference points cannot be defined.

During the Diagnostic and Empirical Approach Benchmark, the following text and table were agreed to and will be included in the proceedings document for that meeting. It is provided here for context, "In the current year *y*, the catch is being set for the next fishing year, *y* +1, without making projections for population dynamics (e.g. catch, survey catch, recruitment, weight at age, selectivity) in year *y*." TAC refers to total allowable catch (quota).

Reasons to decrease TAC	**Reasons to maintain or increase TAC**
Lack of convincing evidence that the stock is increasing (or any convincing evidence at all)	Lack of convincing evidence that the stock is declining (or any convincing evidence at all)
Recent recruitment has generally been below average. - Larvae index collapse, low age 1/2 in indices, low proportion of age 1/2 in catch	No clear decline in biomass in indices (Spring and Fall) - High relative to late 80s early 90s, and stock recovered then with higher catch
Condition factors poor	Current relative F low, M (potentially) increasing - Relative F is not driving the stock right now
Survey biomass indices declining	MSY approach: do not forgo potential catch
Precautionary approach (first do no harm)	Closed area 'safety net' (for now) + bycatch avoidance programs
Danger of reducing age structure and spawning opportunities if M stays high	

Source Documents

Legault, C.M., L. Alade, W.E. Gross, and H.H. Stone. 2014. Stock Assessment of Georges Bank Yellowtail Flounder for 2014. TRAC Reference Document 2014/01.

O'Brien, L., and K. Clark, editors. 2014. Proceedings of the Diagnostic and Empirical Approach Benchmark Review for Georges Bank Yellowtail Flounder: Report of Meeting held 14-18 April 2014. TRAC Proceedings 2014/01.

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.

Correct Citation

TRAC. 2014. Georges Bank Yellowtail Flounder. TRAC Status Report 2014/03.

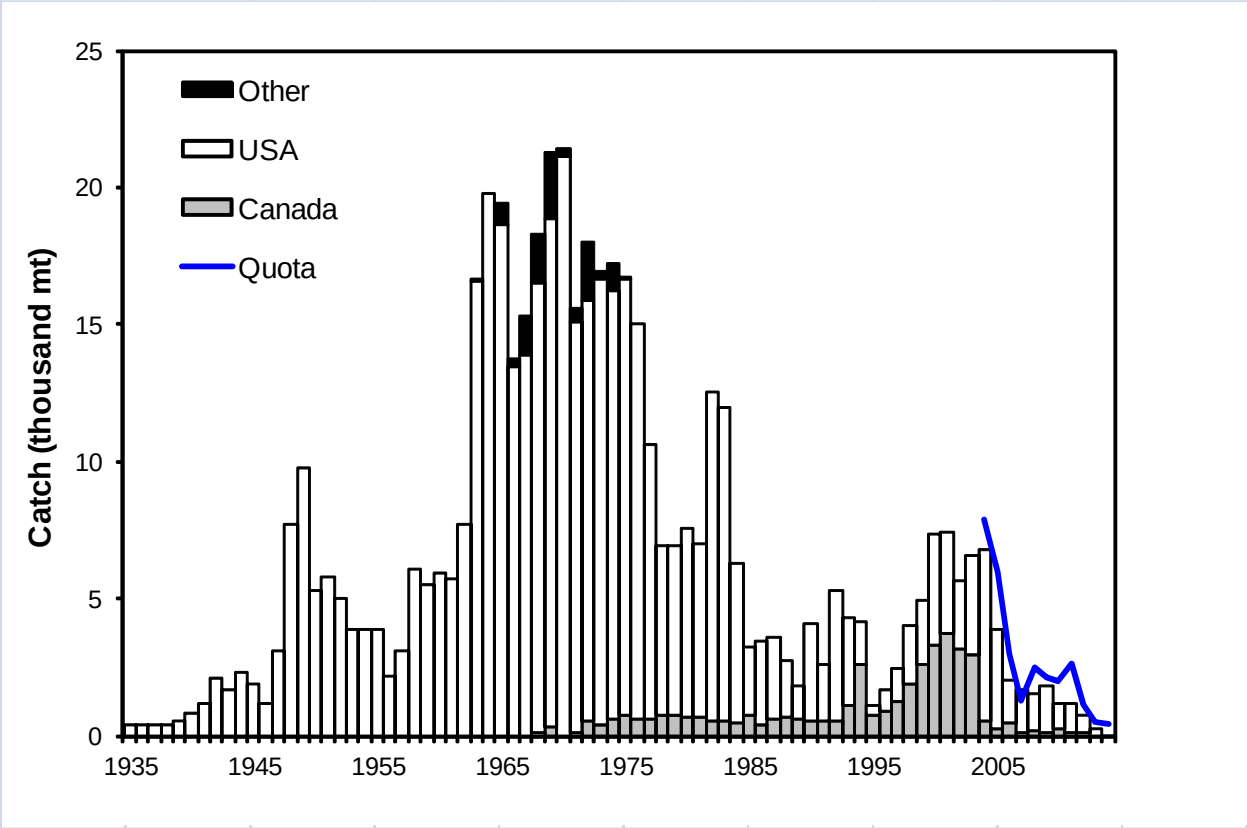


Figure 1. Catches and quota for Georges Bank yellowtail flounder.

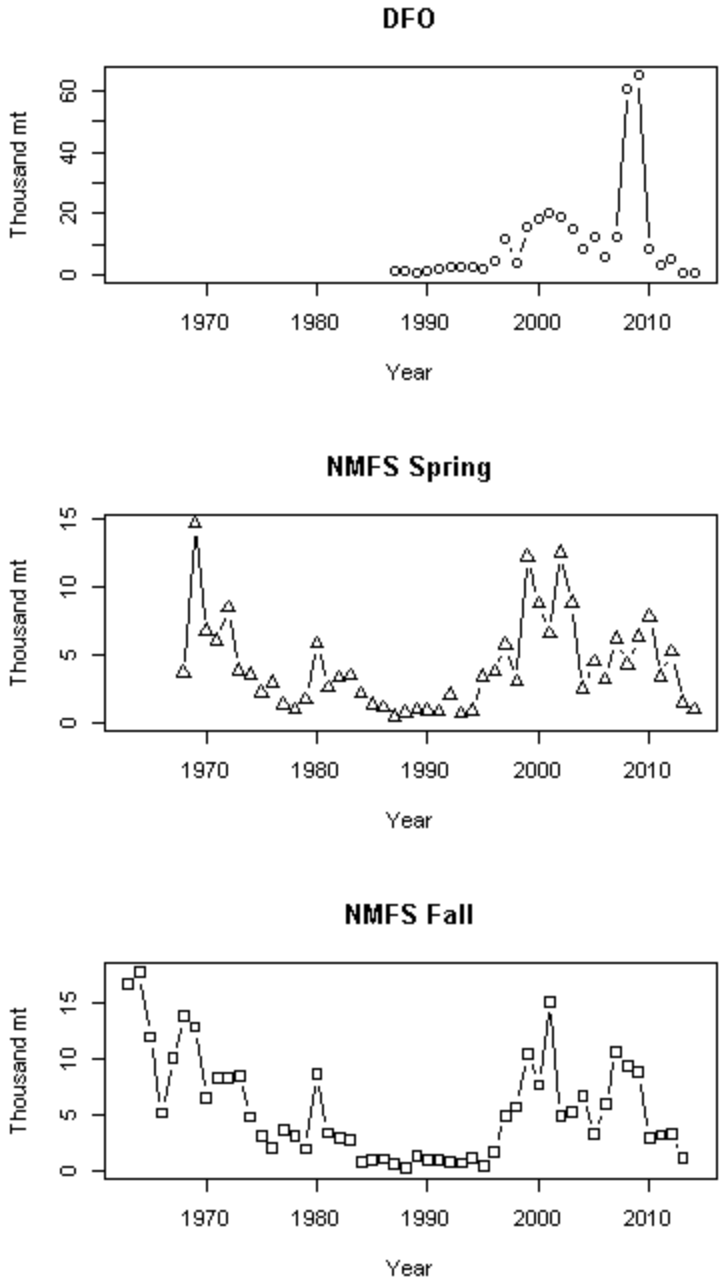


Figure 2. Research survey estimates of biomass for Georges Bank yellowtail flounder.