



Transboundary Management Guidance Committee

Guidance Document 2018/01

The Transboundary Management Guidance Committee (TMGC), established in 2000, is a government-industry committee composed of representatives from Canada and the United States. The TMGC's purpose is to develop guidance in the form of harvest strategies, resource sharing, and management processes for Canadian and U.S. 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 2019 fishing year (calendar year for Canada; May 1, 2019, through April 30, 2020, for the United States). 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 is at record high abundance.

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

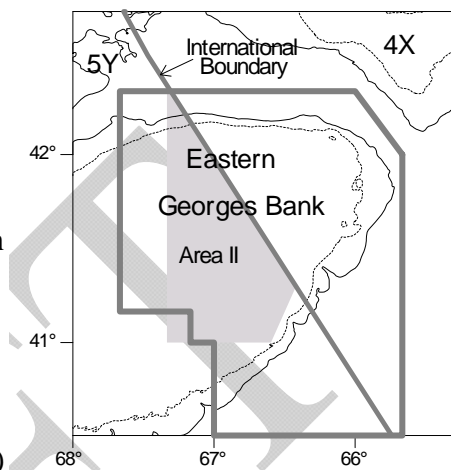
In 2017, the Transboundary Resource Assessment Committee (TRAC) introduced a new process of review for eastern Georges Bank cod and haddock and Georges Bank yellowtail flounder. The TRAC and TMGC revised this process following its implementation in 2017, and some modifications were made to further improve clarity in the process. An overview of the process is available at <https://www.nefsc.noaa.gov/saw/trac/trac-process-overview-2017.pdf>.



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

Guidance

The TMGC concluded that the most appropriate combined Canada/U.S. Total Allowable Catch (TAC) for Eastern Georges Bank cod for the 2019 fishing year is 650 mt. The status of the stock remains poor. This TAC is a 32-percent reduction from 2018, and is within the catch advice that the TRAC provided. The TMGC sought to balance the utilization of other species and signals of the survey indices. The TMGC also highlighted concerns around the size and potential survival of the 2013 year class, combined with the concern about the apparent lack of recent recruitment. The annual allocation shares between countries for 2019 are based on a combination of historical catches (10% weighting) and resource distribution based on trawl surveys (90% weighting). Combining these factors entitles the United States to 29% and Canada to 71% of the TAC, resulting in a national quota of 189 mt for the United States and 461 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.

At the 2013 cod benchmark assessment, the TRAC agreed that the current $F_{ref} = 0.18$ is not consistent with the VPA “M 0.8” model given that it was derived with an assumption of natural mortality (M) = 0.2 in the assessment. Based on analyses presented at the 2014 TRAC, the TMGC agreed that $F = 0.11$ is an appropriate fishing reference point to use for providing catch advice based on the VPA “M 0.8” model.

Fishery Exploitation

Combined Canada/U.S. catches in 2017 were 526 mt, which included 18 mt of discards, with a quota of 730 mt. Historically, catches averaged 17,200 mt between 1978 and 1993, peaking at 26,463 mt in 1982. Catches declined to 1,683 mt in 1995, then fluctuated at about 3,000 mt until 2004, and have subsequently declined.

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

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Avg ¹	Min ¹	Max ¹
Canada ⁹	Quota	1.2	1.0	0.9	0.5	0.5	0.5	0.5	0.5	0.6	0.7			
	Catch	1.2	0.8	0.7	0.5	0.4	0.5	0.5	0.4	0.5		5.2	0.4	17.9
	Landed	1.0	0.7	0.7	0.4	0.4	0.4	0.5	0.4	0.5		5.1	0.4	17.8
	Discard	0.2	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1
USA ⁹	Quota ²	0.5	0.3	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.3			
	Catch ²	0.5	0.3	0.2	<0.1	<0.1	0.1	0.1	<0.1	<0.1				
	Landed	0.4	0.4	0.3	0.1	<0.1	<0.1	<0.1	<0.1	<0.1		3.2	<0.1	10.6
	Discard	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	0.3
Total ⁹	Quota	1.7	1.3	1.1	0.7	0.6	0.7	0.7	0.6	0.7	1.0			
	Catch ^{3,4}	1.7	1.1	0.9	0.5	0.4	0.5	0.6	0.5	0.5				
	Catch	1.8	1.3	1.0	0.6	0.4	0.6	0.6	0.5	0.5		8.5	0.5	26.5
From VPA "M 0.8" model														
Adult Biomass ⁵		9.4	7.4	6.0	5.0	6.0	7.6	8.1	12.5	13.9	9.5	25.2	5.9	59.7
Age 1 Recruits		1.1	1.2	3.2	1.7	0.8	6.0	2.6	0.3			5.6	0.5	24.1
Fishing mortality ⁶		0.17	0.21	0.26	0.14	0.08	0.06	0.06	0.05	0.04		0.33	0.05	0.66
Exploitation Rate ⁷		18%	23%	51%	44%	6%	6%	6%	7%			26%	6%	44%
Exploitation Rate ⁸		24%	23%	17%	11%	32%	11%	5%	1%			23%	1%	46%

¹1978-2017²for fishing year from May 1-April 30³for Canadian calendar year and USA fishing year May 1-April 30⁴sum of Canadian landed, Canadian discard, and USA catch (includes discards)⁵Jan 1 ages 3+⁶ages 4-9⁷ages 4-5; M=0.2⁸ages 6-8; M=0.8⁹ unless otherwise noted, all values reported are for calendar year**State of Resource**

Survey biomass indices decreased for all three surveys, while recruitment has been poor for the last 25 years. Relative fishing mortality (F) has declined since 1995, although total mortality from all sources (Z) has remained high.

Evaluation of the state of the resource was based on results from an age structured analytical assessment (i.e., VPA "M 0.8" model), which used fishery catch statistics and sampling for size and age composition of the catch for 1978 to 2017 (including discards). The VPA was calibrated to trends in abundance from three research bottom trawl survey series: Fisheries and Oceans Canada (DFO), National Marine Fisheries Service (NMFS) spring, and NMFS fall. A statistical catch at age model (ASAP), which uses the same data as the VPA, was also examined. In addition, a suite of indicators derived solely from survey and fishery data were updated.

At the 2013 benchmark review, there was no consensus on an assessment model; however, it was agreed that the VPA "M 0.8" model would be used to provide catch advice (Claytor and O'Brien, 2013). Natural mortality (M) was fixed at 0.2 for all the ages in all years, except for ages 6 and older in years after 1994, where M=0.8. The scale of the biomass values were lower for the ASAP

results but both models showed low recent biomass, poor recent recruitment, and high recent total mortality.

The estimated **adult population biomass** at the beginning of 2018 from the VPA model was 9,502 mt, which was approximately 20% of the adult biomass at the start of the time series in 1978.

Recruitment at age 1 has been low in recent years, but the 2013 year class estimated from the VPA “0.8” model at 4.4 million fish shows the highest estimated recruitment since 2000, but is still about half the average recruitment seen between 1978 and 1990. The current estimate of the 2016 year class from the VPA model is 1.0 million fish at age 1, which is one of the lowest recruitment estimates on record, although model estimates are highly uncertain

Fishing mortality (population weighted average of ages 4-9) in 2017 was estimated from the VPA “M 0.8” model to be 0.04. In recent years, ages 6+ are not fully selected to the fishery. As a result, this average F_{4-9} does not reflect exploitation on fully recruited ages. In 2017, only ages 3 and 4 were fully recruited, with F values of 0.03 and 0.04, respectively. Consequently, the average F on ages 4-9 cannot be directly compared to the model reference $F=0.11$, so it is difficult to conclude whether a low risk of exceeding $F=0.11$ is being achieved.

Productivity

Recruitment, age structure, fish growth (as measured by length and weight at age), and spatial distribution typically reflect changes in productive potential. The current biomass is well below the threshold where higher recruitment is observed. The population age structure displays a low proportion of ages 7+ compared to the 1980s. Survey weights at age of cod on eastern Georges Bank decreased gradually throughout the 1990s and early 2000s, and have remained stable at a low level since then. Total mortality on older age groups has remained high throughout the assessment time period, while relative F (fishery catch at age per survey abundance indices) has declined significantly since the 1990s. The research survey spatial distribution patterns of adult (3+) cod have not changed over the past decade. Lower weights at age in the population in recent years, a truncated age structure, poor recruitment, and high total mortality have contributed to the lack of rebuilding.

Outlook

This outlook is provided in terms of consequences with respect to the harvest reference points for alternative catch quotas in 2019 and 2020. Three assessment methodologies were used to generate 2018 catch advice.

The analytical models used in this assessment (VPA and ASAP) exhibit diagnostic problems with strong residuals and retrospective patterns. The retrospective pattern in both models leads to an overestimation of spawning stock biomass (SSB) in the terminal year and an underestimate of fishing mortality, as compared to previous assessments.

Benchmark Formulation (VPA “M 0.8” model)

In 2019, a 50% risk of not exceeding $F=0.11$ corresponds to catches less than 860 mt, and a lower (25%) risk of not exceeding $F=0.11$ corresponds to catches less than 743 mt. Due to the 2013 year class progressing through the ages of high natural mortality, there is greater than a 90% risk that the adult biomass will decrease from 2019 to 2020, even with no fishing.

In 2020, a 50% risk of not exceeding $F=0.11$ corresponds to catches less than 668 mt, and a lower risk (25%) of not exceeding $F=0.11$ corresponds to catches less than 599 m. Even with no catch in 2020, conditional on a 2019 F of 0.11, there is greater than a 90% risk of a decrease in adult biomass from 2020 to 2021.

Probability of Exceeding $F = 0.11$	25%	50%	75%
2019 Catch	743 mt	860 mt	991 mt
2020 (if $F_{2019}=0.11$)	599 mt	668 mt	752 mt

Consequence Analysis

A consequence analysis was examined to understand the risks associated with assumptions of the VPA “M 0.8” and ASAP “M 0.2” models (reviewed at the 2013 cod benchmark assessment). Natural mortality is assumed to be higher for age 6+ in the VPA ($M=0.8$) since 1994 compared to $M=0.2$ for all ages in the ASAP model. Comparison of the 2018 assessment results of the two models indicates that biomass (ages 3+) is estimated to be higher in the VPA, in contrast to the ASAP model that estimated lower biomass. The consequence analysis estimated the projected catch at F_{ref} (0.18) and $F = 0.11$ as if each model represented the true state of the resource and examined the consequences to expected biomass under alternative model assumptions.

Catch 2017	526 mt		
Quota 2018	951 mt		
		VPA “M 0.8”	ASAP “M 0.2”
2018 biomass (3+)		11,520	3,311
2019 biomass (3+)		9,502	3,478
Projected catch			
VPA $F=0.11$ at neutral risk		"true state"	"alternate state"
2019 catch = 860 mt	2019 F	0.11	0.31
	2020 Biomass (mt)	9,058	3,006
	% Change in Biomass from 2019	-15.3%	-14%
2020 catch = 668 mt	2020 F	0.11	0.24
	2021 Biomass (mt)	7,823	3,778
	% B from 2020	-13.6%	26%

ASAP F=0.18 median		"alternate state"	"true state"
2019 catch = 524 mt	2019 F	0.07	0.18
	2020 Biomass (mt)	9,290	3,339
	% Change in Biomass from 2019	-13.2%	-4%
2020 catch = 568 mt	2020 F	0.09	0.18
	2021 Biomass (mt)	8,060	4,189
	% B from 2020	-13.2%	25%

Empirical Approach

The empirical approach method was developed in 2016 to provide quota advice independently of the two models. The method adjusts recent quotas by recent population biomass trends derived from fitting the average of the three surveys (DFO spring, NMFS spring, NMFS fall) to a *loess* smoother. This method relies on recent quotas (2015-2017) and assumes that these quotas reflect sustainable catch levels.

Quota advice (mt) resulting from application of the empirical approach method, where recent average quota (668 mt) is multiplied by the most recent 3-year average biomass trend, is shown below. The percentiles (50% = median) reflect the probability that the true average 3-year trend is within a given bound, rather than risk. For example, between 5% and 95%, the true average 3-year trend will fall within these bounds 90% of the time.

5%	25%	50%	75%	95%
566	600	644	697	763

TRAC Advice

The TRAC recommends remaining consistent with the TMGC harvest strategy. The neutral risk catch advice of 676 mt is the average of the VPA and ASAP 50% risk of exceeding model-specific reference F (860 mt and 524 mt) and the empirical approach median (644 mt). The low risk catch advice of 602 mt is derived from the VPA and ASAP 25% risk (743 mt and 418 mt) and the empirical approach median (644 mt) because risk associated with the empirical approach is not well defined. Even in the absence of fishing, the stock is not expected to increase from 2019 to 2020 or 2020 to 2021 in the VPA due to the 2013 cohort entering the ages of high natural mortality.

A decrease in quota advice from 2018 is consistent with the continued absence of older fish, no signs of incoming strong recruitment since the 2013 year class, a general trend of lower weights at age, high unaccounted for mortality and a decrease in biomass for all three surveys in the most recent year.

Special Considerations

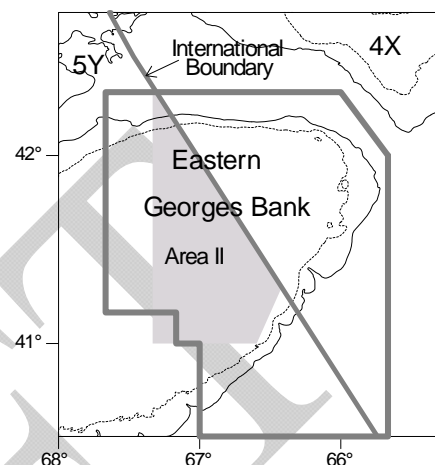
The TRAC had significant concerns with all three assessment approaches. The TRAC provided the results of the analyses this year, but cautioned that the results are becoming increasingly unreliable for management purposes, and an alternative approach for stock status advice is urgently required. As a result, the TMGC agreed that a different process should be used for 2019 and 2020. Under this new process, the TRAC would report on various biological and fishery indicators to inform catch advice for 2020, and develop alternative methods of assessing the stock and providing catch advice. This is expected to guide decisions for a future benchmark assessment for this stock.

DRAFT

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

Guidance

The TMGC concluded that the most appropriate combined Canada/U.S. TAC for Eastern Georges Bank haddock for the 2019 fishing year is 30,000 mt. The 2018 TRAC was provided in the form of an interim update, and did not include analytically-based catch advice. The TRAC was requested to provide guidance on whether a quota of 40,000 mt was appropriate based on a set of indicators. The TRAC determined that 40,000 mt is too high. As a result, the TMGC adopted a 25-percent reduction compared to 2018 TAC. This quota continues to take into account the growth of the 2013 year class, the need to manage that year class, and provides some stability in inter-annual TAC setting, while still acknowledging that biomass is expected to remain high. In 2019, it is expected that the TRAC will provide a full assessment update to help inform future catches. The annual allocation shares between countries for 2019 are based on a combination of historical catches (10% weighting) and resource distribution based on trawl surveys (90% weighting). Combining these factors entitles the U.S. to 50% and Canada to 50% of the TAC, resulting in a national quota of 15,000 mt for the U.S. and 15,000 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. In recent years, substantial fish growth changes and changes in fishery management measures led to concerns whether the F_{ref} is still reflective of the current fishery, and analyses provided by TRAC suggest that the F_{ref} is more conservative than when originally negotiated and remains relevant.

Fishery Exploitation

Combined catches for U.S. and Canada increased from 12,409 mt in 2016 to 13,679 mt in 2017, against a quota of 50,000 mt. Canadian catches increased to 13,384 mt in 2017, with 8 mt of discards from the scallop fishery and negligible discards from the groundfish fishery. The full Canadian quota of 20,500 mt was not caught in 2017.

U.S. catches decreased from 340 mt in 2016 to 295 mt in 2017 (USA calendar year), with 81 mt of discards estimated from the otter trawl and scallop dredge fisheries. As in other years, otter trawl gear accounted for nearly all of USA 2017 landings and discards. U.S. catch in fishing year 2017 was 1.4% of its 29,500 mt quota.

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

		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Avg ¹	Min ¹	Max ¹
Canada²	Quota	15.0	18.9	17.6	12.5	9.1	6.4	16.5	19.2	21.8	20.5				
	Landed	14.8	17.6	16.6	11.2	5.0	4.6	13.0	14.6	11.9	13.4		6.2	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	0.1	<0.1	0.2
USA²	Quota³	8.1	11.1	12.0	9.5	6.9	4.0	10.5	17.8	15.2	29.5				
	Catch³	1.6	1.6	1.8	1.1	0.4	0.6	1.3	1.9	0.5	0.3				
	Landed	1.1	2.2	2.2	1.3	0.4	0.3	1.2	1.5	0.3	0.2		1.9	<0.1	9.1
	Discard	0.1	0.1	<0.1	0.1	0.1	0.1	0.1	0.4	0.1	<0.1		0.5	0.0	7.6
Total²	Quota³	23.0	30.0	29.6	22.0	16.0	10.4	27.0	37.0	37.0	50.0	40.0			
	Catch^{4,5}	16.5	19.2	18.4	12.3	5.5	5.2	14.3	16.5	12.4	13.8				
	Catch	16.0	19.9	18.8	12.7	5.6	5.1	14.2	16.1	12.4	13.7		8.7	2.1	23.3
	Adult Biomass⁶	93.0	92.8	66.2	40.4	23.9	85.0	105.0	95.6	293.3	274.5	265.9	45.8	4.9	293.3
	Age 1 Recruits	4.5	1.8	4.0	243.5	20.8	9.9	884.9	10.6	45.9	111.6		39.6	0.2	884.9
	Fishing Mortality⁷	0.15	0.25	0.36	0.41	0.47	0.36	0.41	0.12	0.10			0.32	0.10	0.57
	Exploitation Rate⁷	12%	20%	28%	30%	34%	28%	31%	10%	9%			24%	9%	40%

¹1969 – 2017² unless otherwise noted, all values reported are for calendar year³for fishing year from May 1st – April 30th⁴for Canadian calendar year and USA fishing year May 1st – April 30th⁵sum of Canadian landed, Canadian discards, and USA catch (includes discards)⁶ages 3+; from the 2017 assessment⁷ages 5-8 for 2003 – 2016; from the 2017 assessment**Indicators**

In the most recent surveys, total biomass indices have decreased from record highs in the 2016 DFO survey and 2015 NMFS fall survey. In the most recent NMFS fall (2017), DFO (2018), and NMFS spring (2018) surveys, biomass indices decreased by 65%, 6%, and 49%, respectively.

The bias-adjusted adult biomass from the 2017 haddock assessment was projected to decrease from 274,482 mt in 2017 to 265,881 mt in 2018, assuming the 2017 quota of 50,000 mt was caught. The catchability (q) adjusted survey biomass showed a decrease in the recent spring (2018) and fall (2017) surveys. In order to smooth inter-survey variation whilst still providing information on incoming year-classes, the three surveys (2017 NMFS fall, 2018 DFO, and 2018 NMFS spring) were averaged to give an estimate that could be considered close to that of the start of the calendar year. The average survey biomass for January 2018 (68,017 mt) is about 74% lower than that predicted by the VPA model in the 2017 haddock assessment (265,881 mt). When compared to the rho-adjusted biomass of 133,841 mt, the average survey biomass was 49% lower than that predicted from the VPA.

Consistent with the trend reported in 2017, the measured weight at age from the DFO survey exhibit a declining trend from 2000 to present, especially for ages 4 to 8. Growth of the 2013 year class is slower than other strong year classes. The beginning of year weight-at-age used in projecting the 2018 biomass were overestimated for fish aged 5 (2013 year class) and 8 (2010 year class). Considering the 2013 and 2010 year classes are expected to contribute 75% and 10% of the total 2018 population biomass, the overestimation of weight at age for these year classes would produce an overestimate of projected population biomass. The underestimation or overestimation of the weight at age of all other year classes is expected to have little effect on the projected 2018 biomass.

Quotas for catch years 2010-2012 were set using a neutral risk of exceeding $F_{ref}=0.26$, yet resulted in estimates of fishing mortality that exceeded F_{ref} in those years despite the fact that 35%-65% of quotas were caught. In 2013 and 2014, neutral and low risk quotas were adopted by TMGC and only about half of the quotas were landed. The estimated F for these years was 0.36 and 0.41, respectively, which also exceeds F_{ref} despite not achieving quotas and selecting low risk quota advice in 2014. In 2017, a neutral risk quota of 50,000 mt was adopted by TMGC and only about 27% of the quota was landed. This trend of positive bias in the projected quota, and underestimated risk of exceeding F_{ref} is a consequence of the retrospective pattern which has emerged and increased in the last four assessments, as well as the overestimation of projected weight at age for large year classes.

TRAC Conclusions and Recommendations

In 2017, the TMGC agreed on a quota of 40,000 mt for 2018 and suggested an upper level of 40,000 mt for catch advice for 2019. There are several positive signals for the stock, such as the 2018 DFO survey index of abundance of haddock for age 5 fish (2013 year class) being the highest value for the time series and the second highest for NMFS spring survey. All three surveys are above average values despite the decrease from 2017 to 2018. Only 27% of the 2017 quota was caught, and the 2018 projected quota (86,000 or 53,000 mt, standard or rho- adjusted) is unlikely to be caught.

The TRAC consensus was that the standard projections are overestimated. The reasons include: the large discrepancy between the VPA-projected 2018 biomass and the q-adjusted average survey biomass, the incompatible patterns between survey Z and relative F, the expected impact of 2018 survey decline on population abundance estimates, uncertainty about the magnitude of the 2013 year class, and overestimation of the 2013 and 2010 WAA.

For these reasons, the 2018 TRAC advice was that the upper bound of 40,000 mt suggested at TMGC for 2019 catch advice is too high, especially in light of the 68,017 mt estimate of average survey 3+ biomass in 2018. The TRAC advised that the rho-adjusted 2019 catch for low and neutral risk, which yields a range of 23,000 mt to 27,500 mt, is a more appropriate range for catch in 2019.

Probability of exceeding F_{ref}	25%	50%	75%
2018 catch	71,000 mt	86,000 mt	102,000 mt
2018 catch (rho adjusted)	35,000 mt	44,000 mt	53,000 mt
2019 catch	44,500 mt	53,000 mt	63,000 mt
2019 catch (rho adjusted)	23,000 mt	27,500 mt	33,000 mt

Special Considerations

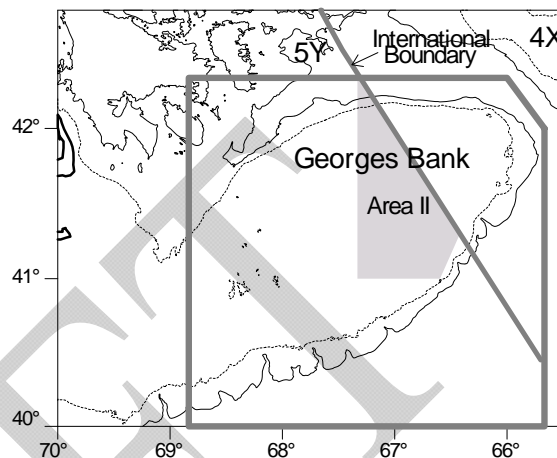
The TMGC is requesting that the Steering Committee schedule a benchmark review for Eastern Georges Bank haddock. The last benchmark review was conducted in 1998. This, combined with declines in model performance, changes in productivity, and the TMGC's recent reliance on TRAC's two year catch advice with an interim report to form the basis for management, all suggest an increased need for a benchmark.

DRAFT

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

Guidance

The TMGC concluded that the most appropriate combined Canada/U.S. TAC for Georges Bank yellowtail for the 2019 fishing year is 140 mt. The declining trend of the stock remains. However, available information suggests that current levels of catch are not the primary factor impacting stock rebuilding. Total mortality remains high in spite of record low catches. The large inter-annual change in the survey indices with minimal catch resulted in concerns about the accuracy of some of the survey estimates. Although the TMGC did not reach a consensus on how to resolve these concerns, the final quota was influenced by these considerations. In light of this information, the TMGC sought to balance yellowtail flounder stock conditions and the utilization of other species. A quota of 140 mt is above the TRAC's recommendation; however it is a 53-percent reduction from 2018, and the lowest quota on record. The TMGC and the TRAC will continue to explore the most appropriate catch strategy to use for this stock in its current state of productivity. The annual allocation shares between countries for 2019 are based on a combination of historical catches (10% weighting) and resource distribution based on trawl surveys (90% weighting). Combining these factors entitles the United States to 76% and Canada to 24% of the TAC, resulting in a national quota of 106 mt for the United States and 34 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.

Due to the lack of an assessment model, an estimate of fishing mortality rate can no longer be calculated. Status determination relative to reference points is not possible because reference points cannot be defined.

Fishery Exploitation

Total catches of Georges Bank yellowtail flounder peaked at about 21,000 mt in both 1969 and 1970. The combined Canada/US catch increased from 1995 through 2001, averaged 6,300 mt during 2002-2004, but declined to 95 mt in 2017 due in part to restrictive management measures.

Catches (thousands mt)

		2012	2013	2014	2015	2016	2017	2018	Avg ¹	Min ¹	Max ¹
Canada²	Quota	586	285	72	106	85	93	87			
	Landed	46	1	1	3	1	<1		430	<1	2,913
	Discard	48	39	14	11	10	2		428	10	815
USA²	Quota³	564	215	328	248	269	207	213			
	Catch³	379	93	122	68	26	84 ⁴				
	Landed	443	130	70	63	26	35		3,792	26	15,899
	Discard	188	49	74	41	7	57		519	7	3,021
Total²	Quota⁵	1,150	500	400	354	354	300	300			
	Catch⁵	473	132	136	82	36	87 ⁴				
	Catch⁶	725	218	159	118	44	92		5,192	44	17,211

¹1973 – 2017² unless otherwise noted, all values reported are for calendar year³ for fishing year May 1 – April 30⁴ preliminary estimate⁵ for Canadian calendar year and USA fishing year May 1 – April 30⁶ sum of Canadian landed, Canadian discarded, and USA catch (includes discards)***State of Resource***

The declining trend in survey biomass to low levels, despite reductions in catch to historical low amounts, indicates a poor state of the resource. Recent catch is low relative to the biomass estimated from the surveys (relative F) but catch curve analyses indicate declining but high total mortality rates (Z above 1 for most years). Fishing does not appear to be a major driver of stock status currently, although large amounts of missing catch could change this interpretation.

Productivity

Recruitment, spatial distribution, and fish growth typically reflect changes in the productive potential. Recent recruitment has generally been below average and age structure is truncated (i.e., both fewer young fish and fewer old fish). Recent spatial distribution patterns from the three bottom trawl surveys generally follow the ten year average, although low survey catches makes these comparisons difficult. Growth, as measured by length at age in the surveys, has been variable without trend, and condition (weight at length) has been poor recently, although low survey catches makes interpreting these trends difficult. Stock biomass is low and productivity is poor.

2017 Catch Risk Assessment

For catch advice, the TRAC recommended an upper bound of 6% for the exploitation rate, which results in 68 mt for 2019. Survey biomass decreased 95% from 2010 to 2017 and decreased again in 2018. Historical exploitation rates can be computed from either the quota or the catch. The TRAC used the exploitation rate associated with the quota to set the catch advice because quotas have limited the catch directly and indirectly. The average exploitation rate associated with the quota for years 2010 to 2017 is 6% and ranged from 3% to 11%.

Including 2018 increases the average to 8%, but the 2018 quota was set higher than the 6% exploitation rate recommended by TRAC last year so is not considered to be appropriate as part of the average. The average exploitation rate associated with the catch for years 2010 to 2017 is 2% and ranged from 1% to 5%. The TRAC notes increasing the exploitation rate above the chances of rebuilding. During 2010 to 2017, the quota has averaged 3.1 times the catch, ranging from 1.6 to 8.1 times the catch. The TRAC recognizes that catch has been well below the quota recently and expect this to continue in the future. If quota utilization increases, the exploitation rate used to provide catch advice may need to be reconsidered. The TRAC recommends low exploitation to allow for the possibility of rebuilding.

The quota and catch have been relatively constant and low since 2012 and the average survey biomass has continued to decline during this period. The TRAC considers the recent quota too high to continue as a constant quota approach given the continued decline in survey biomass. If a constant quota approach is considered by TMGC, the TRAC recommends using a lower value than recent quotas. The TRAC recognizes that catch has been well below the quota recently and expects this to continue in the future.

There are a number of reasons to reduce the catch advice from the recent quota of 300 mt. The exploitation rate associated with continuing the 2018 quota of 300 mt is 27%. The most recent survey biomass is at a record low for two surveys and the second lowest in the time series for the third survey. All three surveys show low recruitment recently. Total mortality declined recently in two surveys but continues to be high based on the age structure in all three surveys. Although covering only a small portion of Georges Bank, a multispecies survey conducted using a scallop dredge in Closed Area II during 2016 to 2018 also indicated low and declining abundance of yellowtail flounder.

There are two observations that would support maintaining the current quota. Relative F continues to be low compared to pre-1995 values and catch has been below the quota in both countries every year.

Special Considerations

Although current levels of catch are not the primary driver of the stock, the TMGC noted that it is important to monitor for changes in productivity to indicate that further reductions in catch could have a higher probability of future rebuilding.

The TMGC recognizes that its 2019 recommendation will be constraining and require continued efforts to reduce catch as much as practicable. This significant reduction in quota will be challenging for both countries.

Source Documents

Noble, V., Q. McCurdy, and E.N. Brooks. 2018. 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 2018. TRAC Reference Document 2018/04.

TRAC. 2018. Eastern Georges Bank cod. TRAC Status Report 2018/01.

TRAC. 2018. Eastern Georges Bank haddock. TRAC Status Report 2018/02.

TRAC. 2018. Georges Bank yellowtail flounder. TRAC Status Report 2018/03.

Consultations

2018 TRAC meeting, Woods Hole, Massachusetts, 10-12 July 2018.

TMGC public consultation in Canada, Yarmouth, Nova Scotia, 17 August 2017.

TMGC public consultation in U.S., Gloucester, Massachusetts, 27 August 2018.