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 TMGC's guidance to both countries for the 2020 fishing year (calendar year for Canada; May 1, 2020 through April 30, 2021, for the United States). Pertinent reference documents and consultations used in the TMGC deliberations are listed at the end of this document.

Since inception, 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 TMGC have been reduced and Eastern Georges Bank Haddock is at a 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.
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.

The annual allocation shares between countries for 2020 are based on a combination of historical catches ( $10 \%$ weighting) and resource distribution based on trawl surveys ( $90 \%$ weighting).

## Canadä

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

## Guidance

TMGC concluded that the most appropriate combined Canada/U.S. Total Allowable Catch (TAC) for Eastern Georges Bank Cod for the 2020 fishing year is 650 mt . The status of the stock remains poor. The TAC remains the same as 2019, and is within the catch advice that the TRAC provided for that year. No new catch advice was provided by TRAC for cod in 2020, TRAC reviewed data and indices and saw no reason to change the 2019 advice. TMGC sought to balance the utilization of other species and signals of the survey indices.

Applying the allocation shares for 2020 entitles the U.S. to
 $29 \%$ and Canada to $71 \%$ of the TAC, resulting in a national quota of 188.5 mt for the U.S. and 461.5 mt for Canada.

## Harvest Strategy \& Reference Points

The strategy is to maintain a low to neutral risk of exceeding the fishing mortality limit reference, $\mathrm{F}_{\text {ref }}=0.18$. When stock conditions are poor, fishing mortality rates should be further reduced to promote rebuilding. Due to the lack of assessment model, an estimate of fishing mortality rate can no longer be calculated.

## Fishery Exploitation

Combined Canada/U.S. catches in 2018 were 565 mt , which included 9 mt of discards, with a quota of 951 mt (59\% of the quota). Historically, catches averaged 17,200 mt between 1978 and 1993, peaking at $26,463 \mathrm{mt}$ in 1982. Catches declined to $1,683 \mathrm{mt}$ in 1995 , then fluctuated at about $3,000 \mathrm{mt}$ until 2004, and have subsequently declined.

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

${ }^{1}$ 1978-2018
${ }^{2}$ 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 $3+$
${ }^{6}$ ages 4-9
'ages 4-5; M=0.2
${ }^{8}$ ages $6-8$; M $=0.8$
${ }^{9}$ unless otherwise noted, all values reported are for calendar year

## State of Resource

For 2019 the TRAC used 2018-2019 data to provide an update of biological and fishery indicators for Eastern Georges Bank Cod, including condition factor, survey biomass indices, fishery and survey catch at length, relative F, total mortality and catch.

Survey biomass indices increased for two of the three surveys, but all three remained below the time series average. Condition factor is at or above the long-term mean for the two NMFS surveys, but remains at low levels for the DFO survey. Recruitment has been poor for the last 25 years. Large cod continue to be missing from both fishery and survey catch compared to historical distributions. Relative fishing mortality (F) has declined since 1995, although total mortality from all sources (Z) has remained high.

## 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

Following the 2018 TRAC, poor diagnostics of both the VPA and Age Structure Assessment Program (ASAP) models for Eastern Georges Bank Cod resulted in the TMGC requesting that TRAC investigate alternative methodologies for providing catch advice. In 2019, two possible approaches were presented at TRAC: the Rose approach and the Data Limited Methods Tool (DLMtool). The Rose approach uses a variety of assessment models to address retrospective patterns and provide catch advice based on the ensemble of models through either a formulaic calculation or making trade-offs between short and long term consequences. The DLMtool provides a simulation platform which mimics stock dynamics across a range of uncertainties, against which simple index-based management procedures for provision of interim advice can be tested. The TRAC discussed the advantages and disadvantages of both the proposed alternative approaches and agreed to proceed with the continued development of the DLMtool to provide future catch advice. To move forward with DLMtool approach the assessment team requires predetermined clear management objectives from TMGC to choose the proper management procedures for catch advice. The development of this approach will take a considerable amount of time and catch advice may not be provided at TRAC for 2021. TRAC will review the data and determine if there is a need to modify the catch advice.

## TRAC Advice

No new catch advice was provided by TRAC for cod in 2020. TRAC reviewed data and indices and saw no reason to change the advice from 2019.

## Special Considerations

The DLMtool approach for providing catch advice will be pursued by the assessment team. TRAC advised that the development of the DLMtool approach would require the development of quantifiable management objectives by TMGC at an intersessional meeting in 2020. Leading up to the intersessional a working group of TMGC members will be appointed to develop draft management objectives. The assessment team will develop candidate management procedures and proposed metrics to measure against the management objectives. These will then go back to TMGC for approval. The assessment team will continue development of operating models throughout this time period. This process is anticipated to take several years with the goal of completion by TRAC 2021. In 2020, TRAC will report on various biological and fishery indicators to inform catch advice for 2021, and provide an update on the development of the DLMtool approach. A timeline for this approach was developed at the TMGC meeting and is shown below.

Timeline for the Development of the Data Limited Methods Tool for Eastern Georges Bank Cod

| TRAC | Date | TMGC/ working group |
| :---: | :---: | :---: |
| TRAC recommends development of DLMtool | July 11, 2019 |  |
|  | September 11, 2019 | TMGC recommends development of DLMtool and drafts a timeline for completion |
| Develop Operating Models (OM) | Fall 2019 |  |
|  | November 2019 | Form working group. Develop strawman Management Objectives (MO) |
|  | February 2020 | Intersessional. <br> Review OMs and MOs, approve MOs |
| Test OMs to achieve MOs. Develop candidate management procedures | Spring 2020 | Develop candidate management procedures |
|  | April 2020 | Refine and Approve Management Objectives |
| Annual TRAC meeting. Review OM and candidate management procedures | July 7-9, 2020 |  |
|  | September 1-2, 2020 | Annual TMGC Meeting. Review development of DLMtool Select management procedures for use in 2021 |

## Italics denote tasks assigned to TMGCs DLMTool Working Group.

* At a minimum, Management Objectives should address:

1. Biomass: Desired state, minimum permissible
2. Removals: Bounds on fishing mortality or exploitation
3. Yield: Long-term average, desired variability
4. Population: Desired changes in age structure

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

## Guidance

TMGC concluded that the most appropriate combined Canada/U.S. TAC for Eastern Georges Bank Haddock for the 2020 fishing year is $30,000 \mathrm{mt}$. The TAC is the same as 2019. The amount is within the catch advice that was provided by TRAC for 2020.

Applying the allocation shares for 2020, entitles the U.S. to $54 \%$ and Canada to $46 \%$ of the TAC, resulting in a national quota of $16,200 \mathrm{mt}$ for the U.S. and $13,800 \mathrm{mt}$ for Canada.

The Virtual Population Analysis (VPA) model used to determine status of the resource since 1998 was rejected by TRAC in 2019. In the absence of a model, there are no
 analytical projections to characterize risk for catches in 2020 and 2021. The TRAC used survey and relative F trend comparisons with the 2003 year class in 2009 (which is akin to the 2013 year class in 2019), and results from the 2012 Virtual Population Analysis (VPA), to relate current relative measures to analytical estimates from the last VPA with acceptable performance.

## Harvest Strategy \& Reference Points

The strategy is to maintain a low to neutral risk of exceeding the fishing mortality limit reference, $\mathrm{F}_{\text {ref }}=0.26$. When stock conditions are poor, fishing mortality rates should be further reduced to promote rebuilding. In the absence of an assessment model, an estimate of fishing mortality rate cannot be calculated and therefore the status of the stock determination relative to $\mathrm{F}_{\text {ref }}$ cannot be determined. Relative F (Catch/Average survey biomasss) is shown instead of fishing mortality rates, but it is noted that the two measures are not comparable.

## Fishery Exploitation

Combined catches for U.S. and Canada decreased from 13,679 mt in 2017 to 12,495 mt in 2018, against a quota of $40,000 \mathrm{mt}$. Canadian catch decreased from $13,384 \mathrm{mt}$ in 2017, to $12,222 \mathrm{mt}$ in 2018. There were 5 mt of discards from the scallop fishery and negligible discards from the groundfish fishery. The full Canadian quota of $24,000 \mathrm{mt}$ was not caught in 2018.
U.S. catches decreased from 295 mt in 2017 to 274 mt in 2018 (USA calendar year), with 21 mt of discards estimated from the otter trawl, with a small amount from the scallop dredge fisheries. U.S. catch in fishing year 2018 was $1.7 \%$ of its $16,000 \mathrm{mt}$ quota.

## State of the Resource

The 2018 and 2019 survey indices were above their respective means for the time series. In the most recent year both DFO and NMFS fall indices decreased (16\% from 2018 to 2019 for the DFO survey, and $27 \%$ from 2017 to 2018 for the NMFS fall survey), while the NMFS spring index increased by $35 \%$ from 2018 to 2019.

In the past, the evaluation of the state of the resource was based on results from an age structured analytical assessment (the VPA). In 2019 the TRAC agreed that the assessment model was no longer able to provide reliable advice on the current abundance nor was it able to provide reliable advice for catch. Due to the VPA's poor performance, and increased uncertainty in the age-specific data, survey biomass and total catch were summarized to describe the state of the resource, rather than the results from the rejected model. With no analytical projections to characterize risk for catches in 2020 and 2021, the TRAC used survey and relative F trend comparisons with the 2003 year class in 2009 (which is akin to the 2013 year class in 2019), and results from the 2012 Virtual Population Analysis (VPA) in an attempt to relate current relative measures to analytical estimates from the last VPA with acceptable performance.

Average survey biomass is well above (30-40\% higher in 2018-2019) the time series mean. The 2013 year class remains the largest observed in the entire survey time series, but two out of three surveys declined in the most recent year, and further decline is expected in the immediate future as the large 2013 year class declines in numbers.

Relative fishing mortality ( F ) was calculated individually for each of the surveys and then an annual average relative fishing mortality was calculated using the DFO and NMFS Spring surveys and the NMFS Fall survey in the previous year, 1987-2018. Relative F tended to be above the mean during the earlier years of the time series until 1997 and has remained low since 2012.

Catches, Survey Biomass Index (thousands mt ) and relative fishing mortality of haddock.

|  |  | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Avg ${ }^{1}$ | Min ${ }^{1}$ | Max ${ }^{1}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Canada ${ }^{2}$ | Quota | 15 | 18.9 | 17.6 | 12.5 | 9.1 | 6.4 | 16.5 | 19.2 | 21.8 | 20.5 | 24.0 |  |  |  |  |
|  | Landed | 14.8 | 17.6 | 16.6 | 11.2 | 5 | 4.6 | 13 | 14.6 | 11.9 | 13.4 | 12.2 |  | 6.4 | 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 |
| $\text { USA }^{2}$ | Quota ${ }^{3}$ | 8.1 | 11.1 | 12 | 9.5 | 6.9 | 4 | 10.5 | 17.8 | 15.2 | 29.5 | 16.0 |  |  |  |  |
|  | Catch ${ }^{3}$ | 1.6 | 1.6 | 1.8 | 1.1 | 0.4 | 0.64 | 1.3 | 1.9 | 0.5 | 0.4 | 0.6 |  |  |  |  |
|  | Landed | 1.1 | 2.2 | 2.2 | 1.3 | 0.4 | 0.3 | 1.2 | 1.5 | 0.3 | 0.2 | 0.3 |  | 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 | <0.1 |  | 0.5 | 0.0 | 7.6 |
| Total ${ }^{2}$ | Quota ${ }^{3}$ | 23 | 30 | 29.6 | 22 | 16 | 10.4 | 27 | 37 | 37 | 50.0 | 40.0 | 30.0 |  |  |  |
|  | Catch ${ }^{5,6}$ | 16.5 | 19.2 | 18.4 | 12.3 | 5.5 | 5.2 | 14.3 | 16.5 | 12.4 | 13.9 | 12.5 |  |  |  |  |
|  | Catch | 16 | 19.9 | 18.8 | 12.7 | 5.6 | 5.1 | 14.2 | 16.1 | 12.4 | 13.7 | 12.9 |  | 8.7 | 2.1 | 23.3 |
| Avg Survey <br> Biomass |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Index ${ }^{6}$ |  | 74.4 | 54.3 | 50.8 | 33.4 | 59.7 | 90.7 | 76.1 | 138.0 | 176.3 | 104.8 | 65.7 | 62.0 | $34.8{ }^{8}$ | $3.3{ }^{8}$ | $176.3^{8}$ |
| Relative $\mathbf{F}^{7}$ |  | 0.6 | 0.9 | 1.0 | 1.2 | 0.3 | 0.2 | 0.6 | 0.3 | 0.2 | 0.4 | 0.5 |  | 1.0 | 0.2 | 3.8 |

${ }^{1}$ 1969-2018
${ }^{2}$ unless otherwise noted, all values are reported for the calendar year
${ }^{3}$ for fishing year from May $1^{\text {st }}-$ April $30^{\text {th }}$
${ }^{4}$ for Canadian calendar year and USA fishing year May $1^{\text {st }}$-April $30^{\text {th }}$
${ }^{5}$ sum of Canadian landed, Canadian Discards, and USA catch (including discards)
${ }^{6}$ Average survey biomass index for NMFS Spring, DFO and the NMFS fall from the previous year (not adjusted for catchability)
${ }^{7}$ Relative fishing mortality; The standardized average (1987-2018) of the annual catch divided by the biomass index for each of the three survey indices (DFO, NMFS spring and fall).
${ }^{8}$ 1969-2019

## Productivity

Recruitment, as well as age structure, spatial distribution and fish growth reflect changes in the productive potential. Recruitment, while highly variable, has generally been higher when adult biomass has been above $40,000 \mathrm{mt}$, and the stock has produced several exceptionally strong year classes in the last 16 years. There are no indications of exceptional year classes coming into the population. There are preliminary indicators of above average recruitment for 2016, although that observation is uncertain. The population age structure displays a broad representation of age groups, reflecting improving recruitment since 1995. The spatial distribution patterns observed during the most recent bottom trawl surveys were similar to the average patterns over the previous ten years.

Consistent with the trend reported in 2017, the measured weight at age from the DFO survey exhibit a declining trend from 2000 to present. As biomass has increased, growth rates and asymptotic length have declined. Growth of the 2013 year class is slower than other strong year classes. This decline in size at age is exacerbated for the 2012 year class. Fish condition has generally been below the time series average since 2004 for DFO and the NMFS Spring Surveys. In 2018 (NMFS Fall) and 2019 (NMFS Spring) the condition increased above the time series mean, in 2019 condition in the DFO survey increased but remained below the time series average.

## Outlook and TRAC Advice

The assessment model was rejected, so there are no analytical projections to characterize risk for catches in 2020 and 2021. Instead, survey and relative F trends, and comparisons with the 2003 year class in 2009 (which is akin to the 2013 year class in 2019) were provided. In addition to these model-free summaries, results from the 2012 VPA were summarized in an attempt to relate current relative measures to analytical estimates from the last VPA with acceptable performance. Model free observations about the population status and reasons to adjust future quotas were summarized (Table 1), and positive and negative considerations to inform quota advice further discussed.

The population is expected to decline from 2019-2020 and 2021 even if no catches are taken in 2020. This is due to the decline in numbers of the exceptionally large 2013 year class, which is expected to have very little gain in weight from ages 6 to 8 .. With a quota of $30,000 \mathrm{mt}$ for 2019, the TRAC agreed the quotas for 2020 and 2021 should not be increased. Two alternatives for catch advice are to maintain status quo, or to decrease quota. Although the population is still abundant, and well above the time series average survey biomass, maintaining a constant quota on a declining population would lead to an increasing trend in relative F. Furthermore, the availability of the 2013 year class to the fishery at older ages is uncertain. The uncertain availability, combined with the weights at age being the lowest observed, argue against status quo quota.

The remaining alternative is to decrease 2020 and 2021 quota advice from the 2019 quota of $30,000 \mathrm{mt}$. The TRAC recommended no increase in the quota in 2020 above the 2019 quota but recommended a decrease in 2021. There was no consensus on whether to decrease quota in 2020.

For guidance on a potentially reasonable range of quota advice, the TMGC was encouraged to use the quota advice for the 2003 year class in 2009-2011 as a starting point. The average survey biomass in 2009 (54, 254 mt ) is of similar magnitude to the 2019 average survey biomass (62, 041 mt ), and it might be expected to see a similar biomass trend as the 2012 year class declines with age and moves towards the plus group (ages 9 and older). The quotas set in 2010-2011 predate the appearance of the VPA retrospective pattern, suggesting that the scale of those quotas was probably appropriate. The catches removed in those years are estimated to have been below F ref (0.26), and even if the full quota had been removed the F would have ranges from 0.190.27 .

Weights at age and survey trends, as well as relative F from 2019, will likely provide information to inform the 2021 quota recommendation.

Table 1. Information from the 2012 VPA (yellow highlighted cells in years 2009-2011) and the 2019 average survey biomass. The 2012 VPA is the last model iteration that had no retrospective pattern, and provides a measure of scale between average survey biomass (AvgSurvB) and VPA estimated 3+ biomass (B), and between VPA estimates of $F$ on ages 5 through 8 (F5-8) corresponding to catch removed from the average survey biomass (Rel.F). In the final column, F5-8 is scaled by the ratio of quota/catch (Q/C) to estimate what F might have been if the full quota had been caught. *Indicates values that will be filled in at TRAC2020 and ** will be filled in after TMGC 2019.

| Year | F5-8 | Rel. F | B | AvgSurvB | Catch | Quota | Quota/Catch | $\underline{F} \mathbf{Q}$ /C |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2009 | 0.12 | 0.94 | 132,500 | 54,250 | 19,855 | 30,000 | 1.51 | 0.19 |
| 2010 | 0.15 | 0.99 | 102,000 | 50,800 | 18,794 | 29,600 | 1.57 | 0.24 |
| 2011 | 0.15 | 1.20 | 75,000 | 33,400 | 12,656 | 22,000 | 1.74 | 0.27 |
| 2019 |  | * |  | 62,000 | * | 30,000 |  |  |
| 2020 |  |  |  | * |  | ** |  |  |
| 2021 |  |  |  |  |  | ** |  |  |

## Special Considerations

The VPA assessment was rejected for provision of advice this year. This limited the TRAC's ability to provide analytically based quota advice and risk characterization. In the absence of any analytical model, uncertainty about the quota and the absolute scale of the population is very high. In light of this, TMGC reaffirms its request for a benchmark for Eastern Georges Bank Haddock and notes the 2021 US domestic research track.

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

## Guidance

TMGC concluded that the most appropriate combined Canada/U.S. TAC for Georges Bank yellowtail for the 2020 fishing year is 162 mt . This TAC is a small increase from 140 mt in 2019 and is within TRACs recommendation for 2020. The declining trend in survey biomass to low levels, despite reductions in catch to historical low amounts indicates a poor state of the resource. Available information suggests that current levels of catch are not the primary factor impacting stock rebuilding. Total mortality remains high despite record low catches. TMGC and TRAC will continue to explore the most appropriate method for providing catch
 advice for this stock in its current state of productivity. Applying the allocation shares for 2019, entitles the U.S. to $74 \%$ and Canada to $26 \%$ of the TAC, resulting in a national quota of 120 mt for the U.S. and 42 mt for Canada.

## Harvest Strategy \& Reference Points

The strategy is to maintain a low to neutral risk of exceeding the fishing mortality limit reference, $\mathrm{F}_{\text {ref }}=0.25$. 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 45 mt in 2018 due in part to restrictive management measures.

Catches (mt)

|  |  | $\mathbf{2 0 1 3}$ | $\mathbf{2 0 1 4}$ | $\mathbf{2 0 1 5}$ | $\mathbf{2 0 1 6}$ | $\mathbf{2 0 1 7}$ | $\mathbf{2 0 1 8}$ | $\mathbf{2 0 1 9}$ | Avg $^{1}$ | Min $^{1}$ | Max $^{1}$ |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Canada $^{2}$ | Quota | 285 | 72 | 106 | 85 | 93 | 87 | 34 |  |  |  |
|  | Landed | 1 | 1 | 3 | 1 | $<1$ | $<1$ |  | 414 | $<1$ | 2,913 |
|  | Discard | 39 | 14 | 11 | 10 | 2 | 3 |  | 410 | 2 | 815 |
| USA $^{2}$ | Quota $^{3}$ | 215 | 328 | 248 | 269 | 207 | 213 | 106 |  |  |  |
|  | Catch $^{3}$ | 93 | 122 | 68 | 26 | 84 | $40^{4}$ |  |  |  |  |
|  | Landed $^{2}$ | 130 | 70 | 63 | 26 | 35 | 32 |  | 3,711 | 26 | 15,899 |
|  | Discard $^{\text {Total }}$ |  |  |  |  |  |  |  |  |  |  |
|  | Quota $^{\mathbf{5}}$ | 59 | 74 | 41 | 7 | 57 | 11 |  | 508 | 7 | 3,021 |
|  | Catch $^{5}$ | 132 | 136 | 82 | 36 | 87 | $42^{4}$ |  |  |  |  |
|  | Catch $^{6}$ | 218 | 159 | 118 | 44 | 95 | 45 |  | 5,080 | 44 | 17,211 |

${ }^{1} 1973-2018$
${ }^{2}$ unless otherwise noted, all values reported are for calendar year
${ }^{3}$ for fishing year May 1 - April 30
${ }^{4}$ preliminary estimate
${ }^{5}$ for Canadian calendar year and USA fishing year May 1 - April 30
${ }^{6}$ sum of Canadian landed, Canadian discard, 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). However, the low catches in the survey in recent years make interpretation of the current relative F and survey Z difficult. 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.

## Outlook and TRAC Advice

The assessment findings this year support reasons to both decrease the quota ( 140 mt in 2019) and to maintain or increase the quota for 2020. Last year's catch was $15 \%$ of the quota, the relative F continues to be low, two surveys increased, and survey total mortality decreased to
low values in two of the surveys, which supports maintaining or increasing the quota. One survey declined last year to the lowest value in the time series, all three survey biomass estimates remain low compared to their means, and recent recruitment continues to be below average, which supports decreasing the quota.

The TRAC recommended an upper bound for the exploitation rate of $6 \%$ for catch advice, which results in 199 mt for 2020. Survey biomass decreased 95\% from 2010 to 2019.

The TRAC used the exploitation rate associated with the quota to set the catch advice because it has 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 $11 \%$. The TRAC noted that increasing the exploitation rate above the average from 2010 to 2017 when the stock declined substantially is risky and reduces the chances of rebuilding. Despite the possibility of other factors influencing the population trends, such as environmental factors or missing catch, the TRAC recommended setting the exploitation rate as low as possible below the upper bound of $6 \%$.

## Special Considerations

Although current levels of catch are not the primary driver of the stock, 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. Results from the most recent surveys are considered valid for use in the empirical approach.

## Source Documents

M.A. Barrett and E.N. Brooks. 2019. Update of Allocation Shares for Canada and the USA of the Transboundary Resource of Atlantic Cod, Haddock, and Yellowtail Flounder on Georges Bank Through Fishing Year 2020.

TRAC.2019. Cod Reference Document
TRAC. 2019. Eastern Georges Bank Cod. Working Paper
TRAC. 2019. Eastern Georges Bank Haddock. TRAC Status Report 2019.
TRAC. 2019. Georges Bank yellowtail flounder. TRAC Status Report 2019.
TMGC. 2019. DLMTool Summary Schedule.

## Consultations

2019 TRAC meeting, St. Andrew’s, New Brunswick, 11-13 July 2019.

TMGC public consultation in Canada, Yarmouth, Nova Scotia, 1 August 2019.
TMGC public consultation in U.S, Gloucester, MA, 28 August 2019.

