Yellowtail Flounder Backup Plan

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Introduction

This working paper addresses Term of Reference 8: Develop a backup assessment approach to providing scientific advice to managers if the proposed assessment approach does not pass peer review or the approved approach is rejected in a future management track assessment. The proposed assessment approach for all three yellowtail flounder stocks is the Woods Hole Assessment Model (WHAM). The addition of years of data in future management tracks may require changes to the formulation of WHAM approved during this research track. Such changes to the WHAM formulation, including both simplifying and adding complexity, are considered part of the management track process for the accepted model and would follow the evaluation criteria that were used in TOR4. These changes would not be considered switching to the backup assessment approach. Only if all WHAM formulations explored during this research track or future management tracks were rejected for one of the stocks would the backup assessment approach be invoked.

The yellowtail flounder research track working group (WG) considered reasons why future management track WHAM assessment might fail when developing the backup assessment plans. The three stocks were split into two groups of potential failures. For the Georges Bank (GB) and Southern New England-Mid Atlantic (SNEMA) stocks, the WG is concerned that future low abundance might lead to a number of true zero surveys, meaning surveys were conducted as normal but did not catch any yellowtail flounder within the entire stock range. Such a situation, especially if it were to continue for a number of years might lead to WHAM being unable to converge due to lack of survey information. WHAM currently treats true zero surveys as missing information, although this could change in future updates to the model. For the Cape Cod-Gulf of Maine (CCGOM) stock, the WG is concerned that future catches may be so low due to a lack of market that WHAM is unable to find a stable magnitude for the population. Continued low catches while the surveys continue to increase make it challenging for any model to distinguish between a very large population with very light exploitation from a large population with light exploitation.

The WG considered a number of alternative backup assessment approaches, but decided to recommend approaches that could directly address their concerns for why WHAM might fail in the future. For the GB and SNEMA stocks, the WG recommends an approach called the

Limiter, with some modification for the SNEMA stock. For the CCGOM stock, the WG recommends an empirical approach using an exploitation rate defined as the fishery catch divided by the survey to derive catch advice. Both recommendations rely on expanded survey biomass using results from a recent chainsweep experiment. This calculation is described below, along with the details of the Limiter and empirical approach recommended for each stock. Biological reference points (BRPs) cannot be defined using the Limiter, but can be using the empirical approach, so are provided for the CCGOM stock as well.

Methods

Chainsweep Expanded Biomass

The Northeast Fisheries Science Center (NEFSC) conducts bottom trawl surveys from Maine to North Carolina twice a year using a stratified random design (Azarovitz 1981). The original vessel used for the bottom trawl survey, Albatross IV, was replaced in 2009 by the Henry B. Bigelow. This change in vessel was accompanied by a number of changes to the operating procedures, including the gear used, length of tow, and an increase in gear mensuration (Politis et al. 2014). Between 2015 and 2017, paired-gear experimental trawls were made using a twin-trawl vessel to compare a chainsweep with the standard roller gear of the bottom trawl survey (Miller et al. 2023). These studies allow the bottom trawl survey results for some species to be expanded to account for survey catchability of fish, such as yellowtail flounder, that might not be captured due to passing under the roller gear. Estimates of catchability at length and accounting for day/night differences are provided in Miller et al. (2023) and have since been updated to account for the footprint of each survey tow. The resulting metric tons of yellowtail flounder estimated by expanding the bottom trawl survey to account for the area of the surveys and the catchability of the roller gear are referred to as chainsweep expanded biomass (Figure 1 and Table 1).

To allow the most recent information to be used in assessments conducted during the summer/early fall, the NEFSC spring survey in year Y is combined with the NEFSC fall survey in year Y-1 (denoted offset). The calculation of the mean can either allow one of the surveys to be missing (denoted meannarmTRUE) or require both surveys to be present (denoted meannarm-FALSE). Although both surveys are standardized using the chainsweep experimental results, there can still be some difference in magnitude between the estimates of chainsweep expanded biomass between the two seasons. For this reason, the emphasis in this working paper will be on the approach that requires both surveys to be present when deriving values.

Limiter

The Limiter was developed for the GB stock of yellowtail flounder in the Transboundary Resources Assessment Committee (TRAC) and used by the Transboundary Management Guidance Committee (TMGC) to set the quota for this shared stock with Canada (TRAC 2023).

The Limiter uses the NEFSC spring and fall bottom trawl surveys along with the Department of Fisheries and Oceans (DFO) bottom trawl survey. The Limiter is based on the idea that the recent population is so low that the survey changes are tracking noise at a low level instead of actual population changes, so it uses a constant quota as long as the mean biomass from the three surveys falls between two limits. These limits were negotiated based on recent catch rates and concerns regarding the potential exploitation rate becoming too high if the full quota was in fact caught. Currently, the Limiter applied to the GB stock has a constant quota of 200 mt as long as the mean of the three surveys falls between 1,000 mt and 7,300-8,500 mt. In recent years, there have been missing surveys for a range of reasons, and a process was developed to handle such missing surveys. In 2023, the quota was reduced to account for the mean of the available surveys falling below the lower limit. In 2024, all three surveys were available and the mean was between the limits, so the quota was again set at 200 mt.

In this working paper, the DFO survey is not considered, and a modification of the Limiter is examined which removes the lower limit. This modification is made because of the recent catches of less than five yellowtail flounder in some surveys of the SNEMA stock indicating that true zeros may happen if the population continues to decline. The Limiter advice associated with true zero surveys would be zero quota, which would effectively shut down the stock area to groundfish fishing. Zero does not seem like a reasonable quota. Instead of adjusting the quota to a different level below the lower limit, this working paper proposes maintaining the constant catch advice even if the surveys are true zeros.

Empirical Approach

The empirical approach was first developed for GB yellowtail flounder in 2014 and was used until replaced by the Limiter (e.g., Legault and McCurdy 2018). This approach also uses the chainsweep expanded biomass from the NEFSC spring and fall bottom trawl surveys with the fall offset one year. Instead of using a constant catch advice, a constant exploitation rate is found from earlier years and applied to the recent expanded survey biomass, so that as the surveys rise or fall so does the catch advice. The exploitation rate is simply the catch in a year divided by the mean expanded survey biomass from the spring survey in that year and the fall survey from the previous year (Figure 2, Table 2). This computation ignores any differences between the survey and fishery selectivity, or any changes in the fishery selectivity over time. The challenge for this approach is determining an appropriate time period to calculate the mean exploitation rate. A stable and high or increasing period of biomass is desirable for the mean exploitation rate. Note that this approach is being recommended for the CCGOM stock because the stock appears to be in relatively good condition with little concern about true zero survey values. It is not recommended for GB or SNEMA stocks because of the potential for true zero surveys which would result in zero catch advice regardless of the mean exploitation rate.

Results/Application

GB and SNEMA

To set the upper limit for the Limiter for the GB and SNEMA stocks, the maximum value of the chainsweep expanded biomass since 2014 was calculated, 8789 and 7591 mt, respectively. Since the most recent values of both time series, 1777 and 63.5 mt, respectively, are well below these upper bounds, the constant catch advice would be used. The constant catch advice can be found from the maximum sustainable yield (MSY) of the most recently accepted WHAM run, 554 mt and 97 mt, respectively assuming the WG proposed formulations in this research track are approved. Since MSY is appropriate for stocks in good condition, the constant catch advice for the Limiter can be found from some multiple of MSY. For example, using half of MSY results in constant catch advice of 277 mt and 48.5 mt. Given that the current Limiter for GB uses constant catch advice of 200 mt, and the desire to prevent shutting down the entire SNEMA region to groundfish fishing, constant catch advice of 50 mt is recommended by the WG.

The Limiter does not allow for determination of biological reference points (BRPs) or status determination. However, the low stock sizes associated with the use of the Limiter when the chainsweep expanded biomass is below the upper limit are indicative of an overfished condition.

CCGOM

To calculate the mean exploitation rate for CCGOM, a stable period of years 2010-2022 is selected. This results in an exploitation rate of 0.029. The 2024 chainsweep expanded biomass is 16639 which means the catch advice is the product of the exploitation rate and current biomass, 477.7 mt.

Assuming 2010-2022 is a stable period for defining BRPs, the Bmsy proxy is 18123.125 mt and the Fmsy proxy is 0.029. Based on the 2022 values for CCGOM, 35420 mt of biomass and 0.0085545 exploitation rate, the stock is not overfished and overfishing is not occurring.

Is there a better period in the past to define the BRPs if the full Albatross and Bigelow calibrated time series is considered? Figure 3 does not appear to show a better period when the biomass was high and stable than the 2010-2022 period from the Bigelow time series. The survey units for the long time period are kg/tow instead of chainsweep expanded biomass because the Miller et al. (2023) study results cannot be applied to the Albatross IV time series. This results in exploitation rates that appear unusual.

Discussion

These backup plans are only for consideration when the main assessment approach, WHAM, is unable to converge in any formulation or is rejected by a peer review panel during a management track. The WG has provided these backup plans taking into consideration possible reasons why this might happen. There are also some reasons these backup approach might not work. The recommended approach for SNEMA (modified Limiter) might be rejected because it fails to prevent overfishing. Given the current low catches of this stock, well below the current and proposed quotas, the WG considers this an unlikely outcome. However, since the Limiter cannot provide reference points, it is a possibility even if it cannot be measured. Of more practical concern is that the approaches for all three stocks rely on the chainsweep expanded biomass values from NEFSC bottom trawl surveys. If the surveys are unable to be completed successfully in each region, the approaches could fail. Missing surveys are a different problem from true zero surveys. The true zero surveys would be problematic for the GB and CCGOM stock, but could be handled for the SNEMA stock, assuming the above question about overfishing is not raised. Finally, for the CCGOM stock, the selection of the stable period for determining BRPs could lead to incorrect advice. At the stakeholder meeting, the WG heard that there is currently not much of a market for yellowtail flounder. This had reduced effort even in the region where the fish are relatively abundant. If this has been happening for a while, the exploitation rate during the 2010-2022 might be artificially low relative to an actual Fmsy exploitation rate. The WG examined the recent time series and noted that only the 2022 values of exploitation and biomass are different from the rest of the time series. Removing the 2022 values would increase the mean exploitation rate and reduce the mean biomass, but only slightly. These changes were not considered significant by the WG.

Conclusions and Recommendation

For the GB stock, the WG recommends reverting to the currently accepted Limiter as the backup assessment approach. The current Limiter approach is the result of many years of negotiations and is already in use. It also uses the DFO survey, has agreed bounds of 1,000 to 7,300-8,500 mt, has a negotiated constant catch of 200 mt, and has a pre-defined process for dealing with missing surveys.

For the SNEMA stock, the WG recommends using a modified Limiter as the backup assessment approach. The modification is to not use a lower limit. The other settings for the Limiter are an upper limit of the maximum chainsweep expanded biomass since 2014 and the constant catch advice of 50 mt (approximately half of MSY from the proposed WHAM model).

For the CCGOM stock, the WG recommends an empirical approach as the backup assessment approach. The empirical approach uses 2010-2022 as the stable period for exploitation rate calculation and BRPs.

For all three stocks, the WG recommends that if a backup approach does become necessary in the future that WHAM continue to be applied as best it can as an informational assessment for comparison and context. This approach was demonstrated in the 2024 witch flounder assessment where an empirical approach was used for catch advice but an informational age-structured assessment program (ASAP) model was also provided for comparison and context.

References

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Figures

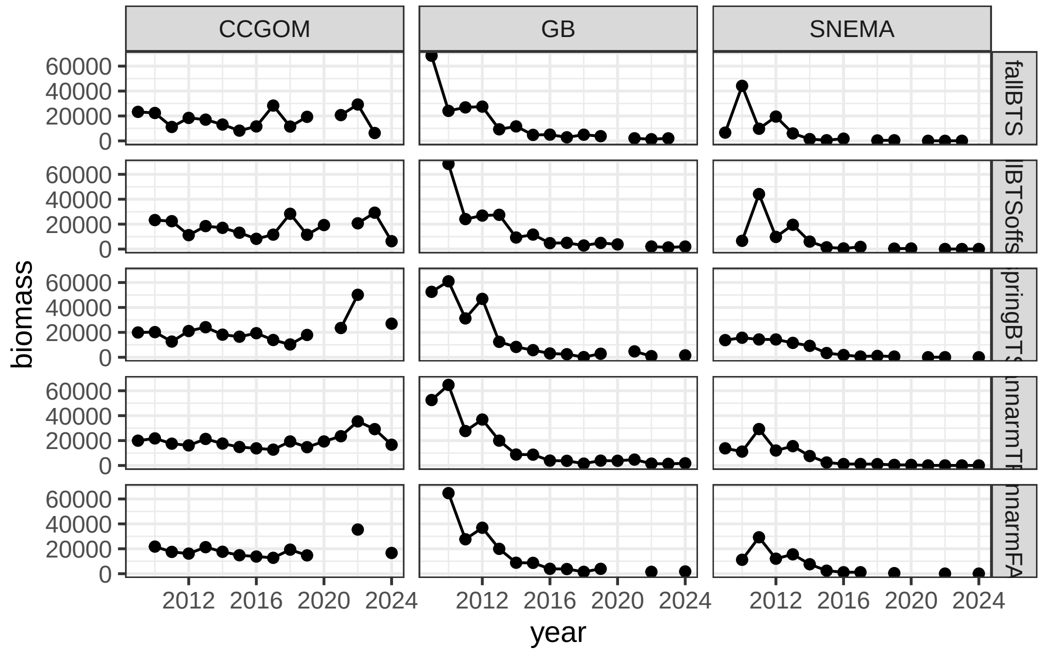

Figure 1: Chainsweep expanded biomass for the three yellowtail flounder stocks (columns) for the fall bottom trawl survey (BTS), fall BTS offset one year, spring BTS, mean with either survey available (meannarmTRUE), mean requiring both surveys (meannarm-FALSE).

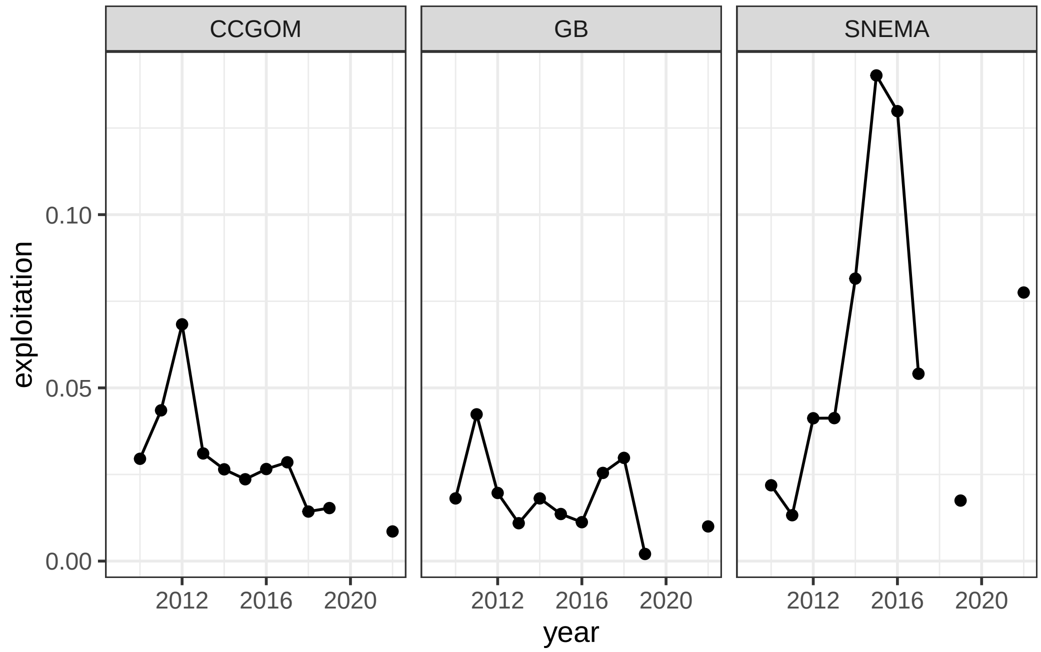

Figure 2: Exploitation rate (catch/survey) for the three yellowtail flounder stocks.

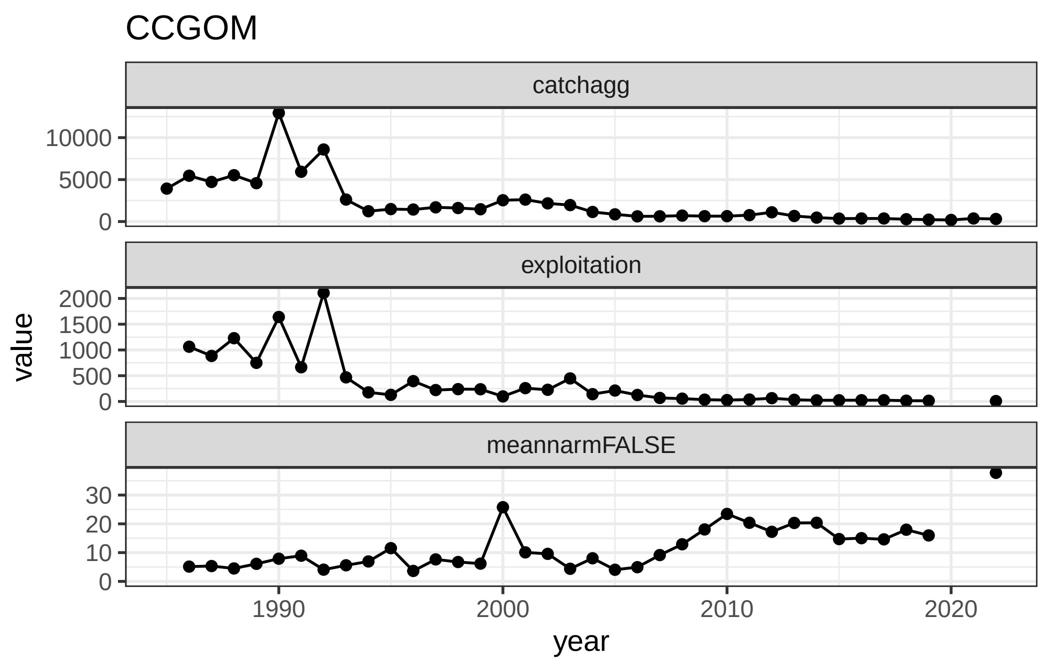

Figure 3: Long time series of catch, survey, and exploitation rate (catch/survey) for consideration in empirical approach applied for Cape Cod-Gulf of Maine yellowtail flounder.

Tables

Table 1: Chainsweep expanded biomass data for the three yellowtail flounder stocks.

stock	year	fallBTS	fallBTSoffset	springBTS	meannarmTRUE	meannarmFALSE
CCGOM	2009	23283	NA	19909	19909.0	NA
CCGOM	2010	22387	23283	20205	21744.0	21744.0
CCGOM	2011	11174	22387	12596	17491.5	17491.5
CCGOM	2012	18449	11174	21078	16126.0	16126.0
CCGOM	2013	17037	18449	24165	21307.0	21307.0
CCGOM	2014	13122	17037	18152	17594.5	17594.5
CCGOM	2015	8217	13122	16520	14821.0	14821.0
CCGOM	2016	11597	8217	19334	13775.5	13775.5
CCGOM	2017	28327	11597	13861	12729.0	12729.0
CCGOM	2018	11481	28327	10286	19306.5	19306.5
CCGOM	2019	19301	11481	17918	14699.5	14699.5
CCGOM	2020	NA	19301	NA	19301.0	NA
CCGOM	2021	20692	NA	23499	23499.0	NA
CCGOM	2022	29196	20692	50148	35420.0	35420.0
CCGOM	2023	6317	29196	NA	29196.0	NA
CCGOM	2024	NA	6317	26961	16639.0	16639.0
GB	2009	68346	NA	52538	52538.0	NA
GB	2010	24079	68346	61012	64679.0	64679.0
GB	2011	26887	24079	31211	27645.0	27645.0
GB	2012	27491	26887	46879	36883.0	36883.0
GB	2013	9282	27491	12387	19939.0	19939.0
GB	2014	11625	9282	8296	8789.0	8789.0
GB	2015	4784	11625	5741	8683.0	8683.0
GB	2016	4992	4784	3052	3918.0	3918.0
GB	2017	2870	4992	2473	3732.5	3732.5
GB	2018	4936	2870	151	1510.5	1510.5
GB	2019	3773	4936	2852	3894.0	3894.0
GB	2020	NA	3773	NA	3773.0	NA
GB	2021	2070	NA	4725	4725.0	NA
GB	2022	1327	2070	929	1499.5	1499.5
GB	2023	2018	1327	NA	1327.0	NA
GB	2024	NA	2018	1536	1777.0	1777.0
SNEMA	2009	6615	NA	13768	13768.0	NA
SNEMA	2010	44148	6615	15692	11153.5	11153.5
SNEMA	2011	9743	44148	14316	29232.0	29232.0
SNEMA	2012	19498	9743	14316	12029.5	12029.5
SNEMA	2013	5996	19498	11566	15532.0	15532.0

stock	year	fallBTS	fallBTSoffset	springBTS	meannarmTRUE	meannarmFALSE
SNEMA	2014	1430	5996	9186	7591.0	7591.0
SNEMA	2015	510	1430	3392	2411.0	2411.0
SNEMA	2016	1769	510	1800	1155.0	1155.0
SNEMA	2017	NA	1769	598	1183.5	1183.5
SNEMA	2018	360	NA	1093	1093.0	NA
SNEMA	2019	481	360	556	458.0	458.0
SNEMA	2020	NA	481	NA	481.0	NA
SNEMA	2021	63	NA	70	70.0	NA
SNEMA	2022	47	63	66	64.5	64.5
SNEMA	2023	79	47	NA	47.0	NA
SNEMA	2024	NA	79	48	63.5	63.5

Table 2: Exploitation rate (catch/survey) data for the three yellowtail flounder stocks.

stock	year	catchagg	meannarmFALSE	exploitation
CCGOM	2009	641	NA	NA
CCGOM	2010	642	21744.0	0.0295254
CCGOM	2011	761	17491.5	0.0435068
CCGOM	2012	1102	16126.0	0.0683368
CCGOM	2013	662	21307.0	0.0310696
CCGOM	2014	466	17594.5	0.0264855
CCGOM	2015	350	14821.0	0.0236151
CCGOM	2016	366	13775.5	0.0265689
CCGOM	2017	363	12729.0	0.0285176
CCGOM	2018	276	19306.5	0.0142957
CCGOM	2019	225	14699.5	0.0153066
CCGOM	2020	190	NA	NA
CCGOM	2021	364	NA	NA
CCGOM	2022	303	35420.0	0.0085545
GB	2009	1806	NA	NA
GB	2010	1170	64679.0	0.0180893
GB	2011	1171	27645.0	0.0423585
GB	2012	725	36883.0	0.0196568
GB	2013	218	19939.0	0.0109333
GB	2014	159	8789.0	0.0180908
GB	2015	118	8683.0	0.0135898
GB	2016	44	3918.0	0.0112302
GB	2017	95	3732.5	0.0254521
GB	2018	45	1510.5	0.0297915
GB	2019	8	3894.0	0.0020544
GB	2020	68	NA	NA
GB	2021	51	NA	NA
GB	2022	15	1499.5	0.0100033
SNEMA	2009	424	NA	NA
SNEMA	2010	244	11153.5	0.0218765
SNEMA	2011	387	29232.0	0.0132389
SNEMA	2012	496	12029.5	0.0412320
SNEMA	2013	641	15532.0	0.0412696
SNEMA	2014	619	7591.0	0.0815439
SNEMA	2015	338	2411.0	0.1401908
SNEMA	2016	150	1155.0	0.1298701
SNEMA	2017	64	1183.5	0.0540769
SNEMA	2018	18	NA	NA
SNEMA	2019	8	458.0	0.0174672

stock	year	catchagg	meannarmFALSE	exploitation
SNEMA	2020	7	NA	NA
SNEMA	2021	5	NA	NA
SNEMA	2022	5	64.5	0.0775194