New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
John F. Quinn, J.D., Ph.D., *Chairman* | Thomas A. Nies, *Executive Director*

MEMORANDUM

DATE: August 13, 2018

TO: Scientific and Statistical Committee (SSC)

CC: Groundfish Committee

FROM: Groundfish Plan Development Team (PDT)

SUBJECT: **Rebuilding strategies for several groundfish stocks**

The Groundfish Plan Development Team (PDT) met on July 31, 2018 in Gloucester, MA and again by webinar on August 7, 2018 and discussed **rebuilding strategies for several groundfish stocks.**

Information reviewed included:

- 2017 Groundfish Operational Update Reports for ocean pout, GB winter flounder, witch flounder, Northern windowpane flounder, and SNE/MA yellowtail flounder (NEFSC, 2017).
- Revisions to the National Standard 1 Guidelines for the Magnuson-Stevens Fishery Conservation and Management Act (NOAA, 2016)
- 2014 National Academy of Sciences Report on *Evaluating the Effectiveness of Fish Stock Rebuilding Plans in the United States*.
- Memo from Groundfish PDT to SSC re Groundfish ABCs and rebuilding plans (August 9, 2013).
- American Plaice and Gulf of Maine Cod Rebuilding Strategies (September 3, 2013 Memo from SSC to Tom Nies).

1. Overview

A 2018 Council priority states: *revise rebuilding plans as needed*. In an August 31, 2017 letter from GARFO to NEFMC[1], several stocks were identified as making inadequate progress toward rebuilding following the 2015/2016 stock assessments: ocean pout, Georges Bank (GB) winter flounder, witch flounder, Northern windowpane flounder, and Southern New England/Mid-

[1] Available at: https://s3.amazonaws.com/nefmc.org/A8_170831_Bullard-to-Quinn_Groundfish-Inadequate-Rebuilding-Progress.pdf

Atlantic (SNE/MA) yellowtail flounder. The letter explains that the Council must implement a new or revised rebuilding plan for these stocks within 2 years of the date of notice (i.e., by August 31, 2019).

***Stocks with projections*:**
The PDT constructed rebuilding plan options for stocks with projections (GB winter flounder and SNE/MA yellowtail flounder) building off the approach outlined in Framework Adjustment 51 (i.e., Gulf of Maine (GOM) cod and American plaice rebuilding plans) and revised National Standard 1 guidelines. Revisiting changes to the ABCs from 2019 to 2020 is not warranted for the development of the new rebuilding plans, since these ABCs were set with the most recent assessments in 2017.

Similar to the Framework 51 rebuilding schedules, the PDT decided to base all rebuilding plans on a 50% probability of success to help avoid confusion between rebuilding timelines, probability of rebuilding, and the interaction with the ABC uncertainty buffer (i.e., 75%F_{MSY} or the constant harvest buffers). For example, reducing the rebuilding timeline is equivalent to increasing the probability of rebuilding by a certain date.

A. Minimum time for rebuilding a stock (T_{min}).

The National Standard 1 guidelines state:

> *T_{min} means the amount of time the stock or stock complex is expected to take to rebuild to its MSY biomass level in the absence of any fishing mortality. In this context, the term "expected" means to have at least a 50 percent probability of attaining the B_{MSY}, where such probabilities can be calculated. The starting year for the T_{min} calculation should be the first year that the rebuilding plan is expected to be implemented.*

To determine T_{min}, rebuilding projections were developed for each stock assuming F=0 beginning in 2021, with a 50% probability of achieving B_{MSY}. The rebuilding plan should be initiated in 2019 and therefore January 1, 2020 will be the first year for both stocks. T_{min} for both GB winter flounder and SNE/MA yellowtail flounder is 3 years, rebuilding by 2022 (see Attachment 2).

B. Maximum time for rebuilding a stock to its B_{MSY} (T_{max}).

The National Standard 1 guidelines state:

> *If T_{min} for the stock or stock complex is 10 years or less, then the maximum time allowable for rebuilding (T_{max}) that stock to its B_{msy} is 10 years.*

T_{min} for both stocks is less than 10 years. Therefore, T_{max} was defined as 10 years for GB winter flounder and SNE/MA yellowtail flounder.

C. Target time for rebuilding a stock (T_{target})

The National Standard 1 guidelines state:

> *T_{target} is the specified time period for rebuilding a stock that is considered to be as short a time as possible, taking into account the factors described in paragraph (j)(3)(i) of this section. T_{target} shall not exceed T_{max}, and the fishing mortality associated with achieving T_{target} is referred to as $F_{rebuild}$.*

The factors include:

The status and biology of any overfished stock, the needs of fishing communities, recommendations by international organizations in which the U.S. participates, and interaction of the stock within the marine ecosystem. In addition, the time period shall not exceed 10 years, except where biology of the stock, other environmental conditions, or management measures under an international agreement to which the U.S. participates, dictate otherwise.

To examine possible T_{target} and $F_{rebuild}$ options, rebuilding projections were developed across a range of fishing mortality rates including $25\%F_{MSY}$, $50\%F_{MSY}$, $75\%F_{MSY}$, and F_{MSY}. In addition, a 6-year rebuilding plan option was examined for SNE/MA yellowtail flounder and GB winter flounder, with a 50% probability of achieving B_{MSY}, based on consideration of the needs of the fishery and uncertainty associated with the long-term projections, which experience has shown tend to be overly optimistic.

Projections suggest GB winter flounder and SNE/MA yellowtail flounder will rebuild within 10 years. Therefore, a T_{max} of 10 years with a 50% probability of achieving B_{MSY} was developed as one T_{target} rebuilding option. The basis for setting $T_{max} = T_{target}$ is that recruitment may not increase as assumed in the projections. Recent recruitment estimates for both stocks have been relatively low, which will make the T_{target} projections overly optimistic.

The National Standard 1 guidelines state:

(v) While a stock or stock complex is rebuilding, revising rebuilding timeframes (i.e., T_{target} and T_{max}) or $F_{rebuild}$ is not necessary, unless the Secretary finds that adequate progress is not being made.
(vi) A stock or stock complex has not rebuilt by T_{max}, then the fishing mortality rate should be maintained at its current $F_{rebuild}$ or 75 percent of the MFMT, whichever is less, until the stock or stock complex is rebuilt or the fishing mortality rate is changed as a result of the Secretary finding that adequate progress is not being made.

Therefore, $F_{rebuild}$ would be established with the rebuilding plan, and it is not necessary to re-estimate $F_{rebuild}$ when new ABCs are determined through future assessments. The PDT suggests the SSC may want to discuss how this guideline interacts with the ABC control rule, at a future meeting. For this SSC meeting, the PDT would like feedback from the SSC on if $F_{rebuild}$ established with the rebuilding plan should be considered as an approach or a specific value (e.g., $50\%F_{MSY}$ or 0.261).

***Stocks without projections*:**
Three stocks, (ocean pout, witch flounder, and Northern windowpane flounder) of the five stocks requiring new or revised rebuilding plans do not have a projection model. Therefore, T_{min} when F=0 is undefined and thus, T_{min} could be less than or greater than 10 years. Without T_{min}, no direct methods for estimating T_{max} are available.

The National Standard 1 guidelines state:

If T_{min} for the stock or stock complex exceeds 10 years, then one of the following methods can be used to determine T_{max}:

(i) T_{min} plus the length of time associated with one generation time for that stock or stock complex. "Generation time" is the average length of time between when an individual is born and the birth of its offspring.,

(ii) The amount of time the stock or stock complex is expected to take to rebuild to B_{MSY} if fished at 75 percent of MFMT, or

(iii) T_{min} multiplied by two.

In situations where T_{min} exceeds 10 years, T_{max} establishes a maximum time for rebuilding that is linked to the biology of the stock. When selecting a method for determining T_{max}, a Council, in consultation with its SSC, should consider the relevant biological data and scientific uncertainty of that data, and must provide a rationale for its decision based on the best scientific information available. One of the methods listed in subparagraphs (j)(3)(i)(B)(2)(ii) and (iii) may be appropriate, for example, if given data availability and the life history characteristics of the stock, there is high uncertainty in the estimate of generation time, or if generation time does not accurately reflect the productivity of the stock.

Although other factors could be considered when developing rebuilding plans for these stocks including setting T_{target} to greater than 10 years, data is limited. For ocean pout and Northern windowpane flounder[2], no aging data is currently available. Therefore, an evaluation of mean generation time for these two stocks is not possible. Ocean pout has not responded to low catches, despite low relative F, indicating a T_{target} of 10 years may be too short. Recently, overfishing ended on Northern windowpane flounder which may suggest a positive sign for the stock toward becoming not overfished, indicating a T_{target} of 10 years may be appropriate. An examination of the yield-per-recruit analysis from the 2015 assessment of witch flounder suggests a mean generation time of 9 years, when F=0. Witch flounder are long-lived species, and a T_{target} of 10 years may be too short given their life history. However, in the previously developed witch flounder rebuilding plan the stock was able to rebuild according to the projections. In addition, there were signs of a relatively large incoming year class (2013) in multiple surveys which could indicate rebuilding is possible for this stock. Additional considerations by stock are summarized under the *Results* section.

In the absence of projections, the PDT developed one option for each stock with a T_{target} of 10 years. By comparison, for stocks with projections under the groundfish control rule, most stocks would be expected to rebuild in 10 years when fishing at 75%F_{MSY}. Although for these stocks, rebuilding was not achieved as previously planned despite application of the control rule. The PDT would like feedback from the SSC on possible approaches and basis to extend the T_{target} beyond 10 years for these stocks or whether it is more appropriate to have an undefined rebuilding date (e.g., like the wolffish stock).

2. Stocks with projections

a. Georges Bank Winter Flounder

Recent assessment

Based on the 2017 peer review, GB winter flounder was not overfished, and overfishing was not occurring. A retrospective adjustment was applied to the terminal year (2016) estimates of F and SSB in the assessment. The rho adjusted estimate of SSB in 2016 was 3,946mt, while SSB_{MSY} is 7,600mt. GB winter flounder is in a rebuilding plan with a rebuild by date of 2017 with a 75% probability of achieving SSB_{MSY}. Projections at the time of the assessment indicated that the

[2] Ageing of Northern windowpane flounder is presently underway at the NEFSC, but the work has not been peer reviewed.

stock could not rebuild by 2017 with F=0. A revised rebuilding plan is needed. Biological reference points were defined as F_{MSY} = 0.522 and SSB_{MSY} = 7,600 mt in the 2017 operational assessments.

Projection assumptions
The 2017 bridge year catch assumption was updated and estimated at 437 mt (392 mt US estimate + 45 mt assumed Canadian catch) (Attachment 1). ACL catch (787 mt) plus the Canadian catch assumption (45 mt) was assumed from 2018 to 2020 (832 mt in each year). Recruitment within the projections are based on a stock recruit relationship.

Results
Option 1/No Action- previously thought to rebuild by 2017 - Fishing mortality will target rebuilding of the stock with a 75 percent probability of success by 2017, according to Amendment 16 calculations. Amendment 16 implemented the rebuilding plan.

Option 2- T_{target} is *less than 10 years (prior to 2029)*- GB winter flounder could rebuild in less than 10 years (Attachment 2, Figure 1).

- Option 2a: T_{target} of 3 years, rebuilding by 2022, at $F_{rebuild}$ of 25%F_{MSY} = 0.131, with a 55 percent probability of achieving B_{MSY}.
- Option 2b: T_{target} of 4 years, rebuilding by 2023, at $F_{rebuild}$ of 50%F_{MSY} = 0.261, with a 59 percent probability of achieving B_{MSY}.
- Option 2c: T_{target} of 5 years, rebuilding by 2024, at $F_{rebuild}$ of 75%F_{MSY} = 0.392, with a 53 percent probability of achieving B_{MSY}.
- Option 2d: T_{target} of 6 years, rebuilding by 2025, at $F_{rebuild}$ of 0.45, with a 50 percent probability of achieving B_{MSY}.

Option 3 - $T_{target} = T_{max}$, which is *10 years (2029)*- $F_{rebuild}$ (0.5) was estimated to be below F_{MSY} (0.52), but above $F_{75\%MSY}$ (0.392), with the maximum 10-year rebuilding plan (Attachment 2, Figure 1).

b. Southern New England/Mid-Atlantic Yellowtail Flounder

Recent assessment
Based on the 2017 peer review, SNE/MA yellowtail flounder was overfished, and overfishing was occurring in 2016. A retrospective adjustment was applied to the terminal year (2016) estimates of F and SSB in the assessment. The rho adjusted estimate of SSB in 2016 was 157mt, while the SSB_{MSY} proxy is 1,987mt. The stock is not currently in a rebuilding plan, because it was considered rebuilt as of 2011. A new rebuilding plan needs to be developed. Biological reference points were defined as F_{MSY} = 0.341 and SSB_{MSY} = 1,860 mt in the 2017 operational assessments.

Projection assumptions
The 2017 bridge year catch assumption was updated and estimated at 64 mt. ACL catch was assumed from 2018 to 2020 (2018 ACL = 65 mt, 2019 ACL= 66 mt, 2020 ACL = 66 mt) (Attachment 1). Recruitment was based on recent estimates of recruitments from the model time

series (i.e. corresponding to year classes 1990 through 2015) to reflect the low recent pattern of recruitment in the stock.

Results

Option 1/No Action- previously thought to rebuild by 2014 and rebuilt as of 2011 – The rebuilding program was developed to rebuild the stock with a median (50 percent) probability by 2014. Amendment 13 implemented the rebuilding plan.

Option 2- T_{target} is *less than 10 years (prior to 2029)*- SNE/MA yellowtail flounder could rebuild in less than 10 years (Attachment 2, Figure 2).

- Option 2a: T_{target} of 3 years, rebuilding by 2022, at $F_{rebuild}$ of 25%F_{MSY} = 0.085 , with a 58 percent probability of achieving B_{MSY}.
- Option 2b: T_{target} of 3 years, rebuilding by 2022, at $F_{rebuild}$ of 50%F_{MSY} = 0.171 , with a 51 percent probability of achieving B_{MSY}.
- Option 2c: T_{target} of 4 years, rebuilding by 2023, at $F_{rebuild}$ of 75%F_{MSY} = 0.256, with a 59 percent probability of achieving B_{MSY}.
- Option 2d: T_{target} of 6 years, rebuilding by 2025, at $F_{rebuild}$ above F_{MSY} (therefore this was not shown here).

Option 3 – $T_{target} = T_{max}$, which is *10 years (2029)*- Projections suggest that the stock can rebuild in five years (2024) at F_{MSY}. The 10-year option might still be justified based on concerns that recruitment may not increase quickly to the average as assumed in the rebuilding projections (Attachment 2, Figure 2).

3. Stocks without projections

a. Witch Flounder

Recent assessment

Based on the 2017 peer review, witch flounder was overfished, and overfishing was unknown in 2016. Witch flounder is in a rebuilding plan with a rebuild by date of 2017, but projections are not possible with the current empirical model formulation. A revised rebuilding plan is needed. However, F_{MSY} and SSB_{MSY} or B_{MSY} are undefined. Determination of when the stock rebuilds will be difficult to assess.

Results

Option 1/No Action- previously thought to rebuild by 2017 - Fishing mortality targeted rebuilding of the stock with a 75 percent probability of success by 2017, based on Amendment 16 calculations. Amendment 16 implemented the rebuilding plan.

Option 2 - T_{target} is *10 years (2029)*- No projections are available for this stock. Therefore, the maximum 10-year rebuilding plan was developed.

b. Northern Windowpane Flounder

Recent assessment

Based on the 2017 peer review, northern windowpane flounder was overfished but overfishing was not occurring in 2016. Northern windowpane flounder is in a rebuilding plan, which was intended to rebuild by 2017, and in 2016 biomass was at 17% of the B_{MSY} target. The relationship between the catch and the survey index appears to be worsening in the 2017 operational model. Catch projections are not acceptable for this stock. A revised rebuilding plan is needed. Biological reference points were defined as F_{MSY} proxy = 0.34 and B_{MSY} proxy = 2.06 kg/tow in the 2017 operational assessments.

Results

Option 1/No Action - previously expected to rebuild by 2017 - The goal was to rebuild this stock by 2017. No probability was associated with this goal since it was an index-based stock and the projection methodology was deterministic. In addition, the Council did not identify a specific rebuilding mortality target because the GARM III panel concluded that given the high uncertainty of index-based assessments, it was not appropriate to calculate $F_{rebuild}$ for this stock. Amendment 16 implemented the rebuilding plan.

Option 2 - T_{target} is *10 years (2029).* No projections are available for this stock. Therefore, the maximum 10-year rebuilding plan was developed.

c. Ocean Pout

Recent assessment

Based on the 2017 peer review, ocean pout was overfished but overfishing was not occurring in 2016. Ocean pout is in a rebuilding plan but did not rebuild by 2014 as planned. In 2016, biomass was at 5% of the B_{MSY} target. Catch projections are not possible for this stock. A revised rebuilding plan is needed. Low fishing morality and reductions in catch over time have not resulted in a response in this stock. Productivity appears to be low. Similar trends were also seen in the wolffish stock, and rebuilding was undefined for wolffish. The PDT questions whether a similar undefined determination can be made for ocean pout. Biological reference points were defined as $F_{MSY\ proxy}$ = 0.76 and $B_{MSY\ proxy}$ = 4.94 kg/tow in the 2017 operational assessments.

Results

Option 1/No Action- rebuild by 2014 – The rebuilding program was developed to rebuild the stock with a median (50 percent) probability by 2014. Amendment 13 implemented the rebuilding plan.

Option 2 - T_{target} is *10 years (2029)*- No projections are available for this stock. Therefore, the maximum 10-year rebuilding plan was developed.

Attachment 1:
Updated calendar year 2017 bridge year catch estimates for GB winter flounder and SNE/MA yellowtail flounder.

Estimated CY 2017 NE Multispecies Catch (mt)

	ACLs and sub-ACLs; (with accountability measures (AMs))								sub-components: No AMs	
Stock	**Total Groundfish**	Groundfish*	Commercial Landings	Commercial Discard	Recreational	Herring Fishery	Scallop Fishery	Small Mesh Fisheries	State Water	Other
	A to G	A+B+C	A	B	C	D	E		F	G
GB Winter	391.8	378.9	377.7	1.2					NA	12.8
SNE Yellowtail	63.6	48.5	46.6	1.8			4.4		2.4	8.3

Values in live weight

*Includes estimate of missing dealer reports

Source: NMFS Greater Atlantic Regional Office

July 10, 2018

These data are the best available to NOAA's National Marine Fisheries Service (NMFS). Data sources for this report include: (1) Vessels via VMS; (2) Vessels via vessel logbook reports; (3) Dealers via Dealer Electronic reporting. Differences with previous reports are due to corrections made to the database.

Commercial groundfish and scallop fishery: Based on FY16 and FY17 DMIS data as of June 23, 2018.

Other Subcomponent: Based on final FY16 DMIS data and preliminary FY17 DMIS data run May 17, 2018.

State Water: Landings based on FY16 and FY17 DMIS data as of June 23, 2018 and apportioned using Mass harvester data as of July 6, 2018. Discards estimated by proportioning up FY16 estimated discards by the CY17/FY16 landings ratio..

Attachment 2: Rebuilding Plan Analysis Results

Tables

Table 1- Summary of GB winter flounder fishing mortality (top panel), catch (middle panel), and SSB (bottom panel) trends for F=0, 25%FMSY, 50%FMSY, 75%FMSY, and FMSY projections. T_{target} projections for 6 and 10-year options. Preliminary year-end catch estimates for the bridge year (2017), were used in the projections, and the catch from 2018-2020 was assumed to be equal to the ACL.

Fishing Mortality

Description	rebuilding clock	year	T-min F=0	25%Fmsy	50%Fmsy	75%Fmsy	6 year	10 year	Fmsy
bridge yr		2017	0.152	0.152	0.152	0.152	0.152	0.152	0.152
acl		2018	0.361	0.361	0.361	0.361	0.361	0.361	0.361
acl	0	2019	0.332	0.332	0.332	0.332	0.332	0.332	0.332
acl	1	2020	0.216	0.216	0.216	0.216	0.216	0.216	0.216
yr 2	2	2021	0.000	0.131	0.261	0.392	0.45	0.503	0.522
yr 3	3	2022	0.000	0.131	0.261	0.392	0.45	0.503	0.522
yr 4	4	2023	0.000	0.131	0.261	0.392	0.45	0.503	0.522
yr 5	5	2024	0.000	0.131	0.261	0.392	0.45	0.503	0.522
yr 6	6	2025	0.000	0.131	0.261	0.392	0.45	0.503	0.522
yr 7	7	2026	0.000	0.131	0.261	0.392	0.45	0.503	0.522
yr 8	8	2027	0.000	0.131	0.261	0.392	0.45	0.503	0.522
yr 9	9	2028	0.000	0.131	0.261	0.392	0.45	0.503	0.522
yr 10	10	2029	0.000	0.131	0.261	0.392	0.45	0.503	0.522

Total Catch

Description	rebuilding clock	year	T-min F=0	25%Fmsy	50%Fmsy	75%Fmsy	6 year	10 year	Fmsy
bridge yr		2017	437	437	437	437	437	437	437
acl		2018	832	832	832	832	832	832	832
acl	0	2019	832	832	832	832	832	832	832
acl	1	2020	832	832	832	832	832	832	832
yr 2	2	2021	0	755	1,434	2,046	2,305	2,528	2,600
yr 3	3	2022	0	994	1,744	2,304	2,520	2,684	2,725
yr 4	4	2023	0	1,219	2,019	2,543	2,735	2,866	2,884
yr 5	5	2024	0	1,431	2,274	2,776	2,928	3,033	3,065
yr 6	6	2025	0	1,611	2,479	2,949	3,071	3,156	3,193
yr 7	7	2026	0	1,757	2,635	3,089	3,193	3,259	3,292
yr 8	8	2027	0	1,887	2,778	3,187	3,283	3,345	3,357
yr 9	9	2028	0	1,981	2,871	3,257	3,343	3,388	3,400
yr 10	10	2029	0	2,053	2,926	3,305	3,369	3,413	3,436

SSB

Description	rebuilding clock	year	T-min F=0	25%Fmsy	50%Fmsy	75%Fmsy	6 year	10 year	Fmsy	SSBmsy
bridge yr		2017	3,064	3,064	3,064	3,064	3,064	3,064	3,064	7,600
acl		2018	2,574	2,574	2,574	2,574	2,574	2,574	2,574	7,600
acl	0	2019	2,705	2,706	2,706	2,705	2,706	2,706	2,705	7,600
acl	1	2020	4,165	4,165	4,165	4,165	4,165	4,165	4,165	7,600
yr 2	2	2021	6,225	6,089	5,925	5,742	5,695	5,631	5,590	7,600
yr 3	3	2022	8,884	7,991	7,193	6,460	6,203	5,958	5,842	7,600
yr 4	4	2023	11,593	9,800	8,351	7,137	6,724	6,342	6,189	7,600
yr 5	5	2024	14,402	11,575	9,443	7,817	7,232	6,756	6,594	7,600
yr 6	6	2025	16,980	13,073	10,307	8,304	7,604	7,042	6,868	7,600
yr 7	7	2026	19,287	14,267	10,948	8,700	7,890	7,267	7,083	7,600
yr 8	8	2027	21,285	15,319	11,551	8,989	8,139	7,458	7,229	7,600
yr 9	9	2028	22,966	16,122	11,934	9,185	8,277	7,558	7,326	7,600
yr 10	10	2029	24,353	16,730	12,199	9,334	8,351	7,609	7,403	7,600

Table 2 - Summary of SNE/MA yellowtail flounder fishing mortality (top panel), catch (middle panel), and SSB (bottom panel) trends for F=0, 25%FMSY, 50%FMSY, 75%FMSY, and FMSY projections. Preliminary year-end catch estimates for the bridge year (2017), were used in the projections, and the catch from 2018-2020 was assumed to be equal to the ACL.

Fishing Mortality

Description	rebuilding clock	year	Tmin F=0	25%Fmsy	50%Fmsy	75%Fmsy	Fmsy
bridge yr		2017	0.357	0.357	0.357	0.357	0.357
acl		2018	0.451	0.451	0.451	0.451	0.451
acl	0	2019	0.27	0.27	0.27	0.27	0.27
acl	1	2020	0.113	0.113	0.113	0.113	0.113
yr 2	2	2021	0	0.085	0.171	0.256	0.341
yr 3	3	2022	0	0.085	0.171	0.256	0.341
yr 4	4	2023	0	0.085	0.171	0.256	0.341
yr 5	5	2024	0	0.085	0.171	0.256	0.341
yr 6	6	2025	0	0.085	0.171	0.256	0.341
yr 7	7	2026	0	0.085	0.171	0.256	0.341
yr 8	8	2027	0	0.085	0.171	0.256	0.341
yr 9	9	2028	0	0.085	0.171	0.256	0.341
yr 10	10	2029	0	0.085	0.171	0.256	0.341

Total Catch

Description	rebuilding clock	year	T-min F=0	25%Fmsy	50%Fmsy	75%Fmsy	Fmsy
bridge yr		2017	64	64	64	64	64
acl		2018	65	65	65	65	65
acl	0	2019	66	66	66	66	66
acl	1	2020	66	66	66	66	66
yr 2	2	2021	0	96	187	271	351
yr 3	3	2022	0	136	253	351	433
yr 4	4	2023	0	173	308	409	486
yr 5	5	2024	0	200	344	444	514
yr 6	6	2025	0	220	368	464	529
yr 7	7	2026	0	235	384	477	537
yr 8	8	2027	0	245	394	484	541
yr 9	9	2028	0	252	400	488	543
yr 10	10	2029	0	257	405	491	545

SSB

Description	rebuilding clock	year	T-min F=0	25%Fmsy	50%Fmsy	75%Fmsy	Fmsy	SSBmsy
bridge yr		2017	200	200	200	200	200	
acl		2018	164	164	164	164	164	
acl	0	2019	411	411	411	411	411	1,860
acl	1	2020	957	957	957	957	957	1,860
yr 2	2	2021	1,556	1,520	1,484	1,449	1,416	1,860
yr 3	3	2022	2,149	2,005	1,874	1,754	1,645	1,860
yr 4	4	2023	2,733	2,450	2,204	1,996	1,815	1,860
yr 5	5	2024	3,213	2,775	2,420	2,134	1,895	1,860
yr 6	6	2025	3,588	3,011	2,559	2,207	1,933	1,860
yr 7	7	2026	3,891	3,191	2,661	2,267	1,965	1,860
yr 8	8	2027	4,125	3,307	2,718	2,296	1,978	1,860
yr 9	9	2028	4,306	3,390	2,751	2,305	1,971	1,860
yr 10	10	2029	4,459	3,456	2,786	2,317	1,981	1,860

Figures

Figure 1- GB winter flounder fishing mortality (top panel), catch (middle panel), and SSB (bottom panel) trends for F=0, 25%FMSY, 50%FMSY, 75%FMSY, and FMSY projections. T_{target} projections for 6 and 10-year options. Preliminary year-end catch estimates for the bridge year (2017), were used in the projections, and the catch from 2018-2020 was assumed to be equal to the ACL.

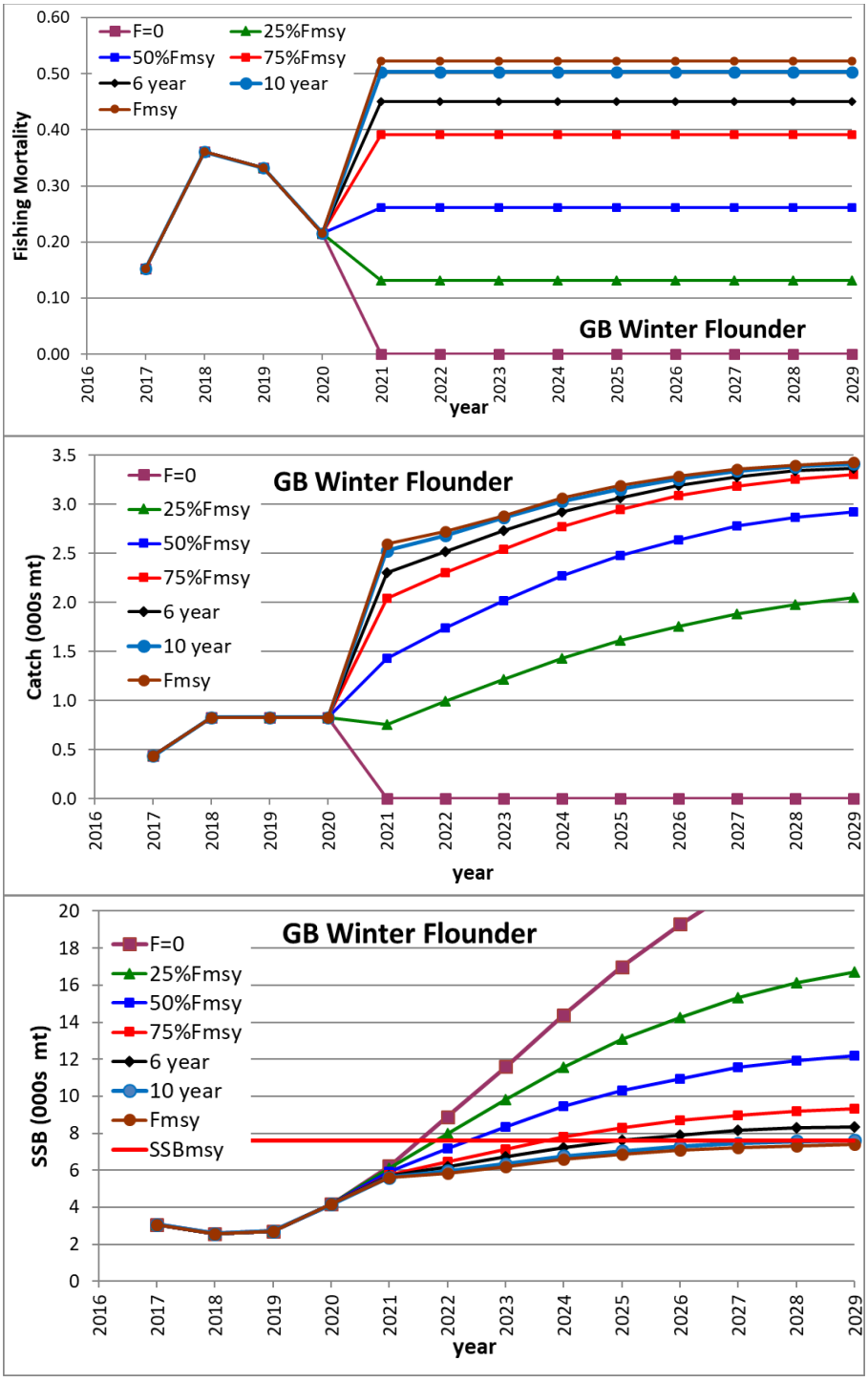

Figure 2- SNE/MA yellowtail flounder fishing mortality (top panel), catch (middle panel), and SSB (bottom panel) trends for F=0, 25%FMSY, 50%FMSY, 75%FMSY, and FMSY projections. Preliminary year-end catch estimates for the bridge year (2017), were used in the projections, and the catch from 2018-2020 was assumed to be equal to the ACL.