Framework Adjustment 51

To the

Northeast Multispecies FMP

Appendix II

Analytic Techniques: Rebuilding Plan Analysis

Rebuilding Plan Analysis

1) American plaice and Gulf of Maine cod rebuilding plans

Need

New rebuilding plans need to be developed for American plaice and Gulf of Maine (GOM) cod. Both stocks had original rebuilding plan end dates in 2014. However adequate progress towards rebuilding was not made, which requires new rebuilding schedules to be developed within two years (see letter to Council from Acting Regional Administrator Dan Morris dated May 30, 2012). The Magnuson-Stevens Act states that rebuilding time periods should be as short as possible, not to exceed 10 years.

Concerns about rebuilding plans

The Groundfish Plan Development Team (PDT) is concerned that, for most stocks, has not occurred according to plan due to: 1) starting in the wrong place (e.g., terminal year of the assessment), 2) the difficulty of setting catch advice that is related to achieving a target fishing mortality rate, and 3) recruitment that was less optimistic than what is seen in the projections.

The PDT noted that management based on rebuilding plans and F-rebuild for groundfish has not typically worked well in the past. Groundfish stocks have not rebuilt as predicted from past projections. For most stocks, updates to data and assessment models have revealed that stock size was smaller than believed when rebuilding began, that fishing mortality was higher than expected, and/or that realized recruitment was lower than predicted. For two stocks (redfish and GB haddock), rebuilding has occurred much quicker than planned, mainly because of better than expected recruitment. Redfish had a 50 year plan due to life history constraints, but the stock rebuilt in less than 10 years. One groundfish stock (Southern New England/Mid-Atlantic (SNE/MA) yellowtail flounder) is rebuilt not because the stock biomass has increased but because biomass reference points changed in response to perceived changes in stock productivity (i.e., lower recruitment and biomass).

As rebuilding plan end dates get closer, inadequate progress toward a set biomass target can also require disproportionate cuts in catch to achieve the calculated F-rebuilding mortality rate. ABCs based on F-rebuild can dramatically change from one assessment to the next if recruitment is not realized as the rebuilding end date approaches. The enhanced PDT projection simulation work showed that long-term projections are unreliable and tend to be optimistic. ABCs based on F-rebuild are also unreliable, since F-rebuild in the near term is dependent on recruitment from longer term projections.

The PDT also discussed whether comparing short-term rebuilding, versus long-term rebuilding and comparing the outputs relative to revenues, yields and stock rebuilding would be a better approach. Another approach could be to develop biomass, trawl index, or recruitment threshold that, when exceeded, catches could be increased (e.g., to 75% F_{MSY}). Such approaches would require further discussion and development.

Revised American plaice and GOM cod rebuilding plans

Recent assessments and assumptions- American plaice was last assessed during the 2012 groundfish updates, with a terminal year of 2010 for the assessment. An estimated catch was used for the 2011 and 2012 bridge years in the projection. The SSC set 2013-2015 ABCs for American plaice using 75%F_{MSY} projections. GOM cod was assessed at SARC 55 in December 2012. Two accepted models (base and m-ramp) were used for setting constant catch ABCs for 2013-2015 by the SSC in January 2013.

The PDT proposes to develop two rebuilding plan options (see below) for each stock that meets two requirements:

1) Assume no changes in the SSC's ABC decisions.
2) F-rebuild is not allowed to be initially limiting ($75\%F_{MSY}$ < F-rebuild).

Rebuilding plan options-

1) Developed to be more conservative using a time period less than 10 years, with $75\%F_{MSY}$ still estimated to be below but closer to the F-rebuild estimate.
2) Developed based on the maximum 10-year plan.

The PDT also based 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 ($75\%F_{MSY}$ or the newer constant harvest buffers). For example, reducing the rebuilding timeline has the same effect as increasing the probability of rebuilding by a certain date. Rebuilding schedules less than the maximum 10-year or rebuilding plans with a higher probability than 50% will make it more likely that F-rebuild will be used for ABC determination in the future.

Rationale- The PDT felt that one way to rebuild stocks is with uncertainty buffers on the fishing mortality rate. Basing ABCs on F-rebuild is not desirable, since it can quickly lead to dramatic reductions in the ABCs based on less accurate longer term projections as the rebuilding end date gets closer. In addition, as F-rebuild approaches zero then it is less likely to get adopted for ABC determination (e.g., SNE/MA winter flounder). ABCs based on F-rebuild are less desirable since considerable uncertainty surrounds the F-rebuild estimate due to the estimate's dependence on future recruitment, which is difficult to predict.

Results- Rebuilding schedule development was based on the latest projection for each stock that was used for estimating the ABCs and ACLs. These projections were treated more as theoretical projections since the PDT did not change bridge year catch assumptions. The PDT also assumed the ACL catch for the three years that are already in place. However, the original bridge year catch assumptions are similar to the updated PDT catch from DIMS (See Appendix B).

The proposed rebuilding plan options that meet the PDT requirements (see above) are shown in Figures 1-3. American plaice has the 7, 8, and 10-year plan options at 50% probability of success (Figure 1; Tables 1-3). GOM cod has 8 and 10-year plan options at 50% probability of success (base case Figure 2, Tables 4-6; m-ramp Figure 3, Tables 7-9).

American plaice

Option 1- rebuild in 7 or 8 years- American plaice could rebuild in seven years with a fishing mortality that is still above $75\%F_{MSY}$. A rebuild schedule of 8 years was also calculated with similar results.

Option 2 - rebuild in 10 years- F-rebuild was estimated to be below F_{MSY} with the maximum 10 year rebuilding plan.

GOM cod

There is little difference in the rebuilding time needed under the accepted base case or m-ramp model (M=0.2 in projections) for GOM cod. However, the catches estimated in the out years and the SSB_{MSY} are different between the models. The m-ramp projection assumes a change in M back to 0.2. The SARC 55 Panel concluded that if m is currently 0.4, then it seemed more reasonable to assume that in the short-term m would remain at 0.4, rather than reduce to 0.2. However, a change back to 0.2 is required to rebuild the stock. It is not known when M will change back to 0.2 in the future for the m-

ramp formulation, so interpretation and development of rebuilding plans using the m-ramp model is more difficult.

Option 1-rebuild in 8 years- GOM cod requires at least eight years for F-rebuild to remain above 75%F_{MSY}.

Option 2- rebuild in 10 years- F-rebuild was estimated to be below F_{MSY} with the maximum 10 year rebuilding plan.

Conclusions- The PDT discussed all the developed options for American plaice and GOM cod. The PDT discussed under what circumstances that a rebuilding time line could be extended beyond the requirement to minimize time (i.e., species generation time, recruitment, extenuating fishery considerations). Some PDT members were concerned that even under a shorter time frame (i.e., 7 versus 10 years) fishing mortality rates might not be achieved. Recent catch estimates for American plaice and Gulf of Maine cod are in Tables 10 and 11.

The PDT also discussed concerns that under both stock projections, catches would be increasing appreciably, even in the near term. The PDT viewed this as unrealistic and an inaccurate portrayal of potential future catch streams.

year	F=0	75%Fmsy	7 year	8 year	10 year	Fmsy
2011	0.143	0.143	0.143	0.143	0.143	0.143
2012	0.164	0.164	0.164	0.164	0.164	0.164
2013	0.128	0.128	0.128	0.128	0.128	0.128
2014	0.127	0.127	0.127	0.127	0.127	0.127
2015	0.127	0.127	0.127	0.127	0.127	0.127
2016	0.000	0.135	0.147	0.160	0.171	0.180
2017	0.000	0.135	0.147	0.160	0.171	0.180
2018	0.000	0.135	0.147	0.160	0.171	0.180
2019	0.000	0.135	0.147	0.160	0.171	0.180
2020	0.000	0.135	0.147	0.160	0.171	0.180
2021	0.000	0.135	0.147	0.160	0.171	0.180
2022	0.000	0.135	0.147	0.160	0.171	0.180
2023	0.000	0.135	0.147	0.160	0.171	0.180
2024	0.000	0.135	0.147	0.160	0.171	0.180

Table 1: Fishing mortality from 2012 groundfish update American plaice AGEPRO projections. Original bridge year catch (2011-2012) and ACLs (2013-2015) catch were assumed in all projections. Rebuilding projections that rebuild the stock in 7, 8 and 10 years that meet the PDT requirements are shown. Projections at F=0, 75%Fmsy, and Fmsy are also shown for comparison.

year	F=0	75%Fmsy	7 year	8 year	10 year	Fmsy
2011	1,624	1,624	1,624	1,624	1,624	1,624
2012	1,922	1,922	1,922	1,922	1,922	1,922
2013	1,482	1,482	1,482	1,482	1,482	1,482
2014	1,442	1,442	1,442	1,442	1,442	1,442
2015	1,470	1,470	1,470	1,470	1,470	1,470
2016	0	1,742	1,887	2,043	2,174	2,280
2017	0	1,927	2,069	2,219	2,342	2,440
2018	0	2,108	2,247	2,391	2,506	2,597
2019	0	2,259	2,393	2,529	2,636	2,719
2020	0	2,382	2,510	2,638	2,738	2,815
2021	0	2,493	2,617	2,738	2,831	2,902
2022	0	2,604	2,723	2,839	2,927	2,993
2023	0	2,683	2,799	2,909	2,990	3,053
2024	0	2,738	2,847	2,954	3,029	3,088

Table 2: Catch from 2012 groundfish update American plaice AGEPRO projections. Original bridge year catch (2011-2012) and ACLs (2013-2015) catch were assumed in all projections. Rebuilding projections that rebuild the stock in 7, 8 and 10 years that meet the PDT requirements are shown. Projections at F=0, 75%Fmsy, and Fmsy are also shown for comparison.

year	F=0	75%Fmsy	7 year	8 year	10 year	Fmsy
2011	11,631	11,631	11,631	11,631	11,631	11,631
2012	12,171	12,171	12,171	12,171	12,171	12,171
2013	11,961	11,961	11,961	11,961	11,961	11,961
2014	11,733	11,733	11,733	11,733	11,733	11,733
2015	12,031	12,031	12,031	12,031	12,031	12,031
2016	13,759	13,356	13,321	13,285	13,254	13,227
2017	16,760	14,681	14,511	14,327	14,174	14,052
2018	20,009	16,033	15,723	15,400	15,133	14,920
2019	23,207	17,178	16,746	16,288	15,914	15,624
2020	26,134	18,150	17,601	17,029	16,562	16,186
2021	29,102	19,047	18,386	17,717	17,163	16,729
2022	32,165	19,944	19,179	18,404	17,775	17,276
2023	34,778	20,578	19,737	18,872	18,192	17,649
2024	36,862	21,016	20,098	19,175	18,430	17,858

Table 3: Spawning stock biomass from 2012 groundfish update American plaice AGEPRO projections. Original bridge year catch (2011-2012) and ACLs (2013-2015) catch were assumed in all projections. Rebuilding projections that rebuild the stock in 7, 8 and 10 years that meet the PDT requirements are shown. Projections at F=0, 75%Fmsy, and Fmsy are also shown for comparison.

year	F=0	75%Fmsy	8 year	10 year	Fmsy
2012	0.459	0.459	0.459	0.459	0.459
2013	0.161	0.161	0.161	0.161	0.161
2014	0.135	0.135	0.135	0.135	0.135
2015	0.098	0.098	0.098	0.098	0.098
2016	0.000	0.135	0.139	0.165	0.180
2017	0.000	0.135	0.139	0.165	0.180
2018	0.000	0.135	0.139	0.165	0.180
2019	0.000	0.135	0.139	0.165	0.180
2020	0.000	0.135	0.139	0.165	0.180
2021	0.000	0.135	0.139	0.165	0.180
2022	0.000	0.135	0.139	0.165	0.180
2023	0.000	0.135	0.139	0.165	0.180
2024	0.000	0.135	0.139	0.165	0.180

Table 4: Fishing mortality from SARC 55 gulf of Maine cod base run AGEPRO projections. Original bridge year catch (2012) and ACLs (2013-2015) catch were assumed in all projections. Rebuilding projections that rebuild the stock in 8 and 10 years that meet the PDT requirements are shown. Projections at F=0, 75%Fmsy, and Fmsy are also shown for comparison.

year	F=0	75%Fmsy	8 year	10 year	Fmsy
2012	3,767	3,767	3,767	3,767	3,767
2013	1,470	1,470	1,470	1,470	1,470
2014	1,470	1,470	1,470	1,470	1,470
2015	1,470	1,470	1,470	1,470	1,470
2016	0	2,911	2,993	3,517	3,814
2017	0	3,818	3,915	4,522	4,854
2018	0	4,594	4,700	5,350	5,702
2019	0	5,283	5,394	6,064	6,417
2020	0	6,037	6,151	6,829	7,179
2021	0	6,733	6,851	7,534	7,872
2022	0	7,263	7,378	8,046	8,375
2023	0	7,631	7,749	8,404	8,706
2024	0	7,908	8,016	8,641	8,928

Table 5: Catch from SARC 55 gulf of Maine cod base run AGEPRO projections. Original bridge year catch (2012) and ACLs (2013-2015) catch were assumed in all projections. Rebuilding projections that rebuild the stock in 8 and 10 years that meet the PDT requirements are shown. Projections at F=0, 75%Fmsy, and Fmsy are also shown for comparison.

year	F=0	75%Fmsy	8 year	10 year	Fmsy
2012	8,995	8,995	8,995	8,995	8,995
2013	9,355	9,355	9,355	9,355	9,355
2014	11,949	11,949	11,949	11,949	11,949
2015	16,795	16,795	16,795	16,795	16,795
2016	24,175	23,567	23,550	23,435	23,372
2017	33,584	30,077	29,983	29,363	29,016
2018	42,760	35,449	35,273	34,074	33,398
2019	51,697	40,043	39,756	38,001	37,003
2020	63,228	45,603	45,192	42,662	41,287
2021	76,173	51,292	50,773	47,332	45,543
2022	87,114	55,489	54,800	50,697	48,536
2023	96,531	58,494	57,710	53,025	50,574
2024	104,039	60,772	59,909	54,727	52,017

Table 6: Spawning stock biomass from SARC 55 gulf of Maine cod base run AGEPRO projections. Original bridge year catch (2012) and ACLs (2013-2015) catch were assumed in all projections. Rebuilding projections that rebuild the stock in 8 and 10 years that meet the PDT requirements are shown. Projections at F=0, 75%Fmsy, and Fmsy are also shown for comparison.

year	F=0	75%Fmsy	8 year	10 year	Fmsy
2012	0.517	0.517	0.517	0.517	0.517
2013	0.177	0.177	0.177	0.177	0.177
2014	0.130	0.130	0.130	0.130	0.130
2015	0.076	0.076	0.076	0.076	0.076
2016	0.000	0.135	0.143	0.166	0.180
2017	0.000	0.135	0.143	0.166	0.180
2018	0.000	0.135	0.143	0.166	0.180
2019	0.000	0.135	0.143	0.166	0.180
2020	0.000	0.135	0.143	0.166	0.180
2021	0.000	0.135	0.143	0.166	0.180
2022	0.000	0.135	0.143	0.166	0.180
2023	0.000	0.135	0.143	0.166	0.180
2024	0.000	0.135	0.143	0.166	0.180

Table 7: Fishing mortality from SARC 55 gulf of Maine m-ramp run (m=0.2) AGEPRO projections. Original bridge year catch (2012) and ACLs (2013-2015) catch were assumed in all projections. Rebuilding projections that rebuild the stock in 8 and 10 years that meet the PDT requirements are shown. Projections at F=0, 75%Fmsy, and Fmsy are also shown for comparison.

year	F=0	75%Fmsy	8 year	10 year	Fmsy
2012	3,767	3,767	3,767	3,767	3,767
2013	1,470	1,470	1,470	1,470	1,470
2014	1,470	1,470	1,470	1,470	1,470
2015	1,470	1,470	1,470	1,470	1,470
2016	0	4,110	4,341	4,996	5,390
2017	0	5,507	5,785	6,560	7,010
2018	0	6,747	7,055	7,895	8,372
2019	0	7,846	8,172	9,043	9,532
2020	0	9,099	9,440	10,337	10,818
2021	0	10,100	10,443	11,330	11,791
2022	0	10,804	11,148	12,006	12,452
2023	0	11,316	11,644	12,466	12,879
2024	0	11,649	11,969	12,762	13,155

Table 8: Catch from SARC 55 gulf of Maine cod m-ramp run (m=0.2) AGEPRO projections. Original bridge year catch (2012) and ACLs (2013-2015) catch were assumed in all projections. Rebuilding projections that rebuild the stock in 8 and 10 years that meet the PDT requirements are shown. Projections at F=0, 75%Fmsy, and Fmsy are also shown for comparison.

year	F=0	75%Fmsy	8 year	10 year	Fmsy
2012	8,196	8,196	8,196	8,196	8,196
2013	9,094	9,094	9,094	9,094	9,094
2014	13,649	13,649	13,649	13,649	13,649
2015	22,156	22,156	22,156	22,156	22,156
2016	33,951	33,136	33,089	32,950	32,862
2017	47,825	42,975	42,713	41,963	41,522
2018	61,633	51,296	50,774	49,286	48,419
2019	75,841	58,971	58,150	55,829	54,483
2020	95,799	68,889	67,648	64,239	62,248
2021	114,755	76,902	75,240	70,707	68,130
2022	130,536	82,387	80,376	75,016	72,010
2023	143,324	86,602	84,290	78,162	74,689
2024	154,005	89,281	86,809	80,067	76,358

Table 9: Spawning stock biomass from SARC 55 gulf of Maine cod m-ramp run (m=0.2) AGEPRO projections. Original bridge year catch (2012) and ACLs (2013-2015) catch were assumed in all projections. Rebuilding projections that rebuild the stock in 8 and 10 years that meet the PDT requirements are shown. Projections at F=0, 75%Fmsy, and Fmsy are also shown for comparison.

Table 10: Estimated calendar year 2011, 2012, and 2013 Northeast multispecies American plaice catch (mt)

Estimated CY 2011, 2012 and 2013 NE Multispecies American Plaice Catch (mt)

Stock		ACLs and sub-ACLs: (with accountability measures (AMs))						sub-components: No AMs	
	Total Groundfish	Commercial Groundfish*	Landings	Discard	Recreational	Herring Fishery	Scallop Fishery	State Water	Other
	A to G	A+B+C	A	B	C	D	E	F	G
Plaice									
2011	1,615.1	1,574.8	1,383.4	191.5				16.4	23.8
Jan - Jun 2011	733.7	705.8	601.1	104.7				10.4	17.5
Jul - Dec 2011	881.4	869.0	782.3	86.7				6.1	6.3
2012	1,838.2	1,709.3	1,467.5	241.7				28.0	100.9
Jan - Jun 2012	882.5	844.1	713.0	131.1				10.0	28.4
Jul - Dec 2012	955.6	865.1	754.5	110.6				18.0	72.5
2013	1,574.2	1,472.5						32.7	69.0
Jan - Jun 2013	773.5	702.8	597.4	105.4				17.2	53.5
Jul - Dec 2013 (est)	800.7	769.7						15.5	15.5

Values in live weight

*Includes estimate of missing dealer reports

Source: NMFS Northeast Regional Office

August 5, 2013: Data Dates: May 28 2013, July 31, 2013

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.

Sector/Common Pool:
Jan 2011 -Jun CY13 commercial data from Data Matching and Imputation System
Jul-Dec CY13 value = (Jul-Dec CY12 value)*(May-Jun CY13 value / May-Jun CY12 value)

State Water, - CY sum of monthly average FY10 and FY11 actual catch plus monthly
Other Subcomponent average of FY12 and FY13 catch limit

Table 11: Estimated calendar year 2011, 2012, and 2013 Northeast multispecies Gulf of Maine cod catch (mt)

Estimated CY 2012 and 2013 NE Multispecies GOM Cod Catch (mt)

Stock		Total Groundfish	ACLs and sub-ACLs: (with accountability measures (AMs))						sub-components: No AMs	
			Groundfish*	Landings	Discard	Recreational	Herring Fishery	Scallop Fishery	State Water	Other
		A to G	A+B+C	A	B	C	D	E	F	G
GOM Cod										
	2012	3,636.7	3,345.0	2,669.5	143.5	531.9			240.8	50.9
Jan - Jun 2012		1,860.4	1,726.2	1,317.3	79.0	329.9			114.3	19.9
Jul - Dec 2012		1,776.3	1,618.8	1,352.2	64.6	202.0			126.5	31.0
	2013	2,237.6	2,030.0			1,062.3			153.0	54.7
Jan - Jun 2013		1,505.7	1,375.0	514.3	41.4	819.3			101.5	29.2
Jul - Dec 2013 (est)		732.0	655.0			243.0			51.5	25.5

Values in live weight

*Includes estimate of missing dealer reports

Source: NMFS Northeast Regional Office

August 8, 2013: Data Dates: May 28 2013, July 31, 2013

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

Sector/Common Pool:	
Jan 2012 -Jun 2013 commercial data from Data Matching and Imputation System	
Jul-Dec CY13 value = (Jul-Dec CY12 value)*(May-Jun CY13 value / May-Jun CY12 value)	
Recreational	- CY12: wave 6, 2011 - wave 5, 2012 landings only - CY13: sum of monthly average FY11 actual catch plus monthly average of FY12 and FY13 catch limit
State Water and Other Subcomponent	- CY sum of monthly average FY11 actual catch plus monthly average of FY12 and FY13 catch limit

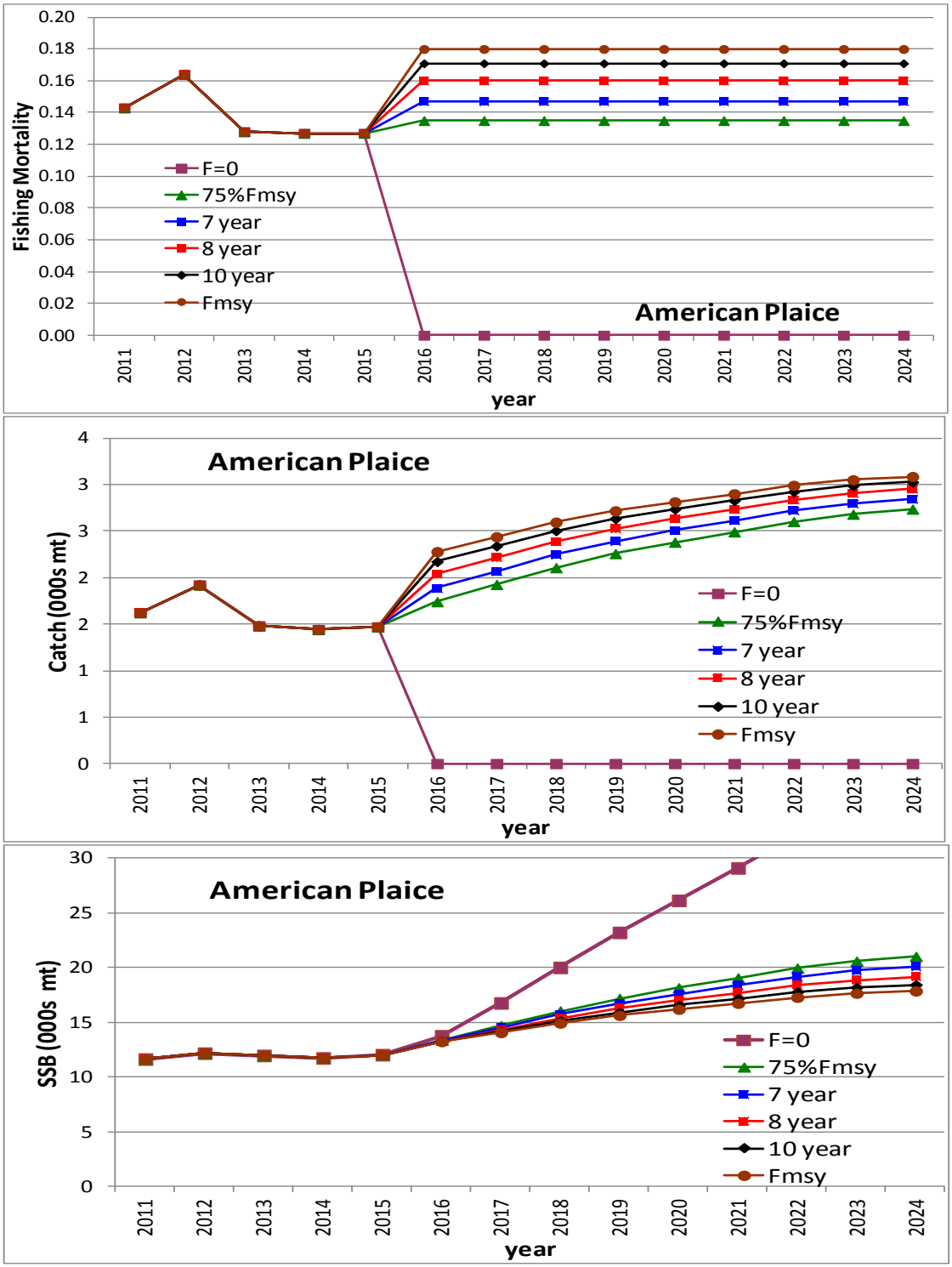

Figure 1: American plaice fishing mortality, catch, and SSB trends for F=0, 75%F_{MSY}, and F_{MSY} projections. Proposed rebuilding plans that meet the PDT requirements are shown in the 7 year, 8 year, and 10 year projections. Bridge year catch and ACL assumptions were made from 2011-2015.

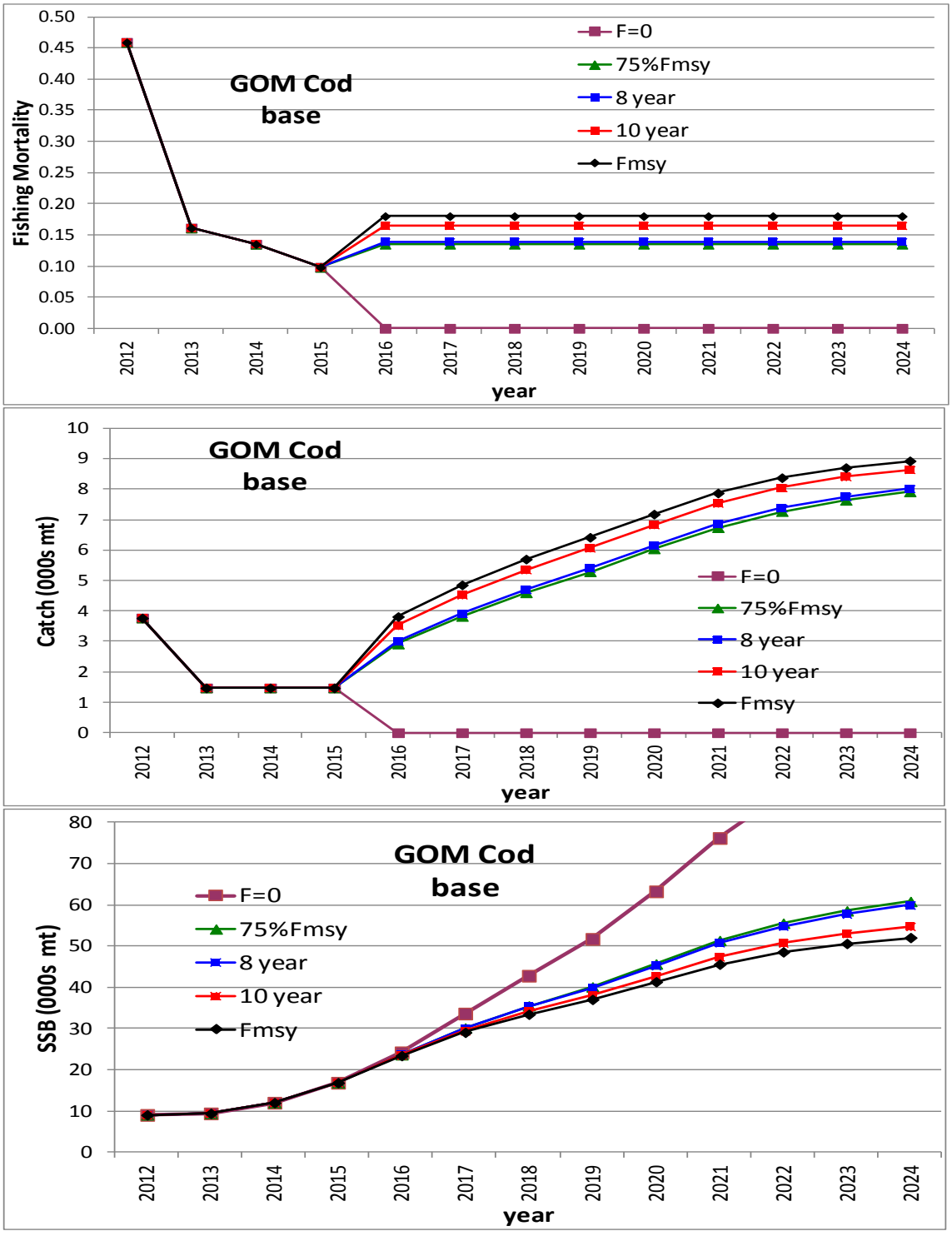

Figure 2: Gulf of Maine cod base model fishing mortality, catch, and SSB trends for F=0, 75%F_{MSY}, and F_{MSY} projections. Proposed rebuilding plans that meet the PDT requirements are shown in the 8 and 10 year projections. Bridge year catch and ACL assumptions were made from 2012-2015.

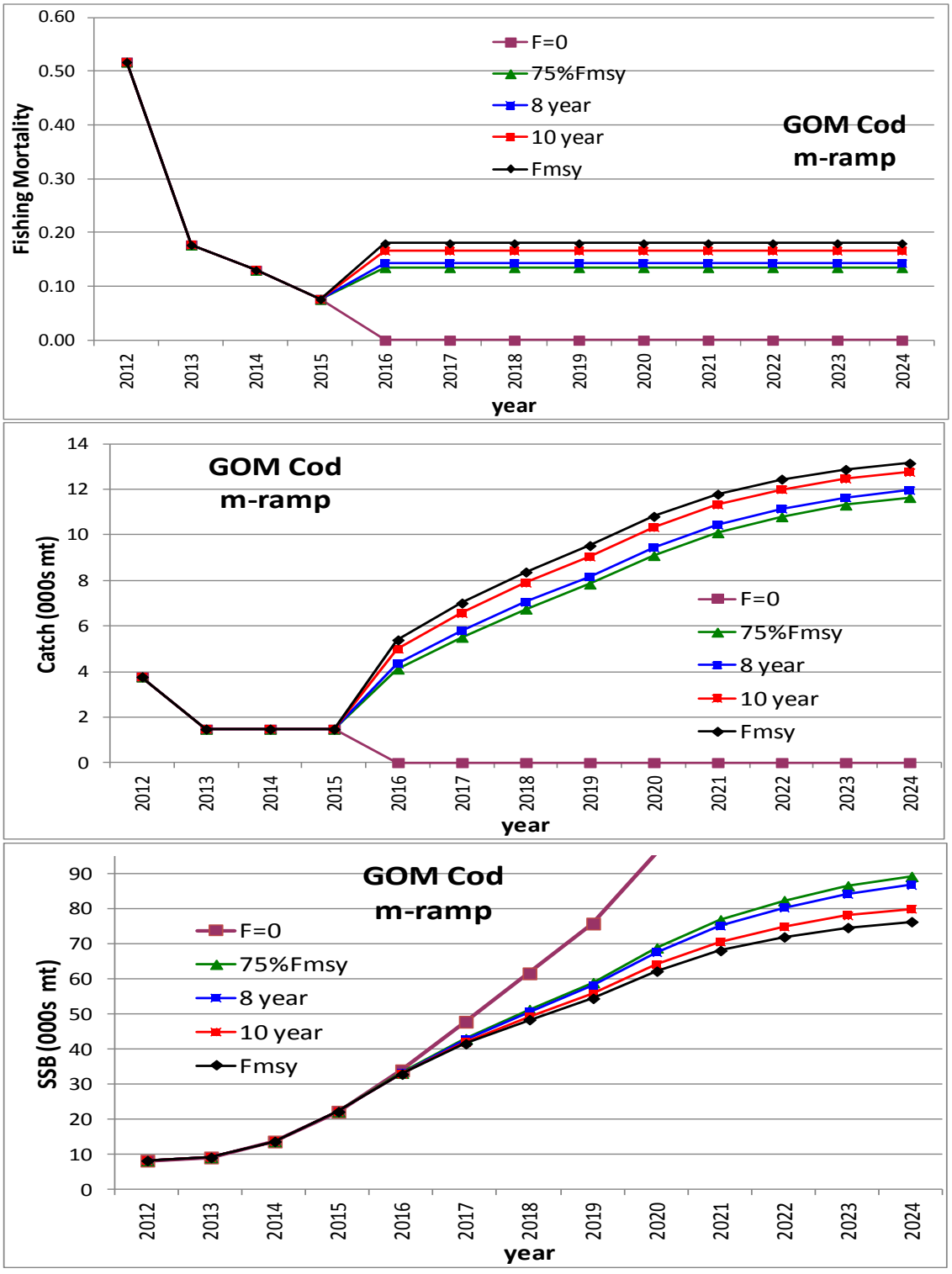

Figure 3: Gulf of Maine cod m-ramp model fishing mortality, catch, and SSB trends for F=0, 75%F_{MSY}, and F_{MSY} projections. Proposed rebuilding plans that meet the PDT requirements are shown in the 8 and 10 year projections. Bridge year catch and ACL assumptions were made from 2012-2015.