Atlantic States Marine Fisheries Commission

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MEMORANDUM

TO: **Atlantic Striped Bass Management Board**

FROM: **Atlantic Striped Bass Technical Committee and Stock Assessment Subcommittee**

DATE: **July 22, 2025**

SUBJECT: **Updated Projections for Draft Addendum III and Review of Maryland Recreational Season Baseline Proposal**

The Atlantic Striped Bass Technical Committee and Stock Assessment Subcommittee (TC-SAS) met via webinar on June 16, 2025, to address two tasks for Draft Addendum III: 1) review updated projections incorporating final 2024 MRIP estimates; and 2) review Maryland's recreational season baseline proposal.

Updated Projections and Final 2024 MRIP Estimates

Draft Addendum III projections were initially developed and discussed by the TC in March 2025 (March 2025 TC-SAS Summary). The projections were updated in May 2025 to incorporate final MRIP estimates for 2024 and initial commercial harvest estimates for 2024 provided by the states. This resulted in a 7% increase in 2024 removals driven by the 7% increase in final MRIP estimates. Total 2024 removals were still much lower than removals in the past few years, representing a 27% reduction from 2023, while total directed MRIP effort in 2024 was 14% lower than 2023. Appendix A details the difference in preliminary vs. final 2024 MRIP estimates.

Even though 7% is a relatively small increase, with the preliminary MRIP estimates falling within the 95% confidence intervals of final estimate (Figure 1), this resulted in a higher estimate of *F*2024 which propagated through to the estimates of *F*2025 and *F*2026-2029 due to the assumptions for those years relative to *F*2024 (Table 1; Figure 2). These results, along with the results of the sensitivity runs, highlight one of the major sources of uncertainty in these projections, which is what fishing effort and fishing mortality will look like in future years in the absence of management changes.

In 2025, with no management change from 2024, *F* is predicted to increase as the above-average 2018 year-class enters the current ocean slot limit. The TC previously agreed that the best assumption to use for the *F*2025 increase is +17% relative to 2024 based on the observed +17% increase from 2021 to 2023 when part of the strong 2015 year-class was still in the newly reduced ocean slot limit. The TC notes the magnitude of increase may be overestimated since the 2018 year-class is not as strong as the 2015 year-class was. For 2026-2029, the TC previously agreed that assuming *F*2026-2029=*F*2024 is a reasonable assumption under the same narrow slot limit and as an above-average year-class grows out of the slot.

The updated projections with final 2024 MRIP estimates indicate a lower probability of rebuilding by 2029 as compared to the initial projections with the preliminary 2024 MRIP estimates, although the upward trend in SSB remains (Table 1; Figure 3). The reductions needed for 2026 to reduce *F* to *F_rebuild* with either a 50% or 60% probability are 12% and 18%, respectively (Table 2).

The TC-SAS continues to highlight several major sources of uncertainty underlying any projections, including projecting *F* beyond the years included in the assessment and predicting how *F* will change from year to year in the future. The assumptions for *F* in 2025-2029 are the TC-SAS's best assumptions based on past observations with strong year-classes. The magnitude of increases or decreases in future effort and *F* is highly uncertain, as is future recruitment. The probabilities of rebuilding and management reductions are calculated based on this one set of assumptions, which is just one possible future outcome.

Table 1. *F* estimates for March and May 2025 projections using preliminary and final MRIP data, respectively.

	Preliminary (May 2025)	**Final (May 2025)**
2024 Removals	3.80 million fish	4.07 million fish
***F*2024**	0.123	0.133
***F*2025**	0.144	0.156
***F*2026-2029**	0.123	0.133
Probability of Being Above SSB Threshold (not overfished)	99%	99%
Probability of Being Above SSB Target (rebuilt)	49%	30%
F_rebuild 50%	*0.122*	*0.115*
F_rebuild 60%	*0.114*	*0.108*

Table 2. 2026 Reduction Calculations

	Preliminary (March 2025)	**Final (May 2025)**
2026	3.54 million fish	3.75 million fish
2026 Removals to achieve *F_rebuild 50%*	3.50 million fish *-1%*	3.28 million fish ***-12%***
2026 Removals to achieve *F_rebuild 60%*	3.29 million fish *-7%*	3.09 million fish ***-18%***

Updated Sensitivity Runs Requested by the Board

In addition to the TC-SAS's preferred base run for the projections (described above), the Board also requested a set of sensitivity runs to provide context for the base projections, which were not used to develop options. Specifically, the Board requested runs that:

1. Extend base run projections to 2035
2. Use the most recent 6 years of very low recruitment instead of the 2008-2023 values
3. Project a moderate *F* value for 2026 onwards (i.e., higher than the very low value projected for 2024 but lower than the *F* target)

These sensitivity runs were updated with final 2024 MRIP estimates and results are presented in Appendix B. The TC-SAS noted that these Board-requested sensitivity runs are more pessimistic scenarios compared to the base run and do not encompass the possibility of more optimistic future scenarios.

The general findings of these sensitivity runs remain the same. In the base run, SSB continues to increase after 2029. In the scenarios where recruitment is drawn from the very low recruitment regime, spawning stock biomass (SSB) will begin to decline after 2030 as the 2015 and 2018 year-classes continue to die off due to natural and fishing mortality and are replaced by the weak 2019-2024 year-classes. In the moderate *F* scenario (i.e., slightly increased *F* from the base run), the probability of being at or above the SSB target in 2029 decreases, and the trajectory of SSB after 2029 depends on the recruitment scenario, with SSB continuing to increase after 2029 under the 2008-2023 recruitment regime and SSB declining after 2029 in the very low recruitment scenario.

Maryland Recreational Season Baseline

As tasked by the Board, the TC-SAS reviewed Maryland's proposed new recreational season baseline option. The TC-SAS initially reviewed Maryland DNR's methodology in March 2025 (March 2025 TC-SAS Summary), and Maryland DNR updated their methodology to incorporate

the TC-SAS recommendations from March. For this second review, the Board requested the TC-SAS review the updated methods, the assumption of constant effort when opening a current closure and discuss any potential impacts of allowing fishing in the spring on staging pre-spawn fish.

MDDNR's proposed new recreational baseline season would 1) change the month of April from no-targeting to allowing catch-and-release (C&R); 2) change May 1-15 from no-targeting to allowing harvest; 3) shift the summer no-targeting closure from July to August and extend the closure from 16 days to 31 days; and 4) close the harvest fishery a few days earlier in December. Specific details are provided in MDDNR's proposal in the Board materials for the August 2025 Board meeting.

For the calculations to estimate increased releases from opening April and May from no targeting to allowing C&R, the TC-SAS previously recommended pooling 2021-2024 data for MDDNR's analysis of March release rates where C&R is currently allowed. MDDNR incorporated that recommendation and calculated the average number of releases per trip observed in March for 2021-2024 when C&R was allowed and applied that to the number of trips per day assumed for the April and May season openings. One challenge when opening a season from no-targeting to allowing C&R is the assumption of effort (i.e., number of trips per day). Ideally, a past year when C&R was allowed during the spring could be used to estimate the number of trips per day. However, prior to the spring no-targeting closures, Maryland's spring season was open not only for C&R but also for harvest during part of April and the first half of May for the spring trophy season. So, the effort estimates from past years are not directly applicable to a new season where only C&R is allowed. MDDNR used an assumption of constant effort despite the change to a catch-and-release only season and maintained the number of trips per day observed in 2024.

The TC-SAS discussed this assumption, noting that an increase in effort would be expected with a season opening from no-targeting to allowing C&R. For comparison, when a no-targeting closure is implemented, Maryland assumes that there will be a reduction in effort, as trips targeting only striped bass would no longer occur. So, it is logical to expect an increase in effort when a season is opened to fishing. However, the TC-SAS agreed that it is very difficult to predict the magnitude of effort increase, especially without an applicable historical reference period. Additionally, the TC-SAS noted effort has varied from year-to-year even under the same regulations. The TC-SAS could not develop a quantitative assumption about how effort would change when the season is opened from no-targeting to C&R that was any more defensible than the assumption of constant effort for now, and so accepted the use of that assumption in this case.

Overall, the TC-SAS accepted the MDDNR methods presented for calculating a new season baseline and recommended the proposal note the uncertainty of predicting the magnitude of effort change associated with opening a current no targeting closure to allowing C&R.

Regarding pre-spawn fish, the Board expressed concern about the potential impact of re-opening April to C&R on staging pre-spawn striped bass. A prior literature review by MDDNR on sub-lethal effects of C&R on spawning striped bass (Durell and Speir 2000) noted the lack of data on this topic specific to striped bass. Following the May 2025 Board meeting, MDDNR staff conducted an initial exploratory search and did not find any new studies specific to C&R impacts on spawning or pre-spawn striped bass.

MDDNR noted the existing spawning ground closures in Maryland Bay tributaries, which start March 1, are not affected by the new baseline season (i.e., the spawning ground closures are remaining in place). It was also noted that additional gear restrictions are in place for April striped bass fishing in Maryland Chesapeake Bay, including a limit on the number of trolling rods and requiring barbless hooks. It was further noted that the number of fish being caught and released would be much lower than when trophy harvest was allowed in the past.

The following is a brief summary of some of the studies noted in the previous MDDNR literature review (Durell and Speir 2000) as well as a recent study example for another species.

There are differing results regarding the movement of striped bass after being caught and released during their spawning run. Hocutt (1990) used radio transmitters on the Nanticoke and Choptank Rivers and found that “striped bass do not significantly alter their primary behavior after handling and tagging, i.e., they do return to the specific spawning area during the immediate spawning season and in future years”. Fish of both sexes were observed moving back and forth from brackish to freshwater during their stay on the spawning grounds, perhaps to deal with osmotic stress. However, other studies have observed downstream migration after releasing a fish during its upstream spawning run (referred to as ‘fallback’) for several species. Carmichael (1995) observed fallback for striped bass in the Roanoke River where most striped bass released either did not migrate up to the spawning grounds or left the spawning grounds with only some returning after some time. One difference between the Nanticoke and Choptank Rivers and Roanoke River is the Roanoke River striped bass spawning grounds are much further from the river mouth than in either the Nanticoke or Choptank.

Spawning may impose increased energy demands on fish, which could increase the stress fish experience when hooked and released, especially depending on other factors (e.g., fighting and handling time, water temperature, salinity) (Muoneke and Childress 1994, Uphoff et al. 1997).

Regarding other species, some studies on steelhead trout conclude C&R had no effect on homing behavior or the number of eyed eggs produced by steelhead trout (Reingold 1975, Pettit 1997,). For Australasian snapper, one study found stress from hooking may cease spawning activity and absorb their eggs (Pankhurst and Sharples 1992).

A recent study simulating pre-spawning catch and release of wild Atlantic salmon found that females exposed to exercise and/or air spawned at their usual time but with fewer eggs (Papatheodoulu et al. 2021).

The TC-SAS was not aware of any additional work on this issue for striped bass. The TC-SAS noted that the effect of catch-and-release fishing on spawning success was a source of uncertainty in this analysis, given the extremely limited information on this topic.

References

Carmichael, J. T. 1995. Effects of flow and temperature on spawning and migratory behavior of Albemarle Sound-Roanoke River striped bass. Master's thesis. North Carolina State University, Raleigh.

Durell, E.Q. and H. Speir. 2000. Potential Sub-Lethal Effects of Catch-and-Release Fishing on Spawning Striped Bass: a Literature Review. MD DNR Fisheries Technical Memo No. 19. 8 pp.

Hocutt, C. H., S. E. Seibold, R. M. Harrell, R. V. Jesien, and W. H. Bason. 1990. Behavioral observations of striped bass (Morone saxatilis) on the spawning grounds of the Choptank and Nanticoke rivers, Maryland, USA. Journal of Applied Ichthyology 6: 211 .. 222.

Muoneke, M. I. and W. M. Childress. 1994. Hooking mortality: a review for recreational fisheries. Reviews in Fisheries Science 2(2): 123-156.

Papatheodoulou et al. 2021. Simulated pre-spawning catch and release of wild Atlantic salmon (Salmo salar) results in faster fungal spread and opposing effects on female and male proxies of fecundity. Canadian Journal of Fisheries and Aquatic Sciences. https://cdnsciencepub.com/doi/10.1139/cjfas-2021-0089

Pettit, S. W. 1997. Comparative reproductive success of caught-and-released and unplayed hatchery female steelhead trout (Salmo gairdneri) from the Clearwater river, Idaho. Transactions of the American Fisheries Society 106: 431-435.

Reingold, M. 1975. Effects of displacing, hooking, and releasing on migrating adult steelhead trout. Transactions of the American Fisheries Society 104: 458-460.

Uphoff, J. H., D. T. Cosdell, H. T. Hornick, and R. Lukacovic. 1997. Catch-and-release fishing for striped bass in their spawning areas during spawning season. Fisheries Technical Memo No. 12. Maryland Department of Natural Resources, Fisheries Service.

Figures

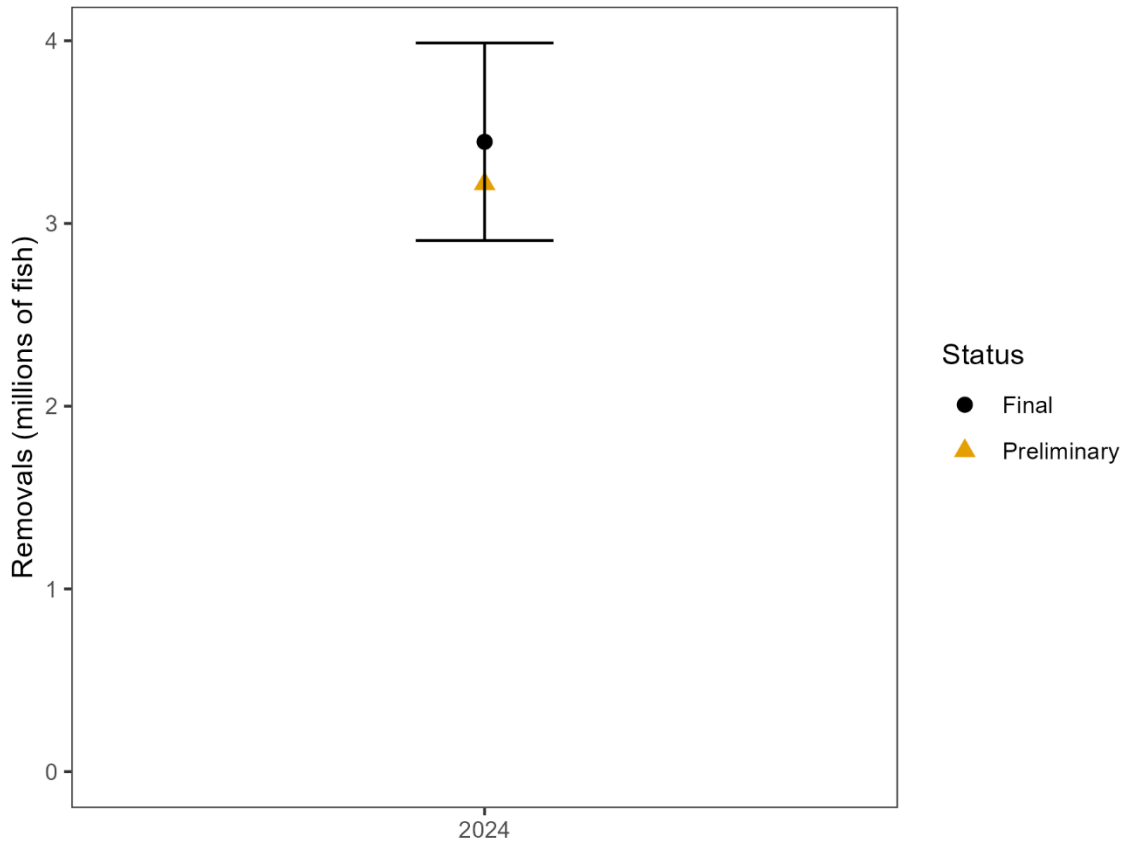

Figure 1. Preliminary and final 2024 MRIP estimates of recreational removals plotted with the 95% confidence intervals of the final estimates.

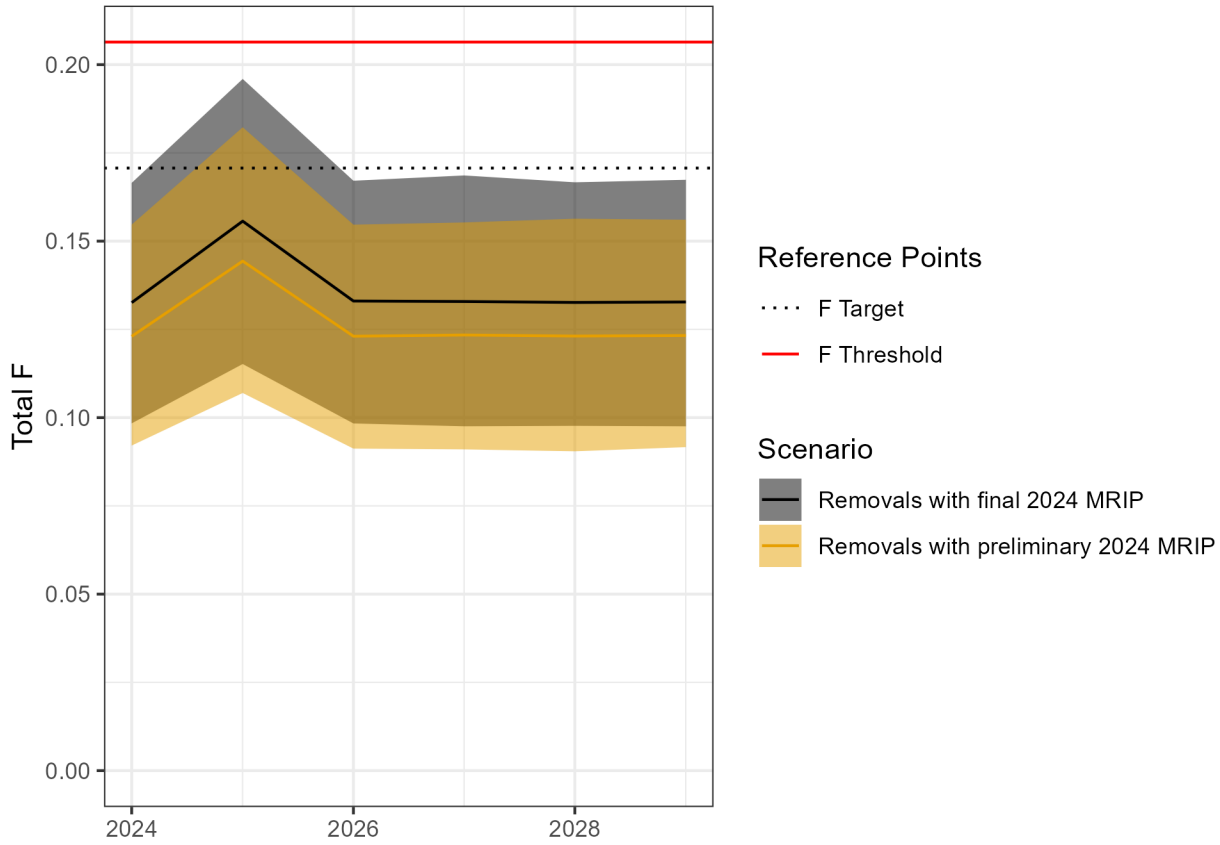

Figure 2. *F* rates used in status quo projection scenarios based on final and preliminary 2024 MRIP data.

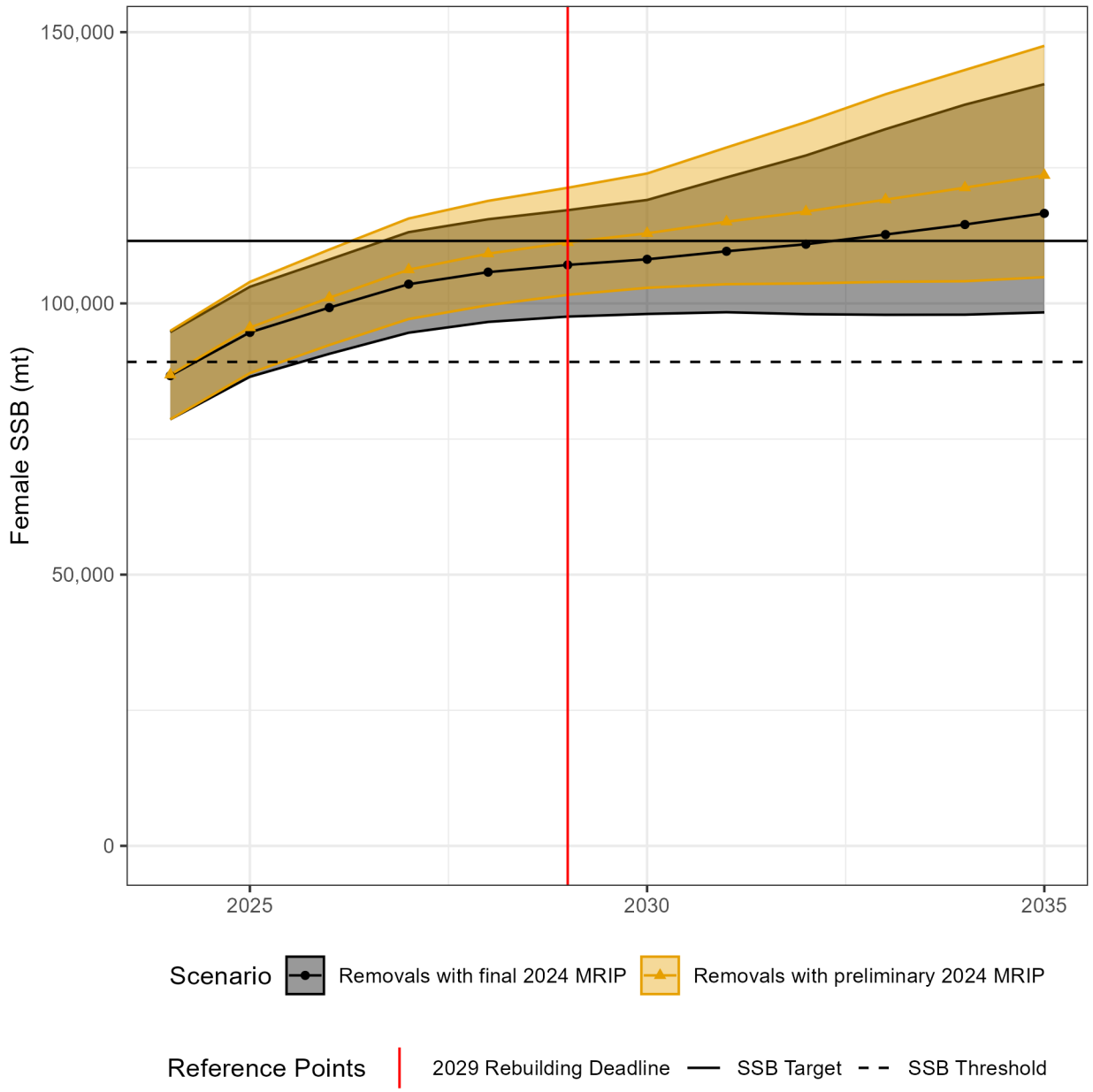

Figure 3. Female SSB trajectories based on final and preliminary 2024 MRIP removals (F2026-2029 = F2024).

TC-SAS Appendix A. Striped Bass 2024 MRIP Preliminary vs. Final Estimates
July 2025

Striped bass rebuilding projections for Draft Addendum III incorporate 2024 MRIP estimates of striped bass harvest and live releases. Projections developed in March 2025 used preliminary 2024 MRIP estimates that were released in February 2025. Final 2024 MRIP estimates were released in May 2025 and are being incorporated into updated projections for the draft addendum.

The final estimate of striped bass recreational removals (harvest + release mortality) is 7% higher than the preliminary estimate (Table A1). While most states had a 3% or less change from preliminary to final MRIP estimates, the change was much greater for New York (final harvest 29% higher; final live releases 34% higher) and Maryland Chesapeake Bay (final harvest 12% higher) (Tables A2-A3).

ASMFC staff contacted NOAA Fisheries MRIP staff for more information on these differences and their response is summarized below.

Typically changes from preliminary to final occur from revisions to effort estimates (which impacts all species in the corresponding estimation domain) or edits/corrections to the intercept data (which tends to be more narrowly focused). In 2024, MRIP also implemented a new expanded estimate review process, which included state agency review in addition to NOAA Fisheries review by regional staff and our internal automated process. The new process has resulted in a substantial increase in the number of (mostly catch) estimate reviews that are conducted before estimates are finalized.

For most waves, MRIP now produces updated catch and effort estimates for a given wave with the preliminary estimates for the following wave (ex: wave 2 is released in June, updated wave 2 is released in August with wave 3). Those updated estimates incorporate the additional FES and VTR data for the wave, and should be much closer (if not identical) to the final estimates released in April of the following year. The release schedule for final estimates prevents this for wave 6—the first release is in February and the second (final) release is in April. Therefore, there is no allowance for an updated wave 6 release which may contribute to any larger changes in wave 6 estimates between preliminary and final, as compared to prior waves.

New York: Landings = +29% increase, Release = +34% increase
Most of the increase is from wave 6 estimates for NY private/rental boat (PR) mode (all areas). Wave 6 PR landings increased by +88,771 fish (90.9%) and releases increased by +916,579 fish (90.9%) due to the 90.9% increase to the base FES effort estimate in Wave 6 (preliminary FES vs final FES). There was no change in the APAIS components.

- Wave 6 NY PR Effort
    - Preliminary Effort: 442,911
    - Final Effort: 845,711
    - Recent years: 1.09M in 2023 and 867,384 in 2022.
- The preliminary estimate was considerably lower than effort in recent years; the final estimate is similar to effort in recent years.
- These estimates were not flagged during estimate review.

The NY difference is attributed to differences in the preliminary vs final FES data. Specifically, there were fewer trips being reported by fishing households in the preliminary FES data compared to the final data which resulted in an increase in estimated mean trips per fishing household for the final estimate. During review there were no highly influential observations identified. MRIP also noted that preliminary FES estimates have become somewhat more variable over time due to a small decline in the contribution of preliminary data to final (i.e., fewer records in the final data were also in the preliminary data). In this case, the change from preliminary to final was an increase in effort, but the opposite can also occur.

Maryland: Inland Landings (Chesapeake Bay): +12% increase
The increase in Maryland Chesapeake Bay landings from preliminary to final estimates were largely due to increased effort estimates in the for-hire mode. Further details on the largest impacts are outlined below. There were no changes to the APAIS components in these cases so the majority of the differences should be attributed to inclusion of additional VTR data.

- Wave 3, Charter (CH) mode, Inland - landings +8,288 fish (28.4%), release +3,537 fish (28.4%)
    - This is the result of a 28.4% increase in effort in this cell.
    - Preliminary Effort: 37,884
    - Final Effort: 48,645
    - 2019 - 2023 ranged from 50,887 to 72,948.
- Wave 4, CH, Inland - landings +10,479 fish (64.1%), release +6,080 fish (64.1%)
    - This is the result of a 64.1% increase in effort in this cell.
    - Preliminary Effort: 34,469
    - Final Effort: 56,560
    - 2019 - 2023 ranged from 47,356 to 69,316.
- Wave 5, CH, Inland - landings + 9,480 fish (43.3%), release +11,168 fish (43.3%)
    - This is the result of a 43.3% increase in effort in this cell.
    - Preliminary Effort: 22,034
    - Final Effort: 31,564
    - 2019 - 2023 ranged from 20,900 to 50,845
- These estimates were not flagged during estimate review.

Table A1. 2024 preliminary and 2024 final MRIP estimates for total striped bass catch and removals in number of fish.

	Preliminary 2024	Final 2024	Percent Change	Final 95% Confidence Intervals	Final PSE
Harvest (A + B1)	1,592,692	1,728,744	**9%**	1,457,677 - 1,999,810	8%
Live Releases (B2)	18,048,518	19,093,771	**6%**	16,099,867 - 22,087,673	8%
Total Removals (A + B1 + 9%B2)	3,217,059	3,447,183	**7%**	2,906,665 - 3,987,701	

Table A2. Ocean 2024 preliminary and 2024 final MRIP estimates for striped bass by state in number of fish.

	ME	NH	MA	RI	CT	NY	NJ	DE	MD Ocean	VA Ocean	NC Ocean Waves 1/6
Harvest Prelim 2024	34,044	25,172	264,666	33,684	50,109	335,582	601,618	1,217	0	0	0
Harvest Final 2024	34,392	25,218	257,820	33,625	51,550	433,045	622,328	1,217	0	0	0
Harvest % Change	**1%**	**0%**	**-3%**	**0%**	**3%**	**29%**	**3%**	**0%**	**-**	**-**	**-**
Releases Prelim 2024	1,322,245	330,474	3,256,511	1,184,421	2,028,386	2,984,185	4,135,346	65,754	11,129	0	0
Releases Final 2024	1,332,472	330,240	3,204,374	1,208,123	2,049,517	3,989,066	4,297,996	64,448	9,551	0	0
Releases % Change	**1%**	**0%**	**-2%**	**2%**	**1%**	**34%**	**4%**	**-2%**	**-14%**	**-**	**-**

Table A3. Chesapeake Bay 2024 preliminary and 2024 final MRIP estimates for striped bass by state in number of fish.

	MD Inland	**VA Inland**
Harvest Prelim 2024	207,518	39,082
Harvest Final 2024	232,610	36,939
Harvest % Change	**12%**	**-5%**
Releases Prelim 2024	2,365,444	364,623
Releases Final 2024	2,263,512	344,472
Releases % Change	**-4%**	**-6%**

TC-SAS Appendix B. Sensitivity Runs With Final 2024 MRIP Data for Draft Addendum III
July 2025

Updated Projections
In addition to the TC-SAS's preferred base run for the Draft Addendum III projections, the Board also requested a set of sensitivity runs to provide context for the base projections, which were not used to develop options. Specifically, the Board requested runs that:

1. Extend base run projections to 2035
2. Use the most recent 6 years of very low recruitment instead of the 2008-2023 values
3. Project a moderate *F* value for 2026 onwards (i.e., higher than the very low value projected for 2024 but lower than the *F* target)

The Board was interested in extending the projections to 2035 to better understand the trajectory of the population after the 2029 rebuilding deadline, since the very weak year-classes from 2019-2024 will only just be beginning to enter the spawning stock biomass by 2029. Using a very low recruitment assumption would provide information on what could happen to the population after the 2029 deadline if recruitment continues at current very low levels into the near future. Previous projections showed that fishing at *F*_2024 resulted in ~50% probability of rebuilding by 2029, while fishing at *F* target meant the population would stabilize somewhere between the SSB target and the SSB threshold, so Board members were interested in a scenario where *F* increased somewhat from *F*_2024 but was still below the *F* target. *F*_2024 was considered a low *F* in this scenario because it is the lowest full *F* the stock has experienced since the stock was rebuilt, although the TC-SAS considers *F*=*F*_2024 to be the most likely scenario for 2026-2029, absent any management changes.

These sensitivity runs were updated with the new estimate of 2024 removals.

The TC-SAS noted that these Board-requested sensitivity runs are more pessimistic scenarios as compared to the base run, and do not encompass the possibility of more optimistic future scenarios.

Scenarios

Recruitment

For the base run, recruitment of age-1 fish in 2024 was predicted from the MD young-of-year index value for 2023, and recruitment for 2025 onward was drawn from the current low-recruitment regime years (2008-2023). For the very low recruitment sensitivity run, recruitment was drawn from the most recent 6 years of data, representing the 2019-2024 year-classes, which is a combination of model-estimated recruitment and recruitment predicted from the MD YOY index.

Median recruitment for the base run is 116 million age-1 fish per year, while median recruitment for the lower recruitment sensitivity run is 86 million age-1 fish (Figure 1).

The recruitment distributions used in the projections were the same for the runs with the preliminary data and the runs with the updated 2024 data using the final MRIP estimates.

Fishing mortality

For the base scenario, the TC-SAS recommended projecting *F*=*F*_2024 for 2026 onward, with a 17% increase in *F* in 2025 only as the above-average 2018 year-class enters the ocean slot limit. For the moderate *F* scenario requested by the Board, *F* was assumed to be equal to the average of *F*_2024 and *F*_2025. This scenario, with *F*=0.144, was between the low *F*_2024 value (0.133) and the *F* target (0.17), but still consistent with the TC-SAS's most likely scenario where *F* increases in 2025 and then decreases again for 2026 onwards. In both scenarios, *F* in each year is drawn from a distribution centered around those values to include uncertainty around *F* going forward (Figure 2).

With the new estimate of removals for 2024, *F*_2024 increased from 0.123 to 0.133, *F*_2025 increased from 0.144 to 0.155 (Figure 3), and the average of *F*_2024 and *F*_2025 increased from 0.134 to 0.144.

Results

The base run projections with the updated 2024 data, drawing from 2008-2023 recruitment and using *F*=F2024 for 2026-2035, show that there will be a 30% probability that SSB will be at or above the SSB target by 2029. In this scenario, SSB will continue to increase after 2029 (black line, Figure 4 - Figure 5).

In the scenario where *F* is low (F2024) and recruitment is drawn from the very low recruitment regime (i.e., the 2019-2024 year-classes), there will be a 27% probability of being at or above the SSB target in that year, similar to the low recruitment regime. However, SSB will begin to decline after 2030, as the 2015 and 2018 year-classes continue to die off due to natural and fishing mortality and are replaced by the weak 2019-2024 year-classes (gold line, Figure 4 - Figure 5).

In the moderate *F* scenarios (*F*2024-2025Avg), SSB has an 18-20% probability of being at or above the SSB target in 2029, although there is a high probability that it will be above the threshold. Under the base recruitment scenario, SSB begins to increase towards the end of the projection as the weak 2019-2024 year-classes are replaced by what are projected to be somewhat stronger cohorts, but if recruitment continues to stay at 2019-2024 levels, SSB will decline after 2029, approaching the SSB threshold more quickly than in the *F*_2024 scenario with very low recruitment (blue and pink lines, Figure 4 - Figure 5).

Figure 6 shows the SSB trajectories for each scenario from the previous March 2025 projections with preliminary 2024 MRIP estimates (gold) and final 2024 MRIP estimates (grey). The confidence intervals substantially overlap with the projections using final data but result in slightly lower median SSB levels.

Figures

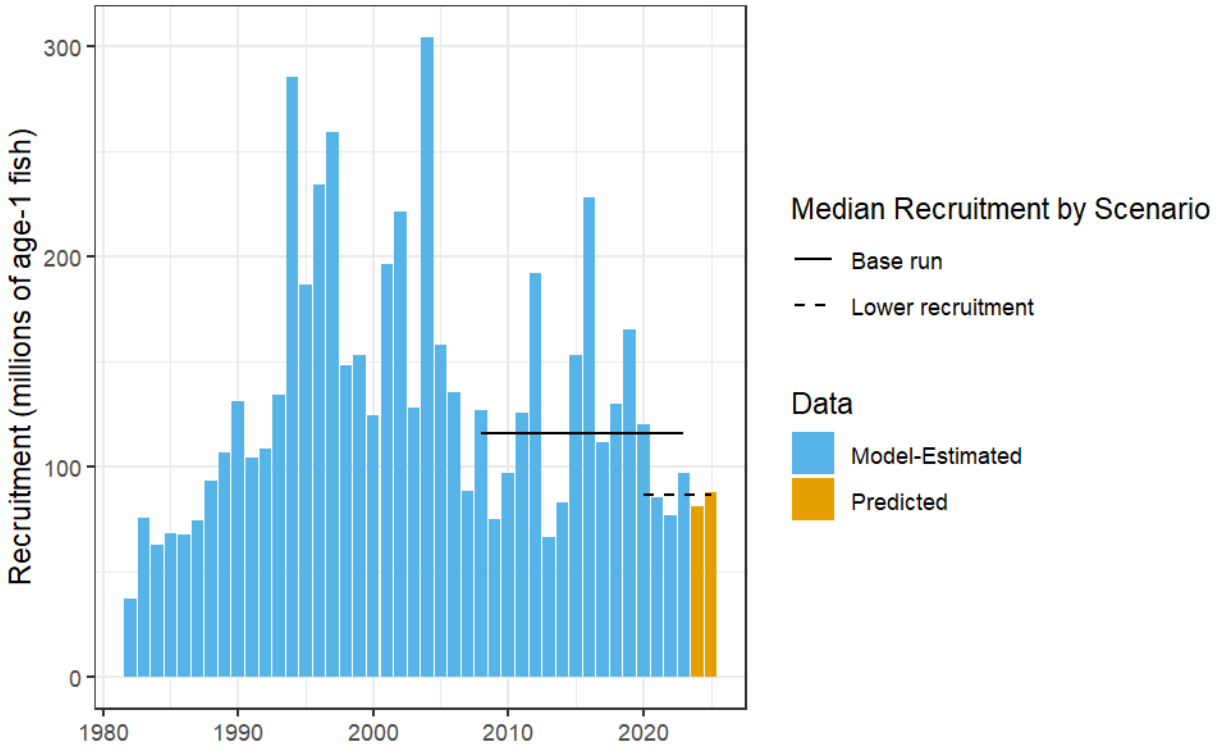

Figure 1. Recruitment time-series used in projections. 1982-2023 values are estimated by the stock assessment and 2024-2025 are predicted from the MD YOY index.

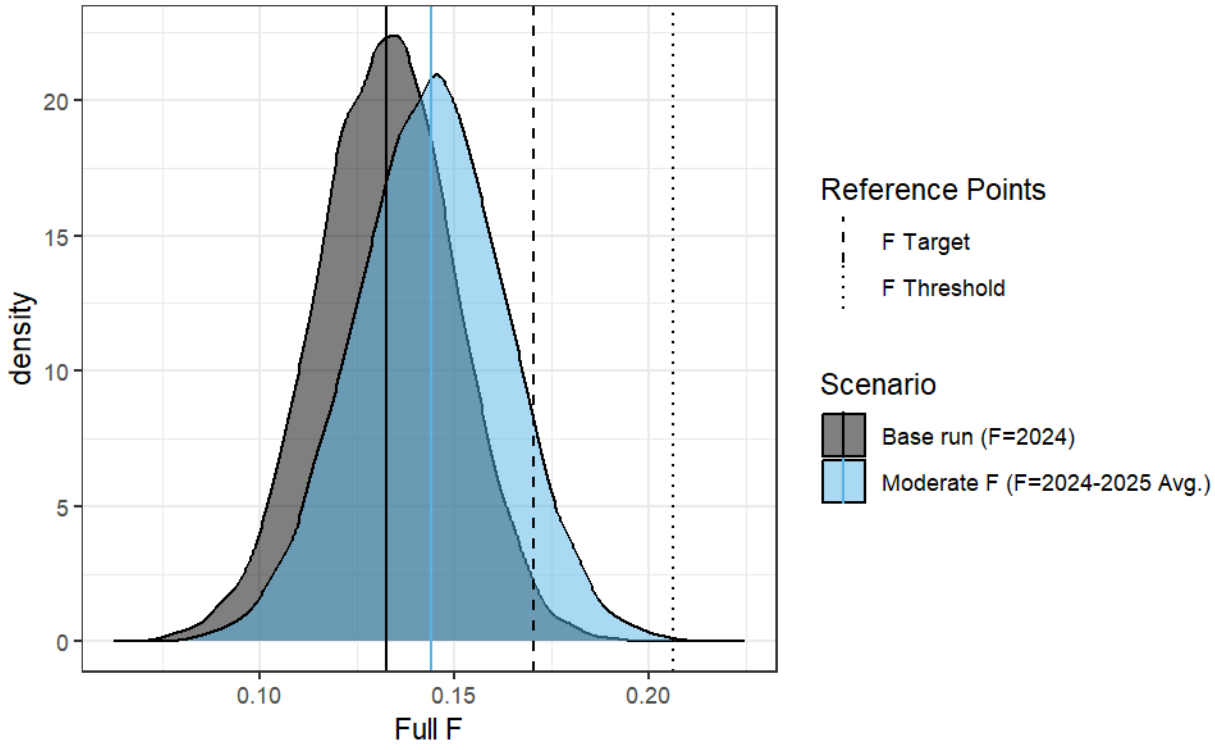

Figure 2. Distribution of *F* rates used in the different projection scenarios plotted with the *F* reference points.

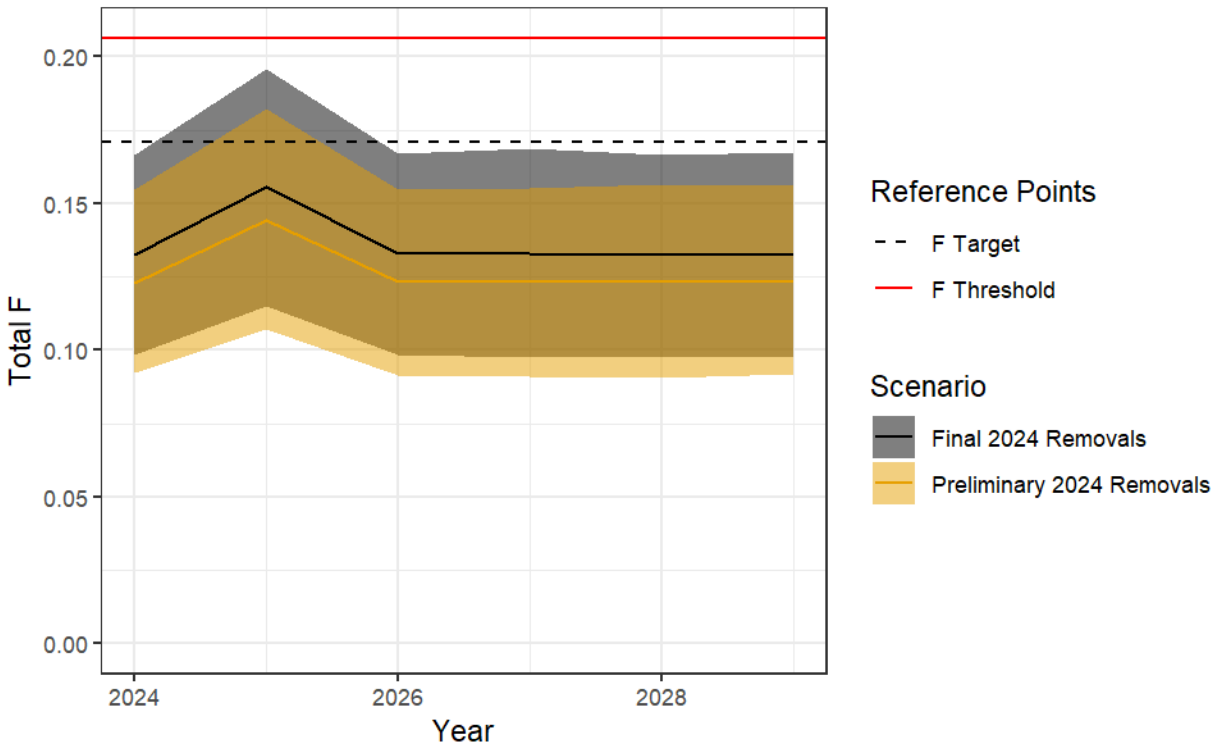

Figure 3. Distribution of *F* used in status quo projections based on preliminary and final 2024 MRIP data.

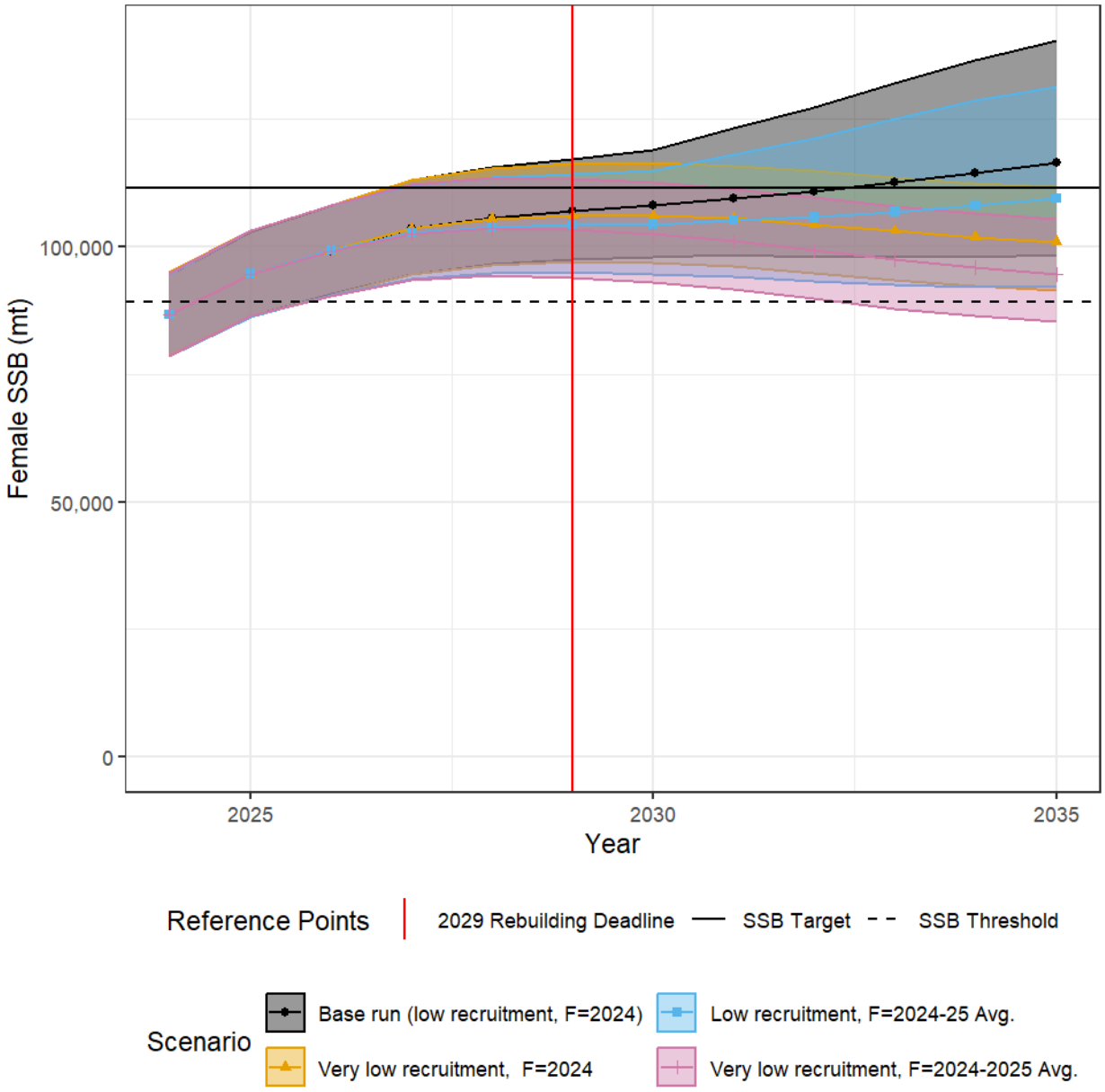

Figure 4. Median SSB trajectories under different assumptions about future *F* and recruitment. Shaded areas indicate 95% confidence intervals.

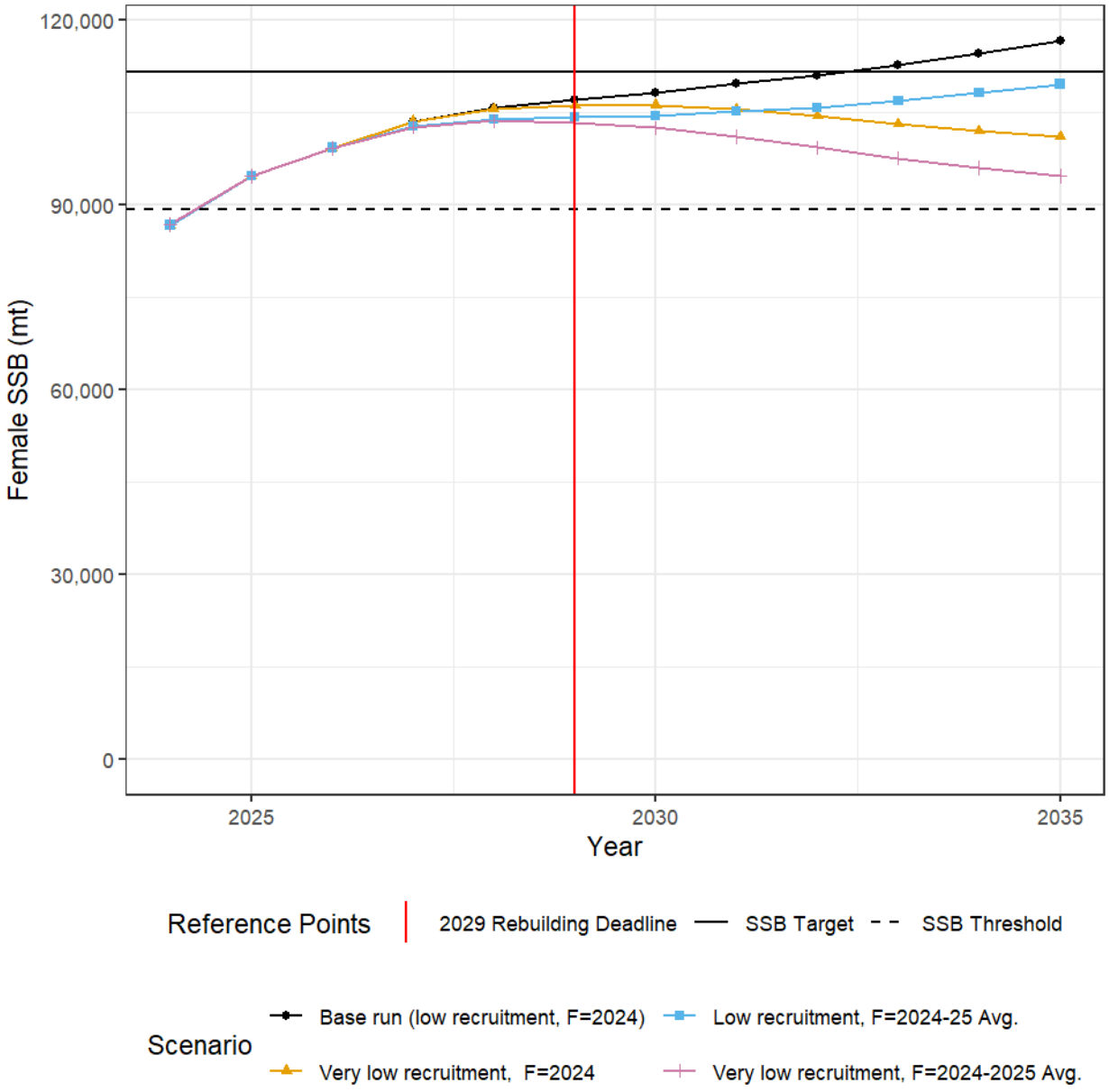

Figure 5. Median SSB trajectories under different assumptions about future *F* and recruitment, plotted without confidence intervals for clarity.

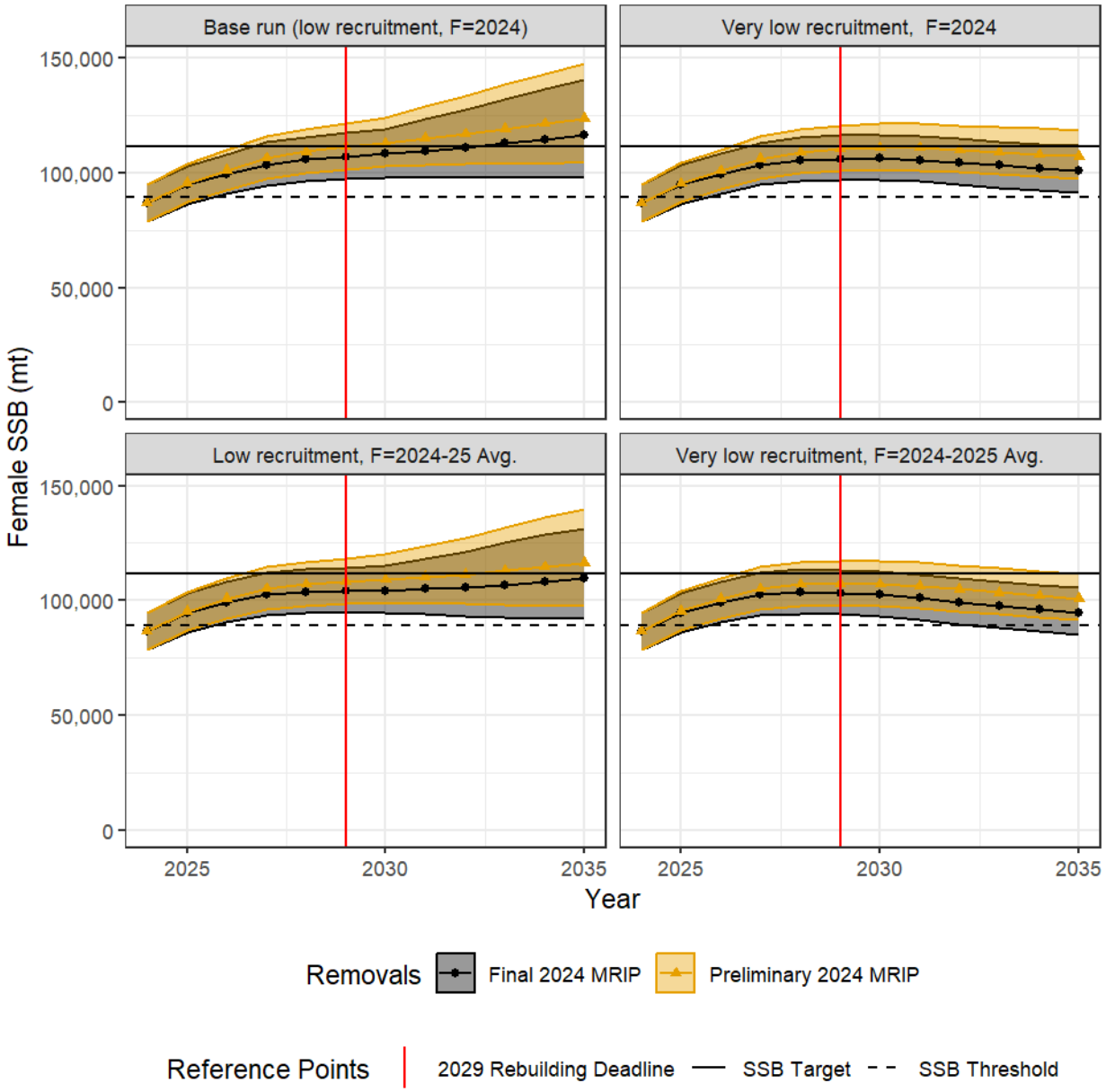

Figure 6. Median SSB trajectories under different assumptions about future *F* and recruitment, using the final and the preliminary 2024 MRIP data. Shaded areas indicate 95% confidence intervals.