Atlantic States Marine Fisheries Commission

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MEMORANDUM

January 11, 2021

TO: **Atlantic Striped Bass Management Board**

FROM: **Atlantic Striped Bass Technical Committee**

SUBJECT: **Release Mortality Sensitivity Runs**

At its 2020 Annual Meeting, the Atlantic Striped Bass Management Board (Board) tasked the Atlantic Striped Bass Technical Committee (TC) with conducting additional runs of the striped bass stock assessment model using different assumptions about the mortality rate on fish released alive by the recreational fishery, as a way to explore the sensitivity of the model to this assumption.

The stock assessment currently assumes that 9% of all striped bass released alive from the recreational fishery die as a result of being caught and released based on a study by Diodati and Richards (1996). The range of estimates from Diodati and Richards (1996) are consistent with estimates from other studies, which have found that factors like temperature, salinity, gear type, angler experience level, and others have an effect on the release mortality rate for striped bass. The TC discussed a range of scenarios to explore for this analysis, including using different release mortality rates for different seasons, regions, and years. The TC had previously developed catch-at-age matrices for the recreational release mortalities by year, region (Bay vs. Ocean), and season (January – February, March – June, and July – December) in order to parameterize the two-stock model. Applying different release mortality rates to these matrices would be straightforward and require minimal additional work, but applying different release mortality rates at a finer scale (such as by month or state) would require significant effort and time. The TC selected four alternative release mortality scenarios to take advantage of the existing catch-at-age matrices and provide reasonable bounds on the problem. Those scenarios are:

- **Base case:** 9% release mortality rate for all regions and seasons
- **Low release rate:** 3% for all regions and seasons (best case scenario rate in Diodati & Richards (1996))
- **High release:** 26% for all regions and seasons (worst case scenario rates in Diodati & Richards (1996))
- **Seasonal release mortality rates:** 5% for January – June, 12% for July – December for both regions (based on regression tree analysis from the 2013 benchmark and other studies)

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- **Regional release mortality rates:** 16% for the Chesapeake Bay, 9% for the ocean for all seasons (based on Lukacovic and Uphoff (2007) for the Bay and Diodati & Richards (1996) for the ocean)

For each scenario, the total catch and the catch-at-age were recalculated based on the new release mortality rate assumption, and the current stock assessment model was run with the new catch data. The SSB threshold (the 1995 estimate of female SSB) and the *F* threshold (the *F* that will maintain the population at the SSB threshold in the long-term) were recalculated for each scenario based on the results of that run. The TC compared estimates of SSB, *F*, recruitment, selectivity patterns, and stock status to determine how sensitive the model was to the release mortality rate assumption.

Results

Overall, changing the release mortality rate assumption changed the scale of the estimates of female spawning stock biomass (SSB), *F*, and recruitment but did not change the overall trend, or change stock status in 2017.

The low and high release mortality rate scenarios had the largest impact on total removals (Figure 1) and therefore on estimates of SSB (Figure 2), *F* (Figure 3), and recruitment (Figure 4). The lower release mortality rate resulted in lower estimates of SSB and recruitment and higher estimates of *F*, while the higher release mortality rate resulted in higher estimates of SSB and recruitment and lower estimates of *F* (Figures 2-4). The seasonal and regional estimates of release mortality, had a smaller effect on total removals (Figure 1), and therefore resulted in smaller changes in SSB, *F*, and recruitment. Estimates of SSB, *F*, and recruitment from the seasonal and regional scenarios were very similar to the base case (Figure 2-4).

The low and high release mortality scenarios also had an effect on selectivity estimates for the fishery. Because fish that are released alive tend to be smaller and younger than fish that are harvested, a higher recreational release mortality rate results in higher selectivity at age for younger fish, while a lower release mortality rate results in lower selectivity-at-age for younger fish (Figure 5). The selectivity patterns estimated for the seasonal and regional scenarios were very similar to the base case selectivity curve. These differences in selectivity were incorporated into the calculations for the *F* threshold, resulting in a lower *F* threshold for the high release mortality scenario, a higher *F* threshold for the low release mortality scenario, and *F* threshold estimates that were very similar to the base case for the seasonal and regional scenarios (Table 1).

Despite the differences in scale across the different scenario, the overall trends were very similar and stock status was the same in all scenarios, with striped bass being overfished and experiencing overfishing in 2017 (Figure 6, Table 1).

Discussion

Significant changes to the release mortality rate (i.e., going from 9% to 3% or 26%) resulted in significant changes to the scale of the population, but did not affect the final stock status determination. The higher release mortality rate did result in a stock trajectory where striped bass became overfished earlier in the time series than the other scenarios, but the 2017 stock status was consistent across all scenarios. The seasonal and regional release mortality rates, which the TC felt were the more realistic scenarios, had minimal impacts on the estimates of SSB, *F*, and recruitment, and minimal impacts on stock status. Therefore, the TC concludes that the model is somewhat sensitive to major misspecification of release mortality rate, but less sensitive to smaller scale misspecifications. Refining the overall coastwide estimate to reflect regional and/or seasonal differences can be pursued for the next benchmark assessment; it would likely not result in significant changes to population estimates or stock status, but could produce minor improvements in the estimates.

The TC stressed that although refining the estimate of the release mortality rate is not expected to have a significant effect on stock status from the assessment model, it does not mean that release mortality is not significant itself. Reducing release mortality through management measures and angler education and outreach – either by reducing the total number of fish caught and released, or by reducing the percent of fish that die as a result of being caught and released through better angling practices – is still important for the recovery of the stock.

The TC noted the limitations of this analysis. First, the different release mortality rates were assumed constant over time. If release mortality rates have been changing over time – for example, increasing due to warming water temperatures, or decreasing due to increased circle hook use or changes in angler behavior – then the impact on population trends and stock status in recent years may be more significant. The TC discussed developing a scenario with a trend in the release mortality rate, but the work to develop a realistic trend tied to temperature or other factors was beyond the scope of this task. Similarly, the release mortality rates explored are the same for all size/age classes of striped bass. There is some limited evidence that release mortality rates may vary by size, but not enough to parameterize a reasonable alternative scenario for this task. These are scenarios that can be explored in more depth for the next benchmark.

Literature Cited

Diodati, P.J. and R.A. Richards. 1996. Mortality of Striped Bass Hooked and Released in Salt Water. Transactions of the American Fisheries Society 125:300-307.

Lukacovic, R. and J. Uphoff. 2007. Recreational Catch-and-Release Mortality of Striped Bass Caught with Bait in Chesapeake Bay. FISHERIES TECHNICAL REPORT SERIES No. 50. Maryland DNR Fisheries Service. Annapolis, Maryland. 21 pp.

Table 1. Comparison of reference points, 2017 estimates, and probability that SSB in 2017 is below the SSB threshold for the base case and the four release mortality scenarios explored.

Scenario	SSB threshold	SSB_{2017}	$P(SSB_{2017}<SSB_{threshold})$	*F* threshold	F_{2017}
Base Case	91,633	68,141	99.9%	0.24	0.31
Low Mortality	86,231	62,699	99.9%	0.28	0.30
High Mortality	130,783	93,755	99.9%	0.21	0.29
Seasonal	93,469	68,080	99.9%	0.24	0.31
Regional	91,555	66,802	99.9%	0.25	0.32

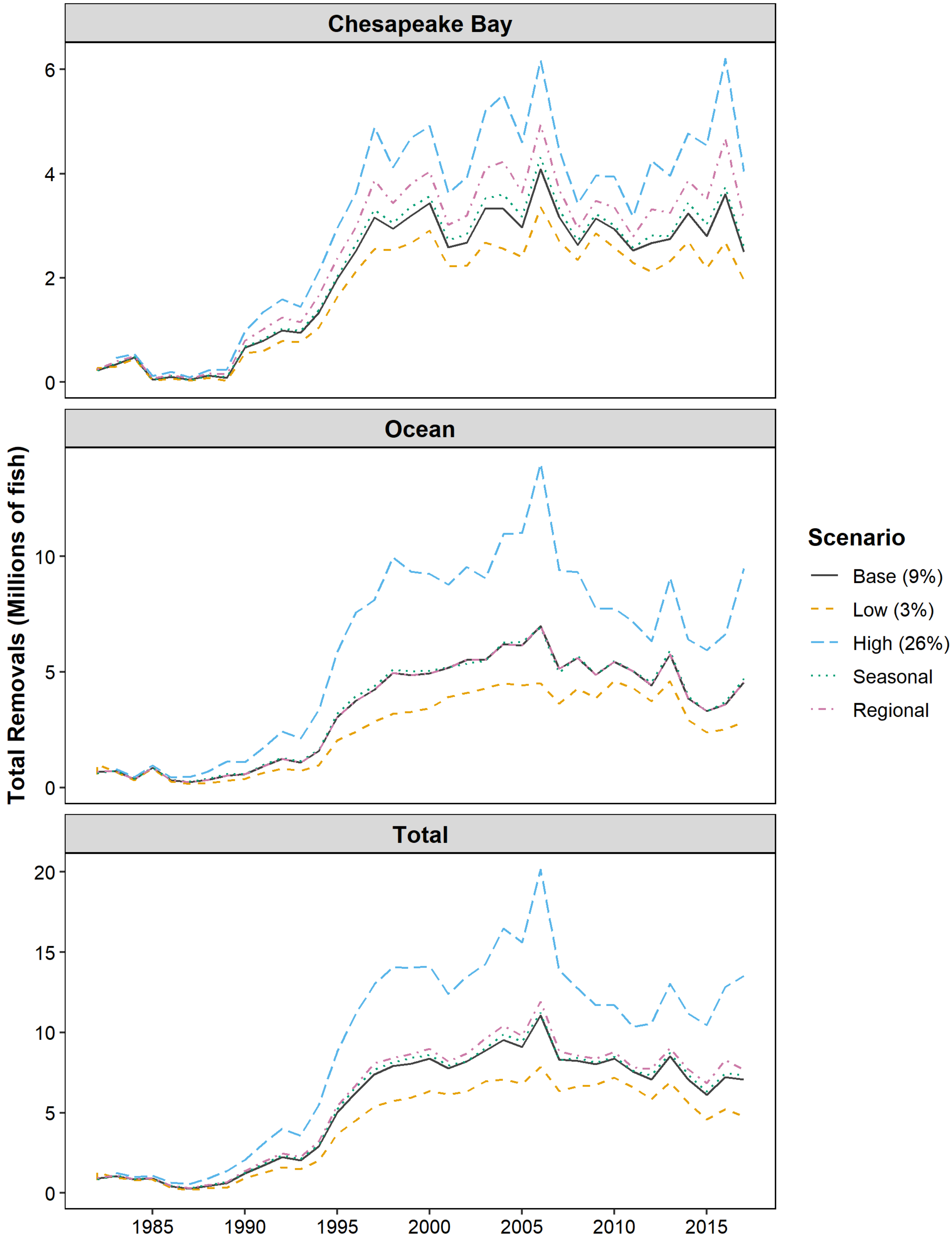

Figure 1. Estimates of total removals by region (top and middle panels) and for the coast (bottom) under different release mortality rate scenarios. Note the difference in scale for the y-axes on each panel.

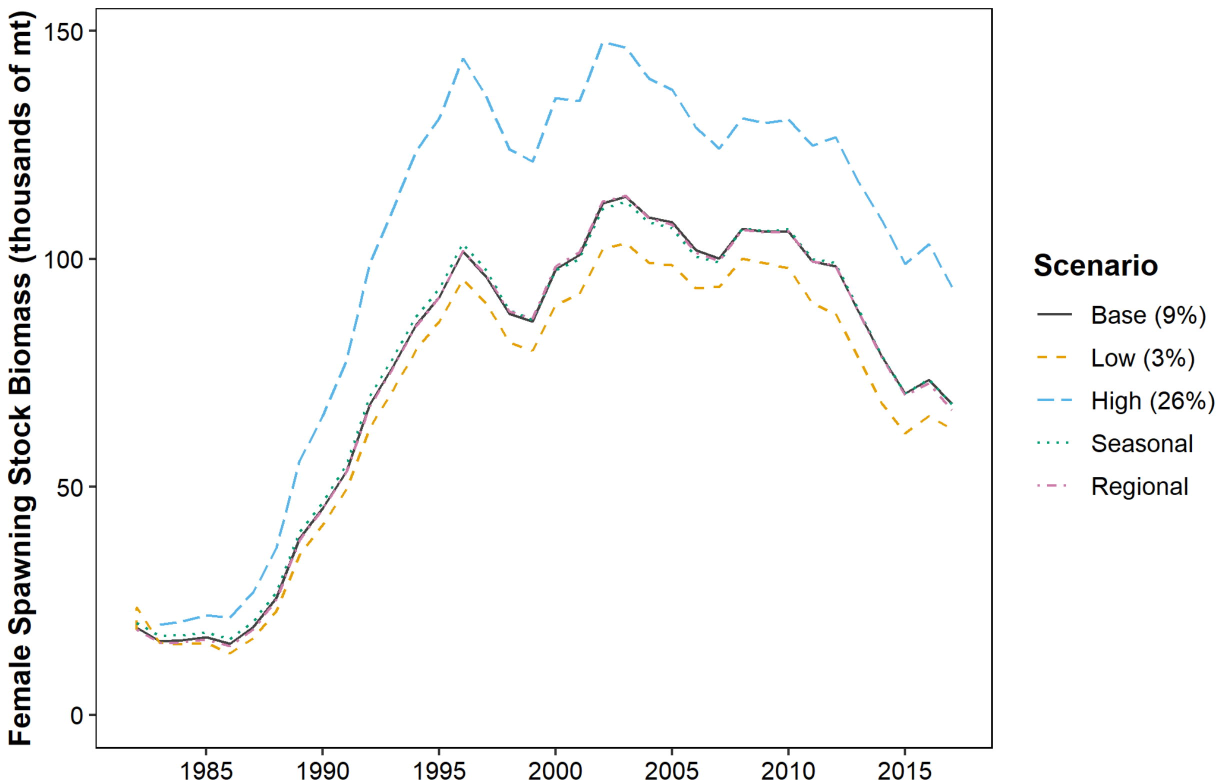

Figure 2. Female spawning stock biomass estimates under different release mortality rate scenarios.

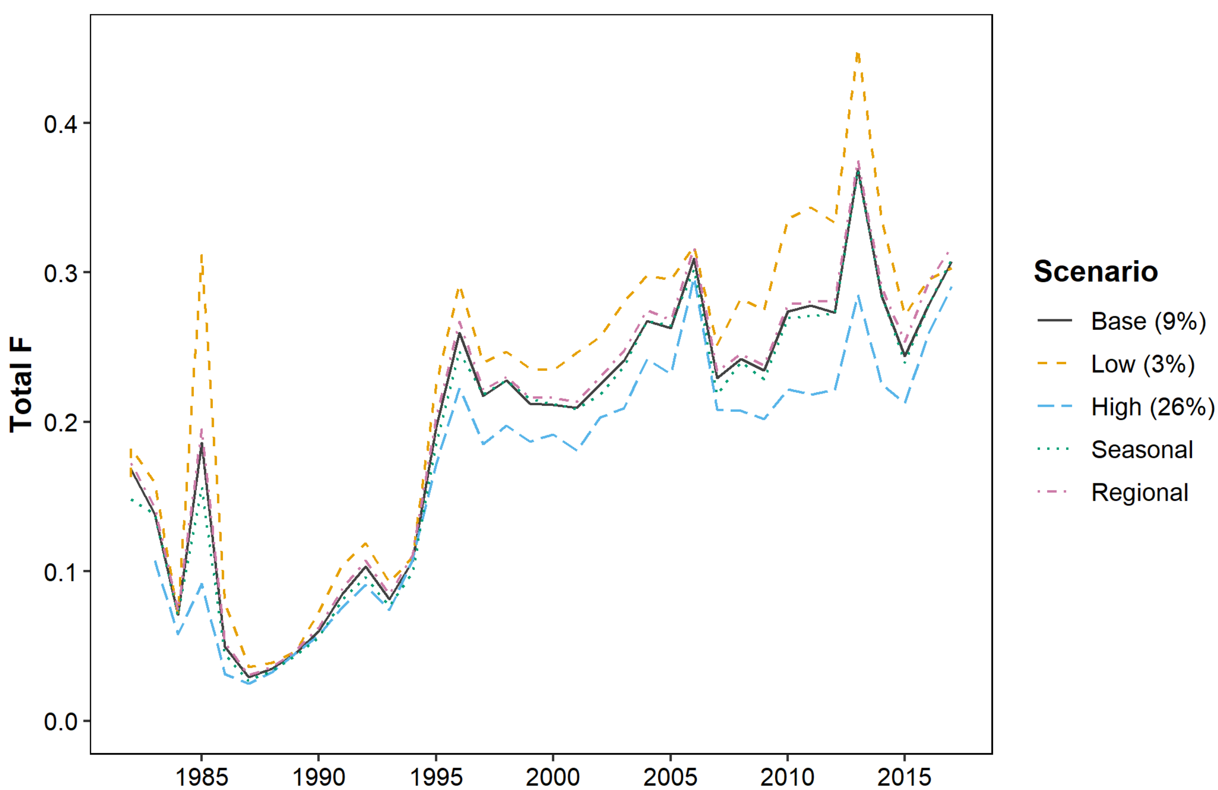

Figure 3. Fishing mortality estimates under different release mortality rate scenarios.

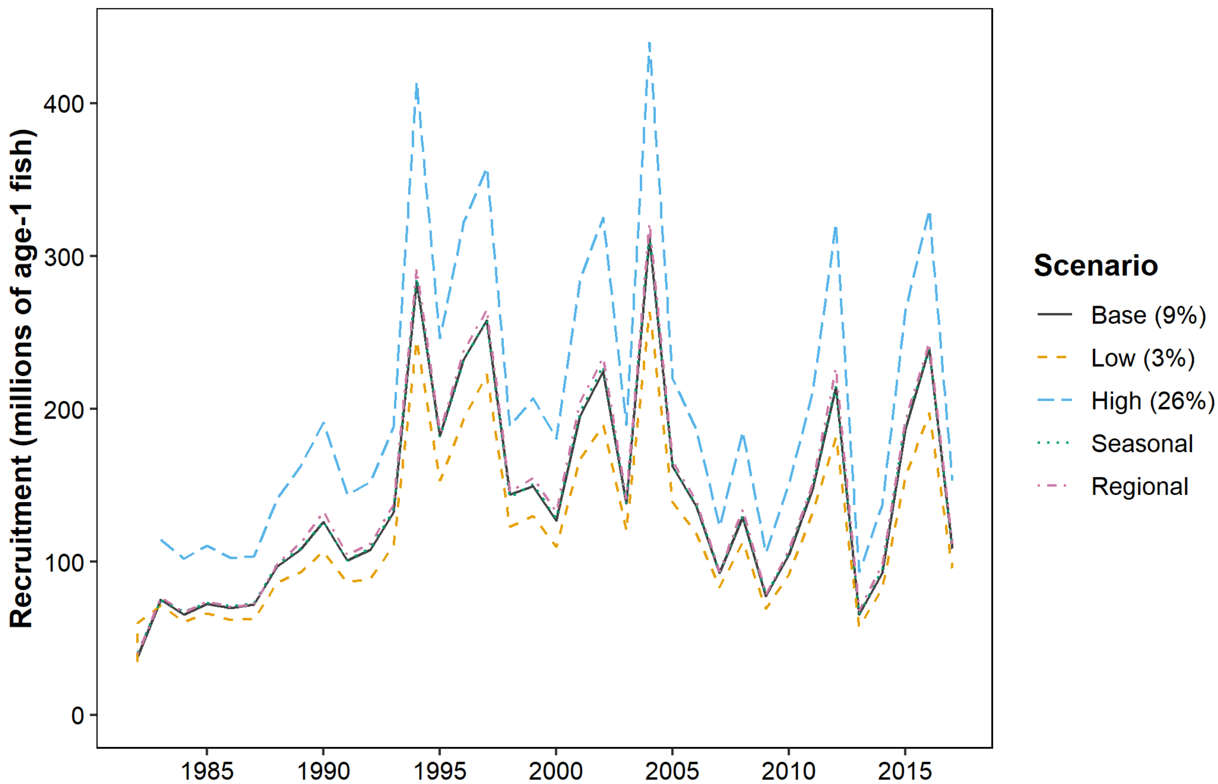

Figure 4. Recruitment estimates under different release mortality rate scenarios.

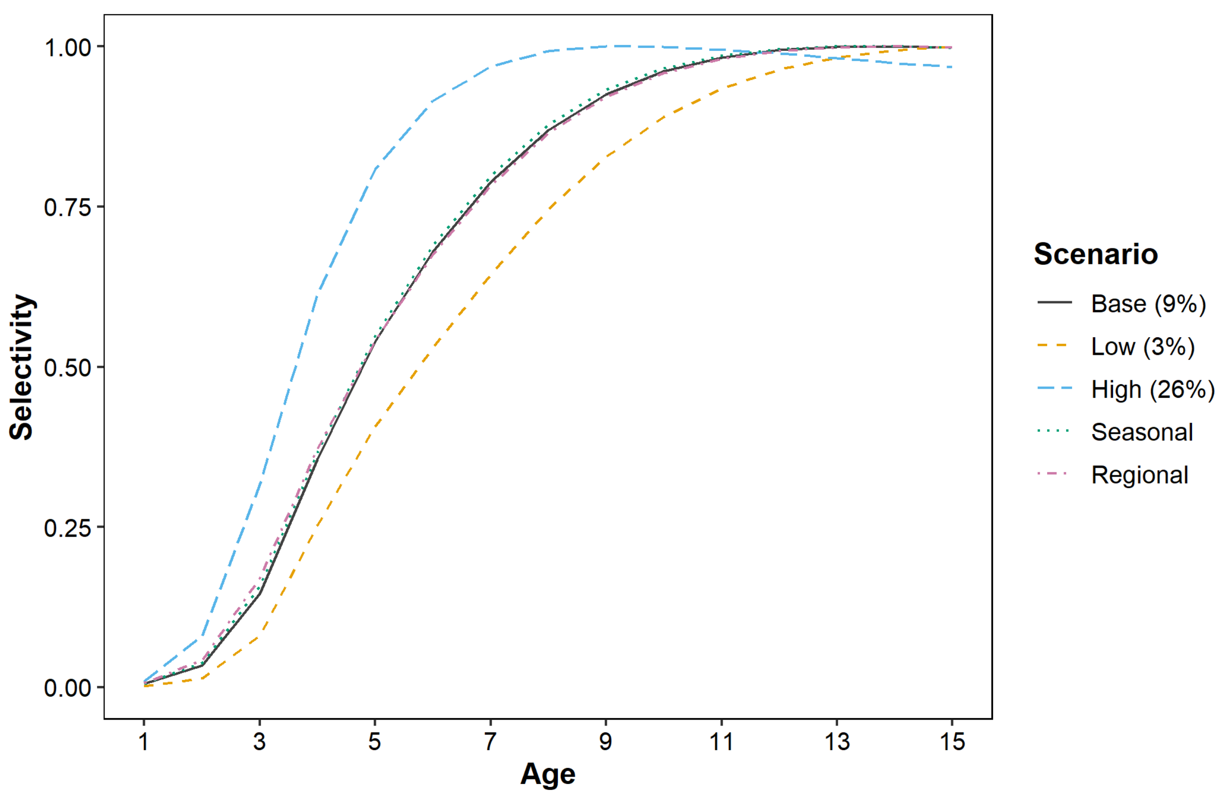

Figure 5. Estimated fishery selectivity patterns under different release mortality rate scenarios.

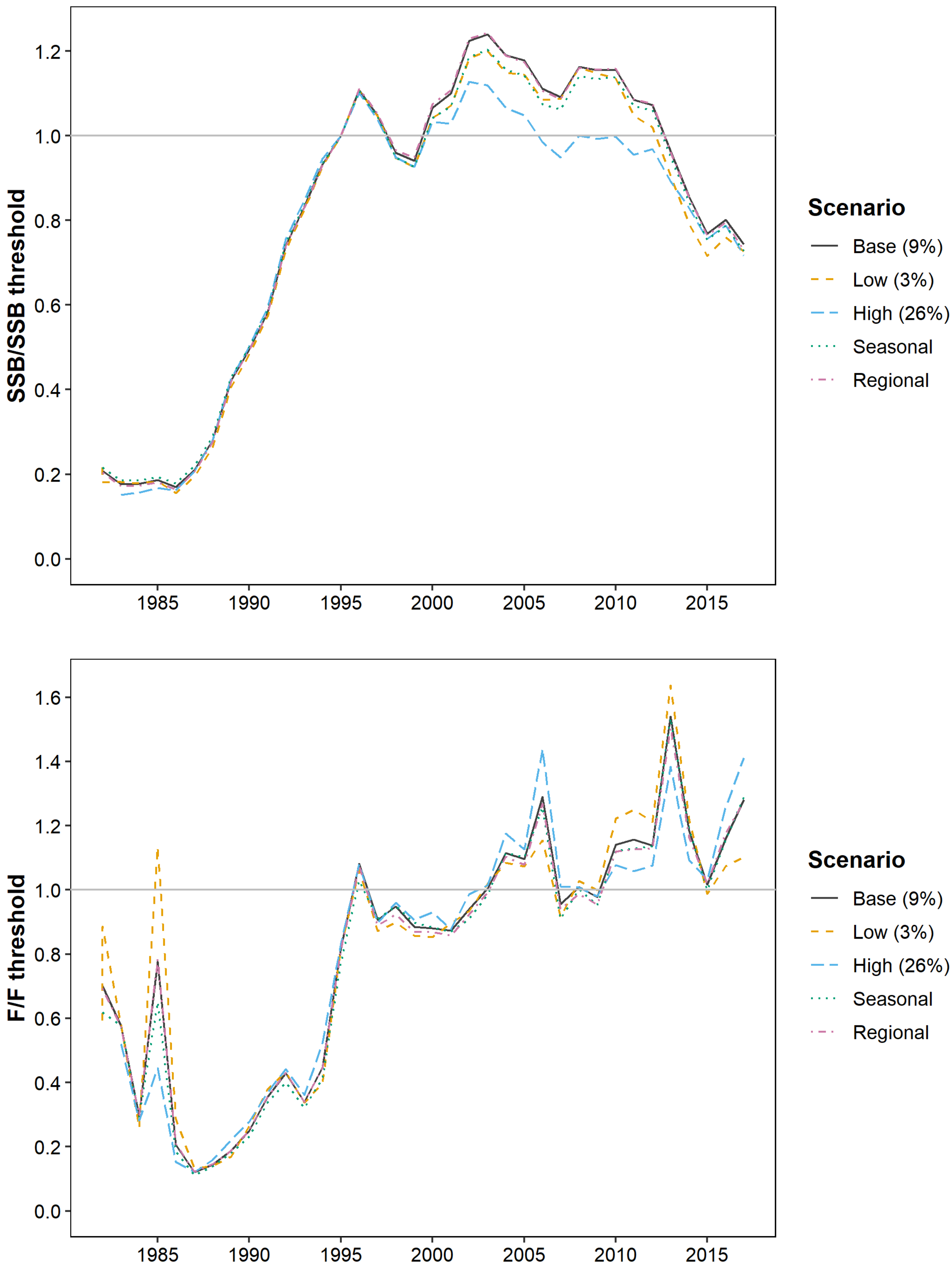

Figure 6. Overfished status (SSB relative to the SSB threshold, top) and overfishing status (*F* relative to the *F* threshold, bottom) under different release mortality rate scenarios.