



New England Fishery Management Council

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MEMORANDUM

DATE: September 8, 2009
TO: Scientific and Statistical Committee (SSC) Members and Council Members
FROM: Lori Steele, NEFMC Staff, Herring PDT Chair
SUBJECT: **Atlantic Herring Overfishing Definition – Proposed Modification to Control Rule**

Background

The 2009 TRAC update assessment results estimate that Atlantic herring biomass was 651,700 mt at the beginning of 2008, which is below B_{MSY} (670,600 mt). Estimated fishing mortality in 2008 was 0.14, which is below F_{MSY} (0.27).

The Atlantic herring stock complex is above $\frac{1}{2} B_{MSY}$ and fishing mortality is below F_{MSY} , so the stock is not overfished and overfishing is not occurring. The current overfishing definition (Atlantic Herring FMP, 1999) for Atlantic herring is provided below.

If stock biomass is equal or greater than B_{MSY} , overfishing occurs when fishing mortality exceeds F_{MSY} . If stock biomass is below B_{MSY} , overfishing occurs when fishing mortality exceeds the level that has a 50 percent probability to rebuild stock biomass to B_{MSY} in 5 years ($F_{Threshold}$). The stock is in an overfished condition when stock biomass is below $\frac{1}{2} B_{MSY}$ and overfishing occurs when fishing mortality exceeds $F_{Threshold}$. These reference points are thresholds and form the basis for the control rule.

The control rule also specifies risk-averse fishing mortality targets, accounting for the uncertainty in the estimate of F_{MSY} . If stock biomass is equal to or greater than $\frac{1}{2} B_{MSY}$, the target fishing mortality will be the lower level of the 80 percent confidence interval about F_{MSY} . When biomass is below B_{MSY} , the target fishing mortality will be reduced consistent with the five-year rebuilding schedule used to determine $F_{Threshold}$.

Table 1 Current (TRAC 2009) Biomass and Fishing Mortality Status/Reference Points for the Atlantic Herring Stock Complex

	BIOMASS	FISHING MORTALITY
REFERENCE POINTS (MSY = 178,374 mt)	$B_{MSY} = 670,600$ mt $B_{Threshold} = 335,290$ mt	$F_{MSY} = 0.27$ $F_{Target} = \text{Unknown}^*$
2008 ESTIMATES (TRAC 2009)	651,700 mt	0.14

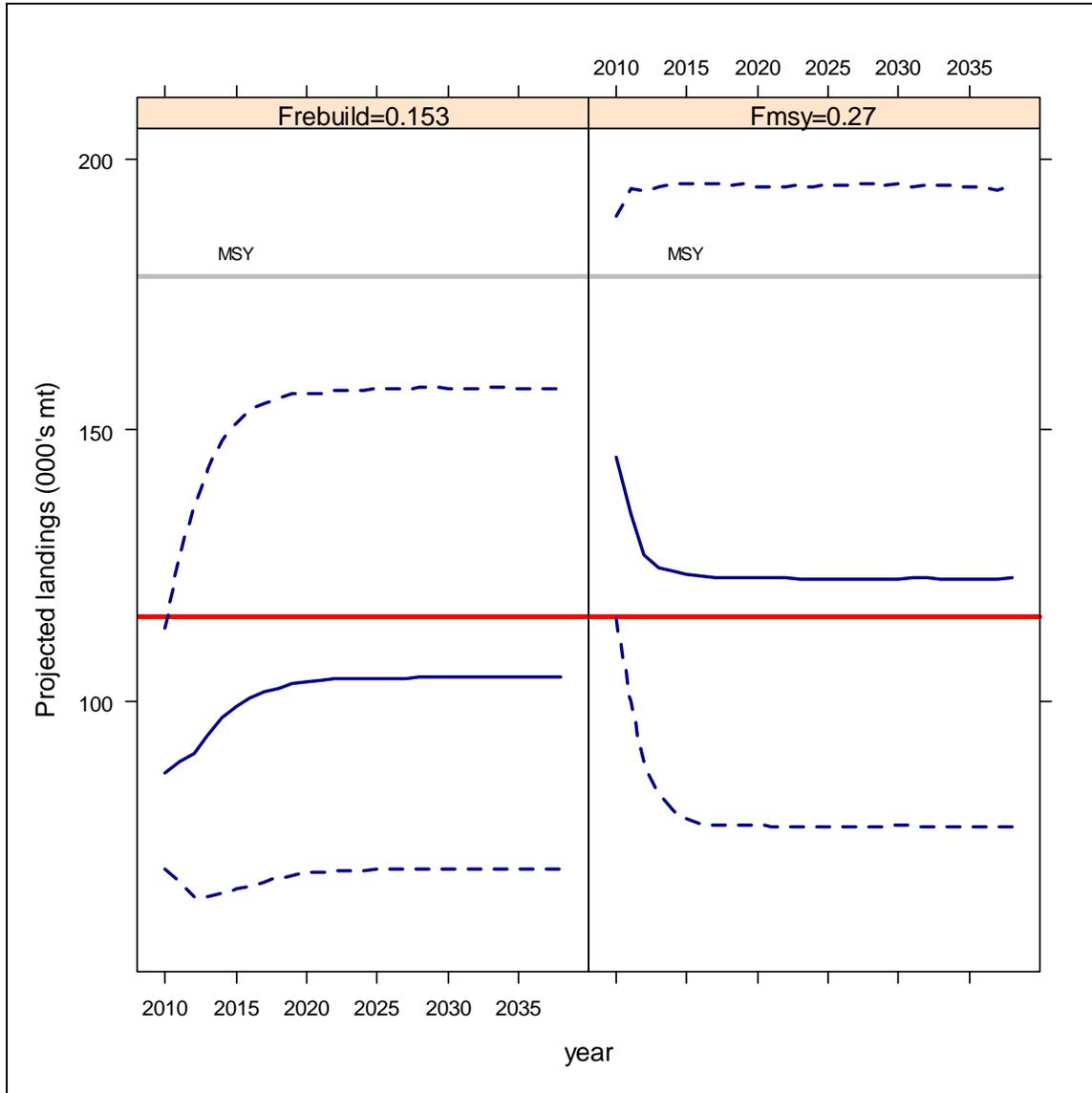
**The methods for calculating reference points in the TRAC assessment do not yield probability distributions, so the 80% confidence interval cannot be calculated.*

Several issues associated with the current overfishing definition for Atlantic herring, which is provided from the original Herring FMP (1999), need attention. The current control rule (with target F) appears to be inconsistent in light of the new MSRA requirements and associated National Standard Guidelines and have estimation problems (developing confidence limits around F_{MSY}). The definition of overfishing is contingent on the relationship of current biomass to B_{MSY} . For biomass at or above B_{MSY} , overfishing is defined as fishing above F_{MSY} . However, when biomass is between $\frac{1}{2} B_{MSY}$ and B_{MSY} , overfishing is defined as exceeding the rebuilding F, specified as an F that allows rebuilding within 5 years with 50% probability. When biomass falls below B_{MSY} , therefore, the control rule requires a rebuilding program. B_{MSY} is a long-term value, and the current control rule does not provide for the expected short-term fluctuation of biomass around B_{MSY} based on changes in recruitment and other factors. Currently, the population does not rebuild to B_{MSY} using long-term projections at F_{MSY} and empirical recruitment (Figure 1, Figure 2). The inconsistency between the long-term projections (required to develop rebuilding F and time periods and stock determination overfishing criterion when B is below B_{MSY}) and the reference points (to define stock status) needs reconciling in order to have a functional control rule. For example, long-term projections at F_{MSY} (0.27) yield a median January 1, 2+ biomass of approximately 483,000 mt (72% B_{MSY}) and an average of 500,000 mt (75% of B_{MSY}). Similarly, long-term projections at F_{MSY} give median landings of 123,000 mt (69% of MSY) and average of 127,000 mt (71% of MSY).

Moreover, the FMP utilizes target F, defined as the lower bound of the percentile of the confidence limits around F_{MSY} . The explicit goal of the F_{target} is to take into account the uncertainty with the F_{MSY} estimate. Two problems with the F_{target} approach are: the current external Fox production model used to define the $F_{threshold}$ does not generate 80% confidence limits of the F_{MSY} estimate needed to estimate the F_{target} ; and the F_{target} does not explicitly account for other sources of scientific uncertainty such as retrospective pattern in the assessment. Under the new MSRA guidelines, ABC is set to provide a low probability of exceeding F_{MSY} given scientific uncertainty. Without the necessary information, overfishing determinations and target fishing mortality rates cannot be determined. However, given current F (about $\frac{1}{2} F_{MSY}$) and current B (97% of B_{MSY}), assuming that the stock is not overfished and overfishing is not occurring is reasonable at this time. Specifying F_{target} does not appear to be necessary under the new approach to specifying an ABC and ABC control rule, as the target F will be the fishing mortality rate that results from following the ABC control rule. A benchmark stock assessment is needed to address issues related to the reference points and projection results as well as the current overfishing definition. Given the inconsistencies between current methods and the

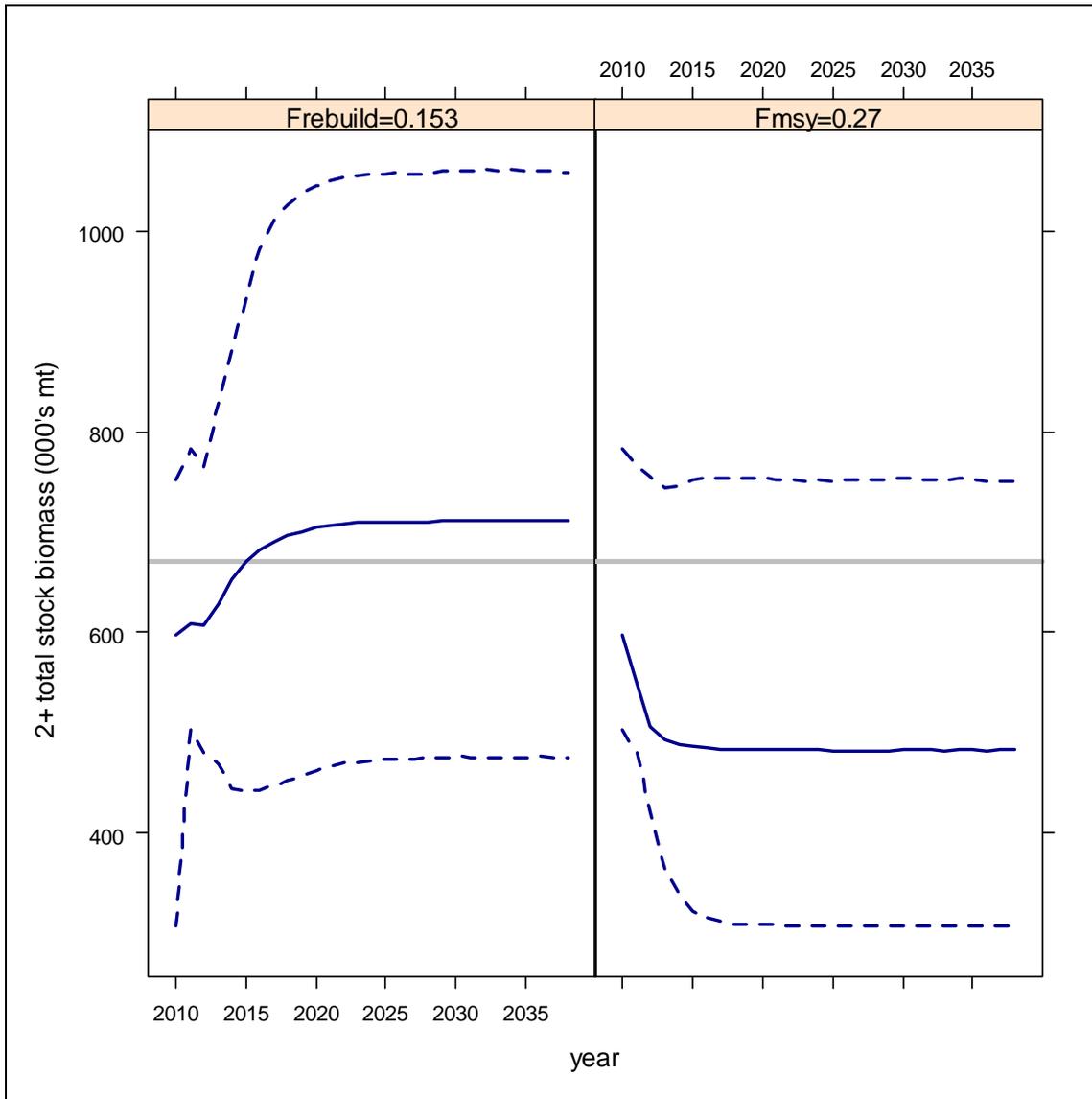
current control rule, the modifications proposed by the Herring PDT should provide a useful approach until the next benchmark stock assessment, with little risk of a stock decline or exceeding F_{MSY} .

Figure 1 Long-term Projections of Landings (000's tons) from 2009-2038



*Left Panel: $F_{rebuild}=0.153$. Right Panel: $F_{MSY}=0.27$. $F=0.16$ in 2009.
 Dark blue line is median landings and dashed blue lines are 5th and 95th percentiles from the distribution of projected landings.
 Gray line is MSY (178.4 000's of tons) from 2009 TRAC assessment.
 Solid red line is average total landings from 1998 to 2008 (115.5 thousand metric tons).*

Figure 2 Long-term Projections of 2+ January 1 Stock Biomass from 2009-2038



Left Panel: $F_{rebuild}=0.153$. Right Panel: $F_{MSY}=0.27$. $F=0.16$ in 2009.
 Dark blue line is median stock biomass, dashed blue lines are 5th and 95th percentiles from the distribution of projected biomass.
 Gray line is B_{MSY} (670.6) from 2009 TRAC assessment.

Proposed Modification to Control Rule (PDT Recommendations)

The Magnuson-Stevens Reauthorization Act requires that every FMP specify “objective and measurable criteria for identifying when the fishery to which the plan applies is overfished.” Guidance on this requirement identifies two elements: (1) a maximum fishing mortality threshold ($F_{\text{threshold}}$, or proxy); and (2) a minimum stock size threshold ($B_{\text{threshold}}$). The PDT recommends that the current thresholds for fishing mortality and biomass be maintained, and that the control rule be modified to be more consistent with control rules for other stocks.

When is the stock overfished?

The stock is overfished when biomass falls below the minimum stock size threshold or its proxy.

B_{threshold}:

- $\frac{1}{2} B_{\text{MSY}}$

When is overfishing occurring?

Overfishing occurs when the fishing mortality rate exceeds the maximum fishing mortality threshold for one year.

F_{threshold}:

- F_{MSY}

Proposed Overfishing Definition Control Rule

When the stock is overfished (below $B_{\text{threshold}}$), the target fishing mortality rate is the rate that will have a 50% probability to rebuild the stock to B_{MSY} in ten years. When stock biomass falls below 75% of B_{MSY} , the target fishing mortality rate is the rate that will have a 50% probability to rebuild the stock to B_{MSY} in five years.

Discussion

The proposed modification to the control rule provides a more appropriate approach that recognizes natural variability associated with maintaining a stock at B_{MSY} . There would still be inconsistencies associated with the projections used to estimate the rebuilding fishing mortality rates and those currently used to specify the reference points and estimate stock status, but these issues would presumably be addressed in the next benchmark stock assessment.