Attachment 2.
Peer Review of "Depletion-Corrected Average Catch Estimates for U.S. South Atlantic Wreckfish"

SAFMC SSC Subcommittee
November 10, 2011

The report (NMFS SERO, October 23, 2011) was reviewed by a subcommittee of the SEFSC SSC (L. Barbieri, chair; J. Berkson; S. Cadrin, and Y. Jiao) and met with A. Strelcheck on November 9 2011. Each of the model inputs (landings series, natural mortality, depletion estimate, and the ratio of Fmsy to natural mortality) to attempt a determination of a 'best run' and a candidate ABC recommendation for review by the entire SSC.

1. Landings:
Time series: Two options for time series of landings were used in the report (1987-2010 and 1989-2010). The subcommittee requested revised analyses that use a time periods of landings that are consistent with the two options for periods used to derive the depletion estimate (1990 to 2006 and 1992 to 2006). The choice on period of rebuilding is discussed below. Total landings were 12.5 mil lb for the 17 years from 1990 to 2006, and 6.8 mil lb from the 15 years of 1992 to 1996.

Uncertainty in landings: The assumed variability in total catch (CV=10%) corresponds to a relatively well-estimated catch in this ITQ fishery with few fishery

2. Natural Mortality (M)
Most likely value of M: The report states: "*M ranged from 0.06-0.09 using Pauly (1979) and 0.11-0.14 using Hoenig (1983). Estimates of M for Hoenig (1983) were based on maximum ages of 30-39 years. More recent age and growth data from Peres and Haimovici (2004) indicate wreckfish may live considerably longer (up to 76 years). Based on Hoenig (1983) and Hewitt and Hoenig (2005) and a maximum age of 76 years, M ranged from 0.04-0.06. Vaughn et al. (2001) recommended 0.1 be used as the preferred estimate of M*."

The subcommittee agreed that calculations of M that are based on the most recent age data are most defensible (Peres et al. 2004; maximum age of 76 years). However, the subcommittee recommended that the estimate of M from Hewitt and Hoenig (2005; M=0.06) is an improvement for deriving M from maximum age than the Hoenig (1983) method.

Uncertainty in M: We can only approximate uncertainty in M, and a standard deviation of 0.5 in Ln(M) produces a reasonable distribution of M (0.04 to 0.10 +/- 1 SD).

3. Depletion:
CPUE standardization: Appendix 1 gives sufficient detail to accept the analysis to provide a standardized CPUE. A large portion of variance was explained (R^2=57%), and the model diagnostics (distribution of residuals, etc.) look quite good.

CPUE trends: The use of CPUE as a measure of relative abundance assumes that catchability of a GLM-standardized unit of effort is constant throughout the time series. Violation of this assumption should be expected to be in a direction of increasing catchability, because of technological advances since the early fishery (1992). Therefore, the apparent depletion from the trend in CPUE may be an underestimate of depletion.

Choice of depletion period: The report states that "*Since 2007, standardized and nominal catch rates have increased. The reduction in CPUE from 1992 to 2010 was 35% for nominal and standardized indices. Reductions in CPUE from 1992 to 2006 were ~57-58%. A 35% change in biomass was used as the lower bound for model runs and a 60% change in biomass was used as the upper bound for model runs. A middle run was also conducted using a 50% change in biomass. This run was based on personal communication with Paul Reiss (September 9, 2011), a wreckfish shareholder who currently lands a significant portion of the annual wreckfish landings. Mr. Reiss indicated that a 50% reduction in his CPUE has likely occurred since landings peaked in the early 1990s. Mr. Reiss also indicated that his CPUE has been increasing in recent fishing years*." (page 4).

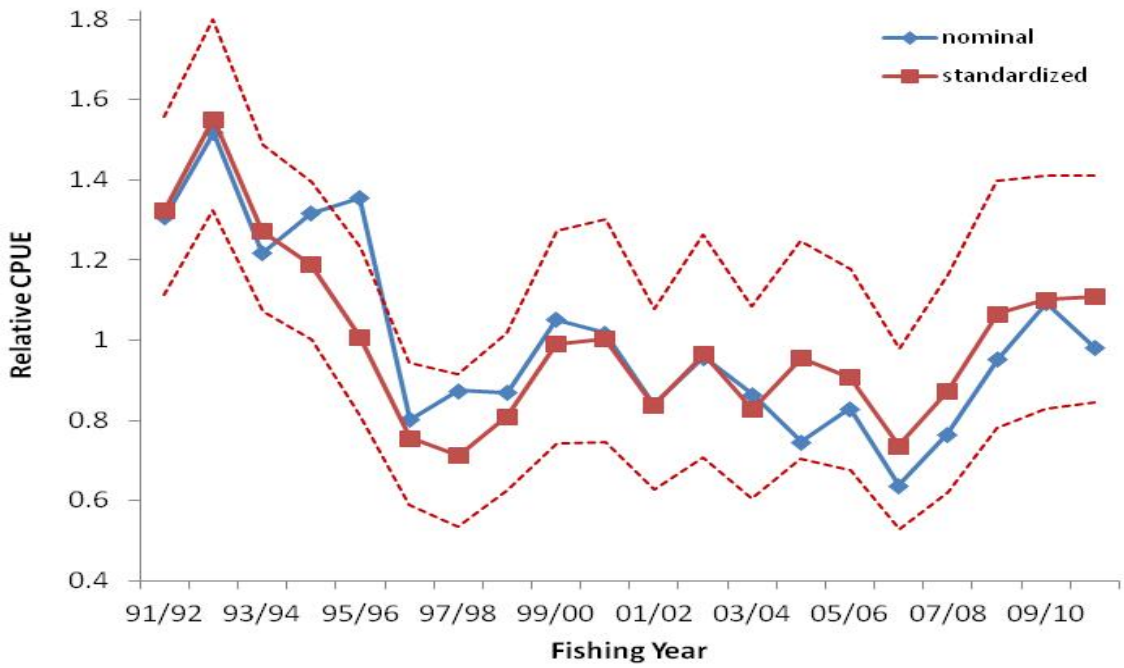

Figure 1. Extended series nominal and standardized index of wreckfish abundance (± 80% confidence intervals) for High-3 fishing vessels, 1991-2010.

The subcommittee supports the derivation of depletion based on the maximum year of CPUE (1992/1993) and the minimum year of CPUE (2006/2007). This choice of depletion period is consistent with MacCall's (2009) application of DCAC to Gulf of Maine redfish in which he chose the year of minimum biomass as the last year of the depletion, and excluded subsequent years of rebuilding to provide a good approximation of MSY from a more informative age-based assessment.

Unfished Biomass: The subcommittee felt that there were two valid options for calculating depletion relative to unfished biomass (B0):

1) $\Delta = \frac{CPUE_{max} - CPUE_{min}}{CPUE_{B0}}$

2) $\Delta = \frac{CPUE_{B0} - CPUE_{min}}{CPUE_{B0}}$

The CPUE standardization was extending further back in time. The Extended series back to 1991 had lower CPUE than 1992, similar to the CPUE series developed by Vaughan et al. (2001). In lieu of a CPUE observation that represents B0, the depletion trend in the CPUE series was extrapolated back to the beginning of the fishery to derive $CPUE_{B0}$ (1.82). The resulting calculations of depletion are 44% (equation 1) and 60% (equation 2).

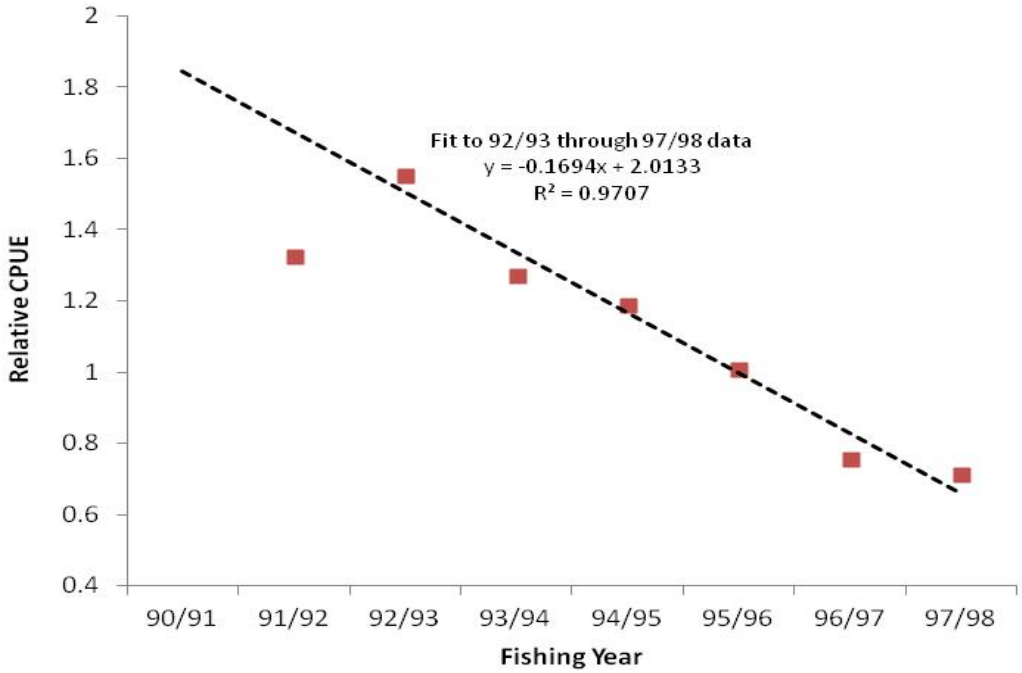

Figure 2. Extrapolation of depletion to the beginning of the fishery to approximate CPUE at B0.

<u>Uncertainty in depletion:</u> The distribution of delta should be a function of uncertainty in the standardized CPUE (e.g., the distribution of maximum and minimum year CPUE) rather than an assumed standard deviation of 0.2. This can be done using a bootstrap analysis of the GLM to derive joint-distributions of the maximum and minimum year CPUE, and the resulting distribution in depletion.

A crude approximation of such an analysis is calculating extremes of depletion using confidence limits of CPUE during the maximum and minimum years. The resulting range of depletion calculations around the point estimate of 44% depletion (17% to 68%) is similar to the distribution of depletions based on a standard deviation of 0.2 (24% to 64% +/- 1 SD).

4. Fmsy:

The report states that "*There is currently no estimate for Fmsy. M is often considered a conservative proxy for Fmsy (Restrepo et al. 1998) and MacCall (2009) noted that a ratio of Fmsy to M = 1 may be considered a target or upper limit for many stocks. Walters and Martell (2004) indicated ratios = 0.75-0.8 may be appropriate in data poor situations and that the ratio of Fmsy to M may be as low as 0.6 for highly vulnerable stocks. For this analysis, sensitivity runs were conducted using Fmsy to M ratios of 0.8 and 1.0.*"

The choice of the parameter c (Fmsy/M) is an expert judgment. Meta-analysis of all stocks in the region with known Fmsy and M indicated that c was greater than 1 for all stocks. There is nothing about wreckfish life history or the fishery that would justify c<1. Therefore, the most defensible value of c provided in the report is c=1.0.

Recommendation

The subcommittee concludes that two alternative analyses are equally valid, and have complementary strengths and weaknesses. The 44% depletion estimate is based directly on observed years of CPUE, whereas the 60% depletion estimate is based on the entire period of depletion. The average estimate of Ysust is 0.235 mil lb. This is 6% less than the previous ABC recommendation of 0.25 mil lb.

In the future, the catch and CPUE series may support a biomass dynamics approach to stock assessment of wreckfish, which would be a more informative basis for fishery management. Both DCAC and biomass dynamics models represent productivity in the fished area, and sustainable yield in the entire resource area may be greater.

Acknowledgments

The subcommittee thanks Andy Strelcheck for his efforts and responsiveness in providing alternative analyses. We are also grateful to Alec MacCall for his technical guidance.

References

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