-For Peer Review Only- **WEAKFISH WP#3 (11/24/08)**

Weakfish Predation Models Summary

Additional analyses for the weakfish stock assessment include several new and updated approaches. Time series (1981-2007) of weakfish age aggregated (ages 1+) *F* and stock biomass (mt) estimates were derived in the new assessment based on blended relative abundance indices from the MRFSS mid-Atlantic private boat fishery, the August NJ trawl survey, and the DE trawl survey.

1) New Analysis - Ricker stock recruitment (S-R) modeling that included the coast-wide blended recruitment index for the 1981 to 2007 year-classes against spawning stock size (mt) that consisted of the age aggregated (ages 1+) biomass (mt) estimates from the index-based analysis. This nonlinear model was run alone and in combination with a blended index of predation (Tpred) consisting of the time series of coast-wide striped bass and spiny dogfish abundance. When the Ricker model was run without predation effects, the statistical fit to the S-R data was strong (high coeifficient of determination and low standard errors about the parameter estimates), but a significant serial correlation in the residuals was noted, indicating serious process error. When the Ricker model was fitted to S-R data in the presence of Tpred, the fit was strong, the precision of the parameter estimates was higher, and most importantly, the residual pattern became random over time, suggesting that enhanced predation of age 0 weakfish (emergence of a demographic bottleneck) by striped bass and spiny dogfish is an important process in the current weakfish stock-recruitment relationship.

2) New Analysis - Comprehensive screening of potential candidate predators (striped bass, spiny dogfish, bluefish and Summer flounder), environmental factors (mean summer (July-September) sea surface water temperature and deviations in the winter North Atlantic Oscillation index) and fishing-related effects (discards (mt) and discard-related F) against several response variables (weakfish surplus production, index of weakfish biomass and juvenile weakfish mortality) using a Pearson correlation matrix and stepwise multiple regression methods in SAS. Results revealed that only striped bass and spiny dogfish abundance was significantly ($P < 0.001$) linked to the recent (post 1998) rise in weakfish juvenile mortality and corresponding decline in weakfish biomass and surplus production.

3) Updated Steele-Henderson (S-H) model runs for Atlantic coast weakfish with and without predatory (Tpred) effects from 1981 to 2007. Another run with the S-H model includes the potential effects of declining menhaden abundance, as a secondary prey effect, on the recent rise in predatory mortality of striped bass on weakfish.

4) Updated (through 2007) equilibrium and non-equilibrium overfishing (Fmsy, Bmsy) estimates and their 95% confidence limits for weakfish based on results from the updated Steele-Henderson model. Results reveal that Atlantic coast weakfish is severely depleted by enhanced predatory mortality but is not overfished.