Review of the 2006 Summer Flounder Assessment Update

Chair's Report

Prepared for the NOAA National Marine Fisheries Service

By

Dr. Richard Methot
NMFS, Office of Science and Technology

At the request of the Science and Research Director of the NMFS Northeast Fisheries Science Center, the NMFS Office of Science and Technology conducted an additional review of the summer flounder stock assessment update.

The Terms of Reference for the review were to:

1) Review the draft document "Summer Flounder Biological Reference Point Update for 2006" by Mark Terceiro (BRP2006_5.doc, dated Aug. 10).
2) Provide comments and recommendations regarding:
   a) Is an appropriate historical time period being used to provide biological inputs for the projections?
   b) Has an appropriate adjustment been made for the assessment model's documented retrospective bias?
   c) Is the rebuilding target and rate based upon an accurate estimate of the recruitment levels expected as the stock rebuilds?
3) Provide comments and recommendations regarding possible future improvements in the assessment of summer flounder.

Reviewers:
Dr. Richard Methot, NMFS Office of Science & Technology, Review Panel Chair
Dr. Owen Hamel, NMFS Northwest Fisheries Science Center
Dr. Joseph Powers, Louisiana State University

Venue: Northeast Fisheries Science Center, Woods Hole, MA; Sept 14-15, 2006

Although this review was conducted outside of the normal Stock Assessment Review Committee process, protocols similar to SARC reviews were followed. The meeting was announced on the NEFSC webpage and public were allowed to attend. A public comment period was provided. No effort was made to provide a consensus among review panel members and each member will provide a separate report to the NEFSC.

The findings documented below represent the general findings of the Review Panel and the specific recommendations of the panel chair.

1) *Review the draft document "Summer Flounder Biological Reference Point Update for 2006" by Mark Terceiro (BRP2006_5.doc, dated Aug. 10).*

Findings:

This document, henceforth referred to as the BRP update, provides a clear and informative description of the history of summer flounder assessments and Biological Reference Point (BRP) calculations. The lead assessment scientist, Mark Terceiro, was extremely cooperative and provided the Panel with timely and complete information and updated model results. We could not have completed this review without his cooperation and assistance.

The assessment was conducted using ADAPT VPA model. Input to this model includes estimates of total catch-at-age from 1982-2005, incorporating estimates of discard and discard mortality in the commercial and recreational fisheries, and 41 indices of abundance from several NMFS and state surveys. The results indicate that the stock reached a low point around 1990, then fishing mortality was substantially reduced in the late 1990s and the abundance of the stock‘s older age groups increased. In more recent years the fishing mortality has remained at least as high as the maximum allowable level (Fmax) and the stock has not continued to increase in abundance. Thus, recent catches have probably not been sufficiently reduced to provide a 50% probability of completing the rebuilding of this stock by 2010.

In addition to the findings noted below, the Panel finds that the use of Total Stock Biomass (TSB) is not the most appropriate measure to track rebuilding of the summer flounder’s reproductive potential. Spawning Stock Biomass (SSB) is a better measure of reproductive potential. The BRP update document and past assessments have calculated TSB on Jan 1. They include age 0 fish and they have used the age 0 body weight from the fishery in this calculation. In fact, the age 0 fish are only a few months old on Jan 1 and their body weight at that time is unmeasured and certainly much, much less than the weight they achieve later in the year when they enter the fishery. The Panel finds that Jan 1 TSB should be reported for ages 1 and older only, and that SSB should be used as the basis for tracking stock rebuilding.

2) *Provide comments and recommendations regarding:*

a. *Is an appropriate historical time period being used to provide biological inputs for the projections?*

Findings:

The BRP update used the recent average (2003-2005) body weights at age in order to maximize consistency among all aspects of the models. The Panel supports use of these recently observed weights for short-term Total Allowable landings (TAL) projections, however the long-term (1982-2005) average body weights should be used for calculation of the biological reference points and in the long-term rebuilding projections. The recent body weights appear to be influenced by a fluctuation towards a higher percentage of older males, which are

smaller than females, so may not be representative of long-term average body sizes. The use of different body weights for short-term and long-term calculations will create some small differences between TAL calculations and longer-term projections. These differences should be acknowledged, but are not in themselves cause for forced consistency.

Calculation of spawning biomass requires information on body weight at age in November. The Panel supports calculation of these weights through seasonal interpolation of the observed fishery average body weights.

The Panel supports the BRP update's use of recent fishery partial recruitment for the calculation of the BRPs and projections. Changes in fishery management have shifted the partial recruitment away from the youngest age groups, so the long-term average partial recruitment is no longer appropriate.

The Panel supports the BRP update's use of the newer estimates of long-term average percentage mature. These estimates have more data than the lower percentage mature values calculated in the 1999 assessment.

b. Has an appropriate adjustment been made for the assessment model's documented retrospective bias?

Findings:

The observed retrospective pattern in the VPA result is that as more years of data are obtained, the calculations of recent fishing mortality go up and recent abundance levels go down. Management measures have been able to keep the total landed catch during 2002-2005 close to the TALs developed on the basis of Fmax projections, so existence of the retrospective pattern in updated F calculations for these years is understandably frustrating. The Panel does not find that it is feasible to make an explicit adjustment of the model calculations for this retrospective pattern. The pattern diminishes in the last year, its cause is not clear, and past patterns in the opposite direction have also diminished after a few years. The several survey indices included in the model increased greatly during the late 1990s and the indices of the oldest age groups have continued to increase. The current model does not track these changes closely, so exploration of alternative models and data interpretations that better reconcile this recent pattern should be a higher priority than the retrospective pattern *per se*. Although the Panel cannot find a specific quantitative adjustment for the retrospective pattern, it would seem appropriate to take this pattern into account when setting management targets.

The Panel finds that one immediate modification of the VPA is justifiable and reduces the retrospective pattern in stock size during 2003-2005. The VPA model for summer flounder currently treats survey observations of zero as missing values. An observation of zero for a particular age of fish in a particular survey year does not mean that there are no fish of that age in the stock, only that the number of survey samples was not sufficient to detect any fish of that age. This

VPA model, as with most assessment models, tunes to the logarithm of the survey observations so cannot explicitly deal with observations of zero. However, treating these zeroes as missing values can result in a bias because time periods of low abundance are underrepresented in the data input to the assessment model. In the case of summer flounder, the result may be an underestimate of the degree to which the stock has rebuilt since the low levels that occurred around 1990. The committee did not discuss this issue during the Sept 14-15 meeting, so is not prepared to present a definitive solution. An interim approach for summer flounder would use a small value in place of the zeroes. A value equal to one sixth of the smallest observed positive value would be reasonable until a more complete statistical solution can be developed.

c. *Is the rebuilding target and rate based upon an accurate estimate of the recruitment levels expected as the stock rebuilds?*

Findings:

The draft BRP update included two alternatives for the recruitment level to be used in calculation of reference points. One is the median recruitment for 1982-2005 and the other used median recruitment for 1996-2005 because the ratio of recruitment to SSB was lower during these years. The Panel does not find that it is appropriate to use only the 1996-2005 recruitments as a basis for BRP and rebuilding calculations. The Panel notes that:

i. A decline in the ratio of recruits to spawners (R/SSB) is naturally expected whenever SSB is being rebuilt and R is already near the level expected from a rebuilt stock. If R/SSB is observed to remain more constant as the stock rebuilds, this would imply that an even higher R and SSB would be expected from a fully rebuilt stock. It is fortunate that R has remained near the average level even though the SSB is still near the overfished level; rebuilding would be even slower if R had been substantially reduced because of the low SSB. In addition, the existence of the retrospective pattern in recent F, R, and SSB levels hinders exact interpretation of trends in R/SSB.

ii. The consistent level of recruitment over a long time period coupled with a relatively small range of SSB during that period means that a stock-recruitment relationship cannot be estimated. Thus, it is necessary to continue reliance on the non-parametric approach. Observations of recruitment and SSB from a fully rebuilt stock (i.e. at SSB about twice current levels) for a number of years will probably be required before an adequate stock recruitment relationship may be estimated.

iii. The low level of recruitment observed in 2005 is essentially the same as the low 1988 recruitment, so it is within the range of recruitment fluctuation used in calculating the expected time to rebuild this stock.

iv. The Panel finds that the most representative approach to calculating BRPs and rebuilding rates would be to use the entire set of recruitments from 1982-2005. The average, not median, of these recruitments should be used for calculation of biological reference points because much of the stock's accumulated biomass comes from the larger recruitments.

Random draws from this set of recruitments would provide a probability distribution of rebuilding rates that is consistent with the occasional occurrence of small recruitments (1988 and 2005) and large recruitments (1982-1987). There is no documented and obvious reason why recruitments were higher during 1982-1987. If such recruitment levels become more common as the stock rebuilds, then the stock may rebuild to an even higher level than is currently targeted. If such recruitment levels do not occur during the next few years of the rebuilding, then the rebuilding target may be not be achieved by the target time to rebuild. More precise forecasts than this are not feasible.

3) *Provide comments and recommendations regarding possible future improvements in the assessment of summer flounder.*

Findings:

Several good recommendations for improvements in this assessment have been made in recent SARC and NRC reviews. The Panel finds no major aspect of these recommendations with which we disagree. In particular, the Panel notes that:

a. Each survey index is given equal weight in the VPA model. While each survey is expected to provide a good index of summer flounder abundance in the geographic range of that survey, the various surveys cover much different geographic ranges and it is not necessarily true that each alone provides a good index of total stock abundance, nor that the simple average of all the surveys is the best index of abundance. A better approach probably would combine several of the surveys into a composite index to be put into the assessment model. This issue of geographically limited observations being used in a broad-scale assessment is a generic issue for many different types of assessment models.
b. Commercial and recreational fisheries probably have different partial recruitment patterns, northern fisheries may differ from southern fisheries, etc. Accounting for such differences could produce more accurate assessments and forecasts.
c. Sex ratios of summer flounder are often skewed, males attain smaller maximum sizes than females, males may not live as long as females, etc. Such gender-differences in life history should be taken into account. The greatest issue may be that natural mortality is based on female longevity and may underestimate the natural mortality of males and may underestimate the natural mortality at younger ages in a combined sex model. Sex-specific life history, catch and survey data should be developed to the extent possible and examined for patterns that may affect assessment results.
d. An improved statistical method needs to be developed to account for the probability of observing zeroes in the survey. This is a generic issue for many different types of assessment models.
e. Estimates of discard and discard mortality in commercial and recreational fisheries need to be validated.

f. Any evidence of catch misreporting needs to be quantified to the extent possible. This could be used to guide the scope of exploratory assessment model configurations.
g. Alternative models should be applied to summer flounder assessment data to validate the robustness of the current conclusions based on the VPA model and to more flexibly explore some of the issues noted above.

On the basis of the above findings, Mark Terceiro of the NMFS NEFSC conducted a preliminary revision of the VPA, the Yield per Recruit analysis, the Biological Reference Points, and the rebuilding calculations. The revised terms of this update include:

VPA:

annual SSB weight at age vectors interpolated to Nov 1;
zero observations in surveys replaced with a value equal to 1/6 of lowest observed value for that survey.

Y/R, SSB/R:

long term (1982-2005) mean SSB weights at age;
short term (2003-2005) Partial recruitment;
1982-2005 mean R

Deterministic Long Term Projection for 2011+ (e.g., calculate time to rebuild to SSBmax at Fmax):

long term (1982-2005) mean SSB weights at age;
short term (2003-2005) PR;
1982-2005 mean R

Stochastic Short Term Projections for 2007-2010 using

short term (2003-2005) mean SSB weights at age;
short term (2003-2005) PR;
sample R from 1982-2005 cumulative distribution function; and
either:
constant Fmax during 2007-2010, or
constant Frebuild during 2007-2010).

The preliminary results tabulated below should be used only to illustrate the general result of the changes. Final updated values will be found in reports prepared by the NMFS-NEFSC.

Factor	2006 Assessment	Update
Average F, ages 3-5 in 2005	0.528	0.407
TSB in 2005	47,800 mt (age 0+)	51,596 mt (age 1+)
SSB in 2005	30,558 mt (different PR and weights)	47,498 mt
Fmax	0.276	0.280
Bmsy proxy	92,645 mt of TSB	89,411 mt of SSB
Rebuilding Status	52% of Bmsy	53% of Bmsy
2007 TAL at Fmax	9,026 mt (19.899 mlbs)	11,280 mt (24.868 mlbs)
Frebuild	0.099	0.150
2007TAL at Frebuild	3,490 mt (7.694 mlbs)	6,421 mt (14.156 mlbs)