WEAKFISH STOCK ASSESSMENT SUBCOMMITTEE

January 7-8, 2008
Norfolk, Virginia

Draft Meeting Report

Participants

Jeff Brust, NJ DEP, Chair	Brian Murphy, RI DEM	Pat Campfield, ASMFC
Joe Cimino, VMRC	Lee Paramore, NC DMF	Nichola Meserve, ASMFC
Vic Crecco, CT DEP	Jim Uphoff, MD DNR	Yan Jiao, Virginia Tech.
Des Kahn, DE DFW		

Overview
The Weakfish Stock Assessment Subcommittee met for two days with the following objectives: review an independent project to improve weakfish stock assessment, update the assessment timeline, draft Terms of Reference, review the updated catch-at-age and survey indices, discuss the measure of central tendency for trawl surveys, review model updates and analyses, update the stock tracking measures for the Board if necessary, and assign responsibilities. ***Bolded and italicized type indicates tasks; a list of tasks is provided on the last page.***

Presentation of the Project: Improving Stock Assessment of Weakfish
Dr. Yan Jiao provided an overview of her, Don Orth, and Rob O'Reilly's VMRC-funded proposal to improve weakfish stock assessment. She hoped to receive comments on the proposed work and establish a means to access weakfish data held by the Subcommittee. The project was developed to address problems identified in past weakfish assessment work and develop appropriate model(s) and methodologies for future weakfish stock assessment.

To address the problem of spatial heterogeneity of the stock, the authors propose to develop a spatial hierarchical growth model and spatial hierarchical statistical catch-at-age model if results from the first model support the hypothesis of spatial heterogeneity of individual growth. To address data conflict among the relative abundance indices and the spatial coverage of the indices, the authors propose spatial mapping and standardization of catch rate data, weighting of the indices based on their sample size and spatial coverage, and application of a subjective Bayesian approach. To address VPA problems such as borrowed age-length keys (ALKs) and uncertainty in the catch statistics, the authors propose to use a flexible statistical catch-at-age model, which has no need to borrow ALKs and can incorporate catch uncertainty. For uncertainty in the ageing of weakfish, the authors propose sensitivity analyses. To address uncertainty in the trend in natural mortality, the authors propose model comparison among the same types of models (i.e., among flexible statistical catch-at-age models, among catch-data free population growth rate models). Several flexible statistical catch-at-age models were proposed, including constant natural mortality known or unknown, time varied natural mortality that follow an autoregressive process, and hierarchical spatial statistical catch-at-age model. Models will be compared based on model comparison criterion, deviance information criterion, to find an appropriate operational model for stock assessment. For uncertainty in the trend in productivity, the authors propose recruitment models that test for climatic and other population drivers (Ricker model, Beverton-Holt model, time series Ricker model (allowing variation in the productivity

parameter), multivariate recruitment model). Because the current harvest control rule may be unreliable, the authors propose to investigate more biological reference points other than the currently used rule. To address uncertainty, the authors propose to take a Bayesian approach.

The Subcommittee had several questions for Dr. Jiao about the proposed work, such as how she would determine if an observed change is due to changing natural mortality or catchability, how various models will be compared, and if she had worked with the proposed models before. There was concern among the Subcommittee members that the data would not be able to support all the analyses and models that the authors hope to perform. Dr. Jiao realizes that this is the case, which is one reason that many models were proposed for the project. Her team hopes to find the most appropriate model(s) for weakfish assessment. Dr. Jiao is available to answer questions or hear comments on the proposal: yjiao@vt.edu, (540) 231-5749.

The Subcommittee members discussed how the proposed work might feed into their assessment. It was realized that this was unlikely given the three year timeline of the proposal and the ~18 month timeline for the Subcommittee's weakfish assessment. However, Dr. Jiao mentioned that her research team will provide their results to the subcommittee, and that they are willing to collaborate with the subcommittee through circulating and discussing results. The Subcommittee will share the available data with the authors. *It was determined that Dr. Jiao will provide a list of the data she would like to receive to Jeff. Additionally, Pat Campfield, with the help of the Technical Committee, will complete a data availability workbook to document what data elements are available for weakfish stock assessment.* This workbook will also be beneficial to the Subcommittee, providing a reference document that allows quick identification of what datasets need to be updated for each assessment. Data will be made available to Dr. Jiao before the data workshop (see below), or sooner if possible.

Assessment Timeline
The Northeast Regional Coordinating Committee delayed the weakfish peer review workshop from the second half of 2008 to the first half of 2009 (June). The Subcommittee determined to continue to work under the current timeline. To increase the likelihood of landings data being available for the data workshop, *a request should be put in with NMFS to expedite 2007 weakfish data.*

DATE	OBJECTIVE
April 2007	Technical Committee Meeting: planning for next assessment
Ongoing	SASC working to address deficiencies identified in past assessments
January 2008	SASC Meeting
Feb or May '08	Board approves Terms of Reference
Ongoing	SASC prepares preliminary analyses and develops working papers and brief presentations on the submitted data sets (data through 2007) and the surveys/data collection methods to bring to Data Workshop (all compiled on CD).
July 2008	**Data Workshop** (TC, SASC, AP Chair, staff, other invited/interested persons)
August 2008	Workshop products finalized by the TC via e-mail for tasks requiring follow-up (finalized materials submitted to assessment workshop participants)
August 2008	Report to Board on Progress
August – September 2008	Lead modelers develop documents describing reasoning and methodology of proposed assessment techniques
September 2008	**Assessment Workshop** (SASC, TC chair and vice chair, staff, invited persons)
October 2008	Stock Assessment Report completed and submitted to TC for approval

November 2008	TC Meeting to approve Stock Assessment Report
June 2009	**Peer Review Workshop**
August 2009	Board approves Stock Assessment Report and Peer Review

Stock Assessment Draft Terms of Reference
The Subcommittee developed the following eight draft Terms of Reference to be approved by the Board on February 5, 2008. The Subcommittee notes that #3 and #4 might be further specified when the Subcommittee knows what models and methods it will be using in the assessment. Once approved by the Board, the Terms of Reference must also be approved by the Northeast Regional Coordinating Committee.

1. Evaluate biases, precision, uncertainty, and sampling methodology of the commercial and recreational catch including landings and discards.
2. Evaluate precision, geographical coverage, representation of stock structure, and relative accuracy of the fisheries independent and dependent indices of abundance.
3. Evaluate the catch at age modeling methods and the estimates of F, spawning stock biomass, and total abundance of weakfish produced, along with the uncertainty of those estimates. Review the severity of retrospective bias.
4. Evaluate the aggregated biomass modeling and index methods and the estimates of F, spawning stock biomass, and total abundance of weakfish produced, along with the uncertainty of those estimates. Determine whether these techniques, including predator-prey extensions, could substitute for age-based modeling for management advice.
5. Review evidence for constant or recent systematic changes in natural mortality.
6. Estimate and determine the accuracy and precision of biological reference points.
7. Review stock projections and impacts on the stock under different assumptions of fishing and natural mortality.
8. Make research recommendations for improving data collection and assessment.

Update on the Catch-At-Age (CAA)
Prior to the meeting, Jeff sent out the CAA that he updated for 2004, 2005, and 2006. The Subcommittee reviewed the methods and data used to develop the four subdivisions of the CAA: commercial harvest, commercial discards, recreational harvest, and recreational discards. ***Jeff will email his presentation on the CAA to the Subcommittee.*** Jeff noted that the CAA is not complete in regard to some missing 2006 data and some other minor issues identified by the Subcommittee. ***Jeff will complete the CAA for 2006.***

Commercial Harvest
Jeff used the same methods as last time. NMFS landings were used if the state data were unavailable. The Subcommittee agreed that state landings should be used. The CAA was developed by year, state and gear, although data substitutions were necessary where direct data were unavailable. Jeff presented the substitution and sample size tables he sent around before the meeting. He questioned whether there should be a minimum sample size, as some components have very small sample size. Des suggested a minimum sample size of 50, except where landings are very low. Rather than pick a specific number, the Subcommittee decided that Jeff should use his best judgment to determine if certain components should borrow from a different section to increase the sample size.

Des wanted to make sure that each state was properly expanding what was measured at fish houses to what was caught, as he noticed that some of Delaware's length frequency data might

not have been expanded properly when only a subset of the catch was sampled. ***All Subcommittee members should check that the length frequency data provided to Jeff for the CAA was properly expanded, and also look over the substitutions and send any suggestions.*** Jeff should also have a description of how each state samples. ***Jeff will fix the sample size numbers for NC***, as the draft table included the expanded numbers rather than the sampled number.

Jeff described how weight is next converted to number for each size, gear, and season. He explained that the conversion was done differently for the southern region. Because all the southern region's data are from NC, and NC had already converted weight to number, Jeff had just had to expand total number to number at size.

Commercial Discards
Jeff tried to duplicate the ratio method that Janaka de Silva had used for the last assessment (explained in a 2004 paper). This looks at weakfish discards in gillnet and trawl fisheries for key species (gillnet = bluefish, croaker, spiny dogfish, weakfish; trawl = butterfish, fluke, loligo, weakfish). Janaka developed annual ratios of these key species harvest to weakfish discards, and expanded these by the landings of the key species. Jeff did not update Janaka's ratio calculations, but used an average ratio from 2001-2003 by species. ***Jeff acknowledged that he needs to fix the 2003 ratio that he used in that average.***

Des argued that the ratios used should be updated, rather than use a 2001-2003 average, as changes to the fisheries might have occurred since then. The Subcommittee agreed that this would be ideal. ***Jeff will request the discard data from NMFS***. Vic noted that when he previously requested this type of data it took about two weeks to be sent. It was also recommended that the Subcommittee consider redoing the work that Janaka did to make sure it is accurate and so that the exact method will be known. ***Jeff will look into redoing and updating Janaka's analysis***.

Jeff noted that he has a concern about the length weight equation, which he will look into.
Janaka had used a single length weight equation for all years. However, length weight equations are available by year and season, which may be more appropriate.

Recreational Harvest
Brian updated this subdivision of the CAA. The same method was used as in the past. The Subcommittee had no concerns or suggested improvements.

Recreational Discards
For recreational discards, 20% of the B2s from MRFSS are used to model dead releases. Jeff used the same length frequency as from the recreational harvest. Des noted that this is a problematic assumption to make, as there are likely more small weakfish discarded due to regulations. The Subcommittee agreed that a different length frequency should be used for the recreational discards. Two sources for length frequency information were noted: the American Littoral Society's logbooks, and Connecticut's Volunteer Angler Survey logbooks. ***Jeff will request the ALS data from Gary Shepherd.*** Vic checked out the CT logbook data and found that it would not be of use. The ALS data will be included in the materials for the data workshop. Vic also suggested using an average weight from the NMFS or NJ trawl survey of all fish sizes likely to be caught in the recreational fishery, such as 10+ inches; ***Jeff and Vic will look into this.***

4

Working towards healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015

Total Catch At Age
Catch at size is then summed across the four subdivisions. The catch at size is then converted to CAA. For this, ALKs were developed with all the available data by region, year, and season (early and late). Jeff noted that substitutions are often required above 20"; however, the percentage of catch that requires a substitution is less than 1%. The CAA is summed across regions and seasons for an annual CAA. Overall, the CAA shows that the total removal of weakfish has been relatively constant from 2004 to 2006.

Survey Data
The Subcommittee reviewed the trawl survey data that Jeff had compiled thus far. ***Jeff will email the indices to the Subcommittee.***

Age-0 and Age-1 Surveys
Jeff presented several indices of age-0 abundance and one of age-1 abundance that the Subcommittee lags and tunes to age-1 and age-2 abundance, respectively. In Delaware, there is the Delaware Bay survey, for which Jeff showed the geometric mean with 95% confidence intervals, and the arithmetic mean. In Maryland, there is the Chesapeake Bay survey and the Coastal Bays survey. Jeff showed two series for each of these—what was used in the last VPA and what was sent to him this year, as both were recently recalculated by DNR staff. In Virginia, there is the VIMS survey, from which the "River Only" index is used. In North Carolina, there are two indices: age-0 and age-1. There is also a New York index, which was not used in the final run of the last assessment. This was also recalculated such that just June and July sampling was included due to sampling problems in 2005 and 2006 in other months. The index appeared to be more variable as a result of this recalculation.

Age-Structured Surveys
Jeff did not have the SEAMAP index, yet. Charlie sent the raw data, but did not develop the index since it was not used in the last assessment the way he had calculated it. ***Lee and Pat will work up the SEAMAP index***. For the NEFSC trawl survey index, Jeff showed the composite index, but he had yet to finish the age-structured indices. ***Jeff will finish working up the NEFSC indices***. Des questioned whether there might be a correlation between temperature and catch in the survey. Jeff indicated that he had started looking into the data, and had not yet found any relationship between these variables. The composite index shows a moderate decrease since the last assessment, although with a lot of noise. The Subcommittee agreed that there was limited signal in the index. Yan noted that you can not follow the cohorts through the time series. The Delaware survey was not presented, as it needs to be reworked. ***Des will update the Delaware survey indices***. Jeff showed the New Jersey ocean trawl survey composite and age-specific indices. There appears to be a lot of noise with limited signal in this index. Jim wondered if substrate might have to do with NJ results. The subcommittee agreed that the ChesMMAP is something to be considered as it now has 2002-2006 data available. NEAMAP on the other hand has only 2006 data available and would be of limited use as of yet.

Which indices to use? What should be used as a measure of central tendency in surveys?
These are two questions that Jim had had to ask himself when he was updating his predator prey model used in the last assessment. He gave a presentation on how he tried to answer these questions.

In analyzing the indices, Jim again found that the NEFSC index and the MRFSS index showed two different trends and were not correlated. The NEFSC shows the highest weakfish biomass in recent years, while the MRFSS shows very low relative abundance. Therefore, Jim had

5

Working towards healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015

performed an analysis in which he generated catchability (index/biomass) of the NJ, DE, MRFSS, and NEFSC indices as compared to the converged portion of the VPA. He found that the NJ, DE and NEFSC indices have one or more large outliers, but that the MRFSS index did not. Based on this analysis, Jim opted to stay with the decision to not use the NEFSC index in his model update. Vic noted this analysis would be very good to do again once the Subcommittee has an updated VPA. ***Jeff will produce an updated VPA for the data workshop to test indices against the converged portion***.

Jim then presented several options that he had considered for how to calculate the indices from the survey data: mean tow weight* exploitable wt fraction; mean fish wt* central tendency* exploitable fraction; central tendency = geometric mean or proportion of tows; exploitable fraction from length-frequency and length-weight. He noted that the ideal way to calculate any of these indices was on the individual tow basis.

In considering the NJ index, Jim calculated exploitable weight per tow with three methods (geometric mean, positive tows, and weight/tow). He found that all three had jagged results, but that two showed a general increase while one showed a general, recent decrease (positive tows). Jim had next looked at the positive tows versus total weight per tow in two time series, 1981-1996 and 1997-2006, and found that they showed different trends (flat and increasing, respectively). He found a similar trend in the NEFSC trawl. This lead him to question what had changed. Was it behavior, habitat or catchability? Jeff noted that NJ has had 4 or 5 different vessels doing this survey over the time series.

Jim had then compared the same three NJ indices of exploitable biomass per tow with two NJ MRFSS indices, harvest/trip and catch/trip. He found that the positive tow weight based index was more highly correlated than the GM and weight/tow indices. Based on this analysis, Jim chose to use the positive tow index in further analyses and model updating. Vic suggested that Jim use coastal rather than NJ MRFSS only for this analysis. For DE, Jim had the mean weight/tow, which follows with MRFSS, so he used a different method for DE.

Overall, Jim had completed analyses and made the decisions to not include the NEFSC survey, to include the NJ and DE surveys, and to calculate the indices from those surveys in the way that was best for each survey. The Subcommittee agreed that it was a good idea for Jim to do these types of analyses to objectively determine which trawl surveys to use and how.

Update on Models and Analyses
Vic and Jim updated with data through 2006 several of the models used in the previous weakfish assessment. An updated VPA will also be produced for consistency and testing the indices.

Relative F and Predator-Prey Modeling
Vic used the recreational cpue approach taken in the last assessment to update ages 1+ fishing mortality and stock biomass estimates from 2004 to 2006. Using relative abundance indices from the MRFSS mid-Atlantic private boat harvest (***for which Vic plans to produce standard error***), average relative fishing mortality rates (in weight and number) were estimated from 1981-2006.

These estimates were then transformed into units of instantaneous fishing mortality, via two scalars based on the average ratio of F (from the 2003 ADAPT runs) to relative F from 1987-1991. Jeff suggested that instead of applying an average scalar to all years, annual scalars could be developed for the converged portion of the VPA and applied to all years through a re-

6

Working towards healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015

sampling technique. Reiterating this technique a number of times would provide confidence intervals around annual F values. Vic had not considered this method and thought it might be possible; however, he was concerned that the assumption of constant M might not be valid over a long time period and applying scalars from many years might bias the results.

Average stock biomass and average stock numbers of age 1+ weakfish were estimated from 1981-2006, by dividing harvest by the appropriate fishing mortality estimate. Across the distribution confidence limits were derived around the estimates.

A time series of surplus production estimates was also derived by subtracting biomass in year t from biomass in year t+1 and adding coastwide harvest. The affect of fishing on surplus production was also examined. With the time series of surplus production and stock size estimates, updated Fmsy and Nmsy thresholds were estimated using the dynamic Gompertz external surplus production model.

To examine potential finfish trophic effects on weakfish surplus production, striped bass and spiny dogfish abundance were added to the external production model. Both of these species' abundance has increased since 1998, when weakfish began to decline. The Steele-Henderson model, which incorporates compensatory stock dynamics of the prey with fishing effects plus a sigmoid Type III functional response by the predator, was also updated. Vic used a robust regression package (least trimmed squares) in addition to normal regression (least squares). The precision of estimates was improved by using the robust regression package. Several Fox models were applied.

Systematic residual pattern (signifying misspecified model) resulted from applying the logistic external model for weakfish without a term for striped bass, the Fox external model without a term for striped bass, and the dynamic Fox model without a term for striped bass. The residuals proved to be more well-behaved when a striped bass term was included in fox external model. The residuals for the S-H model with striped bass predation included were not bad and R^2 ~0.9. A Type 3 response (sigmoid – prey is allowed to persist) fit better than a Type 2 (asymptotic) for this. Non-equilibrium Fmsy from S-H is, for the most part, above the biomass weighted F from the S-H model. The ability to leverage recovery by decreasing F relies on F/Z ratio; the F/Z ratio has declined over time, and managers now have very little leverage on which to rebuild population. ***Vic will continue to work on these analyses and models for the assessment workshop. A completed version of his draft paper will be included in the materials for the assessment workshop.***

Predator-Prey Modeling
Jim gave an update on the predator prey modeling he has been doing. These models hope to answer: Could M have changed? and does a predator make a difference? He uses a logistic biomass dynamic model with a predation term (non-equilibrium M). In the last version, just the MRFSS index was included, but this update also uses DE and NJ surveys. Other inputs are harvest and discards. Striped bass is included as a candidate predator, as age 2+ share the same diet, ontogenetic diet shifts, and range with weakfish in the mid-Atlantic. Four predator-prey functions were tested: types I, II, and III, plus an alternate, nonlinear, menhaden-related type. Types II, III, and the alternate provided the three "best" runs using MRFSS, DE and NJ indices. F, M, and surplus production are estimated. Jim showed those results. F estimates are very low in recent years (<0.1). All show increase in "bass M." ***Jim will continue to work on these analyses***

7

Working towards healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015

and models for the assessment workshop. He will produce a draft paper for inclusion in the materials for the assessment workshop.

Stock Tracking Measures
The Subcommittee agreed that the Board did not need a full update of the stock tracking measures, as there is little new information from what was presented to the Board in 2007. In providing an update to the Board of the Subcommittee's meeting, Jeff will cover any new, available information not previously relayed to the Board.

Responsibilities Assigned
- Yan will provide a list of data that she wants; Pat will send a weakfish data availability workbook to TC members; TC members to fill these out; available data to be provided to Yan before the data workshop
- A request should be put into NMFS to expedite 2007 weakfish data for assessment
- Jeff will email his presentation on the CAA to the Subcommittee
- Jeff will complete the CAA for 2006
- All Subcommittee members will check that the length frequency data provided to Jeff for the CAA was properly expanded, and also look over the substitutions and send any suggestions
- Everyone will check the landings numbers that Jeff has; Jeff will email landings by gear and month
- Jeff will fix the NC numbers in sample size of commercial samples
- Jeff will fix the 2003 discard ratio that he used for the commercial discards CAA development
- Jeff will request the discard data from NMFS for updating the commercial discards ratios and try to redo and update Janaka's work
- Jeff will address the concern he has about the length weight equation for the CAA
- Jeff will request the ALS data from Gary Shepherd
- Jeff and Vic will look into the average weight method for recreational discards CAA
- Jeff will email the indices to the Subcommittee
- Lee and Pat will work up the SEAMAP index
- Jeff will finish working up the NEFSC index
- Des will update the Delaware age-structured survey indices
- Jeff will produce an updated VPA for the data workshop to test indices against the converged portion
- Vic will undertake the suggested changes for his model (e.g., standard error for relative abundance indices)
- Vic will continue to work on these analyses and models for the assessment workshop. A completed version of his draft paper will be included in the materials for the assessment workshop.
- Jim will check the residual of NJ vs. MRFSS, and correlate the index vs. biomass
- Jim will continue to work on these analyses and models for the assessment workshop. He will produce a draft paper for inclusion in the materials for the assessment workshop.

Deadline: everything should be sent to Jeff as soon as possible, but no later than in time for the data workshop (accept those elements identified as for the assessment workshop).

Seeing as there was no other business, the meeting was adjourned.