Scup Stock Assessment Team Report

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<u>Summary</u> – SCeMFiS scientists contributed to the 60th Northeast Regional Stock Assessment Workshop (SAW) for the benchmark assessment of scup. The SCeMFiS scup assessment team identified priority issues for the advancement of the scup assessment, reviewed draft working papers, provided data analyses, submitted working papers, participated in the Southern Demersal Working Group, reviewed the working group report, and participated in the Stock Assessment Review Committee (SARC). Participation of the SCeMFiS scup assessment team contributed to significant improvements in the scup assessment as a basis for fishery management. The updated and revised assessment indicates that the scup stock is not overfished and that overfishing is not occurring. Although some considerable uncertainties remain in the assessment, the stock status is relatively certain, and the stock can sustain status quo catch and possibly more. The contributions of SCeMFiS scientists to the SAW demonstrates a constructive and productive partnership between science and the fishing industry that has great potential to contribute to the advancement of fishery science and the provision of scientific information for fishery management.

Background

The scup stock assessment has developed over the last 25 years, based on data-limited stock assessment methods with some attempts at more advanced approaches. The first analytical assessment of scup was in 1982 and was based on survey trends and age compositions (Mayo 1982), and the relatively simple catch curves and yield-per-recruit analyses formed the basis of the early stock assessments (SAW4, NEFC 1987; SAW7 NEFSC 1989; SAW11, NEFSC 1990). A more advanced Virtual Population Analysis (VPA) based on fishery catch-at-age and age-based survey trends was developed in the mid 1990s (SAW19, NEFSC 1995). However, two years later, the VPA was rejected as a basis for fishery management by because of insufficient sampling of size and age composition, uncertain estimates of discards, and noisy survey indices, reverting to the previous approach of survey trends, catch curves and yield-per-recruit (SAW25, NEFSC 1997; SAW27, NEFSC 1998; SAW 31, NEFSC 2000; SAW 35, NEFSC 2002). In 2008, a more advanced Age Structured Assessment Program (ASAP) and spawner-per-recruit reference points was accepted for the scup assessment (NDPSWG 2009), and the model application was updated annually (Terceiro 2009, 2010, 2011, 2012).

Contributions to the SAW60 Scup Assessment

A benchmark assessment for scup was planned for SAW60. Early in the planning process, SCeMFiS formed an assessment team to participate in the SAW60 working group and contribute to the stock assessment. In August 2014, the SCeMFiS assessment team met during the American Fisheries Society meeting in Quebec City Canada. A major concern of the Mid Atlantic Fishery Management Council and their Scientific and statistical committee was that the scup assessment is overly optimistic. The main objective of the SCeMFiS scup team was to reduce uncertainty in the assessment. The major sources of uncertainty were identified as inter-annual changes in availability of scup to the surveys, the overfishing reference point proxy, the assumed rate of natural mortality, and discard estimates. The team suggested that including fishery catch per unit of effort as an index of stock size in the stock assessment might reduce uncertainty by supplementing noisy survey trends. The SCeMFiS scup team communicated their intention of participating in the SAW60 assessment to NEFSC leadership.

From October 2014 to March 2015, a series of working papers authored by the NEFSC stock assessment lead were reviewed by the SCeMFiS team. The SCeMFiS team submitted a technical review to the SAW Working Group Chair and stock assessment lead in advance of the SAW60 Working Group meeting, primarily to identify any major issues that might be resolved before the meeting, and to offer technical and editorial suggestions for using the working papers in the working group report (Appendix A). Some alternative perspectives with respect to alternative survey strata sets, fishery CPUE standardizations, integrated survey indices and discard estimation were provided. Most importantly, SCeMFiS proposed that trends in catch-per-unit-effort (CPUE) should be considered in the stock assessment for informing relative changes in stock size. In the context of noisy surveys that catch few age-2+ scup, some form of CPUE might effectively complement the surveys.

Recommendations of the SCeMFiS review were responded to and addressed in advance of the working group meeting. Several datasets from dealer reports, logbooks, and observers were provided for explorations of alternative CPUE and landings-per-unit-effort (LPUE) standardizations. These analyses and the associated working papers suggested that LPUE from dealer and logbook statistics offered the most promising approach to developing fishery catch rates.

In preparation for the SAW60 working group meeting, SCeMFiS scientists solicited feedback on the scup fishery and resource from commercial scup fishermen, and the information was documented in a SAW60 Working Paper (Appendix B). Scup fishermen were interviewed in person and via conference call. In late winter 2015, fishermen from Plymouth MA, Pont Judith RI, Greenport NY, Montauk NY, Shinnecock NY, and Mystic CT, involved in inshore and offshore fisheries for scup, squid, butterfish, fluke, whiting, black sea bass, and ling were interviewed. On March 23 2015, scientists and members of the scup fishing industry participated in a conference call to further discuss some of the issues raised during interviews. Feedback from the interviews and call was organized into major themes. Fishermen testified that catch rates peaked around 2010, but are still relatively high, and scup are distributed relatively widely. They explained that catch rates are affected by a number of factors, including targeting, price (related to how much scup was already on the market), trip limits, and environmental conditions. Seasonal trip limits and price were repeatedly mentioned as the primary conditions for targeting scup. When the price is low and trip limits are low, scup are caught as bycatch in trips that are targeting other species. When the price is high and regulations allow, scup can be easily targeted, and the catch is usually >75% scup.

The SCeMFiS scup team participated in the Southern Demersal Working Group (April 20-24 2015, Woods Hole MA). All of the major sources of uncertainty that were identified in the SCeMFiS planning meeting were addressed. Inter-annual changes in availability of scup to the surveys was investigated through quantification of thermal habitat and annual availability of scup to the surveys. Availability was relatively constant, except for the last few years in the fall survey. The stock-recruit relationship remained uncertain, so the overfishing definition was based on conserving 40% of the maximum spawning potential, a commonly applied proxy for achieving maximum sustainable yield. A range of approximations for the natural mortality rate based on life history attributes were considered, and a series of sensitivity analyses were completed to evaluate the implications of uncertainty in that assumption. Discard estimates were improved through the application of a stratified ratio estimator, in which observer data on discarded scup to the entire kept catch was expanded to total multispecies catch by quarter-year, statistical area, and mesh size. The working group concluded that the dealer/logbook standardized LPUE from >75% scup trips was the most appropriate attempt to develop an index of abundance. However, the resulting LPUE series is different than all other survey and CPUE stock indicators (e.g., peak LPUE in mid 1990s). Therefore, the working group concluded that further analysis is needed to standardize the complexity of factors influencing fishery catch rates. Trends in effort were helpful for supporting the model estimates of decreased fishing mortality during the 1990s. Detailed notes on the meeting are provided in Appendix C.

The draft working group report was reviewed, and SCeMFiS scup team chair participated in the Stock Assessment Review Committee (SARC, June 2-4, Woods Hole MA). The SARC supported the working group's assessment model, reference points, status determination (no overfishing and not overfished) and projections (catch associated with overfishing is greater than recent catch). Detailed notes on the meeting are provided in Appendix D. There are some 'special comments' in the SARC's assessment summary that might have management implications to keep in mind:

1) The assessment is relatively uncertain. The SCeMFiS team agrees with this conclusion. Despite the advances since the 2008 data-poor working group, and our conclusion that the ASAP model is the best science available, there are still considerable uncertainties (e.g., commercial discard estimates, recreational catch, noisy surveys, ...). Some of the uncertainties in the scup assessment result from the nature of the fishery and the data available and cannot be resolved without better data. Therefore, the scup assessment is not a "Tier 1" (perfect) assessment in the Mid Atlantic Council's Acceptable Biological Catch control rule. There are considerable

uncertainties that are not captured in the projections (e.g., natural mortality). So, we conclude that it is reasonable to recommend a more precautionary ABC than from a Tier 1 assessment.

2) There was concern from the SARC about the dome-shaped selectivity (i.e., oldest fish are not fully vulnerable to the fishery) in the model. However, it is important to clarify that the assessment does not assume dome-shaped selectivity - the model was allowed to estimate selectivity based on the data and life history information available. There is justification for allowing domed selectivity, some of which is documented in the feedback from fishermen working paper. The practice of using higher-rise nets to target larger scup suggests that older fish are distributed more off-bottom and are not vulnerable to low-rise trawls. Spatial patterns in seasonal occurrence can also make old fish less vulnerable. Fortunately, the stock status is robust to alternative selectivity assumptions.

The next step will be the Mid Atlantic Council's Scientific and MAFMC SSC's determination of Overfishing Limits, Acceptable Biological Catch and Annual Catch Limits for the commercial and recreational fisheries (at either their July 22-23 or September 16-17 meetings).

Conclusions

The SCeMFiS scup team met all of our objectives and addressed all of the priority issues that we identified (survey availability, overfishing reference points, assumed natural mortality, discard estimates, and fishery catch rates). More generally, the scup assessment was a good opportunity for SCeMFiS to contribute to the SAW process. The team foresaw most of the important issues that came up. We had productive interactions with scup fishermen that helped our understanding of the fishery and how they related to assessment model decisions. We hope that our contributions will help improve the openness of the SAW process. We conclude that this investment was a productive step forward for the scup assessment and for SCeMFiS.

Acknowledgments

We thank Eric Powell for his support, guidance and interactions with the SCeMFiS Board. John Boreman provided valuable perspectives on the scup assessment from the SSC's perspective. Our participation in the assessment was greatly facilitated by the provision of technical working papers far in advance of the working group meeting by Mark Terceiro, allowing us plenty of time to provide a detailed review. Mark also responded to our recommendations and provided all the information we requested. Gary Shepherd and Cynthia Jones chaired the working group and SARC meetings such that SCeMFiS scientists could effectively contribute to the meetings. Meghan Lapp and Katie Almeida interviewed fishermen, and Greg DiDomenico facilitated discussions with scup fishermen. Their assistance helped our understanding of the scup fishery.

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Appendix A. Review of Scup SAW60 Working Papers

Steve Cadrin, March 17, 2015

General Comment: The working paper drafts provided by Mark Terceiro were provided well in advance of the April 21-24 Working Group meeting, allowing plenty of time for detailed review. The WPs provide a thorough review of the information available to meet the terms of reference.

These notes are offered in advance of the WG meeting primarily to identify any major issues that may be resolved before the WG meeting, but also to offer technical and editorial suggestions for using the WPs in the WG report. The documents are ordered by the date they were distributed.

I offer some alternative perspectives with respect to alternative survey strata sets, fishery CPUE standardizations, integrated survey indices and discard estimation. Most importantly, I think trends in CPUE should be considered in the stock assessment for informing relative changes in stock size. In the context of noisy surveys that catch few age 2+ scup, I think that some form of CPUE can complement the surveys. If I can help with any of the suggested revisions, please let me know.

<u>TOR 2 & 3: Biological data for scup</u> – by Mark Terceiro (9/23/14)

Minor Suggestion: Page 8 – Predators & Prey Section. I think it would help to explain the statement "The data are insufficient to calculate total absolute predator consumption of scup." What data are lacking, and what would be needed?

Minor Edits:

1. Page 4 – Maturity Section. "The observed percent mature of females is also 12% at age 1, 76% at age 2, 97% for age 3, and 1005 for age 4…" should be 100% for age 4.
2. Page 5 – Natural Mortality Section. "Then et al. (20140…" should be (2014).

Notes (no suggested changes necessary):

1. **Surveys have many years with no age 2+ scup**.
2. The observed %female increased in recent years. The maturity of males and females is similar, so the effect of male +female SSB calculations is not sensitive to increase. However, deriving SSB as just mature female biomass would be affected.
3. There has been a decrease in %mature at age-2 (page 4).

TOR 2: Consideration of alternative strata sets and model based indices from NEFSC spring and fall trawl surveys for scup – by Mark Terceiro (v2 10/21/14)

Suggestions:

1. I agree that survey trends were similar for the standard and alternate strata sets, but I disagree with the justification based on 'no gains in precision' (pages 1, 18 and 47). The low variance of the standard strata set is an artefact of strata with all zeros, which have a variance of zero and artificially reduce the estimate of stratified variance. The alternative strata set excludes many strata with zero catch, so it has greater stratified variance. Adding strata in the deepest waters of the Gulf of Maine would also reduce the variance, but would not improve precision of the survey index as a reflection of scup abundance. **If design-based variance is being considered to statistically weigh multiple surveys in stock assessment models, then the indices with alternative strata sets may provide a more accurate estimate of variance.**
2. I agree with the recommendation for using conventional stratified estimates over generalized model estimates, but I think the justification (pages 1 and 47) needs to be reconsidered. The advantage of the stratified estimates is that they are design-based, and the generalized models are post-hoc. However, **lack of correspondence with the series of stratified estimates cannot be used to reject the generalized models, because we don't know that the stratified estimates are accurate reflections of stock trends**.

Minor Suggestions:

1. In addition to the ratio of deviance to DF, log-likelihood, AIC, convergence, significance of factors for generalized models, I suggest that the % deviance explained by each generalized model offers a simple but informative performance metric.
2. If conventional model validation plots are available from the GENMOD and GAM software (e.g., normality q-q plots, spread-level plots, …) I think they should be included to evaluate model fit. I also think the same validation plots for the stratified random estimates (e.g., a GLM assuming normal distribution, with only year and stratum effects) would show the violation of the normality (or even lognormal) assumption in the stratified estimates. For example, the stratified random estimates would fail the ratio of deviance to DF diagnostic test. The GENMODs and GAMs with alternative error distribution assumptions fit the data better than the stratified random model, but they have annual spikes from unexplained deviance, and I support the continuation of design-based stratified estimates.
3. The analysis of day/night patterns (page 24) might be improved by adding a crepuscular period. Nantucket Sound fishermen rely on a dawn tow for their daily scup catch, suggesting that twilight may be different than daytime or nighttime.
4. Considering the annual variability in catch by stratum, I wonder if the apparent shift in distribution (page 2) is noise or signal. For example, there have been large catches in stratum 2 (1020) since 1997 (Figures 3 and 4), but that stratum still has zero (or near zero) catches in most years during the same recent period. I think the inference of an apparent shift should be couched a bit to reflect the annual variability or the shift should be statistically tested in the context of variability.

TOR 1: Description of Dealer Report trawl gear landings and effort and modeling landings rate (LPUE) data for scup – by Mark Terceiro (11/6/14)

Suggestions

1. Considering the difficulties modeling survey data, I think the **strawman conclusion (page 16) about the utility of commercial LPUE as indices of biomass may be premature**. The result of models not converging or not providing 'valid parameter estimates' may suggest that the management interventions were not an important factor for explaining LPUE. The frequency distribution of Ln(LPUE) (Figure 4) is remarkably normal (MUCH more so than survey data), so generalized models should be powerful for standardization.
2. I think that the data needs to be **filtered to select targeted scup trips, possibly based on %scup in the trip.** Fishermen target scup when the price is high, but they target other species when price is low, catching scup as incidental bycatch. Therefore, trends in LPUE from targeted trips may be more reflective of abundance.
3. I support the attempt to incorporate management variables into the commercial LPUE standardization (pages 15-16). Despite their lack of significance as factors, I think **a table of the variables may be useful for determining periods that might have reasonable constant-catchability assumptions** (i.e., are there periods with similar management variables?).

Minor Suggestions

1. The document focuses on dealer reports, but effort (DF) and statistical area are also included. Are these data derived from a merger of the logbook-dealer databases? I think that the source of that information should be described. If the data is a merger of dealer and logbook data, then perhaps other variables that are in the logbook CPUE standardization (e.g., mesh size) could also be included in the LPUE standardization.
2. In addition to the ratio of deviance to DF, log-likelihood, AIC, convergence, significance of factors for generalized models, I suggest that the % deviance explained and conventional model validation plots should be included.
3. The attempt to model management variables (page 16) produced '(in)valid parameter estimates'. I think 'valid parameter estimates' needs to be explained if that is the basis for rejecting LPUE as an index of abundance.

TOR 1: Description of Vessel Trip Report trawl gear catch and effort data and modeling catch rates (CPUE) for scup – by Mark Terceiro and Alicia Miller (11/13/14)

Suggestions

1. Presumably, the landed portion of catch is recorded much more reliably than the discarded portion in logbooks, and observer discard data are more reliable than logbook discard data. If the effort and location information in the dealer LPUE is from logbooks, I think that **commercial LPUE from dealer/logbooks is using the best data from both datasets, and the CPUE from logbooks is probably less reliable**. This preference for dealer/logbook LPUE or observer CPUE supports the strawman conclusion to exclude logbook CPUE as an index of abundance (page 23).

Minor Suggestions

1. In addition to the ratio of deviance to DF, log-likelihood, AIC, convergence, significance of factors for generalized models, I suggest that the % deviance explained and conventional model validation plots should be included.
2. If the series is used in the assessment, I think that the data needs to be filtered to select targeted scup trips, possibly based on %scup in the trip or subtrip. Fishermen target scup when the price is high, but they target other species when price is low, catching scup as incidental bycatch. Therefore, trends in LPUE from targeted trips may be more reflective of abundance.
3. If the series is used in the assessment, I suggest that mesh size categories (SM<5in, LG>=5in) is different than the categories used in discard estimation (SQUID<2.125in, 2.125in<=SM<4.5in, LG>=4.5in). If the squid fishery has different discard rates, then the CPUE may also be influenced, and the SQUID mesh category should be considered (and the large mesh definition should be consistent). Additionally, fishermen report that scup catch rates (and size distribution) are different when targeting scup with 4.5in mesh or targeting fluke with larger mesh (6in), so additional mesh size categories may improve CPUE standardizations.

Notes (no suggested changes necessary):

1. I think that the geographic plots overlaying survey and fishery data are excellent. I think they show the **complementarity of survey data (broad coverage, but thin coverage, spatially patchy and statistically highly skewed) and fishery data (seasonal patterns, but dense coverage, and more statistically normal)**.
2. Similar to the Ln(LPUE), the frequency distribution of Ln(CPUE) (Figure 3) is remarkably normal (MUCH more so than survey data).

TOR 1: Description and modeling of NEFOP (Observer) fish trawl gear catch rate (CPUE) data for scup – by Mark Terceiro and Alicia Miller (12/1/14).

Suggestions

1. Considering the difficulties modeling survey data, I think the **strawman conclusion (page 19) about the utility of commercial CPUE from observer data as indices of biomass may be premature**. I think that the geographic plots that overlay survey and commercial fishery data show the complementarity of survey data (broad coverage, but thin coverage, spatially patchy and statistically highly skewed) and commercial fishery data (seasonal patterns, but dense coverage, and more statistically normal).
2. I think that the data needs to be **filtered to select targeted scup effort**, either using %scup in the haul or using the target species field in the observer database. Fishermen target scup when the price is high, but they target other species when price is low, catching scup as incidental bycatch. Therefore, trends in CPUE from targeted trips may be more reflective of abundance.
3. Can **mesh size be included in the standardization** (e.g., similar to the discard estimation categories SQUID<2.125in, 2.125in<=SM<4.5in, 4.5<='SCUP?'<6, 'FLUKE?'>=4.5in)? Fishermen report that scup catch rates (and size distribution) are different when targeting scup with 4.5in mesh or targeting fluke with larger mesh (6in), so additional mesh size categories may improve CPUE standardizations.

Minor Suggestion: In addition to the ratio of deviance to DF, log-likelihood, AIC, convergence, significance of factors for generalized models, I suggest that the % deviance explained and conventional model validation plots should be included.

<u>TOR 1: Estimates of commercial fishery scup discards: 1989-2013</u> – by Mark Terceiro and Alicia Miller (12/1/14)

Suggestions:

1. I agree that SBRM MESH240 appears to offer the most precise discard estimates. However, the diagnostic of comparing the method's estimate of landings to dealer landings (Figure 19) shows that none of the methods performed well for estimating landings. **SBRM MESH240 performs best for estimating landings in the last five years, but it was the worst for estimating landings in most years in the 1990s. SBRM QTR4 appears to perform better in the 1990s and has similar performance to SBRM MESH240 in recent years**. I think the evaluation of this diagnostic (page 5) needs to be expanded. The SBRM MESH240 estimates of landings have the strongest correlation (r=0.71) to dealer landings, but I'm not sure it has the least average annual difference. Selecting a best method may be difficult, and SBRM MESH 240 may be the best, but I think we should consider the estimated landings further.
2. Fishermen report that scup catch rates (and size distribution) are different when targeting scup with 4.5in mesh or targeting fluke with larger mesh (6in), so additional mesh size categories may improve discard estimation.

Minor Suggestion:

I think it would be informative to report how discards are estimated for quota monitoring (SBRM?). I don't necessarily think the same method should be used for the stock assessment, but it may help to clarify the differences.

Minor Edits:

1. Page 3 – "large mesh tows (codend or liner <4.5 …" should be >4.5.
2. Most figures (2-19) are missing axis labels in my view of the document. I could not load the embedded links when opening the file, so this may be a version or emulation problem.

TOR 1: Description of MRFSS/MRIP intercept catch and effort and modeling of total catch rate (CPUE) data for scup – by Mark Terceiro (12/11/14)

Suggestions

1. Similar to the commercial LPUE standardization, I support the attempt to incorporate management variables into the recreational CPUE standardization (page 11). Similar to my comment on the commercial LPUE standardization, I think **a table of the variables may be useful for determining periods that might have reasonable or constant-catchability assumptions** (i.e., are there periods with similar management variables?).
2. Considering the difficulties modeling survey data, I think the **strawman conclusion (page 12) about the utility of recreational CPUE as indices of biomass may be premature**. The models with management variables converged, and the factors were insignificant. Therefore, according to the data available, the management interventions did not explain variation in recreational CPUE.

Minor Suggestion: In addition to the ratio of deviance to DF, log-likelihood, AIC, convergence, significance of factors for generalized models, I suggest that the % deviance explained and conventional model validation plots should be included.

TOR 1: Description of Vessel Trip Report Party/Charter Boat catch and effort data and modeling catch rates (CPUE) for scup – by Mark Terceiro and Alicia Miller (12/11/14)

Suggestions

1. Considering the difficulties modeling survey data, I think the **strawman conclusion (page 29) about the utility of for-hire recreational CPUE as indices of biomass may be premature**. The models with management variables converged, and the factors were insignificant. Therefore, according to the data available, the management interventions did not explain variation in recreational CPUE. I think that the geographic plots that overlay survey and recreational fishery data show the complementarity of survey data (broad coverage, but thin coverage, spatially patchy and statistically highly skewed) and recreational fishery data (seasonal patterns, but dense coverage, and more statistically normal).

Minor Suggestions

1. In addition to the ratio of deviance to DF, log-likelihood, AIC, convergence, significance of factors for generalized models, I suggest that the % deviance explained and conventional model validation plots should be included.
2. If management variables are different for the recreational for-hire fishery, they should be listed in a table.

TOR 2 & 8: An approach to the integration of survey abundance indices used for scup population model calibration – by Mark Terceiro (2/19/15)

Suggestions:

1. From my perspective the criteria for **performance of abundance indices should be both a priori (e.g., cohort tracking, design-based variance) and posterior performance of assessment model using the indices (e.g., simulation-based testing, retrospective consistency)**.
2. **If the integrated indices (pooling data from several surveys) were extended to age compositions, cohort tracking might offer guidance** on the information content of integrated vs. separate indices.
3. Although the working paper concludes that integrated indices does not provide more accurate model calibration (page 1), I don't think the conclusion is supported by the analysis, because **accuracy of model predictions can only be evaluated through simulation**.
4. Although the working paper concludes that integrated indices do not provide more consistent model calibration (page 1), **consistency of model predictions should be evaluated through retrospective analysis**.

Minor Suggestions:

1. I think the 2013 review of northeast US data monitoring programs (http://www.nefsc.noaa.gov/program_review/pr2013.html) can be cited in the introduction (page 1) to justify the analysis.
2. The first paragraph of the results (page 8) reports that lognormal models had the smallest values of log-likelihood and AIC, but likelihoods and AIC are not strictly comparable among models with different error assumptions. The sentence should also refer to the smallest values of negative log-likelihood (smallest values of log-likelihood are the poorest fits).

Appendix B. SAW60 Scup Working Paper

Commercial Fishermen's Perspectives on the Scup Fishery and Resource

Meghan Lapp, Seafreeze Ltd. North Kingstown RI

Katie Almeida, The Town Dock, Narragansett RI, and

Steve Cadrin, UMass School for Marine Science & Technology

DRAFT April 20, 2015

Summary – Feedback on the scup fishery and resource was solicited from commercial scup fishermen through interviews and a conference call to provide their perspectives on the SAW60 stock assessment. All fishermen testified that recent catch rates are extremely high and scup are distributed relatively widely. They explained that catch rates are affected by a number of factors, including targeting, price, trip limits, and environmental conditions. Seasonal trip limits and price were repeatedly mentioned as the primary conditions for targeting scup. When the price is low and trip limits are low, scup are caught as bycatch in trips that are targeting other species. When the price is high and regulations allow, scup can be easily targeted, and the catch is usually >75% scup (see photo).

In preparation for SAW60, scup fishermen were interviewed in person and via conference call. In late winter 2015, fishermen from Plymouth MA, Pont Judith RI, Greenport NY, Montauk NY, Shinnecock NY, and Mystic CT, involved in inshore and offshore fisheries for scup, squid, butterfish, fluke, whiting, black sea bass, and ling were interviewed (Table 1). On March 23 2015, scientists and members of the scup fishing industry participated in a conference call to further discuss some of the issues raised during interviews. Feedback from the interviews and call was organized into major themes.

Scup Stock Status

The universal perception is that the scup stock is currently high, and fishermen are reporting record high catches inshore and offshore. Fishermen are catching plenty of the larger size categories. Fishermen have seen extremely large runs of fish in recent years, but are getting low prices (similar to the 1970s), because the market for scup hasn't been fully developed yet. Fishermen reported that catch rates peaked around 2010.

Fishermen are also reporting scup catches in areas and depths where that they were not found before. Scup used to be caught seasonally, but can now be fished on all year. Scup have become a staple fishery that can be fished on all year round when other fisheries have closed.

This winter scup were being caught more to the eastward than normal (offshore), possibly because of relatively cold temperatures, and this pattern has been observed in the past. There is currently an abundance of small scup distributed widely offshore, and catches of larger scup more inshore, off Long Island. Scup appear to be more off-bottom than usual, and are being caught up in the water column and moving more than usual. Fishermen also reported that they are currently catching more males than females.

A few fishermen targeted scup years ago when the biomass was low. They landed large amounts by searching for scup all the way from Block Canyon down to Wilmington Canyon. In 2002, scup became much easier to catch. This population spike occurred before subsequent quota increases had time to catch up to the increased stock. Now, there are so many scup around that people have gotten used to having scup all over the place or not having to look so hard. If the scup are not where fishermen expect them to be, they stop looking because of fuel prices.

Factors Affecting Catch Rates

Scup catch rates are influenced by price, availability, and availability of other species. If scup are too cheap, they are not worth chasing. The price of scup is extremely volatile, and always has been. One week it can be $1.25, the next week $.25. A dealer reported that there is no stability in the price of scup, because there is no frozen market. Price is the primary factor driving scup landings, and is driven by domestic supply and demand. Anytime there is a big landing of scup, the price drops, then then fishermen do not want to target it. Large volume trips in winter significantly drive down the price. When the NY and RI fish traps start catching scup in the summer fishery, it also drives down prices. Often, the first trip landed in a given day will get the better price. Some small dayboats have to catch limits quickly to offset fuel costs. The price of scup changes so quickly that some trips target scup because the price is high only to find a low price when landing. Therefore, price landed cannot be used to determine targeted trips.

Price can also drive what size fish are caught and in what amounts, by being a determining factor in gear choice/selectivity. If the price is low, some fishermen use a larger than regulation codend (5 ½ inch) to only retain larger scup, which are more valuable; and when the price of scup increases, they use the regulation codend of 5 inches to catch more scup. When scup are being targeted, the catch is >75% scup (see photo). When scup are targeted with larger mesh codends, the catch is very clean catch, with almost no discards.

Catch rates were affected greatly in the late 1980s through mid 1990s, after many of the trip limits, size limits and other more stringent regulations were implemented. The 9 inch size limit was welcome, but other regulations either made it unprofitable to target scup, or crashed the price. As described above, mesh size is an important factor in summer catch rates, and a half an inch makes a big difference.

Seasonal regulations are a factor in scup catch rates. The winter fishery is a more directed fishery. When trip limits are high, many fishermen target scup. Some fishermen will often look for scup on their way in after catching the fluke quota. In the summer, it is much more of a mixed fishery. Fishermen are constrained by their state limits on fluke, sea bass, and scup.

Summer trip limits affect scup landings, making summer catches much less than winter catches. Larger boats tend to avoid scup in the summer. Stability of supply is disrupted by changes in trip limits. The current summer trip limits make it unprofitable to develop a specially targeted inshore fishery for a larger boat, especially when coupled with price of the fish and price of the fuel, so most fishermen inshore are not going to spend time and fuel searching for scup. However, fishermen will try to catch their limits when fishing for multiple species.

The small mesh catch cap also constrains scup landings. If fishermen decide that squidding is more lucrative, they will only be able to retain the amount allowed by the small mesh catch cap. The scup catch cap for small mesh fisheries (500 lbs in winter, 200 lbs in summer), was established back when the estimated biomass was much lower. Therefore, fishermen who encounter scup when fishing with small mesh for squid have to make a decision on whether to discard the scup and keep fishing the small mesh species, or to change the codend to the larger mesh to target scup. Now that the quotas and biomass have been raised substantially, the small mesh catch cap could have increased proportionately.

The availability of other species is another considerable factor in scup catch rates. Most fishermen try to land a mix of species to offset uncertainty in prices. If there are more expensive species available, they will fish for them other than for scup, since it tends to be a cheap fish. This is an important factor in the decision to fish for scup. For example, if small mesh species is more valuable, fishermen will not keep the scup. When the small mesh catch cap is higher, they will retain and land more scup when fishing for other species. In summer, the presence of squid in inshore waters will determine if fishermen are going squidding or after their mixed fishery limits. In this scenario, the small mesh catch caps determine the scup landings. Dogfish predation was also mentioned as a factor in scup catch rates, with fewer scup when dogfish are caught. Fishermen may also avoid dogfish.

Environmental conditions influence scup catch rates. The location of large scup catches varies daily and from year to year according to water temperature, weather and currents. Wind makes scup move locations quickly. Weather affects landings. For example, this winter from January- February (especially February) has been horrendous, and smaller boats did not fish.

In the summer, most scup are caught in at sunrise and sunset. Scup are typically targeted during a morning town and an evening tow in the summer. If scup are not caught in the morning tow, they are not caught later in the day. In the offshore winter fishery most scup are caught at night.

Scup catches are influenced by migration patterns. They generally come inshore during the summer and move to deeper water in the winter months. Fishermen are concerned that scup surveys are hit or miss for sampling scup, because they are so spatially concentrated that it is easy to miss them. A boat length away can be the difference between catching no scup and catching 50,000 lb. Scup school up offshore in the winter and inshore in the summer. In the fall they aren't as tightly schooled but can still be caught. In the spring they are difficult to catch, because they are spread out as they migrate inshore. Therefore, the spring and fall surveys are not good timing for assessing scup.

When scup move from inshore to offshore in the fall, large scup leave first, and small scup leave the inshore areas last. Large scup leave first, small ones last. Therefore, if NEAMAP or states are doing a fall survey inshore, it is likely that they are catching either all small scup or a greater proportion of small scup than are in the stock.

Because temperature plays such a big role in the fish movement from inshore to offshore and vice versa, the timing of the surveys is important. If the surveys are not timed consistently with changes in water temperature, they will be sampling different parts of the stock. The NEAMAP survey takes place later in the spring, when scup may have already started to come inshore due to warming water and can be caught in schools.

Fishermen reported that larger scup are often in deeper water. Scup are not always on the bottom and cannot be caught with bottom trawls. When the stock is large, like it is now, it is harder to find large scup with so many small scup around. The small scup appear to be more aggressive and drive away the larger scup. Scup also school vertically, with the large ones on top, and small ones on bottom. Fishermen do not catch many large scup with a low profile, bottom net in deep water. Fishermen use midwater, or high-rise large-mesh nets to target large scup in the winter; you need a high rise net.

Acknowledgments – Thanks to the fishermen who contributed information, to Eric Powell, Greg Didomenico and Karen Reay for organizing the conference call and to Karen Reay for recording minutes of the call.

Table 1. Fishermen interviewed.

Name	Vessel	Port
Ron Borgeson	F/V Justice	Plymouth, MA
Aaron Williams	F/V Heritage	Point Judith RI
Harold Loftes	F/V Mary Elena	Point Judith RI
Jerry Carvahlo	F/V Alicia	Point Judith RI
Joel Hovanesian	F/V Excalibur	Point Judith RI
Steve Follett	F/V Heather Lynn	Point Judith RI
Tommy Williams	F/V Tradition	Point Judith RI
	F/V Determination	Point Judith RI
	F/V Lightning Bay	Point Judith RI
	F/V Rebecca Mary	Point Judith RI
Dick Grachek	F/V Anne Kathryn	Mystic CT
Mark Phillips	F/V Illusion	Greenport NY
Hank Lackner	F/V Jason & Daniel	Montauk NY
Dave Lofstead	F/V Viking Pride	Shinnecock NY

Table 2. Conference Call Participants

Name	Affiliation
Katie Almeida	The Town Dock
Eleanor Bochenek	Rutgers Univ.
Steve Cadrin	SMAST
Greg DiDomenico	SCeMFiS/Garden State Seafood Association
Meghan Lapp	Seafreeze Ltd.
J.J. Maguire	SCeMFiS consultant
Karen Reay	SCeMFiS/VIMS
Mark St. Phillips	F/V Illusion
Mark Terceiro	NEFSC

Appendix C. SAW60- Scup Working Group Meeting Summary

Woods Hole MA, April 20 – April 24, 2015

Participants:

- NEFSC: Gary Shepherd (chair), Mark Terceiro (lead), Tony Wood, Kirsten Curti, John Manderson, Loretta O'Brien, Wendy Gabriel, Paul Rago, Mike Palmer, Chuck Adams
- Others: Kiley Dansey (MAFMC), Julia Beaty (MAFMC), Kirby Rootes-Murdy (ASMFC), Megan Lapp (Sea Breeze Ltd.), JJ Maguire (SCEMFIS), Robert Leaf (SCEMFIS), Steve Cadrin (SCEMFIS), Jason McNamee (RI), Greg Wojak (CT), Mike Bednarski (MA), Sally Roman (VA on phone), John Maniscalco (NY on phone),

Terms of Reference:

1. Estimate catch from all sources including landings and discards. Include recreational discards, as appropriate. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data.
2. Present the survey data being used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.). Characterize the uncertainty and any bias in these sources of data.
3. Describe the thermal habitat and its influence on the distribution and abundance of scup, and attempt to integrate the results into the stock assessment.
4. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and estimate their uncertainty. Include a historical retrospective analysis to allow a comparison with previous assessment results and previous projections.
5. State the existing stock status definitions for "overfished" and "overfishing". Then update or redefine biological reference points (BRPs; point estimates or proxies for BMSY, BTHRESHOLD, FMSY and MSY) and provide estimates of their uncertainty. If analytic model-based estimates are unavailable, consider recommending alternative measurable proxies for BRPs. Comment on the scientific adequacy of existing BRPs and the "new" (i.e., updated, redefined, or alternative) BRPs.
6. Evaluate stock status with respect to the existing model (from previous peer reviewed accepted assessment) and with respect to a new model developed for this peer review.
    a. When working with the existing model, update it with new data and evaluate stock status (overfished and overfishing) with respect to the existing BRP estimates.
    b. Then use the newly proposed model and evaluate stock status with respect to "new" BRPs and their estimates (from TOR-5).
7. Develop approaches and apply them to conduct stock projections and to compute the statistical distribution (e.g., probability density function) of the OFL (overfishing level) (see Appendix to SAW TORs for definitions).
    a. Provide numerical annual projections (3 years). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. Use a sensitivity analysis approach in which a range of

assumptions about the most important uncertainties in the assessment are considered (e.g., terminal year abundance, variability in recruitment).

b. Comment on which projections seem most realistic. Consider the major uncertainties in the assessment as well as sensitivity of the projections to various assumptions.

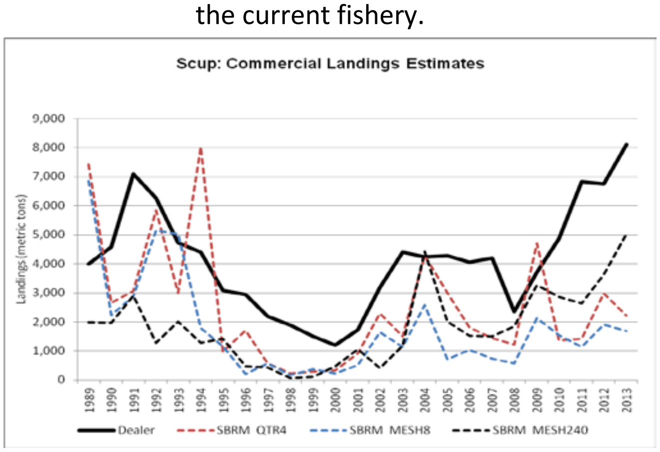
c. Describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming overfished, and how this could affect the choice of ABC.

8. Review, evaluate and report on the status of the SARC, SSC, and Working Group research recommendations listed in most recent SARC reviewed assessment and review panel reports. Identify new research recommendations.

Introduction – Mark

- NEFSC SVs peaked in late 1970s and since 2000
- Commercial landings (and probably total catch) peaked in 1955-1965
- Early analytical assessments (1995-97) were uncertain, transitioned to index-based assessments until 2008 Data Poor Workshop developed ASAP application and subsequent updates
- Rumble strip – data updates NEFSC surveys and catch/biomass

TOR 1 - Review of Commercial landings and discard data

- Landings
    - Peak landings 20kt in late 1950s early 1960s
    - May have been for fish meal
- Discards
    - SBRM MESH240 appears to offer the most precise discard estimates. However, the diagnostic of comparing the method's estimate of landings to dealer landings (Figure 19) shows that none of the methods performed well for estimating landings. SBRM MESH240 performs best for estimating landings in the last five years, but it was the worst for estimating landings in most years in the 1990s. SBRM QTR4 appears to perform better in the 1990s and has similar performance to SBRM MESH240 in recent years.
        - SBRM MESH240 was designed to account for GRAs, so that stratification may not help before GRAs were implemented, but SBRM MESH 240 appears to be best for the current fishery.
- 

- o CVs on SBRM240 are low in some years (e.g., 1%) from high sample size; contrary to variance in estimates among methods. Preliminary ASAP assumes 20%CV (annual average is 22%)
- Distributions
    - o Some outlier locations in logbooks
    - o Large survey tows off VA, but little fishery
        - Possibly because of small size distribution
- Good size/age sampling for last 10 years, but was poor in 1990s

Review of Recreational landings and discard data

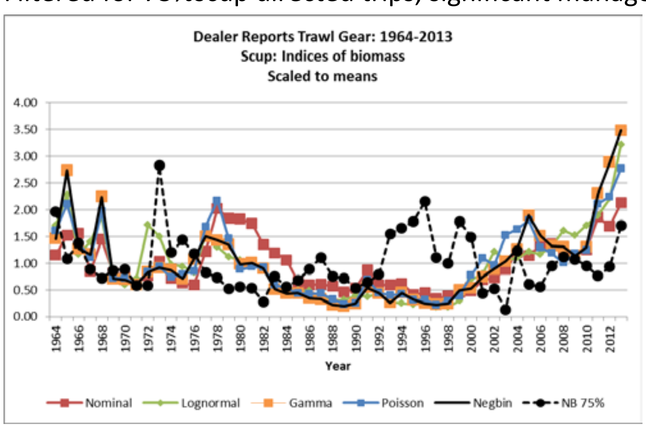
- Recreational catch
    - o Discards 2% of total catch
- Good size/age sampling for last 10 years, but was poor in 1990s

Completion of Catch at age matrix

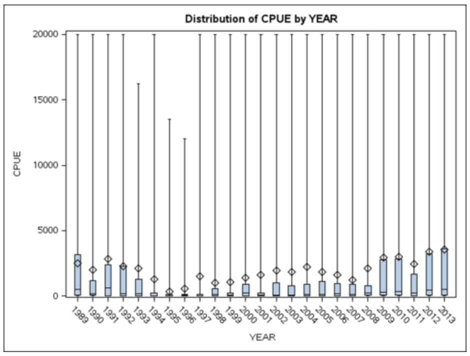
- Large proportion of ages 0-1 in commercial and recreational landings before mid 1990s; very few age-0 and few age-1 since mid 1990s
- No trend in mean weights in last decade, during good sampling period
- Decrease in maturity at age

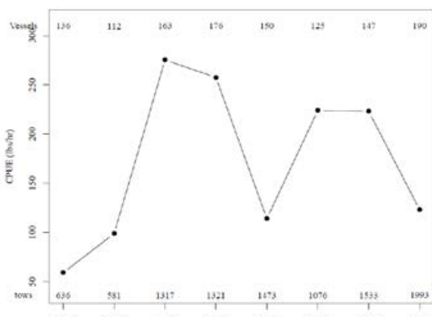
CPUE

- WP on fishermen's perspectives
- Filtered for 75%scup directed trips, significant management effects



-
- NEFSC study fleet – too few vessels?
- CPUE considered in cod benchmark
    - o Management actions confound index of abundance
    - o Technology is not standardized
- Trip limits could be addressed by identifying trips that met the trip limit
- Search time is a concern
- Dealer data wasn't implemented as early as others

- Management actions may be standardized
    - Were significant for %75% scup trips
- Recreational CPUE
- Observer data has best data quality (discards, tow-based effort, target species), but is somewhat noisy (e.g., 1998 big tow)
    - Observer program has had design changes before SBRM – initially issue-driven (estimating discards for ‘problem fisheries’)
    - Low sample size before 2004 (~30 trips, 10 DAS), (~200 trips, ~100 DAS)
    - 

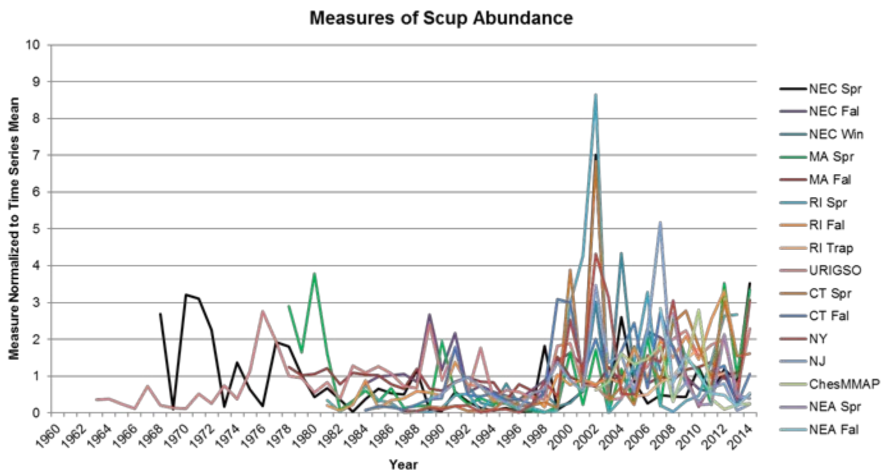
    - OB data should be analyzed on a tow basis rather than a trip basis
    - Bell analyzed OB data on a tow basis
    - 

- Dealer/logbook has much greater sample size
    - 75% scup trips also have less skewed distribution
    - However, series is flatter than all other stock indicators
- Ideally use surveys rather than CPUE
    - But scup surveys are noisy and CPUE may be complementary to trawl surveys
    - noisy surveys, timed during migrations, that catch few age 2+ scup, and don’t track cohorts well at 2+
    - CPUE not scientifically designed, but dealer/logbook census and much less patchy, either attempt to standardize factors or use shorter series in which constant q is assumed
- Exploratory analyses with CPUE
    - All CPUE series and just dealer_trawl
    - Dealer_trawl has a residual pattern (negative since 2000)
    - Lower SSB estimates
    - Loretta – including CPUE even in an exploratory run would give it more credence than it deserves.

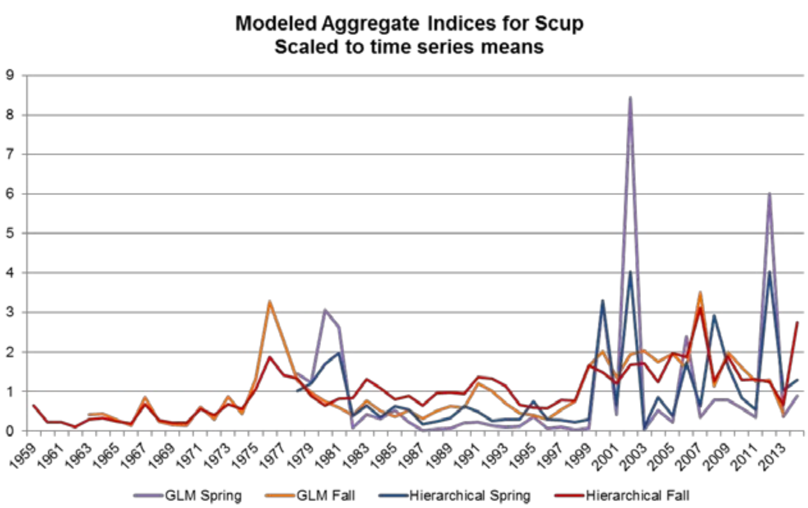
The WG decided to present CPUE information in the report. The WG decided that the dealer/logbook standardized LPUE from >75% scup trips was the most appropriate attempt to develop an index of abundance. However, the resulting LPUE series is different than all other survey and CPUE stock indicators (e.g., peak LPUE in mid 1990s). The WG concluded that further analysis is needed to standardize the complexity of factors influencing fishery catch rates.

TOR 2 - Review of Fishery Independent Surveys

- RI and CT Spring catches more old fish than other surveys



-
- GLM age-aggregate and by age
- Conn's Hierarchical Aggregate Analysis

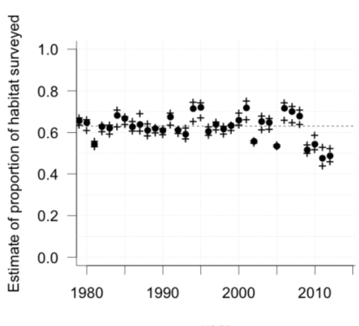


-
- How would this perform in practice of update process
- ADAPT sensitive to survey approach in starting year and plus group
- Conn's Hierarchical Aggregate Analysis - Jason
    - Used for menhaden assessment
        - WG only offered an aggregated index approach
        - Had north and south fleets

        - Difficulty fitting disaggregated length compositions
    - Relax the q assumption in other aggregation approaches
        - Estimates q for each survey
        - GLM is a numerical smoother of each index does not explicitly account for differences in selectivity
    - Age-aggregated only
    - Assumes sampling and process error in **indexing the entire stock abundance**
        - Disaggregated approach assumes indexing the entire geographic stock, but may have different age selectivities
            - Some heavy-handedness is needed in ASAP for modeling selectivity (form, oldest age, CVs)
    - Bayesian estimator
        - Priors on index mean (lognormal), q (lognormal), and process error (wide uniform)
    - Results
        - Spring – only ~2y significantly different
        - Fall – few years significantly different

TOR 3 - Review Habitat information for Scup – John Manderson

- Distribution shifts
    - Fall survey non-systematic size-based shifts, could be related to timing of survey
    - Spring survey shift to north and east
- Habitat suitability index to account for inter-annual changes in thermal habitat and how much of habitat is surveyed for NEFSC and NEAMAP surveys
- Lower portion of habitat sampled in last 4 years (2009-2012) of the fall survey



-
        - That habitat is surveyed by NEAMAP survey, but the 2 surveys are considered to be independent indicators
        - Same 4 years had less habitat sampled for SAW58 butterfish – sampled proportion was as or more variable, but interannual variation was considered to be stable and only informed scale of time-constant q
- Results in ASAP4: NEFSC survey qs variable without long term trend; NEAMAP survey qs variable; changes some SV residual patterns, RMSEs generally larger; estimation results for SSB, R, and F very similar to ASAP3 (within ~5%)

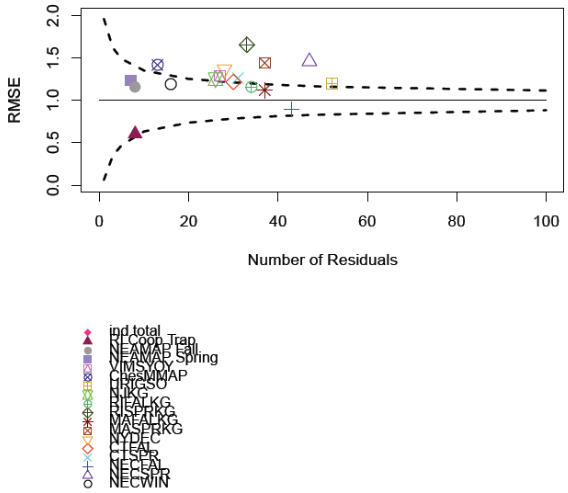
- WG decided to include ASAP4 as a sensitivity analysis, because it has a valid basis in data and biology, but ASAP4 is a beta version and is not fully documented.
- Final ASAP4 run has more sensitivity (2014 SSB ~170kt SSB)

TOR 4 - Evaluate models and results

- M~0.2 to 0.4
    - Recently caught some age-14 fish
    - WG decided to assume M=0.2 in base run with sensitivity runs at M=0.1 (based on likelihood profile) and M=0.3 based on alternative life history approaches
- ASAP (ages coded +1, age-0 coded as age-1)
    - S60_BASE_15
        - 1963 with extrapolated catch, fishery ages start in 1984
        - S-R function 'turned off'
        - Rec devs L = 1, CV from 0.1 to 1.0 in 1984
        - Fishery ESSs: CL = 30, RL = 30, CD = 10, RD = 5
        - Fishery CV: CL = 0.10, RL = 0.10, CD = 0.22, RD = 0.12
    - Were there management changes associated with assumed selectivity (1963- 1996, 1997-2005, 2006-2014) changes?
        - DPSWG 2 periods: 1984-1996 and 1997-2007, with the break roughly coinciding with the advent of substantial regulatory changes in the fisheries (Amendment 8 in 1997 and Amendment 12 in 1998).
        - Assumed change in selectivity in 2006 was based on resolving residual magnitude an patterns (run 10)
            - The AP report suggests no changes, TAC dropped from 20millb in 2006 to 14millb in 2007
            - Fishermen reported change in fishing behavior in the last decade, with much less searching, possibly changing selectivity
    - Residual pattern in recreational discards since 2006, ages 0-1 all negative, ages 2-3 all positive
        - Pattern persisted through several alternative approaches
        - Small portion of the total catch
    - Many survey residual patterns
        - **NEFSC winter** age-1 negative, age-2 positive
        - **CT Spring** 2000 yearclass all positive, 2001-2011 age-1 all negative
        - **NY** age-0 negative before 1997, positive after 1997; age-1 positive before 1997, negative after 1997
        - **ChesMap** age-0 negative, age-1 positive
    - Other survey series with large partial variance, RMSE (2,7,9,10,13) – run 18
        - **NEFSC spring (removed), MA spring, RI Spring, RI fall, CHESMAP**
        - Partial variance is only one model validation diagnostic that indicates lack of fit, removing them makes the model look better, but lack of fit may be from model

problems rather than data problems, and it may suggest excluding valid data (sweeping problems under the rug)

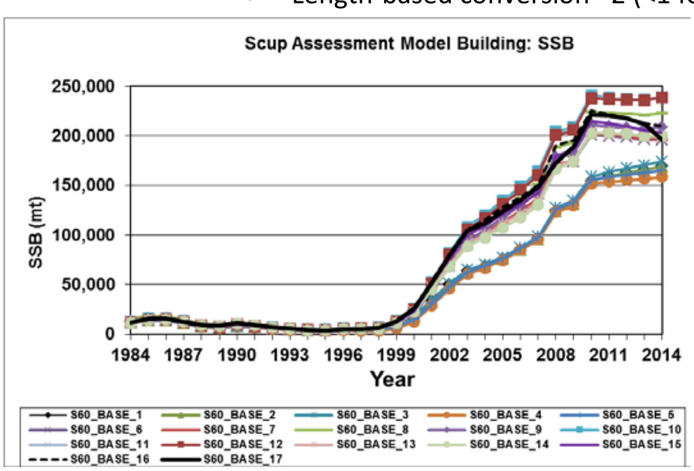
- Partial variance diagnostic is also dependent on assumed measurement error (survey CVs)

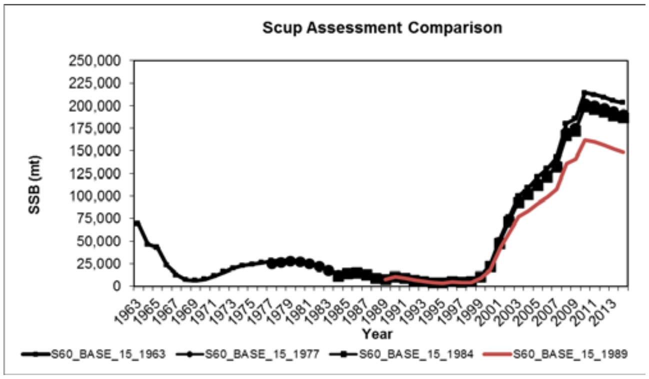


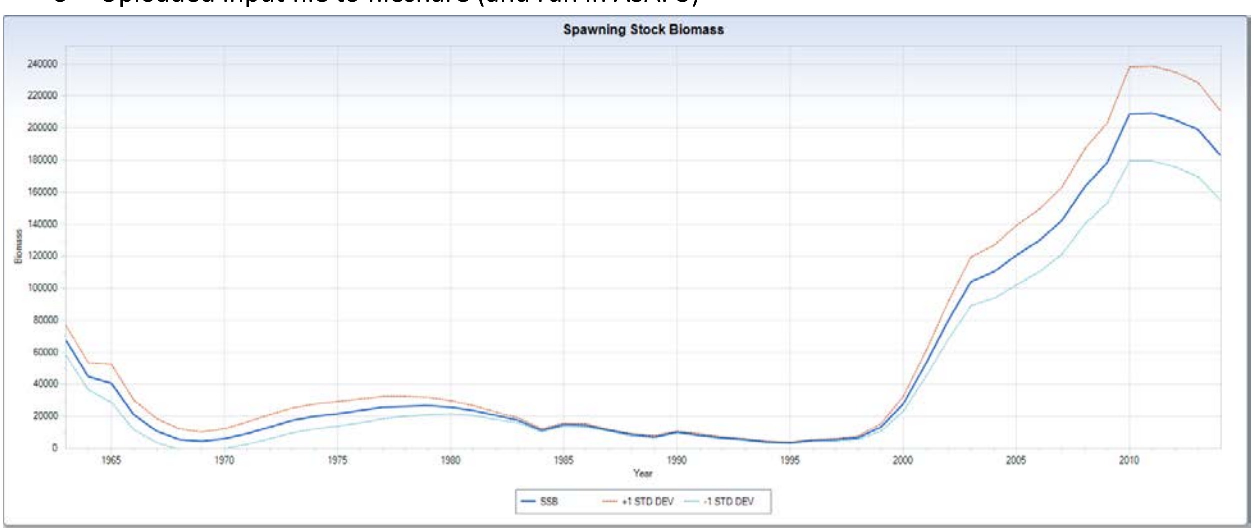
o
- Excluding series with high partial variance produced similar results, slightly lower SSB
  - Other diagnostics – patterns of residuals are equally valid criteria, and would suggest excluding NEFSC winter, CT spring, and NY – leaving little

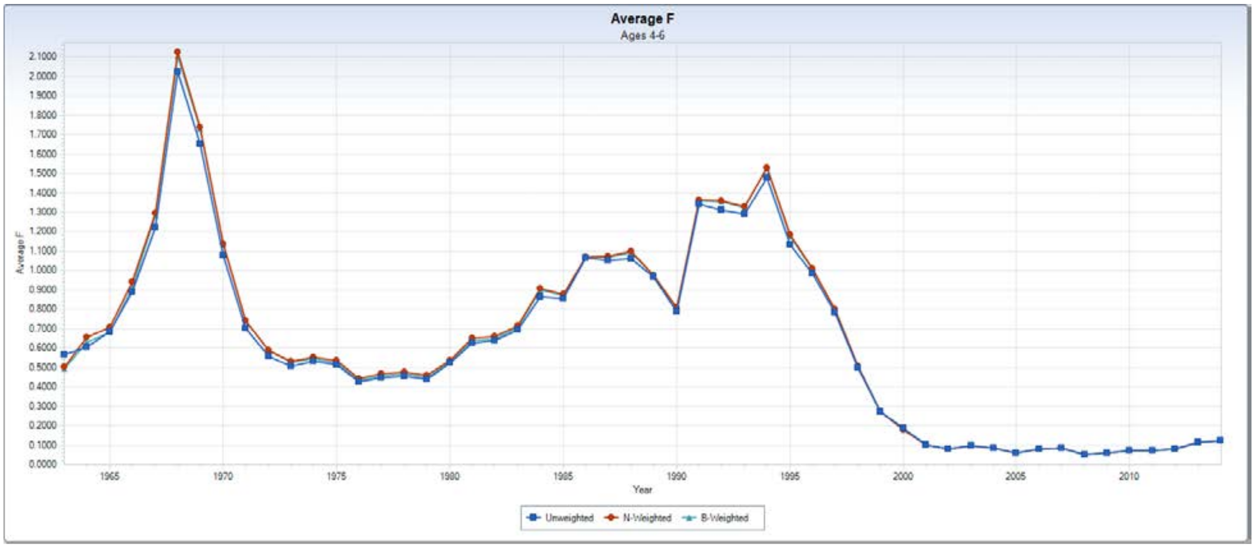
o Retrospectively consistent SSB and F (R pattern underestimation)

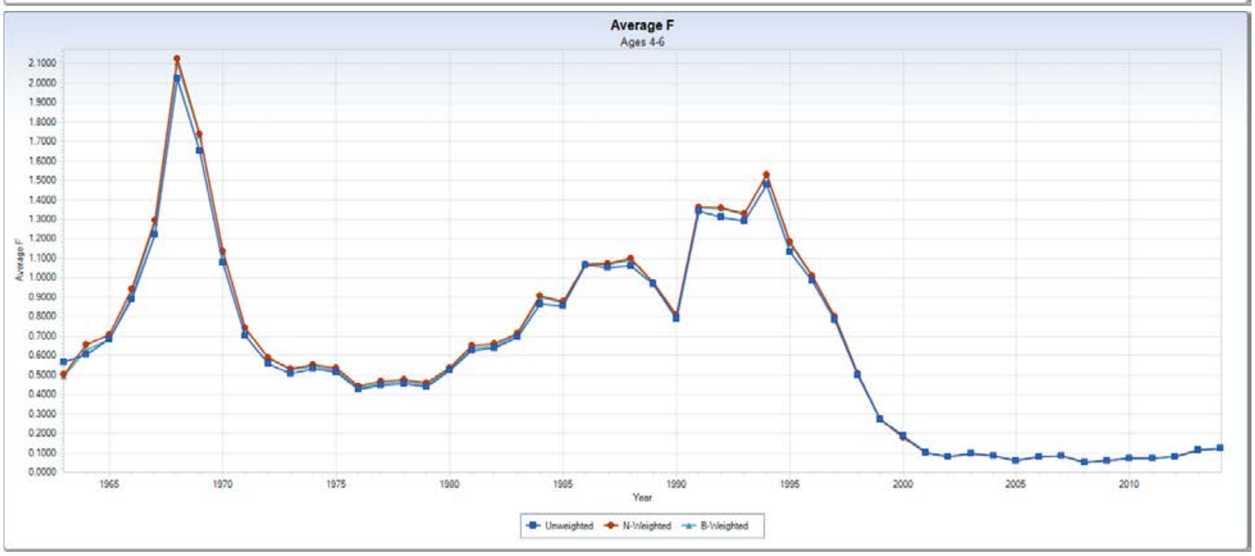
o Q based on area-swept biomass
- NEFSC spring q=0.2 – removed from final assessment
- **NEFSC fall q=2.2**
- NEAMAP<0.1
- Area-swept estimates of stock size from the fall survey are greater than those from ASAP. Both estimates have assumptions (ASAP assumes M, selectivity, etc.; area-swept assumes total area, sampled area, etc.)
- Surveys are in AL units. Aggregate conversion factor = 2.8 (Miller et al. 2010)
  - Length-based conversion ~2 (<1 for large fish ~20-30cm)

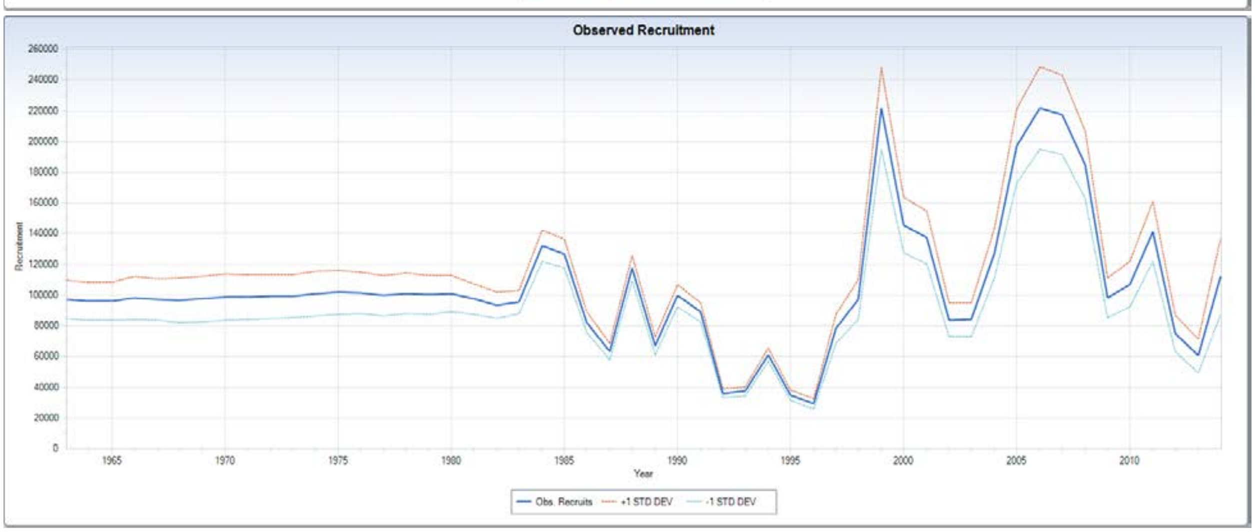
- 

    - Difference between runs 1-4 and 6+ is survey selectivity
- Sensitivity analyses
    - using Bigelow as a new series - similar results
    - starting year
        - 1963 – 1st year of surveys and
        - 1977 – 1st year of survey ages – similar results
        - 1984 – 1st year of fishery ages – similar results
        - 1989 – 1st year of discard estimates (lower estimate of SSC) – suggests that there are still uncertain scale (q) estimates
- 

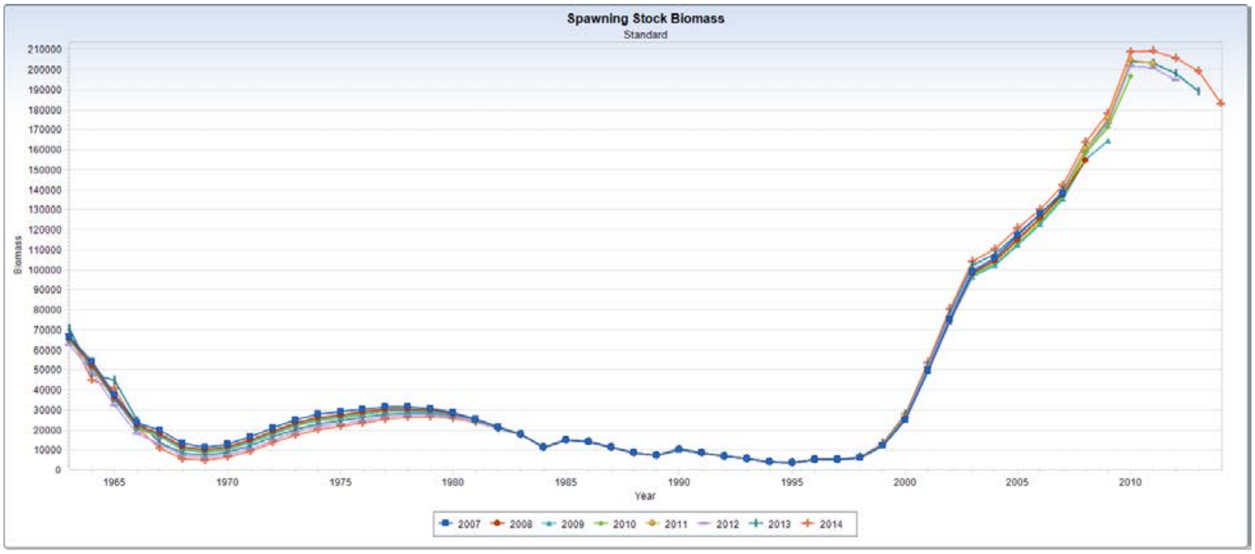
    - Extending as far back as possible uses all the available data and offers historical context for the scale of recent biomass estimates (not seen as far back as early 1960s, during near-peak fishery catches of ~20kt)
    - The 1989 start alternative has similar stock trajectory as early iterations (1-4, before removing priors on survey selectivities)
- Run 19 increased CVs for historical commercial discards and recreational catch (1963-1988)
    - Doesn't change historical estimates and only minor changes to recent estimates
- Run 18 has all updated 2014 data
    - Uploaded input file to fileshare (and run in ASAP3)
- 

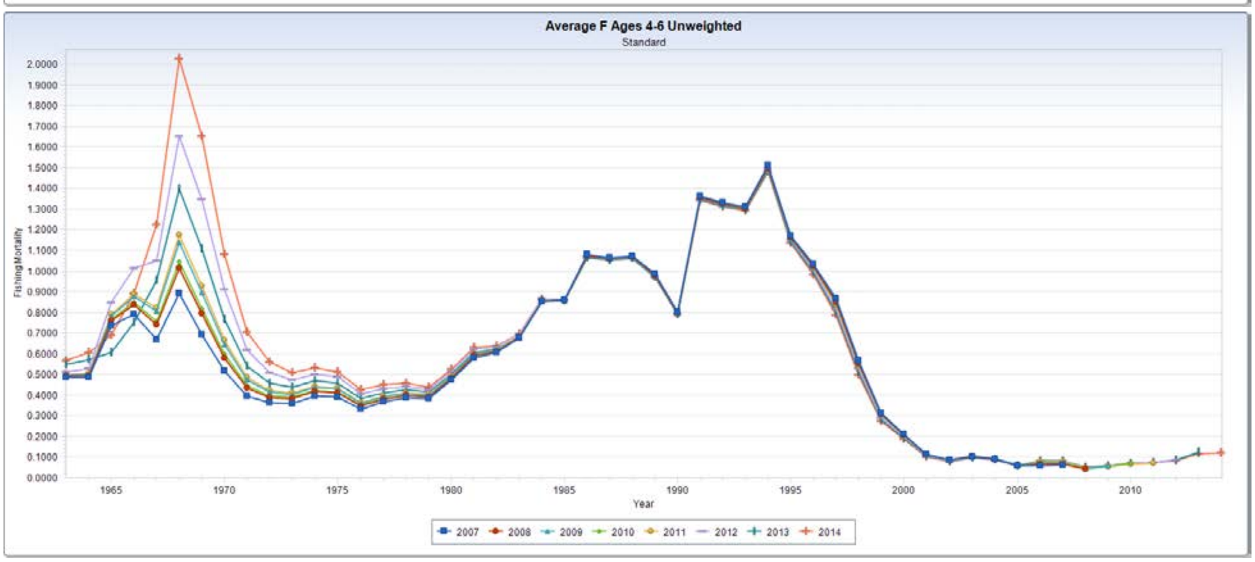
- 

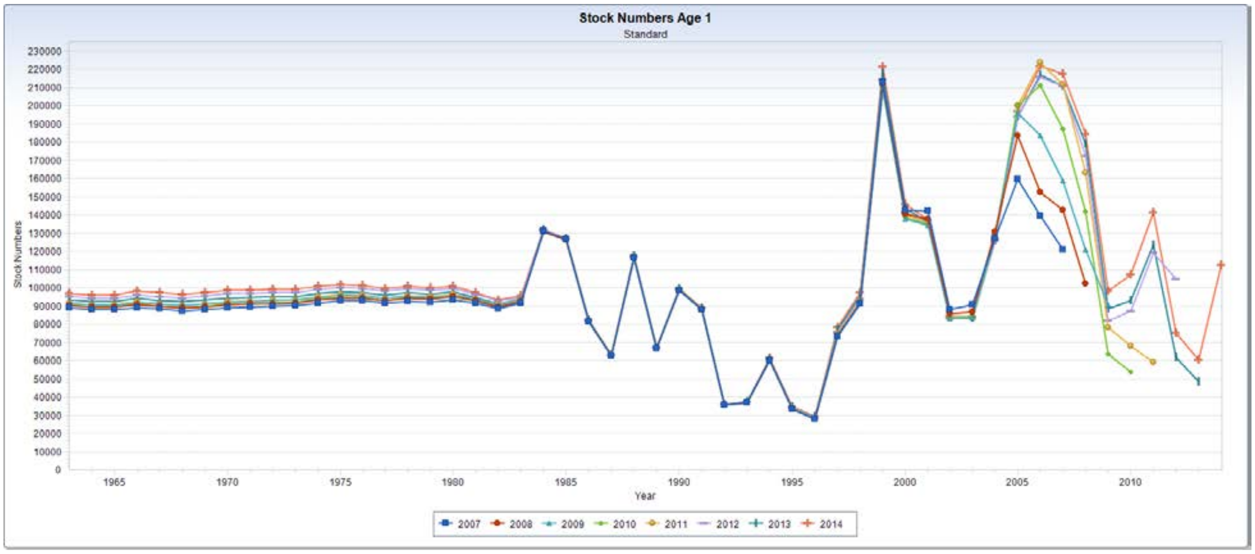
- 

- 

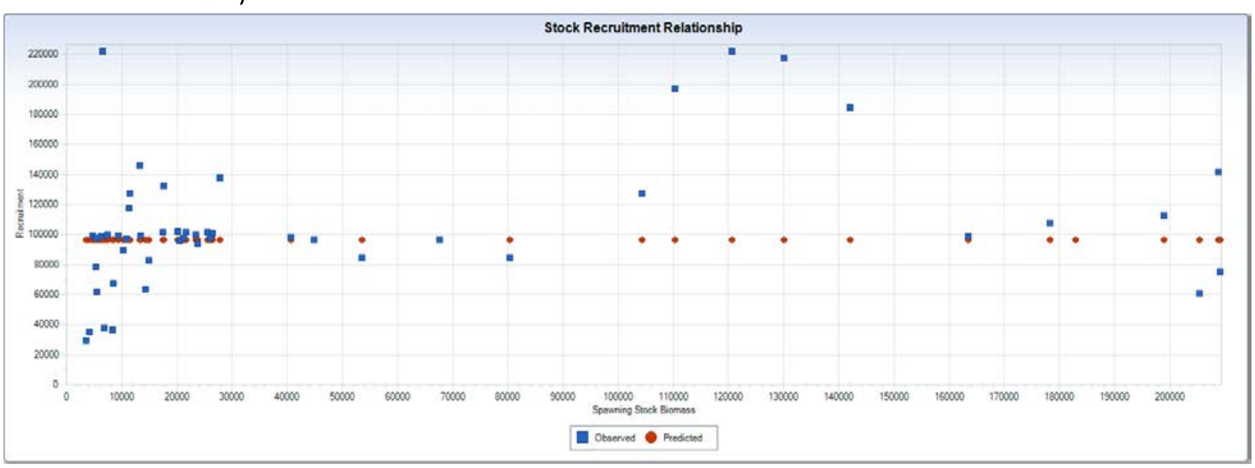
- ASAP Base 18 uses all available information to meet term of reference 4 (estimate annual fishing mortality, recruitment and stock biomass for the time series, and estimate their uncertainty). The general results (e.g., record high stock size and low F in the last decade) is robust to all alternative model configurations. However, there are some indications of poor model fit from lack of correspondence among surveys, and there is considerable uncertainty in recent stock size estimates. Alternative survey selectivities, starting years, and time-varying survey catchability produce considerably lower stock size estimates, and some area-swept survey estimates suggest substantially greater stock size.

- 

- 

* 

TOR 5 – Reference Points

* 2008 DPSWG F40% = FMSY = 0.177, SB40% = SSBMSY = 92,044 mt, MSY = 16,161 mt
* S60_BASE_17 S-R function not estimable (h ~1): use proxy
    * o No S-R relationship (highest R at lowest SSB), but some historical R estimates based on discards or age-0 surveys, not seen at older ages
        * ▪ Pattern since 1984-2011 shows same (1999 yearclasses were strong, from <25kt SSB)
* 

    * o Mean weights, selex from 2010-2014; maturity is 3 yr 2014 value
    * o Recruitment cdf from 1984-2013; 100 year projection
* Overfishing: F40% = FMSY = 0.22 (Fmax=0.49, F0.1=0.31)
    * o 22% increase in F40% from delayed and more domed selectivity, decreased waa,
    * o Biomass Target: SSB40% = SSBMSY 87kt
    * o MSY ~12kt

TOR 6 – stock status

- Not overfished and overfishing not occurring
    - 2014 Fmult=0.123 (56%F40%)
    - 2014 SSB=183kt (2.1 x biomass target)

TOR 7 – projections

- Assumed 2015 catch = 75% ACL
- Tier 3 ABC – use full CV 81% of OFL
- 2016 OFL = 16kt (CV13%)
- 2017 OFL = 14kt (CV12%)
- 2018 OFL = 13kt (CV13%)

TOR 7b - Consider the major uncertainties in the assessment as well as sensitivity of the projections to various assumptions.

- Tier 3 MAFMC risk policy –
    - Reference points estimated outside the model, and M assumed
    - Lower bound of MCMC (run17) doesn't include some estimates from viable sensitivity runs

TOR 8 – Research recommendations

- Aggregate survey methods may perform well for ruble strip
- A standardized CPUE of scup targeted tows, from either post SBRM observer samples or study fleet might be considered as an additional index of abundance to complement survey indices in future benchmark assessments.
- Investigate size/age composition of early fishery to help with starting year abundance at age estimates

Appendix D. SARC60 Meeting Summary

June 2-5 2015, NEFSC Woods Hole MA

Participants

- Cynthia Jones, SARC Chair (SSC lead on bluefish)
- CIE Reviewers: Kevin Stokes (consultant NZ), Norm Hall (Murdoch University, Australia), Sven Kupschus (Center for Environment, Fisheries and Aquaculture Science, UK)
- NEFSC: Jim Weinberg (SAW chair), Chris Legault (acting Population Dynamics Branch Chief), Mark Terceiro (scup lead assessment scientist), Tony Wood (bluefish lead assessment scientist), Gary Shepherd (scup WG chair), Wendy Gabriel (SSC lead on scup), John Manderson, Larry Alade, Brian Linton, Chuck Adams, Loretta O'Brien, Susan Wood, Paul Nitschke, Mike Palmer, Jon Deroba, Brian Linton, Dave McElroy, Kirsten Curty (on phone)
- Others: Jason McNamee (ASMFC scup TC), Julia Beaty (MAFMC), Kirby Rootes-Murdy (ASMFC), Jocelyn Runnebaum (UME), Jose Montanez (MAFMC on phone), Mike Calestino (ASMFC bluefish TC chair), Katie Drew (ASMFC)

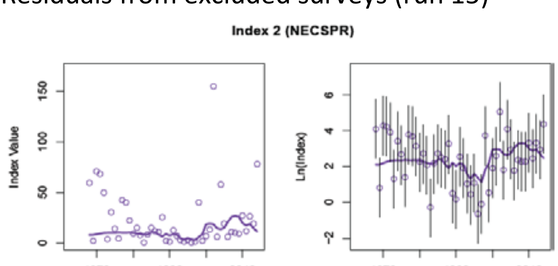
<u>Assessment Presentation</u> - Mark Terceiro

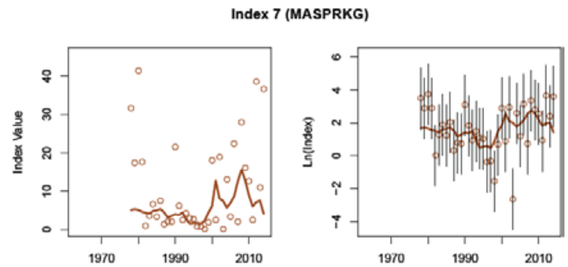
Scup_2015_SARC60_Data (4).ppt

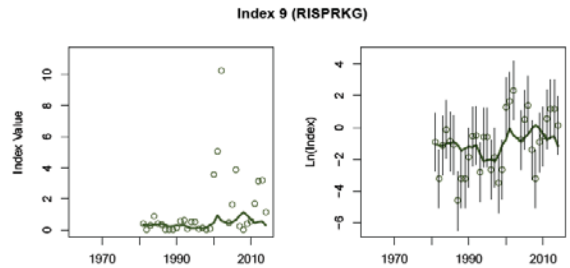
Scup_2015_SARC60_Model (2).ppt

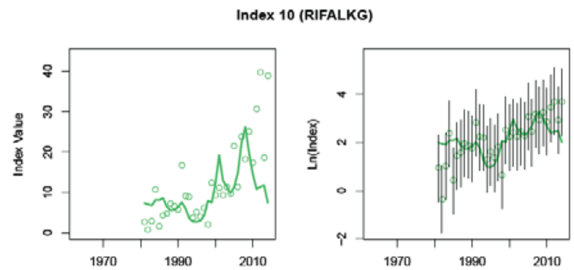
- Norm – CPUE not in the ToR
- Norm – multiple surveys might be better modeled in state-space (?)

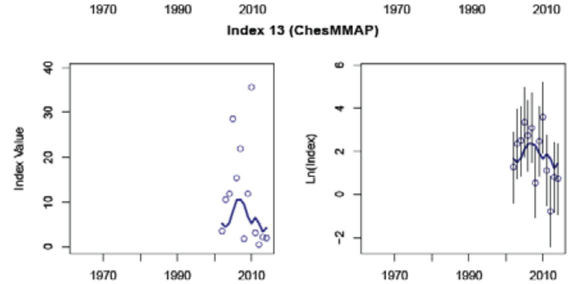
<u>SARC Discussion</u>

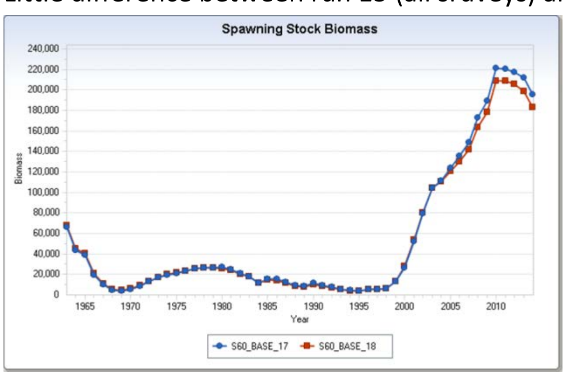
- Norm – is the basis for assumed 15% discard mortality for the recreational fishery reasonable?
  - 2 studies – CTDEP and graduate thesis
  - Commercial discard mortality assumed to be 100%
- Norm – excluded surveys because they deviated from model, but were there any patterns to their deviations that might be explained by inter-annual variability?
  - Run BASE_18 excludes NEC Spr, MA Spr, RI Spr, RI Fal, VIMS ChesMMAP
  - Residuals from excluded surveys (run 15)
  - 

- o 

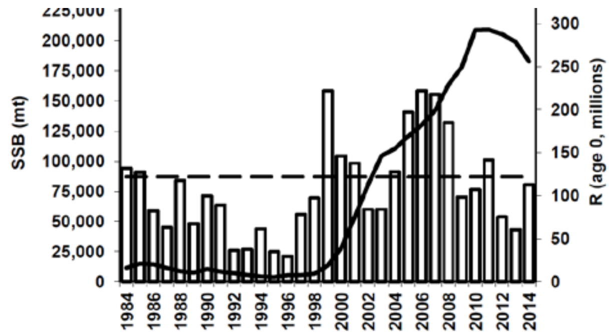
- o 

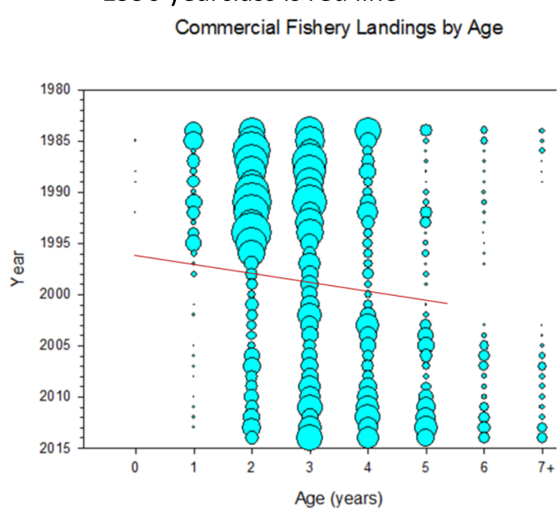
- o 

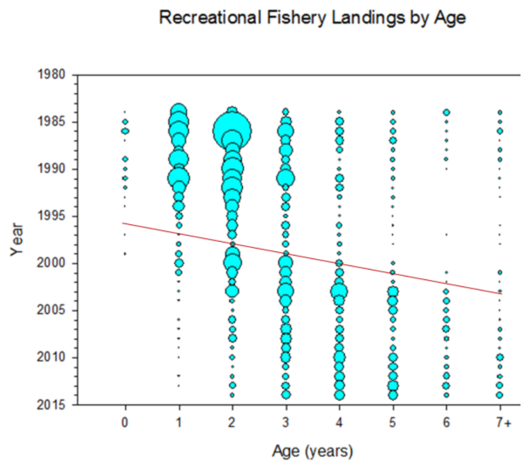
- o 

- o Kevin – a priori, we should rely on surveys
- o Little difference between run 15 (all sruveys) and run 18 (excluding 5 surveys)
- o 

- Norm – what is the sensitivity to the M assumption?
  - o Life history-based M ranged 0.2-0.4, and the model suggested <0.2, so M=0.2 was assumed
  - o Kevin – usually sensitivity analyses suggest similar productivity with different M, because of tradeoffs in model parameters (e.g., M and h)

- Requested sensitivity analyses (WG requested M=0.3 sensitivity) – Mark did a likelihood profile of M=0.05-0.5
    - Ran sensitivities on screen
        - M=0.1, F40%=0.261
        - M=0.2, F40%=0.220
        - M=0.3, F40%=0.172
- Sven – 1996 yearclass strong signal in data (commercial fishery 10+, recreational middle ages), but not in model (weakest yearclass in the time series)
    - Model explains survivors to old age from 96 yearclass as a reduction in F (not increase in R)
    - 

    - I don't see any signal of a strong 1996 yearclass in fishery or survey data
        - 1996 yearclass is red line
    - 



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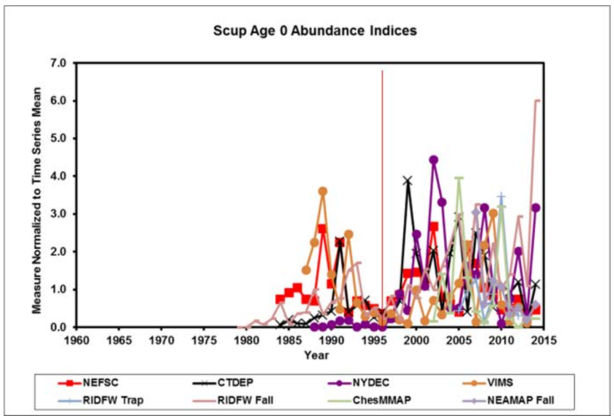

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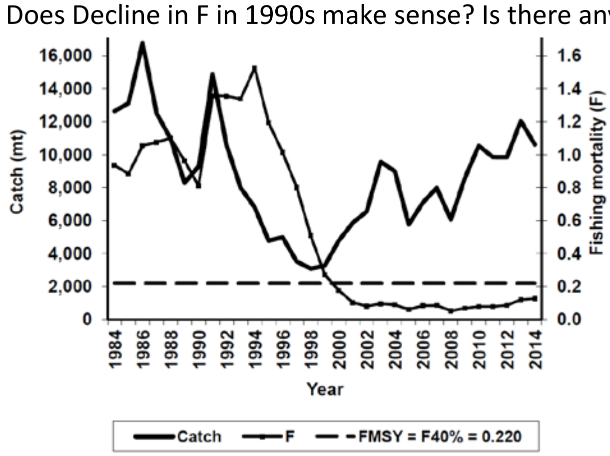
- Sven – we can't rely on F estimates before 1975 because of uncertain initial population estimates
  - o Does Decline in F in 1990s make sense? Is there any evidence of decreased effort?



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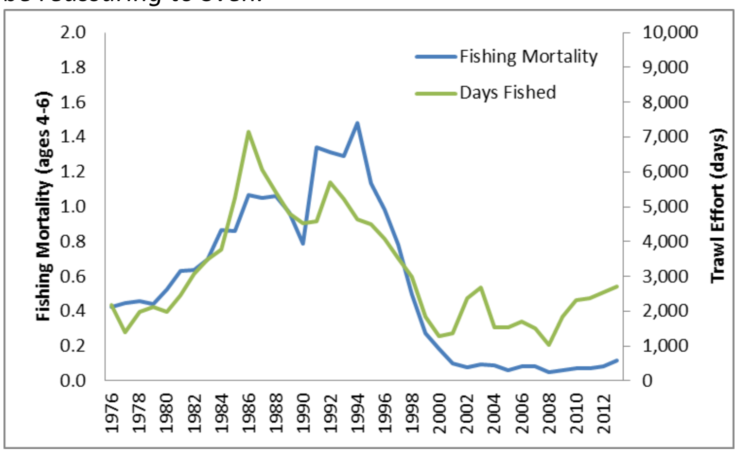
- Jim – any requests for revised analyses?

Public Comments

- Me – the reduction in F can be explained by management actions, because 1996 was the first year that scup had a management plan, and the objective was to decrease F

Email to Gary Shepherd in response to Sven's request:

From: "Steve Cadrin" <scadrin@umassd.edu>
To: "Gary Shepherd" <gary.shepherd@noaa.gov>
Cc: "Mark Terceiro" <mark.terceiro@noaa.gov>
Sent: Tuesday, June 2, 2015 7:57:53 PM
Subject: Re: Public Comment
Hi Gary:
I'm still getting used to the new SARC format, but as I understand it, you are at the table to represent the WG. So, I'll pass this by you to see if it's worth following up.
Sven asked if there were any effort statistics to confirm the sharp decrease in F estimated by the base model. The dealer/logbook effort statistics show a similar decrease in days fished in the trawl fishery (Table 1 of Mark's attached WP). The WG considered this to be the most reasonable series of CPUE (and implicitly effort). I don't expect days fished to exactly match the F series, but their general correspondence may be reassuring to Sven.



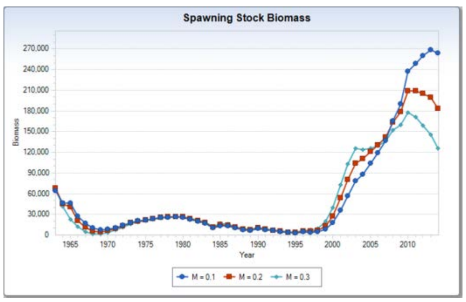
Please let me know if you think this answers his question (or not). If so, please refer the reviewers to that WP.
Thanks,
Steve

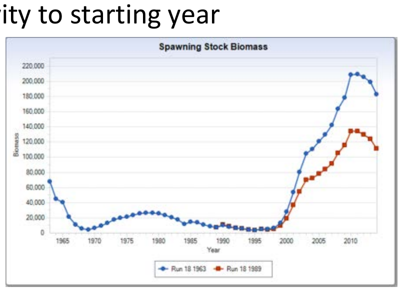
From: "Steve Cadrin" <scadrin@umassd.edu>
To: "Cynthia Jones" <cjones@odu.edu>, "Mark Terceiro" <mark.terceiro@noaa.gov>, "Chuck Adams" <cadams@umassd.edu>
Sent: Tuesday, June 2, 2015 5:58:01 PM
Subject: Public Comment
If needed for the Rapporteur's notes, here is the excerpt from the 2014 Scup Advisory Panel Report that I uploaded to the shared drive:
"The Fishery Management Plan (FMP) for scup has been in place since 1996 when it was incorporated into the Summer Flounder FMP."
... and here is the excerpt from Amendment 8 of the Summer Flopunder FMP (1996):
“This Fishery Management Plan for the Scup Fishery (FMP), prepared by the Mid-Atlantic Fishery Management Council (Council), is intended to manage the scup (Stenotomus chrysops) fishery pursuant to the Magnuson Fishery Conservation and Management Act of 1976, as amended (MFCMA). The management unit is scup (Stenotomus chrysops) in US waters in the western Atlantic Ocean from Cape Hatteras northward. The objectives of the FMP are to:

1. Reduce fishing mortality in the scup fishery to assure that overfishing does not occur.
2. Reduce fishing mortality on immature scup to increase spawning stock biomass.
3. Improve the yield from the fisheries.
4. Promote compatible management regulations between state and federal jurisdictions.
5. Promote uniform and effective enforcement of regulations.
6. Minimize regulations to achieve the management objectives stated above."
My point was that the decrease in F in the 1990s is consistent with this management action.

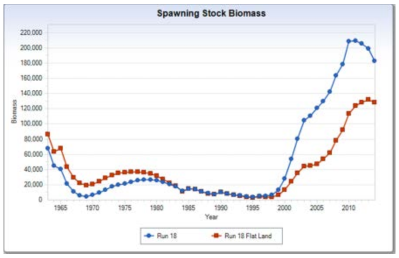
<u>Revisit with presenters</u>

Scup_2015_SARC60_SARC_Work.ppt

- Sensitivity to M
- 

    - M = 0.1:
        - F40 = 0.172, F2014 = 0.111
        - SSB40 = 194 kmt, SSB2014 = 264 kmt
    - M = 0.2:
        - F40 = 0.220, F2014 = 0.127
        - SSB40 =   87 kmt, SSB2014 = 183 kmt
    - M = 0.3:
        - F40 = 0.261, F2014 = 0.146
        - SSB40 =   56 kmt, SSB2014 = 126 kmt
- Sensitivity to starting year
    - 

- Sensitivity to selectivity

- 

- Further explorations of domed selectivity, M and starting year may improve the assessment

- Accepted the WG preferred assessment (S60_BASE_18)

Review/edit Assessment Summary Report (A. Scup) Cynthia Jones, SARC Chair

- State of Stock: no substantial changes
- Projections:
  - Corrected the assumed 100% or 75% of ABC caught in 2015 (not ACL, which are for commercial and recreational sectors)
  - Added M, selectivity to uncertainties that are not accounted for in projections
  - CV of OFL ~30%?
- Catch: mt (lb) standardized
- Stock Distribution & Identification: no changes
- Data & Assessment: minor edits
  - Significant model revisions based on recommendations and explorations
  - NEAMAP, RIDFW and cooperative trap surveys were considered but not used in the model.
  - Sven didn't support WG statement that long time series was informative
- Reference Points: clarified F40% proxy
- Special Comments:
  - "During the evaluation of the base 18 run, some sensitivities were examined that highlighted some additional risk. The most relevant to management was the selectivity pattern. The base model has a strongly domed selectivity pattern which could result in an increasing cryptic biomass given the current stock trajectory. Stock status is robust to these issues, but perceptions may vary if recruitment decreases or fishing effort increases. This could be a problem in the long term."

Scup_WP_A17_SAW60_AssessmentSummaryReport_May20_2015_v3.docx

SARC Report writing.

- TOR1 – fishery data: met
  - Recreational data is problematic
  - The revised discard estimation (mesh240) is an improvement
  - Good commercial sampling
  - Need to document commercial landings estimation
  - Good comparison of alternative estimators
- TOR2 – survey data: met

    - Some surveys may not represent the entire stock
    - The aggregated survey index wasn't used in the final model
- TOR3 – environmental factors: met
    - The approach explored for butterfish may not be relevant for other species, and alternative habitat variables should be explored
- TOR4 – estimate stock size and fishing mortality: met
    - Concerns about domed selectivity, M and starting year
- TORs 5-6 – stock status: met
    - Conclusions robust to model decisions in the short-term, may be a concern in the long-term
- TOR7 – projections: met
    - Not all uncertainty captured in the projections
- TOR8 – research recommendations: met
    - Should be prioritized