Consultant's Report: Summary of the MRFSS/MRIP Calibration Workshop

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KEY WORKSHOP RECOMMENDATIONS

The following recommendations related to matching MRFSS-derived catch estimates with estimates derived from the new MRIP methodology were agreed-upon by a consensus of the workshop participants:

1. There is a need to re-estimate the marine recreational catch for years prior to 2004.
2. Officially re-estimated catch data for 2004 to 2011 represent the best available data and should be used, to the extent available, in stock assessments.
3. Updated and benchmark stock assessments should increase coefficients of variation (CVs) for hind-casted recreational catch estimates, based on 2004-2011 relationships. The methodology for increasing the CVs is still to be determined, but a first order approximation would be to use the ratio of the CVs generated by the MRFSS vs MRIP estimation methodologies for 2004-2011.
4. Prior to 2004 (or whichever year is the first year for which direct re-estimates are available, since the NMFS Office of Science and Technology (ST) is still working on re-estimation for years prior to 2004), hind-casted catch data should use a ratio (MRFSS/MRIP) estimator, either constant throughout the hind-casted time series or trended, based on ancillary information. This approach would not preclude more extensive species-specific approaches, but would be a default "acceptable" approach if other procedures were not available. For species that are rare in the catch and have high variance in the estimate of this ratio, then using the ratio for other related species may be prudent.
5. Until there is a new (updated or benchmark) stock assessment, the new MRIP-derived catch numbers should be adjusted to be in the same scale as catch numbers used for calculating the current recreational annual catch limits (ACLs). When these stocks are re-assessed, landings relative to ACLs would be tracked by using non-adjusted MRIP

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estimates.

6. For data poor stocks that have developed ACLs on the basis of historical catch, the same methodology should be used to recalculate these ACLs, but with MRIP re-estimated numbers where available, and adjusted MRFSS numbers for earlier years.
7. Caution is urged regarding applying MRFSS/MRIP ratios on a scale smaller than the spatial scale of the stock. Uncertainty in the estimates will increase in direct relation to the diminution of scale.
8. Integration of new numbers should not require a full benchmark stock assessment. An update should be sufficient if the magnitude of the "bias" is relatively small, recreational catches do not dominate the overall catch, and major changes in the age composition (induced by re-weighting of the intercept biological samples) do not occur. If re-weighting occurs, then there is the potential for changes in the selectivity pattern for the fishery, which may have implications for biological reference points (BRPs) and may then require a new benchmark assessment.
9. The above recommendations are based on the re-estimation of the MRFSS intercept data and represent the current state of the best science information available. Ongoing work on revision to the effort data collection procedures could result in future recommendations for revision of historical effort estimates. Implementation of the current set of revisions based on the intercept data should not be delayed to wait for possible revisions based on the effort data. The potential effects of revisions to the biological data could be important if the age or size structure of the recreational landings and discards change.
10. At the end of the workshop, participants agreed that a working group should be formed to: (1) identify a list of species whose catch estimates are the most affected by the transition to MRIP, and present this list to the regional stock assessment steering committees for their consideration when scheduling upcoming stock assessments; and (2) develop a technical approach (or approaches) to hind-casting and forecasting catch estimates. Work on both tasks should be completed by May 1st.

Since the new MRIP methodology for catch estimation has already undergone independent peer review, and the applications proposed at the workshop only involve applying ratio estimators to adjust the MRFSS time series to match the MRIP time series (and vice versa), the workshop attendees saw no need to subject the consensus recommendations listed above to further independent peer review. A peer review may be needed, however, if a methodology is developed to expand the variance estimates for catch in hind-casted years.

The sequential release of MRIP data may cause some inconsistencies in the provision of scientific advice. These inconsistencies may arise if adjustment factors derived from the 2004-2011 data are different than estimators derived from the 1998-2011 data (assuming ST can successfully develop re-estimates for 1998-2003). If the entire data set is ultimately available, then we can compare hind-casted values with the revised estimates as a check for consistency. Similarly, changes in selectivity could occur when the length samples are revised. As noted previously, changes in selectivity could result in some changes to the BRPs, which could then require new benchmark assessments.

BACKGROUND

Early in 2012 the NOAA Fisheries Marine Recreational Information Program (MRIP) released re-estimates of catch statistics for the marine recreational fisheries of the US, 2004-2011, based on raw data collected under the Marine Recreational Survey Statistics (MRFSS) program and a newly-created methodology[2] developed under the MRIP program. By the time the numbers were released, MRIP staff had already begun planning a workshop that would develop a methodology for matching catch estimates derived by using the old MRFSS methodology with estimates derived by using the new MRIP methodology.

This objective for the workshop was important for two reasons. First, stock assessment scientists prefer to have time series of catch (and effort) data for the marine recreational fisheries that are as long as possible, uninterrupted by changes in data collection or estimation methodologies. By using a side-by-side comparison (calibration) of the original catch statistics, obtained with the MRFSS estimation methodology, to the re-estimated MRIP-based statistics for 2004 to 2011, it may be possible to hind-cast the time series based on the MRIP methodology to years prior to 2004; i.e., what would have been the likely catch estimates and their associated variances for years prior to 2004 had the MRIP estimation methodology been in place? Second, matching MRFSS-derived and MRIP-derived catch estimates would help fishery managers carry forward regional catch allocations (state-by-state, commercial vs recreational) based on the MRFSS-derived catch statistics to years when only the MRIP-based statistics will be available (beginning in 2013), thus providing as smooth a transition as possible within the management process.

PREPARATIONS FOR THE WORKSHOP

A workshop steering committee was formed in August 2011 to develop terms of reference and, eventually, an agenda and speakers list for the so-called MRFSS/MRIP Calibration Workshop. Committee members initially included representatives from your office (Ron Salz), the Northeast

[2] Breidt, F. J., Lai, H.-L., J. D. Opsomer, and D. A. Van Voorhees. 2012. A Report of the MRIP Sampling and Estimation Project: Improved Estimation Methods for the Access Point Angler Intercept Survey Component of the Marine Recreational Fishery Statistics Survey. NOAA Fisheries, MRIP Program, Silver Spring, MD. 83 pp. (http://www.countmyfish.noaa.gov/projects/index.html)

Fisheries Science Center (Jim Weinberg), the Northeast Regional Office (Sarah Heil), the Southeast Fisheries Science Center (Steve Turner), the Southeast Regional Office (Andy Strelcheck), and the NOAA Fisheries Office of Sustainable Fisheries (Wes Patrick). The committee developed the following three terms of reference for the workshop:

1. Review ongoing and completed studies comparing MRFSS methodologies to those slated for use in MRIP, and propose any additional work that would further facilitate MRFSS/MRIP calibration.
2. Propose a methodology for calibrating MRFSS data to MRIP data, based on the years in which paired estimates are available (currently expected to be 2004-2011), and demonstrate how it would work in hind-casting catch and effort for select data sets (pre-2004).
3. Recommend a plan for implementing the calibration methodology into updated and benchmark stock assessments.

The committee also developed a list of presentation topics associated with the terms of reference, as well as additional topics that would provide background information to help facilitate discussions at the workshop, in close coordination with the potential presenters of those topics (Attachment 1). The committee anticipated that some working papers associated with the presentation topics could be prepared and distributed ahead of the workshop, while others could be prepared following the workshop, based on agreements reached by the workshop participants on their contents.

At this point, the committee agreed (with permission from NOAA Fisheries leadership) to invite the Southeast Data, Assessment, and Review (SEDAR) program to co-sponsor the workshop and have a staff member (John Carmichael) join the steering committee. The SEDAR program is a cooperative Fishery Management Council process initiated in 2002 to improve the quality and reliability of fishery stock assessments in the South Atlantic, Gulf of Mexico, and US Caribbean. The Caribbean, Gulf of Mexico, and South Atlantic regional fishery management councils manage the SEDAR program in close coordination with NOAA Fisheries and the Atlantic and Gulf States Marine Fisheries Commissions. Furthermore, most of the stock assessments for

federally-managed species potentially affected by the switch from MRFSS to MRIP are in the southeast region. In addition to SEDAR staff actively participating in the workshop, the program handled travel arrangements for non-federal attendees, the venue for the meeting, and the meeting room and catering logistics. The Mid-Atlantic Fishery Management Council was asked to handle the web broadcast.

WORKSHOP AGENDA AND WORKING PAPERS

The workshop agenda was designed to address the three terms of reference and allow time for presentation of the background working papers. The finalized workshop agenda, including speakers, is attached (Attachment 2). Each session (Tuesday PM, all day Wednesday, and Thursday AM) was devoted to addressing one of the workshop's terms of reference, in order. The presentations in each session were based on the final list of working paper topics developed by the steering committee (Attachment 1), with additional time slots allotted on the agenda for extended discussions, especially in the second session (addressing the second term of reference – development of a methodology for matching catch estimates from MRFSS to those from MRIP, and vice versa).

All working papers prepared prior to the workshop, as well as presentations made at the workshop, are posted on the SEDAR website:

http://www.sefsc.noaa.gov/sedar/Sedar_Documents.jsp?WorkshopNum=002&FolderType=Data

WORKSHOP ATTENDANCE AND RECORDINGS

A total of 39 people attended the meeting in person (Attachment 3), while another 48 individuals participated via the web (Attachment 4). Besides NOAA Fisheries, participants also represented the regional fishery management councils and interstate commissions, state agencies, recreational fishing groups, and environmental organizations, as well as the public in general. All the sessions were also recorded (audio and what was being projected on the meeting room screen); the recordings are also accessible on the SEDAR website.

SESSION 1 SUMMARY

The purpose of the first workshop session (and the first term of reference) was to provide the workshop participants with background information and context. Presenters reviewed the differences in recreational catch estimates based on the MRFSS and MRIP methodologies in 2004-2011 for federally-managed species along the Atlantic and Gulf coasts, discussed lessons learned from earlier efforts to switch from one survey methodology to another, introduced the workshop participants to changes to the recreational fishing survey that will occur when the survey switches over to become 100% MRIP-based in 2013, and presented findings of MRIP-funded projects that have addressed or are currently addressing calibration of the MRFSS-based survey to the MRIP-based survey.

A number of important points were made during the Session 1 question and answer follow-ups to the presentations (Q&As) and subsequent discussions that were related to all three terms of reference for the workshop:

1. The participants were cautioned to be precise in use of terms such as calibration, avidity, and variance; for instance, calibration can take on many forms and should not be used to characterize hind-casting catch estimates for years when side-by-side MRFSS and MRIP surveys were not conducted.
2. Participants were encouraged to incorporate public outreach through the entire process of matching and combining MRFSS and MRIP catch time series. Difficulty in explaining to the public the statistical basis underlying the process is a good reason to develop effective communication about the changes.
3. Although it is highly desirable to account for multiple design changes simultaneously, it is often not possible to wait until an entire set of changes has been made. Scientists and managers have a mandated responsibility to use the best scientific information. However, incremental transition without sufficient planning and resources could result in significant disruptions to stock assessments and management systems. Coordination among scientists, managers, and the fishing public is essential throughout the transition process.

4. Expect larger differences between the MRFSS and MRIP catch estimates as the scale (spatial, temporal) becomes finer, but recognize that the variance of these finer scale differences is larger and their significance is less.
5. MRIP must anticipate future uses well beyond those envisioned at its inception. This was a principal drawback to the design of the MRFSS-based survey. Flexibility in design and the ability to accommodate regional differences in fishery characteristics should be maintained as MRIP matures.
6. In matching MRFSS- and MRIP-derived catch estimates recognize that the data collection programs under MRFSS have not been static. The MRFSS survey evolved over time; MRFSS in the 1980s was not the same as MRFSS in the 1990s, and the survey continued to evolve during the 2004 to 2011 overlap period.

SESSION 2 SUMMARY – FIRST HALF

The first half of Session 2 (the morning) began with a presentation of the stock assessment ramifications of changes to the time series of marine recreational catch. Key points of the presentation and comments made during the follow-up Q&As were:

1. Biological reference points that are based on indices (proxies) are generally insensitive to catch. Catch helps scale the size of the population, whereas an index, such as CPUE, provides the trend. A constant bias in the catch over the time series may not change the estimate of relative stock status. Additionally, the bias needs to overcome the "noise" already present in the variance of parameters used in the stock assessment; for the northeast surveys, the coefficients of variation are about 30%.
2. When catch is over/under-estimated during a time period in which the abundance index indicates substantial decline, biomass is also over/under-estimated, respectively. When catch is overestimated at the beginning or end of a time series when indexes are not indicating substantial trends, biomass may be underestimated, but the effect is less pronounced.
3. Biases in catch will have more influence on assessments of short-lived species, which have more inter-annual variability in abundance.

4. Adjusting for bias over a catch time series may just be a matter of scaling (multiplying individual values in the time series by a constant or trended coefficient that adjusts for the bias).

Following the discussion on ramifications of bias in catch for stock assessments, scientists from the Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC) provided their preliminary analyses of the impacts of the re-estimated recreational catch for 2004 to 2011 on assessed species. The total recreational catch for recreationally important species in the New England and Mid-Atlantic regions shows very little difference between the original MRFSS-based estimates and the MRIP-based re-estimates; bigger differences exist when examining recreational catch on a species-by-species basis. For the SEFSC, the original MRFSS-based catch estimates are within the MRIP confidence intervals; some species (e.g., red and black grouper, yellowtail snapper, and amberjack) show a systematic bias, but most do not. Most of the SEFSC assessments use an index based on MRFSS catch estimates, but it is usually not the most influential index in the stock assessment model. The greatest systematic bias for SEFSC-assessed species appears to occur in the southern Florida region, and is likely caused by sites in that region having a higher catch rate but lower probability of being sampled.

Several alternative, statistically-based methodologies that could be used to hind-cast prior to the years of side-by-side MRFSS- and MRIP-based estimates were then presented and discussed. The principal problem related to using a hind-casting methodology is changes (documented or undocumented) in the sampling design that occurred during the earlier years; significant effort is needed to find, process, and re-create old design information. Furthermore, the effort needs to be undertaken for all survey variables. Because of inadequate record keeping, re-calibrating catch estimates for the earliest years may not ever be possible. Also, developing methodologies to calibrate the MRFSS-based estimates of catch in earlier years goes beyond the catch value itself – changes to fishery selectivity, which affects the size-frequency patterns in the catch, also needs attention, since the changes may also affect derivation of biological reference points in stock assessments.

SESSION 2 SUMMARY – SECOND HALF

The second half (afternoon) of Session 2 was devoted entirely to a discussion of how MRFSS-based and MRIP-based catch estimates can be matched, and how the match-ups should be used in stock assessments and fisheries management. In 2013, the new MRIP-based intercept portion of the survey will be fully implemented and no MRFSS estimates will be available. The workshop participants decided that MRIP catch estimates should be adjusted to be on the same scale as that used to develop ACLs (i.e., the same scale as MRFSS-based estimates) for the purposes of quota monitoring for species until those ACLs can be re-calculated with an assessment that uses MRIP data. This adjustment would be for species where the ACL is set based on the results of a formal stock assessment model and those where the ACL is set based on historical data. For species where the ACL is set based on historical data, the ACL should be recalculated when the MRFSS re-estimates are available for the time period used to set the ACL. The uncertainty in the catch estimates increases as the spatial scale becomes finer; e.g., estimates of state catch are more uncertain than estimates of regional catch. Caution should be used when converting MRIP numbers on a spatial scale smaller than the scale of the stock ACL.

The group agreed that the calibration method eventually chosen does not need to be peer reviewed, as MRIP and its methodologies have already been thoroughly peer reviewed, and the benchmark assessment framework will provide another chance. However, there was concern about having the calibration method or methods second-guessed by multiple peer review panels going forward. To counter possible second-guessing, stock assessment scientists may want to undertake sensitivity analysis of the hind-casted recreational catch estimates (e.g., varying them by 5, 10, 20%) in order to determine the overall impact of changes in the estimates on biological reference points.

The workshop participants recognized the importance of strong, clear guidelines regarding calibration methods and how and when the methods should be used. Stock assessment scientists do not want to be in the position of developing *ad hoc* calibration methods on a species-by-species and region-by-region basis. There was a discussion of who should be responsible for developing the calibrated numbers for each species: the regional Science Centers and state

Technical Committees or NMFS ST. The ST personnel associated with MRIP clearly have the statistical expertise and the best understanding of the data, but effort that they expend in developing and implementing the calibrations is effort that is redirected from other MRIP tasks. Transparency and repeatability of the calibration process is also important, so that people outside the stock assessment process (anglers, environmental organizations, etc.) know the source and scientific basis for the recreational survey numbers that will be used in the assessment models.

After considerable discussion on the pros and cons of various methodologies that could be used to match MRFSS-based catch estimates with those based on MRIP, the workshop participants agreed that updated and benchmark stock assessments should increase coefficients of variation (CVs) for hind-casted recreational catch estimates, based on 2004-2011 relationships. The methodology for increasing the CVs is still to be determined, but a first order approximation would be to use the ratio of the CVs generated by the MRFSS vs MRIP estimation methodologies for 2004-2011. The participants also agreed that, prior to 2004 (or whichever year is the first year for which direct re-estimates are available, since ST is still working on re-estimation for years prior to 2004), hind-casted catch data should use a ratio (MRFSS/MRIP) estimator, either constant throughout hind-casted time series or trended, based on ancillary information. This approach would not preclude more extensive species-specific approaches, but would be a default "acceptable" approach if other procedures were not available. For species that are rare in the catch and have high variance in the estimate of this ratio, using the ratio for other related species may be prudent. Furthermore, until there is a new (updated or benchmark) stock assessment, the new MRIP-derived catch numbers should be adjusted to be in the same scale as catch numbers used for calculating the current recreational annual catch limits (ACLs). When these stocks are re-assessed, then ACLs and catch tracking would be monitored by using un-adjusted MRIP estimates.

For data-poor stocks that have ACLs based on historical catch, the same methodology should be used to recalculate these ACLs, but with MRIP re-estimated numbers where available, and adjusted MRFSS numbers for earlier years. Until these recalculations can be completed, the procedure described in the preceding paragraph can be used.

The participants also agreed that the re-estimated recreational catch for 2004 to 2011 based on the new MRIP methodology represents the current state of the best science information available. Ongoing work on revision to the effort data collection procedures that will be incorporated into MRIP in the near future could result in future recommendations for revision of historical effort estimates. However, implementation of the current set of revisions based on the intercept data should not be delayed to wait for possible revisions based on the effort data.

In addition to the effect of new MRIP data-weighting procedures on estimated recreational catch, the group acknowledged that this re-weighting (e.g., data from some sample sites becomes more or less influential in the overall catch estimate) will also have some effect on the estimated size composition of the catch and on catch per effort statistics that are sometimes used as an index of abundance. These additional effects were not explored in this workshop, but are worthy of future investigation.

The above recommendations by the workshop participants for matching the MRFSS and MRIP catch estimates represent a consensus opinion. No minority opinions to the contrary were offered.

SESSION 3 SUMMARY

The purpose of this session was to go into further depth of discussion about how and when the time series of MRFSS and MRIP catch estimates would be integrated into stock assessments, especially following the 100% switchover to MRIP in 2013. The session began with an overview of the current SEDAR and Northeast region procedures for scheduling, undertaking, and reviewing stock assessment updates and benchmarks. A benchmark assessment conducted under the SEDAR process takes approximately 15 months to complete, which is added to the time it takes for the assessment to be used by an SSC to develop an ABC recommendation, review of the ABC and action by the fishery management council or interstate commission, development of a specifications package and submittal to NMFS, NMFS review and development of a proposed rule, the public comment period on the proposed rule, publication of a final rule, then implementation at the beginning of the next fishing season. The Northeast has a

similar timeline.

However, integration of new MRIP-derived numbers should not require a full benchmark stock assessment, which would shorten the timeline considerably. An update should be sufficient if the magnitude of the "bias" is relatively small, recreational catches do not dominate the overall catch, and major changes in the age composition (induced by re-weighting of the intercept biological samples) do not occur. If re-weighting occurs, then there is the potential for changes in the selectivity pattern for the fishery, which may have implications for biological reference points (BRPs) and may then require a new benchmark assessment.

The workshop participants then discussed how priorities for conducting updated and benchmark assessments might be changed based on the results of re-estimation of 2004 to 2011 recreational catches for species managed by the councils and commissions. The participants recommended that MRIP numbers be incorporated into the technical updates rather than wait for peer-reviewed benchmark assessments. Although benchmark and updated assessment schedules are already set for 2012 and 2013, decisions have to be made on how to prioritize future assessments that will use the new MRIP numbers. A screening tool should be developed to rank recreational species that need updated assessments and reference points, which includes criteria such as information on the magnitude (absolute and proportional) and statistical significance of the MRFSS-MRIP differences, the proportion of catch that is recreational, the proportion of recreational catch that is released alive, the extent to which management is based on recreational catch estimates, the socio-economic importance of the species, and the current status of the stock. These are just the ranking criteria associated with recreational species affected by the MRFSS to MRIP conversion; the participants recognized that the SEDAR Steering Committee and Northeast Region Coordinating Committee may have other criteria that will also affect scheduling species for updated and benchmark assessments, such as commercial importance and political considerations. Nevertheless, having an objective and understandable set of metrics will increase the transparency of the stock assessment prioritization process.

The sequential release of MRIP data may cause some inconsistencies in the provision of scientific advice. These inconsistencies may arise if adjustment factors derived from the 2004-

2011 data are different than estimators derived from the 1998-2011 data (assuming ST can successfully develop re-estimates for 1998-2003). If the entire data set is ultimately available, then we can compare hind-casted values with the revised estimates as a check for consistency. Similarly, changes in selectivity could occur when the length samples are revised. As noted previously, changes in selectivity could result in some changes to the BRPs, which could then require new benchmark assessments.

FOLLOW-UP ACTIONS

At the end of the workshop participants agreed that a working group should be formed to: (1) identify and prioritize a list of species whose catch estimates are the most affected by the transition to MRIP, and present this list to the SEDAR Steering Committee and Northeast Region Coordinating Committee for their consideration in prioritizing when scheduling upcoming stock assessments; and (2) develop a technical approach (or approaches) to hind-casting and forecasting catch estimates. Members of the working group should be representatives from the two NMFS science centers, the two interstate management commissions, and NMFS headquarters (ST). Work on both tasks should be completed by May 1st to accommodate the timetable for pending updated and benchmark assessments. Subsequent to the workshop, the following people have been named to the working group: Katie Drew (ASMFC), Gregg Bray (GSMFC), Tim Miller (NEFSC), Erik Williams and John Walter (SEFSC), and Ron Salz (ST).

ACKNOWLEDGEMENTS

The workshop and this report would not have been possible without the cooperation and supports from the Workshop Steering Committee (Steve Turner, Jim Weinberg, Wes Patrick, Sarah Heil, John Carmichael, Andy Strelcheck, and Ron Salz) and the workshop rapporteurs (Kari Fenske, John Froeschke, Mike Errigo, Jason Didden, and Katie Drew). Special thanks go to Katie Drew for allowing me to use some of her narrative for the summary of the Session 2 discussion, and to Jason Didden for overseeing the web link-ups. Overall guidance from Gordon Colvin and Dave Van Voorhees is also greatly appreciated.

Attachment 1

MRFSS/MRIP Calibration Workshop: Presentation and Working Paper Topics

Topics Providing Background:

1. How the transition from the MRFSS-based survey to the for-hire survey undertaken in 2003 was handled. Although this transition only involved effort, some lessons may be gained in learning how the transition methodology was handled, and its subsequent impact on stock assessments.
2. Issues associated with how changes to historical recreational catch and effort data influence derivation of biological reference points in benchmark stock assessments.
3. Lessons learned from the calibration of ALBATROSS IV to BIGELOW trawl survey data. This paper should focus on the process, including how the peer review was used, and how the calibration methodology is being integrated into updated and benchmark stock assessments.
4. The switch from MRFSS to the new RecFin methodology in 2003-2004.

Topics Addressing the TORs:

1. Descriptions of the completed and ongoing MRIP-funded projects that address MRFSS/MRIP calibration issues (TOR #1).
2. Changes to the sampling design and estimation methodologies that are anticipated when MRIP is fully implemented in 2013.
3. Each Center should prepare a working paper on how the re-estimated recreational catch statistics for 2004-2010 affects the conclusions (i.e., provide a broad-brush examination of how complicated it would be to do the revised assessments) of the most recent stock assessments for species managed under the purview of the five councils (NEFMC, MAFMC, SAFMC, GFMC, and CFMC) (TOR #2).
4. Working paper(s) on proposed methodology or methodologies that could hind-cast MRIP-based estimates prior to 2004 (TOR #2). The proposed methodologies should also consider how to incorporate additional side-by-side estimates dating back to the late 1990s that will be released around June 2012.
5. Proposed process for incorporating MRIP-based estimates into stock assessments (TOR #3). This paper should focus on generating discussion at the workshop on criteria for determining whether assessment updates or benchmarks are needed, and how stocks/species should be ranked in terms of timing.

Attachment 2

MRFSS/MRIP Calibration Workshop: Agenda

Day 1

1300 – 1320 Welcome and Introductions (J. Boreman)

1320 – 1340 Overview of MRFSS/MRIP comparisons of 2004-2011 estimated catch and effort (J. Foster)

1340 – 1400 Discussion

1400 – 1420 How the transition from the MRFSS-based survey to the for-hire survey undertaken in 2003 was handled (V. Matter)

1420 – 1430 Q and A

1430 – 1450 Lessons learned from the calibration of ALBATROSS IV to BIGELOW trawl survey data (R. Brown and P. Rago)

1450 – 1500 Q and A

1500 – 1520 The switch from MRFSS to the new RecFin methodology in 2003-2004 (D. Van Voorhees and H. Lai)

1520 – 1530 Q and A

1530 – 1550 Refreshment Break

1550 – 1630 Changes to the sampling design and estimation methodologies that are anticipated when MRIP is fully implemented in 2013, including descriptions of the completed and ongoing MRIP-funded projects that could potentially impact MRFSS/MRIP calibration efforts (R. Andrews and R. Salz)

1630 – 1640 Q and A

1640 – 1700 Open Discussion of Day 1 Topics

1700 – 1730 MRIP data sets and analysis methods (J. Foster)

Day 2

0830 – 0850 Recap of Day 1 presentations and discussion (J. Boreman)

0850 – 0910 Issues associated with how changes to historical recreational catch and effort data influence derivation of biological reference points in benchmark stock assessments (R. Methot)

0910 – 0920 Q and A

0920 – 0940 Impacts of re-estimates on NEFSC stock assessments (NEFSC staff)

0940 – 0950 Q and A

0950 – 1010 Impacts of re-estimates on SEFSC stock assessments (SEFSC staff)

1010 – 1020 Q and A

1020 – 1040 Refreshment Break

1040 – 1120 Proposed methodology or methodologies that could be used to hind-cast MRIP-based estimates prior to 2004 (J. Foster, J. Breidt, J. Opsomer)

1120 – 1130 Q and A

1130 – 1220 Open Discussion of proposed methodologies and agreement on approach

1220 – 1330 Lunch Break

1330 – 1700 Continue discussion

1700 – 1730 Wrap-up Day 2

Day 3

0830 – 0850 Recap of Day 2 presentations and discussion (J. Boreman)

0850 – 0920 Proposed process and constraints to incorporating MRIP-based estimates into stock assessments (J. Carmichael, J. Weinberg, J. Coakley)

0920 – 0930 Q and A

0930 – 1030 Open discussion and agreement on approach

1030 – 1050 Refreshment Break

1050 – 1200 Workshop wrap-up (second thoughts, writing assignments, timeline for completion of workshop report, procedure for peer review and updates for its terms of reference, etc.) (J. Boreman)

Attachment 3

MRFSS/MRIP Calibration Workshop: In-Person Attendance

Alexi Sharov, DNR, MD
Carolyn Belcher, DNR, GA
Cynthia M. Jones, ODU, VA
Dave Van Voorhees, NMFS, MD
Erik Williams, NMFS, NC
John Foster, NMFS, MD
Gary Shepherd, NMFS, MA
Greg Stunz, TX A&M, TX
John Carmichael, SEDAR, SC
Jason T. Didden, MAFMC, DE
John Boreman, MRIP, NCSU, NC
John Froeschke, GMFMC, FL
John Walter, NMFS, FL
Kari Fenske, SEDAR, SC
Katie Drew, ASMFC, VA
Laura Lee, DENR, NC
Mike Errigo, SAFMC, SC
Mike Murphy, FWC, FL
Paul Rago, NMFS, MA
Nick Farmer, NMFS, FL
Phil Haring, NEFMC, MA
Pres Pate, MRIP, NC
Rick Methot, NMFS, WA
Rob Andrews, NMFS, MD
Ron Salz, NMFS, MD
Steve Turner, NMFS, FL
Timothy Miller, NMFS, MA
Tom Sminkey, NMFS, MD
Vivian Matter, NMFS, FL
Wes Patrick, NMFS, MD
Ben Hartig, SAFMC, FL
Matt Cieri, DNR, ME
David Cupka, SAFMC, SC
Jeffrey Brust, DEP, NJ
Kathy Knowlton, DNR, GA
Ryan Rindone, GMFMC, FL
Mac Currin, SAFMC, NC
Dick Brame, CCA, NC
Ken Pollock, NCSU, NC
Gregg Bray, GSMFC, MS

Attachment 4

MRFSS/MRIP Calibration Workshop: Web Attendance

Gordon Colvin, NMFS, MD
Scott Ward, Fifth Estate, DC
Tony Kratowicz, PA
Dick Brame, CCA, NC
Beverly Sauls, FWCC, FL
Lewis Gillingham, VMRC, VA
Moira Kelly, NMFS, MA
Andrew Cox, Billfish Foundation, FL
Chris Wilson, NCDMF, NC
Ed Bracken, NJ
Ray Mroch, NCDMF, NC
Sonya Davis, VMRC, VA
Ed Zlokovitz, MDDNR, MD
John Depersenaire, RFA, NJ
Forbes Darby, NMFS, MD
Doug Mumford, NCDMF, NC
Shizhen Wang, NOAA, MD
Geoff White, ACCSP, VA
Russell Porter, PSMFC, OR
Kevin Sullivan, NHFG, NH
Rob Swit, TU, NJ
Patrick Lyman, Envirotactics, NJ
Claudia Friess, Ocean Conservancy, TX
Roy Crabtree, NMFS, FL
Lauren Anderson, Fifth Estate, DC
Ed Hibsch, PSMFC, OR
Julia Byrd, SCDNR, SC
Hongguang Ma, HI
Joe Weinstein, CDFG, CA
Todd Phillips, Ocean Conservancy, TX
David Heil, FWCC, FL
Toby Carpenter, CDFG, CA
Lauren Dolinger-Few, NMFS, MD
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MRFSS/MRIP Calibration Workshop
Ad-hoc Working Group Report

May 16, 2012

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One outcome of the MRFSS/MRIP Calibration Workshop was the formation of an ad-hoc working group charged with the following: 1) Establish a priority list in each region for which species assessments should be updated to incorporate the new MRIP-derived catch estimates; and, 2) Provide a technical approach (or approaches) to hind-casting and forecasting catch estimates, including examples. The ad-hoc working group included representatives from the NEFSC, SEFSC, GSMFC, ASMFC, and S&T Headquarters.

Species Prioritization

At the workshop participants discussed how priorities for conducting updated and benchmark assessments might be changed based on the results of re-estimation of 2004 to 2011 recreational catches for managed species. Although benchmark and updated assessment schedules are already set for 2012 and 2013, decisions have to be made on how to prioritize future assessments that will use the new MRIP numbers. The ad-hoc committee was asked to develop a metric that could be used to rank species based on the potential impact the switch from MRFSS to MRIP estimates could have on assessment outcomes. The metric was based on criteria related to the magnitude and significance of differences between MRFSS and MRIP catch estimates and the relative importance of the recreational catch time series in the overall assessment model. It was noted during the workshop that many other criteria, unrelated to the re-estimation of MRFSS numbers, will likely also affect scheduling species for updated and benchmark assessments (e.g., socio-economic importance, stock status, and political considerations). Nevertheless, workshop participants did see value in having an objective and understandable set of recreational data metrics that could be used as part of the stock assessment prioritization process.

Six criteria were used to rank species:

1. Total MRIP A and B1 in numbers
2. Mean percent difference between MRFSS and MRIP AB1 numbers calculated as:

$$100 * \frac{1}{n}\sum_{i=1}^{n} \frac{(\text{MRFSS AB1}_i - \text{MRIP AB1}_i)}{\text{MRFSS AB1}_i}$$

3. Mean percent difference between MRFSS and MRIP B2 numbers calculated as:

$$100 * \frac{1}{n}\sum_{i=1}^{n} \frac{(\text{MRFSS B2}_i - \text{MRIP B2}_i)}{\text{MRFSS B2}_i}$$

4. Fraction of discards to total catch

$$100 * \frac{1}{n}\sum_{i=1}^{n} \frac{\text{MRFSS B2}_i}{(\text{MRFSS AB1}_i + \text{MRFSS B2}_i)}$$

5. Multiple R^2 (Pearson correlation squared) between the annual MRIP AB1 and MRFSS AB1 values calculated from a linear regression of one versus the other or, equivalently:

$$\text{corr}(\text{MRFSS AB1}_{i,..n}, \text{MRIP AB1}_{i,...n})^2$$

6. Percent of total landings attributed to the recreational sector

The six criteria were chosen to represent a combination of factors that would be important in prioritization of species. First the total A plus B1 numbers give an idea of the magnitude of the recreational fishing mortality associated with landings. Next the percent difference between both AB1 and B2 (released alive) numbers provide an idea of the average difference between MRFSS and MRIP estimates; while noting that the average can be low if positive and negative differences cancel each other out. The fraction of discards provides a measure of the importance of discards which can be quite influential in many assessments. The correlation between the annual AB1 numbers provides an estimate of how well the estimates track each other, noting that the estimates could differ in magnitude but might still have the same trend. Finally, the percent of landings attributed to the recreational sector provide an idea of how influential the recreational landings may be in the assessment model, compared to commercial landings, and how sensitive the results may be to changes in recreational inputs.

For each of the six criterion species were initially assigned categorical ranks ranging from one through the total number of species. For example, 16 species were compared for Northeast region with one representing the lowest priority species for that criterion and 16 the highest priority. Ranks were then scaled back to a 10 point scale to provide relative ranks which could be compared across regions as follows:

Rank 10-point scale = 10 * Initial Rank/Number of Species

The overall priority rank score was calculated as the average of the categorical ranks across the six criteria. Tables 1, 2 and 3 give rankings for the Northeast, South Atlantic and Gulf of Mexico species, respectively. It should be noted that regional separations were based upon MRIP subregions (Northeast

= 4 & 5, South Atlantic = 6, and Gulf of Mexico = 7) which do not necessarily reflect the regional partitions used in all stock assessments.

Table 1. Metrics and rankings for Northeast species prioritization based on projected impact of changes in recreational time series data on stock assessments.

Northeast Region	MRIP AB1 (Number of Fish) Sum 2004-2011		Mean % Difference AB1 Catch		Mean % Difference B2 Catch		Relative Importance of Discards (B2 catch)		R2 Correlation Coefficient MRFSS and MRIP AB1		Avg % Recreational Landings (2004 - 2011)		Overall Priority Rank (higher values indicate greater priority)
Species	Value (1,000s)	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	
tautog	6,508	4.4	0.083	5.6	0.085	6.9	0.092	7.5	0.883	7.5	91%	10.0	**7.0**
scup	28,205	7.5	-0.157	9.4	-0.136	9.4	0.076	3.8	0.818	6.9	32%	4.4	**6.9**
spot	69,387	8.8	0.096	6.9	0.042	5.0	0.043	0.6	0.982	9.4	43%	5.6	**6.0**
spotted seatrout	104,875	10.0	-0.022	2.5	-0.024	3.1	0.080	4.4	0.770	5.0	87%	8.8	**5.6**
striped bass	18,350	5.6	-0.060	4.4	0.011	0.6	0.108	8.8	0.802	6.3	80%	8.1	**5.6**
weakfish	4,268	3.8	0.089	6.3	-0.014	1.9	0.090	6.9	0.991	10.0	41%	5.0	**5.6**
bluefish	52,848	8.1	0.020	1.9	0.011	1.3	0.081	5.0	0.956	8.1	71%	7.5	**5.3**
red drum	26,154	6.9	0.012	1.3	-0.041	4.4	0.089	6.3	0.748	3.8	89%	9.4	**5.3**
atlantic cod	2,908	3.1	0.242	10.0	0.313	10.0	0.086	5.6	0.516	0.6	18%	2.5	**5.3**
summer flounder	482	1.3	0.048	3.8	0.098	7.5	0.119	9.4	0.732	3.1	45%	6.3	**5.2**
atlantic croaker	82,482	9.4	-0.036	3.1	-0.048	5.6	0.074	3.1	0.796	5.6	26%	3.1	**5.0**
spiny dogfish	156	0.6	0.107	7.5	0.103	8.1	0.122	10.0	0.588	1.3	3%	0.6	**4.7**
pollock	1,348	1.9	0.121	8.1	0.064	6.3	0.054	1.3	0.968	8.8	8%	1.9	**4.7**
black sea bass	14,738	5.0	0.008	0.6	0.036	3.8	0.105	8.1	0.595	1.9	51%	6.9	**4.4**
winter flounder	1,736	2.5	0.148	8.8	0.129	8.8	0.055	1.9	0.611	2.5	5%	1.3	**4.3**
spanish mackerel	20,804	6.3	0.077	5.0	0.020	2.5	0.061	2.5	0.757	4.4	30%	3.8	**4.1**

Table 2. Metrics and rankings for South Atlantic species prioritization based on projected impact of changes in recreational time series data on stock assessments.

South Atlantic Region	MRIP AB1 (Number of Fish) Sum 2004-2011		Mean % Difference AB1 Catch		Mean % Difference B2 Catch		Relative Importance of Discards (B2 catch)		R2 Correlation Coefficient MRFSS and MRIP AB1		Avg % Recreational Landings (2004 - 2011)		Overall Priority Rank (higher values indicate greater priority)
Species	Value (1,000s)	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	
red snapper	313	3.6	0.185	8.6	0.123	6.8	0.102	9.5	0.978	8.6	74%	7.7	**7.5**
gray snapper	2,781	7.3	0.164	8.2	0.071	3.6	0.097	7.7	0.986	9.1	71%	6.8	**7.1**
mutton snapper	940	5.0	0.055	4.1	0.127	7.3	0.073	6.8	0.971	8.2	78%	8.2	**6.6**
black sea bass	4,023	8.2	0.083	5.0	0.074	4.1	0.104	10.0	0.958	7.7	36%	2.3	**6.2**
sheepshead	4,599	8.6	0.119	6.4	0.082	4.5	0.055	3.6	0.851	4.5	81%	8.6	**6.1**
wahoo	340	4.1	-0.088	5.5	-0.320	9.5	0.008	0.5	0.947	6.4	95%	9.1	**5.8**
blue runner	5,581	9.1	0.049	3.2	0.070	3.2	0.065	5.5	0.894	5.5	72%	7.3	**5.6**
red porgy	297	3.2	-0.288	9.1	-0.525	10.0	0.055	4.1	0.840	4.1	37%	2.7	**5.5**
red grouper	383	4.5	-0.369	10.0	0.028	0.9	0.087	7.3	0.900	5.9	40%	4.1	**5.5**
cero	132	1.8	0.162	7.7	-0.090	5.0	0.026	1.4	0.955	7.3	100%	9.5	**5.5**
yellow jack	60	0.9	0.123	7.3	0.052	2.3	0.049	2.7	0.988	10.0	100%	9.5	**5.5**
black grouper	29	0.5	-0.119	6.8	0.162	8.2	0.098	8.2	0.430	0.5	69%	6.4	**5.1**
greater amberjack	264	2.3	0.039	2.3	0.093	5.5	0.065	5.9	0.949	6.8	64%	5.5	**4.7**
gray triggerfish	1,072	5.5	0.045	2.7	0.095	5.9	0.066	6.4	0.748	1.8	58%	5.0	**4.5**
scamp	124	1.4	-0.319	9.5	-0.216	9.1	0.051	3.2	0.760	2.3	27%	1.4	**4.5**
spanish mackerel	7,741	10.0	0.103	5.9	0.069	2.7	0.044	2.3	0.839	3.6	34%	1.8	**4.4**
yellowtail snapper	2,005	6.4	-0.054	3.6	-0.129	7.7	0.064	5.0	0.825	2.7	16%	0.9	**4.4**
crevalle jack	2,596	6.8	-0.030	1.8	0.050	1.8	0.099	8.6	0.531	0.9	67%	5.9	**4.3**
vermilion snapper	1,303	5.9	0.067	4.5	0.099	6.4	0.057	4.5	0.651	1.4	38%	3.2	**4.3**
king mackerel	3,435	7.7	0.013	0.5	-0.032	1.4	0.034	1.8	0.987	9.5	52%	4.5	**4.2**
dolphin	7,454	9.5	0.026	0.9	-0.187	8.6	0.019	0.9	0.882	5.0	14%	0.5	**4.2**
gag	266	2.7	-0.027	1.4	0.004	0.5	0.099	9.1	0.832	3.2	38%	3.2	**3.3**

Table 3. Metrics and rankings for the Gulf of Mexico species prioritization based on projected impact of changes in recreational time series data on stock assessments.

Gulf of Mexico Region	MRIP AB1 (Number of Fish) Sum 2004-2011		Mean % Difference AB1 Catch		Mean % Difference B2 Catch		Relative Importance of Discards (B2 catch)		R2 Correlation Coefficient MRFSS and MRIP AB1		Avg % Recreational Landings (2004 - 2011)		Overall Priority Rank (higher values indicate greater priority)
Species	Value (1,000s)	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	
gray snapper	8,189	9.4	-0.088	5.0	-0.047	3.1	0.099	8.8	0.904	6.9	91%	8.8	**7.0**
gray triggerfish	1,824	5.6	-0.105	6.3	-0.306	7.5	0.049	3.1	0.978	9.4	96%	9.4	**6.9**
greater amberjack	615	3.8	-0.111	6.9	-0.212	6.9	0.089	6.3	0.905	7.5	73%	6.9	**6.4**
mutton snapper	238	2.5	-0.398	8.1	-0.851	10.0	0.069	4.4	0.865	5.6	78%	7.5	**6.4**
red grouper	1,651	5.0	-0.118	7.5	0.025	2.5	0.115	10.0	0.983	10.0	20%	1.9	**6.1**
gag	2,862	7.5	-0.055	3.8	0.013	1.9	0.111	9.4	0.968	8.8	69%	5.6	**6.1**
red snapper	6,629	8.8	-0.046	2.5	-0.100	4.4	0.090	6.9	0.957	8.1	65%	5.0	**5.9**
cero	211	1.3	-0.466	10.0	-0.540	8.8	0.022	1.3	0.809	3.8	100%	10.0	**5.8**
bluefish	1,588	4.4	0.092	5.6	0.119	5.0	0.096	8.1	0.815	4.4	63%	4.4	**5.3**
black grouper	93	0.6	-0.453	9.4	-0.508	8.1	0.096	7.5	0.652	1.9	60%	3.8	**5.2**
dolphin	2,525	6.9	-0.415	8.8	-0.646	9.4	0.033	1.9	0.562	1.3	14%	0.6	**4.8**
spanish mackerel	12,780	10.0	0.055	4.4	0.003	0.6	0.069	3.8	0.714	2.5	69%	5.6	**4.5**
cobia	298	3.1	0.047	3.1	0.062	3.8	0.081	5.6	0.763	3.1	90%	8.1	**4.5**
vermilion snapper	2,937	8.1	-0.004	0.6	-0.176	5.6	0.020	0.6	0.831	5.0	14%	0.6	**3.4**
king mackerel	2,355	6.3	0.010	1.3	-0.003	1.3	0.047	2.5	0.895	6.3	41%	3.1	**3.4**
scamp	229	1.9	-0.026	1.9	0.204	6.3	0.080	5.0	0.534	0.6	28%	2.5	**3.0**

Technical Calibration Approach

Workshop participants recognized the importance of strong, clear guidelines regarding calibration methods and how and when the methods should be used. Stock assessment scientists do not want to be in the position of developing ad hoc calibration methods on a species-by-species and region-by-region basis. While more sophisticated and time-consuming calibration approaches were discussed, workshop participants reached consensus that, prior to 2004 (or whichever year is the first year for which direct re-estimates are available, since ST is still working on re-estimation for years prior to 2004), hind-casted catch data should use a straight-forward ratio estimator (i.e., MRFSS/MRIP), either constant throughout time hind-casted time series or trended based on ancillary information. A MRFSS/MRIP ratio estimator was also suggested to approximate adjusted variances associated with the revised catch estimates.

Use of a ratio estimator approach for calibrating from MFRSS to MRIP should not preclude development of more extensive species-specific approaches as warranted. However, for many assessed species the use of a simple ratio estimator may be sufficient considering the relatively small differences found between MRFSS and MRIP numbers, and more importantly the anticipated small impact the revised recreational time series will have on assessment outcomes. The reliability and confidence in using a ratio estimator will increase considerably as more years of re-estimated MRIP numbers become available. At present, only eight years of side-by-side MRFSS-MRIP estimates (2004-2011) are available to develop ratio estimators that for some species will be applied to 23 years of data (1981-2003). ST is currently working on revised estimates for 1998-2003 and may eventually go back even further depending on the availability and quality of original data sources.

The ad-hoc working group recommends the ratio estimator be based on the “ratio of means” (across all comparison years included) rather than based on the “mean of ratios” for individual years. Based on sampling theory, the ratio of means should be less biased and more stable than the "mean of ratios" (Cochran 1977)and it also represents the least-squares estimator for a slope in a zero-intercept model when the variance of y (the MRIP estimate in this case) is proportional to x (the MRFSS estimates in this case). The estimate of the calibration factor that is a ratio of mean catches is calculated as:

Formula A

$$\hat{R}_{RM} = \frac{\bar{C}_{\text{MRIP}}}{\bar{C}_{\text{MRFSS}}} = \frac{\sum_{y=1}^{n} \hat{C}_{y,\text{MRIP}}}{\sum_{y=1}^{n} \hat{C}_{y,\text{MRFSS}}}$$

Calibrated catch estimates for 1982-2003 are then calculated as:

Formula B

$$\hat{C}_{y,\hat{R}} = \hat{R}\hat{C}_{y,MRFSS}$$

The same formulas can also be applied for calibrating variances associated with MRFSS catch estimates.

Variances of the adjusted catch estimates should include two components: 1) calibrated variance of the catch estimate, and 2) variance associated with the ratio estimator used for calibrating the catch estimate. The variance estimator for the ratio of means derived from the formula above can be approximated as:

Formula C

$$\hat{V}\left(\hat{R}_{RM}\right) = \hat{R}_{RM}^2 \left[\frac{\hat{V}\left(\bar{C}_{MRIP}\right)}{\bar{C}_{MRIP}^2} + \frac{\hat{V}\left(\bar{C}_{MRFS}\right)}{\bar{C}_{MRFS}^2} - 2\frac{\hat{C}ov\left(\bar{C}_{MRFS}, \bar{C}_{MRIP}\right)}{\bar{C}_{MRFS}\bar{C}_{MRIP}} \right]$$

Where

$$\hat{V}\left(\bar{C}\right) = \frac{1}{n} \frac{\sum_{y=1}^{n} \left(\hat{C}_y - \bar{C}\right)^2}{n-1}$$

An estimate of the variance of the calibrated estimate of catch that accounts for uncertainty in the estimate of the calibration factor is calculated as:

Formula D

$$\hat{V}\left(\hat{C}_{y,\hat{R}}\right) = \hat{C}_{y,MRFSS}^2 \hat{V}\left(\hat{R}\right) + \hat{R}^2 \hat{V}\left(\hat{C}_{y,MRFSS}\right) - \hat{V}\left(\hat{R}\right)\hat{V}\left(\hat{C}_{y,MRFSS}\right)$$

This assumes the estimate of the ratio is independent of the estimate of the catch that is to be calibrated. The variances of the catches in the above equation, $\hat{V}\left(\hat{C}_{y,MRFSS}\right)$ are the values after being calibrated.

Ratio Estimator Approach Example – Summer Flounder

To show an example of the approach suggested above we will hind-casted summer flounder landings numbers (A+B1) estimates and variances for 2003 based on a comparison of 2004-2011 MRFSS and MRIP estimates. Table 4 shows summer flounder AB1 numbers estimates and associated variances for the eight years of MRFSS and MRIP side-by-side estimates.

Table 4. Virginia through Maine MRFSS and MRIP 2004-2011 summer flounder AB1 numbers estimates, variances, variance of means, and co-variances of means.

Year	MRFSS AB1 Numbers (in 1,000s)	MRFSS Variance (in 1,000s)	MRIP AB1 Numbers (in 1,000s)	MRIP Variance (in 1,000s)
2004	4,557	33,226	4,316	67,076
2005	4,110	42,230	4,028	58,396
2006	4,052	41,047	3,951	76,508
2007	3,393	18,420	3,109	34,795
2008	2,295	13,168	2,350	44,728
2009	1,910	9,120	1,807	16,001
2010	1,484	10,791	1,502	14,433
2011	1,782	25,722	1,830	21,439
Mean 2004-2011	2,948	24,215	2,862	41,672
Variance of the Mean	185,048	22,410,864	160,925	71,527,726
Co-variance of MRFSS and MRIP Means			150,486	28,832,853

Using the "ratio of means" approach (Formula A) the ratio estimator for landings numbers is calculated as:

= 2,862 / 2,948 = 0.970756

When this ratio is applied to the MRFSS 2003 estimate of 4,559 (X 1,000) the calibrated MRIP estimate is 4,425.7 (X 1,000).

Similarly, the ratio estimator for the landings estimate variance is calculated as:

= 41,672 / 24,215 = 1.7209

When this ratio is applied to the MRFSS 2003 variance of 33,255.2 (X 1,000) the calibrated MRIP variance is 57,228.4 (X 1,000).

The next step is to calculate the variance and PSE associated with the ratio estimator.
Using the Formula C provided above, the variance is approximated as:

= 0.9708^2 * (185,048 / 2,948^2 + 160,925 / 2,862^2 – 2 * 150,486 / (2,948 / 2,862))
= 0.004964

The PSE is calculated as:

= 100 * Sqrt (Variance) / (Mean)
= 100 * Sqrt (0.004964) / (0.9708)
= 7.3 %

Finally we calculate the variance and PSE associated with the calibrated landings estimates for each year (Formula D) as:

= (4,559^2 * 0.004964) + (0.9708^2 * 57,228.4) – (0.004964 * 57,228)
= 156,821.9

The PSE for the calibrated estimate is calculated as:

= 100 * Sqrt (Variance) / (Mean)
= 100 * Sqrt (156,821.9) / (4,425.7)

= 8.95 %

Table 5. Original MRFSS AB1 landings estimates, variances and PSEs alongside hind-casted MRIP AB1 landings estimates, variances, and PSEs for summer flounder from 1982-2003.

Year	MRFSS AB1 Numbers of Fish (in 1,000s)	MRFSS Variance (in 1,000s)	MRFSS PSEs	MRFSS AB1 Numbers (in 1,000s) with Ratio Adjustment	MRFSS Variance (in 1,000s) with Ratio Adjustment	Adjusted Variance with Ratio Estimator Variance Factor	Adjusted PSE with Ratio Estimator Variance Factor
1982	15,473	16,184,368	26	15,021	27,851,679	27,296,703	34.8
1983	20,996	2,160,077	7	20,383	3,717,276	5,672,877	11.7
1984	17,475	1,954,404	8	16,965	3,363,334	4,668,685	12.7
1985	11,066	1,763,372	12	10,743	3,034,586	3,452,504	17.3
1986	11,621	661,733	7	11,282	1,138,777	1,737,870	11.7
1987	7,865	154,646	5	7,635	266,130	556,535	9.8
1988	9,960	158,723	4	9,669	273,146	748,484	8.9
1989	1,717	10,613	6	1,667	18,264	31,755	10.7
1990	3,794	23,031	4	3,683	39,634	108,607	8.9
1991	6,068	58,913	4	5,891	101,383	277,815	8.9
1992	5,002	40,032	4	4,856	68,891	188,778	8.9
1993	6,494	67,475	4	6,304	116,118	318,192	8.9
1994	6,703	71,888	4	6,507	123,713	339,002	8.9
1995	3,326	17,700	4	3,229	30,459	83,466	8.9
1996	6,997	44,062	3	6,793	75,827	314,108	8.3
1997	7,167	82,185	4	6,958	141,433	387,560	8.9
1998	6,979	77,930	4	6,775	134,110	367,494	8.9
1999	4,107	26,988	4	3,987	46,444	127,266	8.9
2000	7,801	54,770	3	7,573	94,254	390,441	8.3
2001	5,294	44,842	4	5,139	77,169	211,462	8.9
2002	3,262	17,025	4	3,167	29,298	80,285	8.9
2003	4,559	33,255	4	4,426	57,229	156,821	8.9

Guidelines for Applying Ratio Estimator Approach

The ad-hoc working group recommends the following generally guidelines for applying a ratio estimator to calibrate recreational catch and variance estimates. These guidelines may not apply, or be practical, in all cases as the impact of changes in the recreational time series data will vary by assessment or particular management need:

- Ratio estimators should be calculated using stock level aggregate data to the extent possible. Caution should be used when calculating ratio estimates at finer geographic levels or by fishing mode.
- Ratio estimators can be based on either estimated numbers of fish or weights depending on which units are used directly in the assessment model. The exception may be if ratios based on weights appear unstable due to small sample sizes of weighed fish. In such cases it may be better to calculate a ratio estimator based on numbers and apply it to the weights.
- To the extent practicable, all years for which both MRFSS and MRIP estimates are available should be used to calculate ratios. If one or two years have ratios that are different enough from the other years so as to noticeably impact the overall ratio of means, a balanced trimmed mean approach which removes both the highest and lowest ratios is preferred over simply removing just the highest or lowest year.
- Trended ratio estimators are generally not recommended at present since only eight years are available for comparison. The basic ratio estimator itself could behave poorly with very few years of paired MRFSS and MRIP observations. As additional years of side-by-side estimates are made available bias in the ratio estimator will become negligible and it may be possible to develop trended ratio estimators that better reflect different MRFSS/MRIP ratios at different parts of the time series.
- It is recommended that stock assessment scientists conduct sensitivity analyses of the hind-casted recreational catch estimates (e.g., varying them by 5, 10, 20%) and length frequencies, as available, in order to gauge the overall impact of changes in the estimates on biological reference points. If the assessment results are sensitive to changes in the recreational time series there may be justification for developing more sophisticated models for hind-casting estimates than the ratio estimator approach suggested here.
- The ad-hoc working group did not fully evaluate a ratio estimator approach for calibrating length

frequencies as data were not available at the time of this report. The group did come up with two possible options but also recognized that other options may exist: 1) Adjust the numbers at length using the same ratio as used for total numbers, or 2) Estimate length-class specific ratios and adjust by length class, then sum the adjusted length classes for an alternative adjusted total number.

References

Cochran, W. G. 1977. Sampling techniques. Third Edition. Wiley and Sons. New York.