SOUTH ATLANTIC FISHERY MANAGMENT COUNCIL

SCIENTIFIC AND STATISTICAL COMMITTEE

SSC Meeting Report

October 28 - 30, 2014

Crowne Plaza
North Charleston, SC

VERSION
Final Meeting Report

PURPOSE

Topics to address during this meeting:

- SEDAR planning and update
- SAFMC Assessment Priorities
- Reports on the MRIP Calibration Workshop, 2015 National SSC workshop, and ABC Control Rule Workshop
- Assessments of mutton snapper, hogfish and King mackerel
- Snapper-Grouper RA 16, black sea bass protected resources interactions
- Bag limit analyses, including application to gag grouper
- Progress on current FMP Amendments

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SAFMC PUBLIC COMMENT PROCESS

Written comment:

Written comment on SSC agenda topics is to be distributed to the Committee through the Council office, similar to all other Council briefing materials. Written comment to be considered by the SSC shall be provided to the Council office no later than one week prior to an SSC meeting. For this meeting, the deadline for submission of written comment is 12:00 pm Tuesday, October 21, 2014.

SAFMC
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Verbal comment:

Two opportunities for comment on agenda items will be provided during SSC meetings. The first will be at the beginning of the meeting, and the second near the conclusion, when the SSC reviews its recommendations. Those wishing to comment should indicate such in the manner requested by the Chair, which may be through a show of hands or a written list if the number of interested parties is extensive, who will then recognize individuals to come forward and provide comment. All comments are part of the record of the meeting.

1. INTRODUCTION

1.1. Documents

Agenda
Attachment 1. Minutes of the April 2014 meeting

SUMMARY RECOMMENDATIONS
Committee discussion is summarized under each agenda topic in this report, indicated in the text by italics. Recommendations addressing some specific action items might be provided as addenda to this report or as separate reports.

1.2. Action

Introductions
Review and Approve Agenda
Approve Minutes

The SSC meeting was called to order at 1:00p.m., as scheduled.

The agenda was adopted without change and the minutes of the April 2014 meeting were adopted without further comment or changes. Member introductions were made. The Chair reviewed the agenda and outlined the general format and conduct of the meeting as discussed in the overview document.

2. PUBLIC COMMENT

The public will be provided two opportunities to comment on SSC agenda items during this meeting. The first at the start of the meeting, and the final will be provided at the end during the review of recommendations. Those wishing to make comment should indicate their desire to do so to the Committee Chair.

Accordingly, at this point in the meeting the Chair opened the floor for the first opportunity for public comment. Public comments were provided by Captain Russell "Rusty" Hudson (Directed Sustainable Fisheries).

3. SEDAR ACTIVITIES

3.1. Documents

Attachment 2. SEDAR schedule
Attachment 3. FWC project proposals
Attachment 4. SEDAR Steering Committee Documents

3.2. Overview

The SEDAR Steering Committee met recently, October 6-7 in Charleston. They discussed the assessment schedule, changes in the assessment workshop process and reviewed the SEDAR operating policies (SOPP) in detail. Since the meeting report is not completed as of the Briefing Book deadline, Attachment 4 includes several of the briefing documents from the Steering Committee meeting.

- The Steering Committee agreed to a change in the assessment process that reduced the webinars to 3, scheduled to address specific model development milestones. Assessment analysts may consult with other appointed participants as necessary to develop products for each milestone
- A SEDAR procedures workshop will be held in 2015 to develop best practices for data. An SSC representative is desired to serve on the organizing committee.

SEDAR 41, South Atlantic red snapper and gray triggerfish, will be delayed approximately one year while the SEFSC addresses concerns that data from the early years are unreliable due to misreporting by participants.

The red grouper, golden tilefish blueline tilefish update process assessments for 2015 are also delayed, due to staff turnover and the headboat data issues.
FL FWCC will conduct the next assessments of black grouper, yellowtail snapper and Goliath grouper. All are being considered for transition to the Stock Synthesis package. The SSC will receive a report from FWCC on the process and decisions necessary for the change in model package, and is asked to consider whether the change can be accommodated using the standard process, or whether a benchmark is required. The Steering Committee has authorized Council SSCs, as the peer review body for standard assessment and the group charged with making fishing level recommendations based on assessments, to determine when the changes proposed for a standard process are excessive and therefore a benchmark process should be applied.

Table 1. SAFMC Assessment Project Schedule

SEDAR #	Stocks	Type	Terminal Data	Assessment Complete
U	Mutton snapper	Update	2012	Oct 2014
37	Hogfish	Benchmark	2013	Oct 2014
38	King mackerel	Benchmark	2012	September 2014
41	Red snapper & Gray triggerfish	Benchmark	2014	April 2016
U	Red grouper	Update	2014	April 2016
U	Blueline tilefish	Update	2015	Jan 2017
S/B	Black grouper	TBD	2014	TBD
Future Priorities				
U/S	Tilefish (maybe in 2016)	Update or Std.	2015	TBD
B	Scamp & Gray snapper 2017	Benchmark		
U	Vermilion, GAJ 2017	Update		
S/B	Yellowtail Snapper 2017	S/B	2016	Mid-2018

3.3. Action

- Review black grouper, Goliath grouper, yellowtail snapper proposals and TORs, recommend whether these assessments are conducted through the standard or benchmark process
- Review SAFMC assessment priorities

SSC RECOMMENDATION:

- Review black grouper, Goliath grouper, and yellowtail snapper proposals and TORs, and recommend whether these assessments should be conducted through the standard or benchmark process:

  Luiz Barbieri explained that the FWC-led Goliath grouper assessment will continue to use the SEFSC catch-free model used for the last assessment but that SEFSC and FWC staff will work to streamline program modules and update model components during the assessment process. Further, Luiz explained that detailed, written proposals for using Stock Synthesis 3 (SS3) for the black grouper and yellowtail snapper assessments are not available for this meeting but will be provided for the April 2015 SSC meeting. This will allow the SSC to provide more detailed input on whether the black grouper and yellowtail snapper assessments should be conducted as benchmarks or standards.

- Review SAFMC assessment priorities:

  The SSC accepts the SEDAR assessment priorities and project schedule as presented. The Committee recommends that the Organizing Committee for the planned SEDAR data procedures workshop involve state agency staff that regularly participate in SEDAR Data Workshops (given their experience with data issues that are problematic for the assessment process).

  Further, the SSC recommends devoting a South Atlantic assessment slot for a workshop addressing several data poor stocks and applying a suite of methods to assess these stocks.

4. MRIP CALIBRATION WORKSHOP

4.1. Documents

Attachment 5. Draft MRIP Calibration Workshop Report

4.2. Overview

MRIP Calibration Workshop II was held September 8 – 10, 2014, to address changes in the Access Point Angler Intercept Survey (APAIS) component. Several calibration approaches were recommended to be evaluated in the next few months.

4.3. Action

- No specific actions required.

5. 2015 NATIONAL SSC WORKSHOP

5.1. Documents

Attachment 6. National SSC Draft Agenda

5.2. Overview

The next national meeting of Council SSC representatives will be held February 23 – 25 in Honolulu. The workshop theme is "Providing ABC specifications in the face of uncertainty: from data to climate and ecosystems". Discussion topics include evaluating current ABC control rules, setting ABCs in data limited situations, and incorporating ecological, environmental, and climate change considerations into stock assessments.

Although a budget is not yet final and plans are still underway, since the next meeting of this Committee will occur after the National Workshop, a list of candidates should be developed at this meeting.

5.3. Action

- Provide comment on the agenda and topics.
- Identify candidate SSC representatives.

SSC RECOMMENDATION:

- Provide comment on the agenda and topics

John Boreman provided a brief summary of the agenda and topics being considered for the February 2015 National SSC meeting. Regarding attendance, Dr. Boreman explained that the funds NMFS has budgeted for this meeting allow each Council to send a total of 5 representatives (between SSC members and Council staff). The Chair then requested that members interested in attending the workshop submit their names by e-mail.

- Identify candidate SSC representatives

SSC members: Marcel Reichert, Scott Crosson, Steve Cadrin, and Luiz Barbieri.

SAFMC staff: Mike Errigo

6. ABC CONTROL RULE WORKSHOP REPORT

6.1. Documents

6.2. Overview

The SSC will hold a workshop devoted to the ABC Control Rule prior to this SSC meeting. Recommendations from the workshop will be discussed by the SSC, and control rule revisions considered.

6.3. Action

- Review workshop recommendations.
- Recommend control rule revisions.

SSC RECOMMENDATION:

The ABC Control Rule Workshop was conducted immediately preceding the October 2014 SSC meeting (October 27-28), as scheduled. Specific SSC recommendations regarding this agenda item will be presented in a separate workshop report to be completed and distributed before the April 2015 SSC meeting.

7. HOGFISH ASSESSMENT REVIEW

7.1. Documents

Attachment 7. Hogfish Assessment

7.2. Overview

An assessment of hogfish was recently completed by the FL FWCC. The SSC is asked to review the assessment and provide fishing level recommendations.

7.3. Presentation

Assessment Overview: Mike Murphy, FL FWCC

7.4. Action

- Review the assessment and consider whether it represents Best Scientific Information Available.
- Identify and discuss assessment uncertainties.
- Provide fishing level recommendations.

SSC RECOMMENDATION:

The SSC reviewed the hogfish benchmark assessment conducted by FWC-FWRI. The SSC first considered the evidence of stock separation and justification for conducting separate assessments of the GA-NA and Southeast FL/FL keys stocks. Points of discussion included the following items.

- *The dividing point between the GA-NC and SE Florida stocks is not well defined. One reason for this is a lack of genetic sample coverage from*

Northern Florida through South Carolina. However, the genetic evidence does suggest a distinction between the stocks in NC and South Florida.

- *Whether there is a true biological difference in growth between the different stocks or whether the observed differences reflect age truncation due to heavy fishing.*
    - *Sensitivity analyses show stock status is sensitive to this assumption.*
    - *The SSC recommends investigating this issue by comparing size distributions from the fishery to closed areas within the EFL/FL Keys. Some evidence suggests that the apparent difference in length comps/growth is due to fishing pressure.*
- *Catch uncertainty is high, due to the dominance of harvest by the recreational fishery.*

After much discussion the SSC supported treating hogfish in the South Atlantic as two stocks. Each assessment was then evaluated with regard to fishing level recommendations.

- ***GA-NC stock**: the SSC agreed with recommendations from the CIE reviewers to not consider assessment results for the GA-NC stock as sufficient to determine stock status and inform management decisions. Although there isn't another analysis available for this stock a statistical catch at age model is not the appropriate modeling framework to analyze the available data and therefore this assessment is not considered the best available science. The Committee recommends that catch level recommendations for the GA-NC hogfish stock be developed using the ORCS approach, as outlined in the Council's ABC control rule:*
    - *For application of the ORCS approach the SSC considered the fishery-dependent indices in the assessment model as well as landings trends. Significant discussion points included:*
        - *Many uncertainties in the trends displayed, including competing trends between some of the indices. This indicates a critical need for data workshop participants to prioritize indices for modeling uses and for determination of abundance trends over time. Prioritization of indices would have helped the SSC with respect to decisions used to complete the ORCs approach.*
        - *The SSC did not feel compelling evidence was available to change the Risk of Overexploitation designation given to hogfish during the ORCS Workshop. Therefore, the Committee recommended the use a Risk of Overexploitation of Moderate-High:*
            - *Leads to a risk of overexploitation scalar of 1.25*
            - *1999 is the year of maximum landings within the 1999-2007 time period designated as appropriate during ORCS Workshop.*

Table 2. Hogfish recommendations: GA-NC Stock

Statistic	Value
Risk of Overexploitation	Moderately High
Associated Scalar	1.25
Range of Years	1999-2007
Year of Max Landings	1999
Catch Statistic	32,184 lbs ww
Not OFL	40,230 lbs ww
Council Risk Scalar (Preferred from Am 29)	0.7
Proposed ABC	28,161 lbs ww

- ***SE/SFL stock****: the SSC felt that despite the concerns described above this assessment represents a significant improvement from the methodological approach previously used to set ABC for hogfish. Further the Committee recognized that data-poor methods would not have been sufficient to capture all the complex biological nuances inherent to hogfish life history and population dynamics. Therefore, the SSC considered the benchmark assessment of SE/SFL hogfish to represent the best available science and recommended it be used for fisheries management. Specifically, the Committee accepted the estimate of steepness (h) and associated MSY reference points provide by the base run.*

  In addition to the uncertainties noted for hogfish in general, the Committee notes the following items pertaining to the SE/SFL stock:

  - *Productivity for the SE Florida stock is not well estimated. Estimates suggest the stock began at low biomass at the start of the time series and drops slightly over time, resulting in a lack of contrast.*
  - *As noted in the general comments, observed growth rates of the SE FL stock are below that of the GA-NC stock. Whether this is due to the high exploitation indicated by the model or geographic habitat differences is unknown. From an assessment modeling perspective, there is large variability in the input growth data, yet small CV's assigned to the growth model used internally by the model.*
  - *A likelihood profile on R0 was unavailable. The SSC felt this diagnostic analysis would be very informative given the narrow range of stock abundance seen in this assessment (from 9% of virgin to between 6% and 8% of virgin). This range may not provide enough contrast to infer stock productivity and determine stock status given the amount of uncertainty in the input data and model assumptions.*
  - *The SSC expressed serious concern regarding the fact that data weighting procedures were not used in this assessment. Although effective sample sizes were calculated they were not used to reweight the different data sources used in the assessment.*

- *The SSC also felt that although the estimated dome-shaped selectivities seemed justified, the degree of doming (e.g., terminal selectivity fixed at zero for some fisheries) represents an additional concern. Further, although uncertainty in selectivity was reflected in the bootstraps the fact that the functional form of some selectivities was still imposed indicates that uncertainty in fishery selectivity was not fully captured and characterized.*

Since this assessment falls under Tier 1 of our ABC control rule, ABC was obtained according to a P value. A summary of results from applying the ABC control rule is presented below:*

1. *Assessment Information: Tier 1 (0%)*
2. *Uncertainty Characterization: Tier 3 – Medium (-5%)*
3. *Stock Status: Tier 4 – Overfished and Overfishing is occurring (-7.5%).*
4. *Productivity-Susceptibility Analysis: Tier 3 – High Risk (-10%): based on the MRAG report.*

In total, these results provide for an adjustment score of -22.5%, a P of 27.5%, and a $P_{REBUILD}$ of 72.5%. An yield stream for rebuilding will be provided after the Council either approves the probability of rebuilding recommend above or provides further input on the probability of rebuilding to be used.*

Regarding the next assessment of hogfish, the SSC recommends that it be conducted in 5 years and that it should address all the concerns put forth by the SSC and CIE reviewers. Further, the Committee recommended that the next assessment explore the use of several classes of models (of different complexity) instead of just a statistical catch at age model.

Table 3. Hogfish recommendations: EFL/FL Keys Stock

Criteria	**Deterministic**	**Probabilistic**
Overfished evaluation	Yes, F/Fmsy= 1.593	1.440
Overfishing evaluation	Yes, SSB/MSST= 0.466	0.494
MFMT (Fmsy)	0.138	0.140
SSBmsy (male & female mature biomass, units not reported)	1,043.44	1,033.725
MSST (male & female mature biomass, units not reported)	856.664	848.688
MSY (1000 lb)	156.986	156.973
Y at 75% Fmsy (1000 lb)	Not reported	Not reported
ABC Control Rule Adjustment	22.5%	
P-Star (Prebuild)	27.5% (72.5%)	
OFL (1000 lb)		
ABC RECOMMENDATIONS: Projection results at the recommended P* were not available when this report was finalized. The projection report will be included as an appendix to this report.		

8. MUTTON SNAPPER ASSESSMENT REVIEW

8.1. Documents

Attachment 8. Mutton Snapper Assessment

8.2. Overview

An assessment of mutton snapper was recently completed by the FL FWCC. The SSC is asked to review the assessment and provide fishing level recommendations.

8.3. Presentation

Assessment Overview: Joe O'Hop, FL FWCC

8.4. Action

- Review the assessment and consider whether it represents Best Scientific Information Available.
- Identify and discuss assessment uncertainties.
- Provide fishing level recommendations.

SSC RECOMMENDATION:

The assessment report was not available for this meeting. Therefore, review of Mutton Snapper was postponed until the April 2015 SSC meeting. However, Joe O'Hop (FWC-FWRI) presented a summary of the current status of the analyses so the Committee could provide comments, suggestions, and recommendations before the assessment is finalized and the report is provided for review.

9. KING MACKEREL ASSESSMENT REVIEW

9.1. Documents

Attachment 9. King Mackerel Assessment

9.2. Overview

An assessment of King Mackerel was recently completed through SEDAR 38. The SSC is asked to review the assessment and provide fishing level recommendations.

9.3. Presentation

Assessment Overview: John Walter, SEFSC
Review Panel Perspective: Jim Berkson, Review Panel Chair

9.4. Action

- Review the assessment and consider whether it represents Best Scientific Information Available.

- Identify and discuss assessment uncertainties.
- Provide fishing level recommendations.

SSC RECOMMENDATION:

The SSC reviewed the SEDAR 41 king mackerel benchmark. The most relevant comments, concerns, and discussion points brought up during the SSC meeting included:

- *The SSC discussed application of the SEAMAP index of abundance and adequacy of survey spatial coverage, nothing that the survey does not cover the full stock range. The survey does not cover the full stock range. More specifically, it does not extend as far south as might be needed to capture juvenile abundance trends over the entire stock. A recommendation was made to examine occurrence of king mackerel in SEAMAP trawls as it correlates to the Gulf Stream off FL, since Gulf Stream eddies can increase cross-shelf larval transport and this might help explain inter-annual fluctuations in recruitment.*
- *It was noted that the observed spike in the shrimp fishery effort time series does not correspond to a similar spike in young king mackerel discards. The assessment analyst explained that this may be due to the discard time series being informed by the SEAMAP trawl, which did not correlate well with actual bycatch of king mackerel in shrimp trawls.*
- *The issue of unreliability of early headboat data was also brought up, but the analyst explained that the HB index only influences the model results in the more recent period, after the time when the data is claimed to be unreliable.*
- *A major concern was the strong retrospective pattern, which systematically over-estimates recruitment in the terminal year.*
- *The SSC also discussed the fact that the assessment model shows that SSB can be considered high, and relatively speaking the fishery exhibits recent low landings. The analyst explained that the estimated selectivity functions strongly indicate that the king mackerel fishery is not selecting for the larger, older fish which are responsible for the current high SSB. Reasons for this are that most of the fishery is conducted by trolling, which does not select for larger fish. Even in the live bait fishery, with a high abundance of smaller size classes of king mackerel, larger fish will not be selected by the gear. However, the SSC cautioned that the lack of a fishery independent survey to provide observations on these larger, older fish creates additional uncertainty in estimates of stock biomass.*
- *Similar to comments brought up for the hogfish assessment review the SSC expressed concerns that no iterative reweighting was done for this assessment.*
- *The SSC cautioned that the bootstraps do not represent all the uncertainty in the data and should be seen as an underestimate of model uncertainty. It is possible that the PDF of OFL is very tight and does not capture enough of the uncertainty in*

the model and data (i.e., this might lead to a very small buffer between OFL and ABC).

- *The SSC noted that low contrast in abundance and lack of a robust stock-recruitment relationship are likely causes for the models inability to provide an estimate of steepness (h) and, therefore, MSY. As recommended by the SEDAR Review Panel the SSC accepted $SPR_{30\%}$ as a proxy for MSY and steepness fixed at 0.99 for projections. This value of steepness allows the model to provide projections with constant recruitment.*
- *The SSC accepted the king mackerel assessment as the best available science and deemed it adequate to support fishing level recommendations.*
- *The Committee recommended the Council exercise a degree of caution in setting the ACL given the uncertainties noted with this assessment, particularly related to recent recruitment and overall productivity (see catch level recommendation scenarios below).*
- *Since this assessment falls under Tier 1 of our ABC control rule, ABC was obtained according to a P* value. A summary of results from applying the ABC control rule is presented below:*
  - *Assessment Information: Tier 2 (-2.5%)*
  - *Uncertainty Characterization: Tier 3 – Medium (-5%)*
  - *Stock Status: Tier 1 – Not overfished and no overfishing is occurring (-0%)*
  - *Productivity-Susceptibility Analysis: Tier 3 – High Risk (10%): based on the MRAG report.*

  In total, these results provide for an adjustment score of 17.5% and a P of 32.5%.*

  The SSC recommends short-term projections (given the high uncertainty in recruitment, even in the short-term) of no longer than 5-years at P=50% for OFL and at P*=32.5% for ABC. Further, given the considerable uncertainty associated with recruitment in this assessment, the SSC recommended the Council consider a range of alternative projection scenarios for OFL and ABC:*

  1. *Three sets of projections as specified in the paragraph above but with each considering one of the 3 recruitment scenarios described in the assessment report (i.e., high, medium, and low recruitment). The Committee also recommends the Council be provided a summary of the 2013 and, if possible, 2014 SEAMAP juvenile index data to assist in evaluating which recruitment scenario is the most appropriate for projections.*
  2. *The SSC recommends the Council use a projection at the long-term, equilibrium yield at $F_{30\%SPR}$ as the ACL to reduce the risk of overfishing given the high uncertainty in future recruitment.*

  The SSC recommends a review of updated indices and input data sources every 3 years in order to track the progress of the stock and help identify any potential red flags regarding future recruitment or stock biomass.

The SSC recommended that the next assessment be conducted as an update, ideally before the end of the 5-year projections.

Table 3. King Mackerel recommendations

Criteria	**Deterministic**	**Probabilistic**
Overfished evaluation	No, $SSB/SSB_{30\%SPR}$= 1.86	
Overfishing evaluation	No, $F/F_{30\%SPR}$ = 0.17	
MFMT	$F_{30\%SPR}$ = 0.157	
$SSB_{30\%SPR}$ (unit)	2,372 million eggs	
MSST (unit)	1,991 million eggs	
MSY (1000 lb)	Not recommended	
Y at 75% $F_{30\%SPR}$ (1000 lb)	Not recommended	
ABC Control Rule Adjustment	17.5%	
P-Star	32.5%	
OFL (1000 lb)		

ABC RECOMMENDATIONS

Probabilistic projections of retained yield for OFL and 3 different recruitment scenarios for ABC. All values in lbs ww.

Year	**OFL (50%)**	**ABCHigh (32.5%)**	**ABCMedium (32.5%)**	**ABCLow (32.5%)**
2015	22,058,100	20,106,500	19,676,500	19,112,700
2016	19,750,000	17,447,800	16,545,400	15,370,700
2017	18,291,400	15,821,500	14,329,800	12,938,900
2018	16,698,700	14,125,700	12,933,100	11,939,800
2019	15,187,100	12,658,900	12,055,700	11,571,500
2020	14,298,500	11,540,000	11,250,100	11,024,700

Deterministic projections of retained equilibrium yield at $F_{30\%SPR}$ and 75% $F_{30\%SPR}$. All values in lbs ww.

Year	**$F_{30\%SPR}$**	**75% $F_{30\%SPR}$**
2015	12,702,486	11,582,153
2016	12,702,486	11,582,153
2017	12,702,486	11,582,153
2018	12,702,486	11,582,153
2019	12,702,486	11,582,153
2020	12,702,486	11,582,153

10. SNAPPER GROUPER REGULATORY AMENDMENT 16

10.1. Documents

Attachment 10. Regulatory Amendment 16 Draft

Attachment 11. Interaction analysis*

10.2. Overview

Regulatory Amendment 16 includes one action to address the prohibition on the use of black sea bass pots that was implemented through Regulatory Amendment 19 and became effective on October 23, 2013. Scoping meetings were held in January 2014 and the Council reviewed alternatives at the March 2014 meeting and provided guidance on changes and additional alternatives to include. The Council will review the analyses for this amendment at their December 2014 meeting. Public hearings will be held in January 2015, and the amendment will most likely be approved for submission to the Secretary of Commerce at the Council's June 2015 meeting. The SSC is asked to provide technical review of the analyses prepared by Southeast Regional Office staff.

10.3. Presentation

Analysis of interactions: Nick Farmer, SERO

10.4. Action

- Review interactions analysis approach.
- Recommend whether methods represent BSIA.

SSC RECOMMENDATION:

The SSC reviewed the analysis of Regulatory Amendment 16 alternatives conducted by SERO staff. The most relevant comments, concerns, and discussion points brought up during the SSC meeting included:

- *The SSC expressed concern about the lack of detail in uncertainty characterizations in the analysis. Several sensitivity runs were conducted to evaluate major uncertainties. However, the Committee expressed concern with the ability to discern differences between management alternatives given the information provided. The Committee advised that further exploration and reporting of within-model uncertainties would improve insight into the variability associated with model parameters and help to distinguish between the different alternatives considered. The SSC recognizes that conducting a more complete, in-depth uncertainty characterization would provide a more robust picture of the proposed management alternatives given the amount of uncertainty in model outputs. At the very least it would be useful to explore uncertainty in a subset of runs and give a better picture of how well this analysis can distinguish between alternatives.*
- *Dr. Nick Farmer explained that rerunning the original model using bootstrapping or MCMC technique is not feasible given the current timeline for the amendment. However, the SSC recommended clearly defining this particular deficiency in the*

analysis such that the Council understands that the ranking of considered alternatives might not hold true if a full uncertainty analysis was undertaken.

Overall, the SSC felt the presentation was informative. The approach of ranking the alternatives on a relative scale was supported. Inferring that the analysis evaluates and quantifies risk to whale encounters was not supported. With some refinement, directed at providing information on error associated with estimated scalar values for the alternatives, the analysis could allow the Council to distinguish between the different alternatives.

The SSC cautioned that assuming model output of co-occurrence between black sea bass pot effort and whale sightings is a proxy for whale interaction or entanglement overstates model and data capabilities. The Committee recommended presenting the scalar as a dimensionless value to avoid potential misunderstandings and misuse of the term 'risk'.

In terms of next steps regarding this issue the SSC provided the following recommendations:

1. *Convene an SSC ad hoc sub-Committee to advise Dr. Nick Farmer (SERO) on uncertainty analyses to more reliably distinguish between alternatives.*
2. *The SSC recommends an analysis of relative sea bass gear-whale sighting encounter scalar values (relative to alternative 2) that consider historic as well as current levels of effort.*
3. *The SSC also requested that a staff member from NMFS Protected Resources Division attend the next SSC meeting to address Committee questions and clarify how these types of analyses are used to create a Biological Opinion and guide management.*

11. BAG LIMIT ANALYSIS

11.1. Documents

Attachment 12. Bag Limit Analysis for gag grouper
Attachment 13. Bag limit Analysis for blueline tilefish

11.2. Overview

At their June 2014 meeting, the Council approved development of Regulatory Amendment 22 to address adjustments to the ABC, ACLs, and OY for gag and wreckfish based on results of the stock assessment for those two species. The amendment also includes an action to modify the bag limit for gag. The Council reviewed the amendment at their September meeting and approved it for public hearings, which will be held via webinar in November 2014. The Council will review public hearing comments at their December 2014 meeting and approve the amendment for Secretarial review. The SSC is asked to provide technical review of the bag limit analyses.

The SSC is also provided this opportunity to review bag limit methods in general, and provide recommendations on the adequacy of the approaches used. This request is made for two reasons. First, in trying to streamline SSC operations several years ago the Council agreed that it was not necessary for the SSC to review each and every amendment in its entirety, as had been the practice to that point. Instead SSC review efforts are directed to specific technical analysis of management actions. Bag limits are a clear example of such analyses. Second, during an earlier review of a black sea bass bag limit analysis, conducted in March 2011, the SSC decline to review the method in general due to delayed receipt of the analytical report. During that review the SSC explicitly stated that a consensus position was not developed, and provided broad comments on the application. Allowing the SSC to review current bag limit methods and explicitly stating that they are adequate and based on BSAI principles will streamline review of future analyses applying those methods to particular stocks. Bag limit analyses for gag and blueline tilefish are provide to support this discussion. These represent a range of bag limit change options, with gag addressing an increase and blueline tilefish a decrease.

11.3. Presentation

Bag limit analysis methods and gag grouper application: Nick Farmer, SEFSC

11.4. Action

- Review and provide guidance on general approach to evaluating bag limits.
- Is the approach BSIA?
- Are methods and results reported adequately?
- What role should the SSC play in reviewing application of similar methods to specific stocks in the future?
- Review gag analysis and provide BSIA recommendations.

SSC RECOMMENDATION:

The SSC reviewed the bag limit analysis conducted by SERO staff. Overall, the Committee found the analysis to be sound, the presentation informative, and after discussion accepted the methodology to represent the best scientific information available. The Committee provided the following suggestions for future analyses:

1. *Since changes in angler behavior are not explicitly accounted for in the analysis, the assumption that everyone who met the bag limit in the past will meet the new, increased bag limit might not be realistic. In fact, assuming everyone will meet an increased bag limit is actually a very liberal assumption with regard to catch rates. Therefore, the SSC suggested that future analyses consider other alternatives and provide sensitivity analyses to such assumptions. Assumptions must also be evaluated in more detail, on a species by species basis.*

2. *The SSC requests that SEFSC comments on management analyses, such as bag limit evaluations, be provided in the briefing materials when such analyses are reviewed by the SSC.*

3. *The SSC recommends providing adequate time for SSC review of management evaluations in future amendment planning.*

4. *The SSC supports reviewing management analyses as applied to specific stocks through an ad hoc sub-committee when such analyses must be considered outside of the regular SSC scheduled meetings. This approach can be applied when the general analytical methods has been previously reviewed and endorsed by the Committee, as is the case with bag limit evaluations. The sub-Committee will meet via webinar or conference call and report its findings in writing to the SSC for review before they are provided to the Council.*

12. COUNCIL WORKPLAN UPDATE

12.1. Documents

Attachment 14. SAFMC Work Plan, September 2014
Attachment 15. SAFMC Amendments Overview, September 2014

12.2. Overview

The Committee is provided these documents at each meeting to stay informed of Council activities. Regular detailed reviews of each amendment are no longer requested of the SSC as amendments are developed, instead the Committee is asked to comment on specific technical items that may arise. However, members are welcome to review any ongoing amendments and to provide comments and suggestions directly to staff. Current versions of each amendment are included in the Council Briefing Books distributed to SSC members. Questions or comments about specific items should be addressed to the staff assigned to each FMP, as summarized below.

- Coastal Migratory Pelagic - Kari MacLauchlin
- Corals - Gregg Waugh
- Fishery Ecosystem Plan - Roger Pugliese
- Snapper Grouper - Myra Brouwer
- Snapper Grouper Regulatory Amendment 17 (MPAs) - Gregg Waugh
- Spiny Lobster - Kari MacLauchlin
- Golden Crab - Brian Cheuvront
- Dolphin-Wahoo - Brian Cheuvront

12.3. Action

- Comment on Dolphin Wahoo Amendment 7/SG Amendment 33Action 5, addressing the counting of filets toward possession limits.

SSC RECOMMENDATION:
The SSC was informed that this amendment proposes counting 2 filets as a single fish for possession limits, and offered no suggestions or concerns.

13. OTHER BUSINESS

- *In response to Chairman Hartig's suggestion of inter-assessment adjustments to the ABC, the SSC recommended:*
  - *Updated projections be provided to the SSC on a timescale appropriate to the species/assessment being reviewed.*
  - *Creation and implementation of a "rumble strip" approach (as used by the Mid-Atlantic Fishery Management Council), which would serve as an early alert of potential issues, not an automatic trigger to change ABC. This could include fishery dependent and independent indices, trends in landings and discards, socioeconomic trends, and any other information pertinent to the stock being reviewed.*

14. REPORT AND RECOMMENDATIONS REVIEW, PUBLIC COMMENT

The public is provided an additional opportunity to comment on SSC recommendations and agenda items.

At this time public comments were provided by Captain Russell "Rusty" Hudson (Directed Sustainable Fisheries) and Mr. Ben Hartig (commercial fisher and SAFMC Chair).

The Committee is provided an opportunity to review its report and final recommendations.

The Final SSC report should be provided to the Council by 9 am on Tuesday, November 18, 2014 for inclusion in the first briefing book for the December Council meeting.

15. NEXT MEETINGS

15.1. SAFMC SSC MEETINGS

2015 Proposed Dates

April 28 - 30.
October 20 - 22.

15.2. SAFMC Meetings

2014 Council Meetings

December 1 - 5, New Bern, NC

16. ADJOURN

The SSC meeting was adjourned a bit ahead of schedule given that discussion of several agenda items took less time than originally expected.

SEAMAP Trawl Survey Values for King Mackerel.
Provided by SEAMAP in response to SSC requested noted in item 9.

Table 4. SEAMAP Trawl CPUE for King Mackerel.

	All Trawls									Positive Trawls Only			
		Nominal		Delta-GLM		Normalized Nominal		Normalized Delta-GLM					
Year	n	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE	#Pos	%	CPUE	SE
1990	231	13.161	2.45	9.329	1.55	1.833	0.34	2.917	0.49	98	42	30.888	5.25
1991	233	2.202	0.49	1.904	0.42	0.307	0.07	0.596	0.13	47	20	10.915	1.98
1992	234	11.615	4.18	2.898	0.71	1.618	0.58	0.906	0.22	46	20	59.087	19.93
1993	234	3.628	1.4	1.708	0.39	0.505	0.2	0.534	0.12	46	20	18.457	6.77
1994	234	4.513	1.11	2.328	0.52	0.629	0.16	0.728	0.16	50	21	21.12	4.52
1995	234	11.397	2.92	4.39	0.94	1.587	0.41	1.373	0.29	66	28	40.409	9.51
1996	234	15.969	3.43	6.843	1.29	2.224	0.48	2.14	0.4	81	35	45.148	8.84
1997	234	2.472	0.56	1.883	0.46	0.344	0.08	0.589	0.14	47	20	12.255	2.29
1998	234	15.888	3.81	6.525	1.48	2.213	0.53	2.04	0.46	65	28	56.954	12.35
1999	234	4.474	0.86	4.18	0.8	0.623	0.12	1.307	0.25	77	33	13.597	2.3
2000	234	6.462	1.87	2.815	0.67	0.9	0.26	0.88	0.21	53	23	28.528	7.55
2001	306	4.858	1.66	1.49	0.37	0.677	0.23	0.466	0.12	53	17	27.313	8.79
2002	306	2.891	0.57	1.726	0.34	0.403	0.08	0.54	0.1	65	21	13.641	2.24
2003	306	6.75	1.94	2.853	0.57	0.94	0.27	0.892	0.18	77	25	26.649	7.25
2004	306	15.681	7.47	3.904	0.85	2.184	1.04	1.221	0.27	74	24	65.301	30.56
2005	306	11.09	2.92	5.003	1.02	1.545	0.41	1.565	0.32	59	19	57.362	13.59
2006	306	7.204	1.67	3.503	0.77	1.003	0.23	1.095	0.24	60	20	37.759	7.57
2007	306	7.328	1.5	4.302	0.81	1.021	0.21	1.345	0.25	69	23	32.391	5.72
2008	306	10.397	3.06	3.679	0.79	1.448	0.43	1.151	0.25	50	16	63.42	16.88
2009	336	4.089	1.09	1.877	0.41	0.57	0.15	0.587	0.13	56	17	24.536	5.86
2010	336	1.866	0.43	1.019	0.23	0.26	0.06	0.319	0.07	45	13	13.933	2.62
2011	336	5.304	1.34	1.734	0.46	0.739	0.19	0.542	0.14	40	12	44.55	9.19
2012	336	3.214	1.11	0.96	0.22	0.448	0.15	0.3	0.07	48	14	22.5	7.19
2013	295	2.273	0.47	1.086	0.22	0.317	0.07	0.34	0.07	55	19	12.109	2.05
2014	306	4.775	1.4	9.329	1.55	0.665	0.2	0.628	0.15	50	16	29.22	7.75

Rebuilding for the Hogfish stock in the South/Southeast Florida region

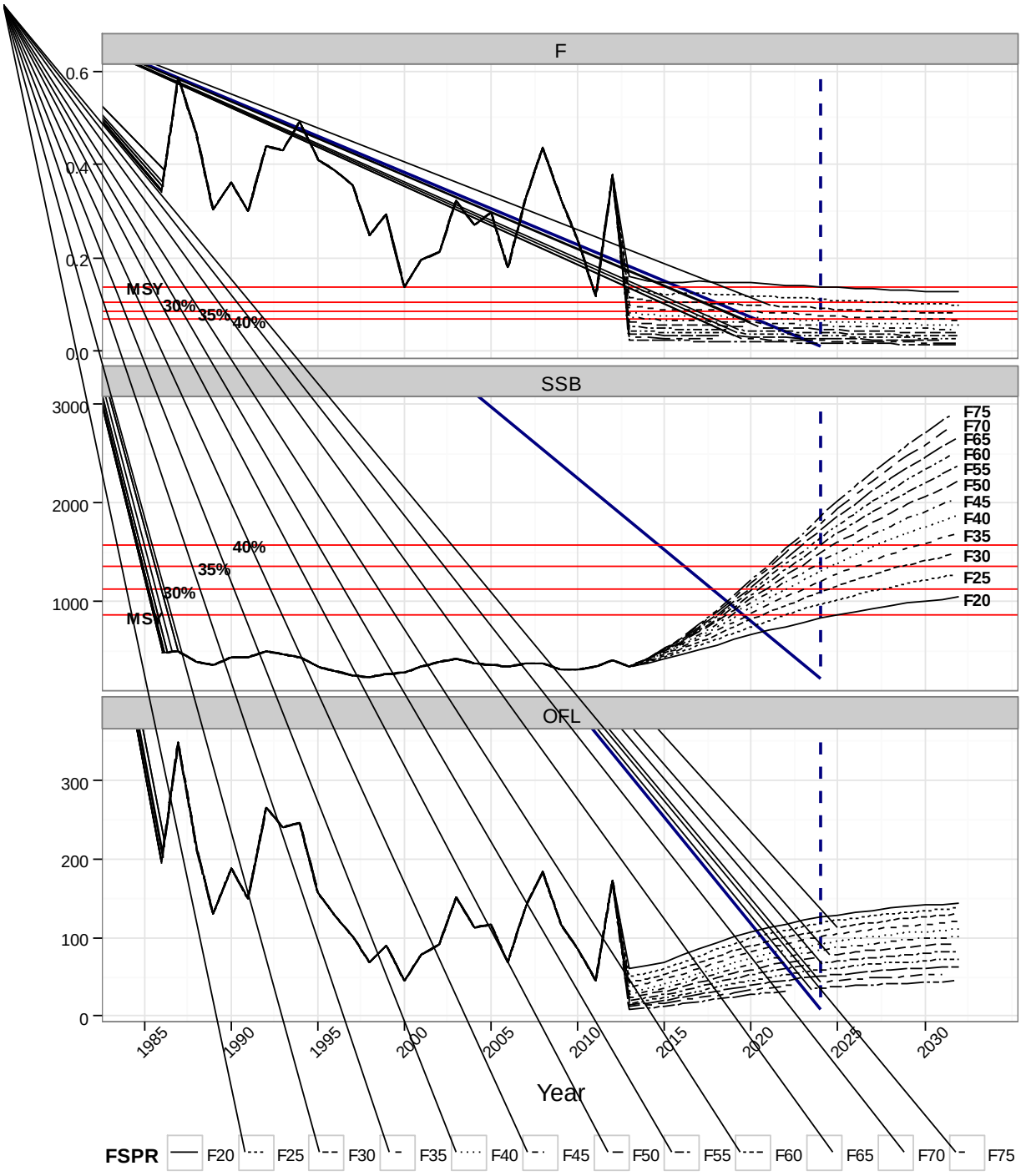
The FLK/EFL stock from the Hogfish stock assessment (SEDAR 37) was the only one found to be strongly overfished across all possible reference point combinations. Therefore, model runs were performed to determine the fishing intensities associated with rebuilding the stock within 10 years. Since the preferred reference point is currently unknown, multiple reference points (RPs) are presented for comparison (F_{MSY}, $F_{30\%}$, $F_{35\%}$, $F_{40\%}$). In addition, management buffers to decrement the catch target from the overfishing limit will have a direct impact on the rebuilding status; therefore, this analysis assumes that the catch target is set to 0.75 fishing limit, often treated as F_{OY} (F_{OY} =0.75* F_{Limit}). Due to this choice of the buffer, this analysis should be viewed as exploratory until guidance is provided by management on the appropriate buffer level and RP to use for the final analyses. Given the unknown status of the preferred RPs and management buffer, only deterministic base model runs are provided here, since a full factorial exploration of RPs and buffers using uncertainty approaches (i.e., bootstrap or MCMC) would take an unrealistic computing time to complete.

Note that Stock Synthesis (SS) treats the spawning potential ratio (SPR) as the most accurate estimate of fishing intensity and therefore conducts forecasts to maintain a constant SPR. As a result, the rebuilding analysis was done by holding SPR constant instead of F, as it is not possible, to the author's knowledge, to fix a constant F in a SS model forecast. For this analysis, the FLK/EFL stock model was forecast at a constant SPR for SPR values of every 5% increment from 20% to 75%. The SSB/MSST for each of the four possible reference points (F_{MSY}, $F_{30\%}$, $F_{35\%}$, $F_{40\%}$) was then computed at the ten year forecast mark to determine the stock status given these alternative fishing intensities.

Tables 1-4 present the SSB/MSST ratios for each of the fishing intensities and reference points. Table 5 presents the F rates associated with each of theSPR-based fishing intensities. The F and SSB relative to the reference points, in addition to the forecast OFLs, are shown in Figure 1. The fishing intensity levels in terms of SPR that achieved recovery of the stocks within ten years (using 2024 as recovery year), were 25%, 35%, 45%, and 55% when using reference points of F_{MSY}, $F_{30\%}$, $F_{35\%}$, $F_{40\%}$, respectively. These SPR fishing intensities equated to a mean fishing exploitation rate of 0.12, 0.085, 0.062, and 0.045, respectively, for the years 2014-2024.

Figures

Figure 1. F, SSB, and OFL projections for the twelve alternative fishing intensities. The reference points are shown as the solid red lines.



Tables

Table 1. Yearly projected SSB/MSST ratios using MSY as the reference point at twelve fishing intensity levels. Green represents a recovered stock. See Table 5 for the exploitation rates that correspond to the fishing intensities.

Year	F20	F25	F30	F35	F40	F45	F50	F55	F60	F65	F70	F75
2012	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
2013	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
2014	0.44	0.45	0.46	0.46	0.47	0.47	0.48	0.48	0.48	0.49	0.49	0.49
2015	0.48	0.51	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60	0.60	0.61
2016	0.54	0.58	0.60	0.63	0.65	0.67	0.68	0.70	0.71	0.72	0.73	0.74
2017	0.60	0.65	0.69	0.72	0.75	0.78	0.80	0.82	0.84	0.86	0.88	0.90
2018	0.66	0.72	0.78	0.82	0.86	0.90	0.93	0.96	0.99	1.01	1.04	1.06
2019	0.71	0.80	0.87	0.92	0.98	1.02	1.06	1.10	1.14	1.17	1.21	1.24
2020	0.77	0.87	0.95	1.03	1.09	1.15	1.20	1.25	1.30	1.34	1.38	1.42
2021	0.82	0.94	1.04	1.13	1.20	1.27	1.34	1.40	1.45	1.51	1.56	1.61
2022	0.87	1.01	1.12	1.22	1.31	1.40	1.47	1.55	1.61	1.68	1.74	1.79
2023	0.92	1.07	1.20	1.32	1.42	1.52	1.61	1.69	1.77	1.85	1.92	1.98
2024	0.96	1.13	1.28	1.41	1.53	1.64	1.74	1.84	1.93	2.01	2.09	2.17
2025	1.01	1.19	1.35	1.50	1.63	1.75	1.87	1.97	2.08	2.17	2.27	2.35
2026	1.04	1.24	1.42	1.58	1.72	1.86	1.99	2.11	2.22	2.33	2.43	2.53
2027	1.08	1.29	1.48	1.66	1.81	1.96	2.10	2.23	2.36	2.48	2.59	2.70
2028	1.11	1.34	1.54	1.73	1.90	2.06	2.21	2.35	2.49	2.62	2.75	2.87
2029	1.14	1.38	1.60	1.80	1.98	2.15	2.31	2.47	2.62	2.76	2.89	3.02
2030	1.17	1.42	1.65	1.86	2.05	2.24	2.41	2.58	2.73	2.88	3.03	3.17
2031	1.20	1.46	1.70	1.92	2.12	2.32	2.50	2.68	2.84	3.01	3.16	3.31
2032	1.22	1.49	1.74	1.97	2.19	2.39	2.58	2.77	2.95	3.12	3.28	3.44

Table 2. Yearly projected SSB/MSST ratios using a 30% SPR as the reference point at twelve fishing intensity levels. Green represents a recovered stock. See Table 5 for the exploitation rates that correspond to the fishing intensities.

Year	F20	F25	F30	F35	F40	F45	F50	F55	F60	F65	F70	F75
2012	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
2013	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
2014	0.33	0.34	0.35	0.35	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.38
2015	0.37	0.39	0.40	0.41	0.42	0.43	0.44	0.44	0.45	0.45	0.46	0.46
2016	0.41	0.44	0.46	0.48	0.49	0.51	0.52	0.53	0.54	0.55	0.56	0.57
2017	0.46	0.49	0.52	0.55	0.57	0.59	0.61	0.63	0.64	0.66	0.67	0.68
2018	0.50	0.55	0.59	0.63	0.66	0.68	0.71	0.73	0.75	0.77	0.79	0.81
2019	0.54	0.61	0.66	0.70	0.74	0.78	0.81	0.84	0.87	0.89	0.92	0.94
2020	0.59	0.66	0.73	0.78	0.83	0.87	0.91	0.95	0.99	1.02	1.05	1.08
2021	0.63	0.72	0.79	0.86	0.92	0.97	1.02	1.07	1.11	1.15	1.19	1.22
2022	0.66	0.77	0.85	0.93	1.00	1.06	1.12	1.18	1.23	1.28	1.32	1.37
2023	0.70	0.82	0.92	1.00	1.08	1.16	1.23	1.29	1.35	1.41	1.46	1.51
2024	0.73	0.86	0.97	1.07	1.16	1.25	1.32	1.40	1.47	1.53	1.59	1.65
2025	0.77	0.91	1.03	1.14	1.24	1.33	1.42	1.50	1.58	1.65	1.73	1.79
2026	0.79	0.95	1.08	1.20	1.31	1.42	1.51	1.60	1.69	1.77	1.85	1.93
2027	0.82	0.98	1.13	1.26	1.38	1.49	1.60	1.70	1.80	1.89	1.98	2.06
2028	0.85	1.02	1.18	1.32	1.45	1.57	1.68	1.79	1.90	2.00	2.09	2.18
2029	0.87	1.05	1.22	1.37	1.51	1.64	1.76	1.88	1.99	2.10	2.20	2.30
2030	0.89	1.08	1.26	1.42	1.56	1.70	1.84	1.96	2.08	2.20	2.31	2.42
2031	0.91	1.11	1.29	1.46	1.62	1.77	1.90	2.04	2.17	2.29	2.41	2.52
2032	0.93	1.14	1.33	1.50	1.67	1.82	1.97	2.11	2.24	2.37	2.50	2.62

Table 3. Yearly projected SSB/MSST ratios using a 35% SPR as the reference point at twelve fishing intensity levels. Green represents a recovered stock. See Table 5 for the exploitation rates that correspond to the fishing intensities.

Year	F20	F25	F30	F35	F40	F45	F50	F55	F60	F65	F70	F75
2012	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
2013	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2014	0.28	0.28	0.29	0.29	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31
2015	0.31	0.32	0.33	0.34	0.35	0.36	0.36	0.37	0.37	0.38	0.38	0.39
2016	0.34	0.36	0.38	0.40	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.47
2017	0.38	0.41	0.44	0.46	0.48	0.49	0.51	0.52	0.54	0.55	0.56	0.57
2018	0.42	0.46	0.49	0.52	0.55	0.57	0.59	0.61	0.63	0.64	0.66	0.67
2019	0.45	0.51	0.55	0.59	0.62	0.65	0.68	0.70	0.72	0.74	0.76	0.78
2020	0.49	0.55	0.60	0.65	0.69	0.73	0.76	0.79	0.82	0.85	0.87	0.90
2021	0.52	0.60	0.66	0.71	0.76	0.81	0.85	0.89	0.92	0.96	0.99	1.02
2022	0.55	0.64	0.71	0.78	0.83	0.89	0.94	0.98	1.02	1.06	1.10	1.14
2023	0.58	0.68	0.76	0.84	0.90	0.96	1.02	1.07	1.12	1.17	1.22	1.26
2024	0.61	0.72	0.81	0.89	0.97	1.04	1.10	1.16	1.22	1.28	1.33	1.38
2025	0.64	0.75	0.86	0.95	1.03	1.11	1.18	1.25	1.32	1.38	1.44	1.49
2026	0.66	0.79	0.90	1.00	1.09	1.18	1.26	1.34	1.41	1.48	1.54	1.61
2027	0.68	0.82	0.94	1.05	1.15	1.24	1.33	1.42	1.50	1.57	1.64	1.71
2028	0.71	0.85	0.98	1.10	1.20	1.31	1.40	1.49	1.58	1.66	1.74	1.82
2029	0.72	0.88	1.01	1.14	1.26	1.36	1.47	1.57	1.66	1.75	1.83	1.92
2030	0.74	0.90	1.05	1.18	1.30	1.42	1.53	1.63	1.73	1.83	1.92	2.01
2031	0.76	0.93	1.08	1.22	1.35	1.47	1.59	1.70	1.80	1.91	2.00	2.10
2032	0.77	0.95	1.10	1.25	1.39	1.52	1.64	1.76	1.87	1.98	2.08	2.18

Table 4. Yearly projected SSB/MSST ratios using a 40% SPR as the reference point at twelve fishing intensity levels. Green represents a recovered stock. See Table 5 for the exploitation rates that correspond to the fishing intensities.

Year	F20	F25	F30	F35	F40	F45	F50	F55	F60	F65	F70	F75
2013	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
2014	0.24	0.24	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.27	0.27
2015	0.26	0.28	0.29	0.29	0.30	0.31	0.31	0.32	0.32	0.32	0.33	0.33
2016	0.29	0.31	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.39	0.40	0.40
2017	0.32	0.35	0.37	0.39	0.41	0.42	0.44	0.45	0.46	0.47	0.48	0.49
2018	0.36	0.39	0.42	0.45	0.47	0.49	0.51	0.52	0.54	0.55	0.56	0.58
2019	0.39	0.43	0.47	0.50	0.53	0.56	0.58	0.60	0.62	0.64	0.65	0.67
2020	0.42	0.47	0.52	0.56	0.59	0.62	0.65	0.68	0.70	0.73	0.75	0.77
2021	0.45	0.51	0.56	0.61	0.65	0.69	0.73	0.76	0.79	0.82	0.85	0.87
2022	0.47	0.55	0.61	0.66	0.71	0.76	0.80	0.84	0.88	0.91	0.94	0.97
2023	0.50	0.58	0.65	0.72	0.77	0.83	0.87	0.92	0.96	1.00	1.04	1.08
2024	0.52	0.61	0.69	0.77	0.83	0.89	0.94	1.00	1.05	1.09	1.14	1.18
2025	0.55	0.65	0.73	0.81	0.88	0.95	1.01	1.07	1.13	1.18	1.23	1.28
2026	0.57	0.68	0.77	0.86	0.94	1.01	1.08	1.14	1.21	1.27	1.32	1.38
2027	0.59	0.70	0.81	0.90	0.99	1.07	1.14	1.21	1.28	1.35	1.41	1.47
2028	0.60	0.73	0.84	0.94	1.03	1.12	1.20	1.28	1.35	1.42	1.49	1.56
2029	0.62	0.75	0.87	0.98	1.08	1.17	1.26	1.34	1.42	1.50	1.57	1.64
2030	0.64	0.77	0.90	1.01	1.12	1.22	1.31	1.40	1.48	1.57	1.65	1.72
2031	0.65	0.79	0.92	1.04	1.15	1.26	1.36	1.45	1.54	1.63	1.72	1.80
2032	0.66	0.81	0.95	1.07	1.19	1.30	1.40	1.50	1.60	1.69	1.78	1.87

Table 5. Exploitation rates associated with each fishing intensity value.

Year	F20	F25	F30	F35	F40	F45	F50	F55	F60	F65	F70	F75
2013	0.161	0.134	0.114	0.097	0.084	0.072	0.062	0.053	0.045	0.038	0.031	0.025
2014	0.151	0.126	0.107	0.092	0.079	0.068	0.059	0.050	0.043	0.036	0.030	0.024
2015	0.148	0.123	0.104	0.089	0.077	0.066	0.057	0.049	0.041	0.035	0.029	0.023
2016	0.149	0.123	0.104	0.089	0.076	0.066	0.056	0.048	0.041	0.034	0.028	0.023
2017	0.149	0.123	0.104	0.089	0.076	0.065	0.056	0.048	0.040	0.034	0.028	0.022
2018	0.149	0.123	0.103	0.088	0.075	0.064	0.055	0.047	0.040	0.033	0.027	0.022
2019	0.148	0.121	0.102	0.086	0.074	0.063	0.054	0.046	0.039	0.032	0.027	0.021
2020	0.146	0.119	0.100	0.085	0.072	0.062	0.053	0.045	0.038	0.032	0.026	0.021
2021	0.144	0.118	0.098	0.083	0.071	0.060	0.051	0.044	0.037	0.031	0.025	0.020
2022	0.142	0.115	0.096	0.081	0.069	0.059	0.050	0.042	0.036	0.030	0.024	0.019
2023	0.140	0.113	0.094	0.079	0.067	0.057	0.049	0.041	0.035	0.029	0.023	0.019
2024	0.138	0.112	0.092	0.077	0.066	0.056	0.047	0.040	0.034	0.028	0.023	0.018
2025	0.136	0.110	0.091	0.076	0.064	0.054	0.046	0.039	0.033	0.027	0.022	0.018
2026	0.135	0.108	0.089	0.074	0.063	0.053	0.045	0.038	0.032	0.026	0.021	0.017
2027	0.133	0.106	0.087	0.073	0.061	0.052	0.044	0.037	0.031	0.025	0.021	0.016
2028	0.132	0.105	0.086	0.071	0.060	0.051	0.043	0.036	0.030	0.025	0.020	0.016
2029	0.130	0.103	0.085	0.070	0.059	0.050	0.042	0.035	0.029	0.024	0.020	0.016
2030	0.129	0.102	0.083	0.069	0.058	0.049	0.041	0.034	0.029	0.024	0.019	0.015
2031	0.128	0.101	0.082	0.068	0.057	0.048	0.040	0.034	0.028	0.023	0.019	0.015
2032	0.127	0.100	0.081	0.067	0.056	0.047	0.040	0.033	0.028	0.023	0.018	0.015