SOUTH ATLANTIC FISHERY MANAGMENT COUNCIL

Wreckfish Stock Assessment

Peer Review

March 17 - 18, 2014

Dates

This Wreckfish Assessment Review was conducted via a series of webinars on March 17 and 18, 2014.

Participants

Review Panel (RP) members:
Marcel Reichert (SC-DNR and SAFMC SSC, RP Co-Chair), George Sedberry (NOAA and SAFMC SSC, RP Co-Chair), Steve Cadrin (School for Marine Science and Technology, Univ. Mass. and SAFMC SSC), Luiz Barbieri (Florida Fish & Wildlife Conservation Commission and SAFMC SSC), and Lew Coggins (NOAA Fisheries - SEFSC)

SAFMC staff:
John Carmichael and Mike Errigo

Assessment Team:
Dr. Rebecca Rademeyer and Dr. Doug Butterworth (Marine Resource Assessment and Management Group, Department of Mathematics and Applied Mathematics, University of Cape Town)

Observers:
Rusty Hudson (Directed Sustainable Fisheries, Inc.), Angela Boehm (Boehm Seafood), Jim Freeman (Wreckfish Fisherman), Doug Vaughn (SAFMC SSC), Julia Byrd (SEDAR), Ken stump (TOF/PCT), and Scott Crosson (SEFSC and SAFMC SSC)

Document List

A1_WreckfishProposal.pdf
A2_SSCWreckfishAssessProposalReviewReport.pdf
A3-SAFMCSSCPeerReviewProcess2013.pdf
A4-WreckfishSCAAOctober2012.pdf
A5-WreckfishSCAAruns.pdf
A6-ABCContRuleRevise1111.pdf
A7_WreckfishRunsOctober2013.pdf
A8-sensitivitiesreviewed.pdf
A9_wreckfishgrowthoptions.pdf
A10_WreckfishLandingsTrend.pdf
A11-WreckfishGrowthVariation.pdf
A11_WreckfishModelforSSC.pdf
A12_Wyanskiagegrowth.pdf
A13-WreckfishMaturityfemales.pdf
A14_SSC_WreckfishAWReport_Final.pdf
A15_WreckfishAssessment_ForPeerReview.pdf
A16_WreckfishCommentsFinal.pdf

Common acronyms used in this report
(see assessment report for model specific acronyms, parameters or abbreviation)

ABC	Allowable Biological Catch
DCAC	Depletion-Corrected Average Catch (assessment method for data poor stocks)
OFL	OverFishing Level
F_{msy}	Fishing mortality at Maximum Sustainable Yield
M	Natural mortality
MSY	Maximum Sustainable Yield
RC	Reference Case, which in other assessments this is normally called the Base Run.
RP	Review RP
SPR	Spawning Potential Ratio
SSC	Scientific and Statistical Committee of the South Atlantic Fisheries Management Council
TOR	Terms of Reference

INTRODUCTION

John Carmichael, Marcel Reichert, and George Sedberry opened the series of review webinars for the Wreckfish assessment at 9:05am on March 17, 2014 by welcoming everyone to the meeting and by providing a brief overview of the procedures, schedules, and expected accomplishments. John reminded participants that the meeting schedule would be flexible and depended on progress and RP decisions, and also that the meeting was broadcasted and recorded. A brief round of introductions followed.

Agenda

The agenda was approved by the RP with no changes.

Public comments

Written comment
One written comment was received from Dr. Alec MacCall which was addressed by the RP (see below).

Verbal comments
Mr. Rusty Hudson thanked all participants for their work and input.

ASSESSMENT DISCUSSIONS

Dr. Butterworth provided an overview of the assessment and walked the RP through the assessment report. Based on this overview and the discussions that followed, the RP requested several additional runs and additional information (see below). Dr. Butterworth and Dr. Rademeyer to provide all requested model runs and information during the webinars series.

Requested additional analyses

1 Provide a model run using a "broken" growth curve.

There was some discussion about the "unrealistic" lower part of the growth curve. This is not uncommon in cases where this is a lack of age data for the smaller fish. After examining the length-at-age data from Adam Lytton's MS thesis (see Appendix A), the RP felt more comfortable with the selected "best fit" growth model choice. However, the RP requested the assessment team to explore a run with a "broken" growth model, using the Von Bertalanffy parameters with a T_o fixed at 0.5 for ages 0-5 and the "best fit" of the parameters for ages 5 and up.

The RP concluded that the model outcome did not change significantly and did not change stock status. Furthermore, it did not affect the fish in the size range relevant to the fishery.

2 Investigate the variability of the length at age.

The RP was interested in how the length composition informed the RC model considering that there appeared to be little contrast in the composition data through time possibly implying little information content. The RP discussed the nature of the chosen SD around the size-at-age. The RC was based on a varying SD of size-at-age and the RP requested a sensitivity run using a fixed SD.

The results indicated that the model preformed worse under a fixed SD. Additional discussions proposed that a realistic measure of variability of size-at-age could be used in the model based on information provided in Mr. Lytton's thesis. The Assessment Team agreed to investigate this and the requested SDs of age-at-length were provided by Mr. Lytton (see Appendix B). The results of the new models runs are discussed below under 6.

3 Model run with two selectivity blocks (1988-1999 and 2000-2010)

The RC model had a residual pattern for predicted catch at length in the early part of the assessment series (1988-1999) in which the model overestimated catch of small fish (30-32cm), underestimated catch of medium-sized fish (34-40cm) and overestimated catch of large fish (42-50cm). An alternative model configuration was requested to explore the pattern of historical catch at length residuals in the reference case. The RP requested a revised configuration that allowed two selectivity periods (1988-1999 and 2000-2010), using the same estimation approach for selectivity within the two periods as in the reference case. The alternative configuration produced similar results and the same residual pattern. Therefore, further iterations of modeling historical selectivity are needed to resolve the apparent problem. Ideally changes in selectivity should be based on information from management changes or changes in fishing practices. The problem was

not considered to be major for assessing current conditions, because the most recent years (2000-2010) did not have a residual pattern.

4 Address likelihood profile over M

In his overview, Dr. Butterworth indicated that the length composition most informed the model estimate of natural mortality and pointed to Table 2, 2a-2c, runs with a fixed M and the effect on the over-all outcome.

The RP agreed that the overall log-likelihood changed with different values of M, but pointed out that the log-likelihood value associated with the length composition data changed very little and that most of log-likelihood change was associated with the index data. This discussion ultimately prompted a request for likelihood profiling over M, with different assumed weights on the length composition data.

The RP was interested to better understand which assessment model parameters were most informed by the length composition data. When questioned on this topic, the analysts replied that the length composition data were most influential on the estimate of natural mortality rate (M). To further inform this question, the RP requested to construct log-likelihood profiles over a range of M values for both the RC configuration and sensitivity run S8c. These two configurations spanned the range of consideration of the length composition data by the available assessment model configurations.

The requested model runs were provided to the RP by the assessment team and the results generally indicated that the length composition data was relatively uninformative for M and that regardless of the model configuration, M was informed predominantly by the index data (See Figure in updated Assessment Report). Furthermore, the length composition data weakly suggested that M was higher than implied by the index data, a finding that the analysts suggested may be related to a decline in gear selectivity by the oldest/largest fish.

5 List of parameters and corrections of the appendix

During the discussions the Assessment Team realized that some information pertaining to the model equations and parameters was missing in the report and that a few corrections were needed. The RP requested that the assessment team provide a list of parameters, parameters choices, and corrections, and add that to the next version of the report (See Table * in updated Assessment report).

The RP was satisfied with the provided information, which clarified issues and answered RP questions.

6 Run the RC using the SD of the determined variability of size at age as provided by Mr. Lytton (see Appendix B)

Mr. Adam Lytton provided the statistical information for the age at length data to the Assessment Team.

7 Provide projections under various F projections

The RP discussed the provided projections in the assessment report and the presentation by Dr. Butterworth and felt it needed to consider a projection at Fmsy. This was requested and provided by the assessment RP (see below). There was some discussion as to the extent of the requested analyses. The RP decided to request projections at Fmsy only.

The Assessment team provided a series of projections under Constant Catch versus Fmsy under the RC. The RP felt that the provided analyses could be the default basis for OFL and ABC recommendations, but further discussions based on options in Table 1 will be held at the full SSC meeting.

After finalizing the RP discussions, Dr. Butterworth and Dr. Rademeyer agreed to update the assessment report with the corrected information and include the additional runs that were requested by the RP.

Discussion of the written comments by Dr. Alec MacCall
(See document A16 in Briefing Materials)

All of the comments by Dr. MacCall were considered by the RP and addressed in the assessment.

- Comments about the age bins: The RP concluded that the plus group includes ages older than 35, so there is not a cut-off, but an inclusion. Furthermore, Wreckfish maximum age is well under 100 years. Based on the length at age data, the RP concluded that an age plus group of 70+ would probably not result in significant improvements in the model. The RP recommended no additional models requests to Dr. Butterworth and Dr. Rademeyer based on this comment.
  - Comment of stock-recruitment: The RP felt that this issue was addressed by the review team (see Fig. 15 and corresponding table and the model outcomes were discussed.
- Comment on reproduction: The RP pointed out that the stock does reproduce and the ogive is based on data from the stock under review. The RP was much more comfortable using empirical observations of wreckfish life history than theoretical expectations from long-lived fishes.
- Comment on size/age emigration: The RP discussed that this issue could potentially be modeled, but based on the available information felt that it would not result in a noticeable improvement in the assessment. Dr. Sedberry reminded the RP of Mr. Paul Reiss's observations regarding seasonal (re)occurrence of larger fish that have yet to be explained.

TERMS OF REFERENCE

Note that the TORs were discussed in two parts. The RP briefly discussed general aspects of the TOR on March 17 based on the available report and discussions that day. On March 18, the RP detailed the conclusions and finalized the recommendations. The discussions were combined in this report for brevity and consistency.

1. Consider the strengths and weaknesses of data sources.

The RP concluded that the assessment team used the best available data and the report and subsequent follow-up work provides the information the RP needed.

Strengths were that the new age data and the growth model parameter estimates from Adam Lytton's recently completed MS thesis (Lytton 2014) resolved some conflicts in earlier modeling efforts. A significant weakness is that the model could be improved if recent (confidential) landings data would be available. Note that these data were not available to the assessment team. The RP recommended that SSC should discuss the implications of this for future assessments. Involved fishermen (e.g. Jim Freeman and Paul Reiss) have indicated that they would have no problem making these data available (see follow-up discussion under TOR 6b). Dr. Cadrin reminded the RP that according to Magnuson Act (Section 402(b)): Nothing in [the confidentiality of information] subsection shall be interpreted or construed to prevent the use for conservation and management purposes by the Secretary, or with the approval of the Secretary... of any information submitted in compliance with any requirement or regulation under this Act. This assessment and discussions on this topic prior to this assessment, including those relative the DCAC illustrate that the Wreckfish is a case where knowledge of the landing is essential for conservation and management. Furthermore, the industry has indicated on various occasions (e.g. comments by Mr. Freeman, an observer to this assessment) that the (current) industry participants on this fishery have no objections against providing these landings data. One complication is that several prior participants (license holder have deceased).

The RP felt that for a better understanding it would be good to provide additional information on the life history and fishery that was not included in the assessment report. As much of this information is captured in Adam Lytton's thesis, the RP recommended to add a reference to that information.

Address the following:

a) Are data decisions documented, consistent with the initial proposal and working group recommendations (or any deviations documented), and are they sound and robust?

b) Are data uncertainties acknowledged, reported, and within normal or expected levels?

c) Are data applied properly within the assessment model?

d) Are input data series reliable and sufficient to support the assessment approach and findings?

The RP felt that the answer to questions 1) a-d was yes, based on the information in the assessment report and the interaction between the assessment team, the SSC, and others during the assessment process.

2. Evaluate the methods used to assess the stock, considering strengths and weaknesses of the approach and taking into account the available data.

There was some discussion as to the level of information in the CPUE data series to allow for a credible estimate of MSY in the production models. The RP believed that an estimate of MSY was possible given different values of mu, but that there was not much guidance from the data itself and perhaps insufficient for a credible estimate of steepness (h). Fixing h at 0.75 was not considered unreasonable, but the RP would like to investigate what the SPR level was that corresponds to that h and start treating reference points from a proxy perspective. Dr. Butterworth pointed to Table 2, the runs with estimates of steepness and their effects on the model outcome. The RP was concerned about the evaluation of the sustainability of higher catch levels with such an uncertain estimate of OFL. This would have been alleviated if the production models had come up with better results. The RP also had concerns that there may not have been sufficient information (in the model) to move away from the earlier employed DCAC ABC recommendation. However, given the information the

RP concluded that OFL is uncertain, but credible. The RP recognized that there may not be enough information for MSY=OFL, but the current information is sufficient for a catch level recommendation (i.e., ABC) until a more informed assessment is available.

The RP felts that given the data limitations, the methods were appropriate and the reference case or base run is the most appropriate model configuration. The strength of the statistical catch-at-length model over previous assessment approaches for Wreckfish (e.g., recent average catch, DCAC) is that it integrates all available information (catch series, size distributions, growth estimates, catch rates and general life history). Despite the advancement in scientific basis for management represented by the reference case model, this assessment remains a data-limited application and substantial uncertainties should be considered in management advice.

a) Are methods scientifically sound and robust, and consistent with the initial proposal and working group recommendations (or any deviations documented)?
b) Are assessment models configured properly and used consistent with standard practices?
c) Are the methods appropriate for the available data?

The RP discussed that the SSC should consider this assessment for what it is: data-limited. SAFMC manages many data-limited fisheries, and we have an explicit category in our P* rubric for fixing h (1b. quantitative assessment with proxy). Several recent papers show that fixing h is equivalent to assuming a SPR proxy for Fmsy. This choice is consistent with previous approaches, as long as the prior on h or fixed value for h or % SPR are reasonable for the species and fishery.

The RP concluded that this assessment provided a credible, but uncertain estimate of OFL. With the exception of the Ricker alternatives, each model configuration (and alternative models) provides a range of uncertainty that is similar to the confidence limits of the reference case. Given this, the RP concluded that it has what it needs to recommend a precautionary ABC.

It was suggested that the RP expresses the approach and uncertainty in the P* categorization (e.g., low/moderate tiers for assessment information, uncertainty, stock status, etc. See below under RP recommendations for P*).

The RP concluded that given the data limitations, the answer to 2) a-c is yes. The RC was properly configured and methods are consistent with standard practices, and are sound and robust. The assessment included 33 sensitivity runs. In addition the assessment team provided several additional analyses and additional information upon request of the RP.

3. Evaluate the assessment findings with respect to the following:
a) Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support status inferences?

The RP had considerable discussion, but given the data the answer is yes. Based on the RP discussion of the assessment report, and the presentations, additional model runs, and other information provided by the Assessment Team, the RP felt that the assessment represented the best available science, appropriately used the best available data, and provided information sufficient for management recommendations. The RP considered the RC the best available/most plausible "state of nature" that can result in a recommendation of an ABC based on an Fmsy related OFL.

The RC model fits all available information reasonably well, but the available data and information on the fishery and resource are limited. Therefore the results are uncertain, but are the best information available for fishery management.

b) Is the stock overfished? What information helps you reach this conclusion?

c) Is the stock undergoing overfishing? What information helps you reach this conclusion?

The RP felt that the data and model provided sufficient information to indicate that the stock is not overfished and overfishing is not occurring. However, there were two plausible sensitivity runs (the two sensitivity analyses that assumed a Ricker stock-recruitment function) indicate the possibility of overfishing (Table 4 of the assessment report shows F>Fmsy for the two Ricker runs, but B=90%Bmsy). Therefore, results from the most likely model and most other analyses suggest that the stock is not overfished and overfishing is not occurring, but that conclusion is conditional on the assumed form of the stock-recruitment relationship and should be considered to be uncertain

d) Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?

The RP concluded that the stock recruitment curve lacked information based on fixed steepness (h=0.75). The Ricker S-R model imposes a different steepness. As the model is unable to estimate steepness, a proxy is essentially used. When the steepness is constrained (with a prior) or fixed, the resulting stock/recruit relationship may not be realistic. The RP agreed that this situation is relatively common for data-limited stocks, but that this lack of information requires some conservative considerations, because it informs us about the uncertainty in setting the OFL. The RP also noted that this is not inconsistent with approaches used for assessment of other data limited stock.

e) Are the quantitative estimates of the status determination criteria for this stock reliable? If not, are there other indicators that may be used to inform managers about stock trends and conditions?

The RP concluded that the estimates were reliable, because CPUE and length frequency data were available and appropriately used. There are probably no other indicators, and a size based model integrates the available indicators and is probably the most appropriate. The use of CPUE, length frequencies, life history knowledge, and fishery history make these criteria in combination adequate, but the RP noted that no individual criterion can determine stock status. There is some uncertainty in production (see 3d), but there were reliable estimates of status determination from CPUE, life history, and length frequency.

4. Evaluate the stock projections, considering the strengths and weaknesses of approaches and available information.

The RP discussions relative to TOR 4 were similar to those of TOR 3.

Consider the following:

a) Are the methods consistent with accepted practices and available data? YES

b) Are the methods appropriate for the assessment model and outputs? YES

c) Are the results informative and robust, and useful to support inferences of probable future conditions?

The RP concluded that the answer to 4) a-c was yes, but discussed how robust the conclusions were (see also TOR 3). Not all catch projections in Fig. 20 are robust and some scenarios indicate overfishing and the projections are sensitive to stock recruit function steepness, Ricker, and M. As a result, the RP considered that the projections were not entirely robust with regard to some of the assumptions in the RC. Catch projections from the wide range of model configurations shows that there is considerable among-model variation, and stochastic projection from the reference case does not account for all sources of uncertainty. The approach used by the Council's tiered ABC control rule allows for assessments that do not account for all sources of uncertainty.

d) Are key uncertainties acknowledged, discussed, and reflected in the projection results?

The RP concluded that not all sources of uncertainty are accounted for. The assessment as a whole addresses uncertainties, but not each sensitivity run. Some of the major uncertainties are captured, but not all of them, and the RP concluded that more caution was needed. The additional runs provided further information, but a considerable uncertainty level remained. As not all sources of uncertainty were included, this will have to be taken into account in the ABC recommendation. The Council's ABC control rule allows for such situations, but the SSC and Council should also consider information from multiple models in management decisions.

5. Consider how uncertainties in the assessment, and their potential consequences, are addressed. They are addressed.

The RP recognized that the nominal precision estimates (Table 1 in the Assessment Report) do not cover the variability in results from the range of sensitivity analyses and do not capture all sources of uncertainty. However, a more formal consideration of all results would have to confirm that all sensitivity scenarios are plausible. See also discussion under TOR 4.

a) Comment on the degree to which methods used to evaluate uncertainty reflect and capture the significant sources of uncertainty in the population, data sources, and assessment methods.

The RP concluded that within model uncertainties are addressed, but the sensitivity runs address the considerable among model uncertainty. The implications of these uncertainties were discussed with the assessment team. The length-based and production models provide a more accurate measure of uncertainties than the within-model precision estimates in Table 1 of the Assessment Report. There are ways of dealing with among model uncertainties, but the RP felt that this was well beyond the scope of this panel or the SSC, and a full SEDAR process should address availability among plausible models.

b) Ensure that the implications of uncertainty in technical conclusions are clearly stated.

The RP felt that measures of uncertainty were sufficiently documented in the assessment report, but the range of results from sensitivity analyses are more informative for evaluating uncertainty than the within-model estimates of precision, and caution should be considered in management.

6. Consider the research recommendations and make any additional recommendations or prioritizations warranted.

a) Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.

The RP made the following recommendations:

- Explore the availability of confidential data to improve the next stock assessment and management (see discussions elsewhere in this report).

- Exploring alternative approaches to modeling historical selectivity, including information from the fishery and management actions that might inform changes in selectivity.

- This was a data-limited assessment and sensitivity analyses indicate some research and monitoring could help addressing uncertainties in the model.

- Sex specific age and growth information may inform the model better. In collaboration with the industry, MARMAP is collecting whole fish to get sex ratio and sex-specific age/growth information and these efforts should be further developed and supported

- Investigate the development of a more reliable standardized CPUE index. Given the nature of the fishery, developing of a fishery independent index is cost-prohibitive and therefore very unlikely. Cooperative research with industry is needed to develop this standardized CPUE.

- There is a need to investigate catchability patterns. This is also something that needs industry input.

b) Provide recommendations on possible ways to improve the stock assessment review process.

The RP agreed that this (external assessment) process has added values and improved scientific basis for evaluation. The most tangible example is the improvement of the ageing process and resulting growth curve that resolved earlier conflicts in the model. The RP felt that the previous DCAC process for Wreckfish was appropriate, but the current assessment represents a considerable and significant improvement. This transition from DCAC to an analytical stock assessment is consistent with the ORCS framework and recommendations.

The SSC review process has improved the assessment and the results will better inform the SSC and Council as to fishing levels and management recommendations. Given the fact that annual full assessments are unlikely given the amount of work and available resources, the Council should consider external assessments through the SSC review. The many process iterations added value, as did the fact that industry, University, MARMAP, SSC, SERO, SAFMC all contributing data and analyses. The RP feels that the current approach is better than the DCAC, but required rigorous peer review provided by the SSC peer review process. The RP acknowledged that the use of industry consultants can potentially be problematic, but this careful process addressed a significant

part of that. The RP felt that this experience should encourage third party process, including a rigorous review.

7. Provide guidance on key improvements in data or modeling approaches which should be considered when scheduling the next assessment.

This TOR was mostly addressed by requesting, and receiving additional model runs, and was addressed in other TORs (see above). If additional data is available, different modeling approaches may be needed, to include sexual dimorphism and how to deal with data and samples from unknown sex.

Given the limited data, the RP felt that this assessment was the best available, but we need to continue following (and possibly guiding) new developments for data-limited situations, and contemporary new approaches to data-limited stock assessments should be considered.

8. Prepare a Peer Review Summary summarizing the RP's evaluation of the stock assessment and addressing each Term of Reference.

A first rough draft of the RP report is expected to be sent to the RP members by March 28. The RP will provide feed-back to the RP chairs by April 4. A draft report will be send to John Carmichael for inclusion into the SSC briefing book by April 9, 2014.

RP ABC control Rule recommendations

To assist the SSC with the review and recommendation, the RP decided to "run through" the ABC control rule for a possible P* recommendation. Steve Cadrin guided the RP through the ABC control rule and based on the assessment discussions, the RP recommended the following scoring to promote discussion, with final recommendations by the full SSC to follow:

I Assessment information 2 (2.5%) or 3 (5%)
This is a data limited stock, but with a certain level of data to possibly justify 3. The SSC may consider 2 as a result of the data gaps. As a result, the RP felt that the score was "below 1 and above 4", and that some further discussion with the full SSC is needed.

II Uncertainty 3 (5%) or 4 (7.5%)
Uncertainties are addressed, but a full analysis of uncertainty is not carried forward with multi-model uncertainty. However, the assessment does provide nominal distributions. The RP felt that further discussion with the full SSC to determine the final score is needed.

III Stock Status 2 (5%)
Most model runs conclude not overfished or overfishing, but some suggest overfishing, adding some uncertainty to the determination. Therefore, the RP felt a score of 2 is appropriate. The RP noted that the Ricker configurations and other model runs are plausible. The score of 2 is therefore based on plausible sensitivity runs.

IV Productivity – Susceptibility 3 (10%)
This score was based on a "high" PSA score as detailed on page 7 in MRAG-PSA report. In addition, this is a data limited stock, further justifying the score.

The resulting overall score (or reduction) was between 22.5% and 27.5%.

Next steps

Dr. Butterworth and Dr. Rademeyer will update the assessment report to included corrections and additional work requested by the RP during the workshop.

The RP decided to move forward with some projections to the full SSC. The current RC and Table 1 will provide sufficient information for this, but there may be a need for additional runs. As the assessment team will need some time to prepare possible additional projections, it was decided that the John Carmichael will to send Dr. Butterworth a list of possible requests prior to the SSC meeting. However, the RP indicated that the full SSC may have additional questions and/or may request additional analyses.

A final draft of the assessment report and the RP report will be available for the briefing book of the full SSC meeting in April, 2014. At that meeting Dr. Butterworth will give a brief overview of the assessment to guide the SSC discussion.

Second Public comment period

The RP provided a second opportunity for public comment at the end of the discussions.
Mr. Rusty Hudson thanked the RP and briefly addressed the confidentiality, and suggested that old trip ticket information may provide useful information. He also mentioned possibly addressing spatial distribution.
Mr. Jim Freeman thanked the workshop participants and offered any help in collecting data and samples where needed. He mentioned that he felt that the Wreckfish fishermen have no problem with providing data or signing waivers if that would help improving the assessments. He addressed the fact that it would be great to have data going back to as far as possible, but some Wreckfish fishery participants have deceased and data and/or waivers to obtain the data may be complicated.

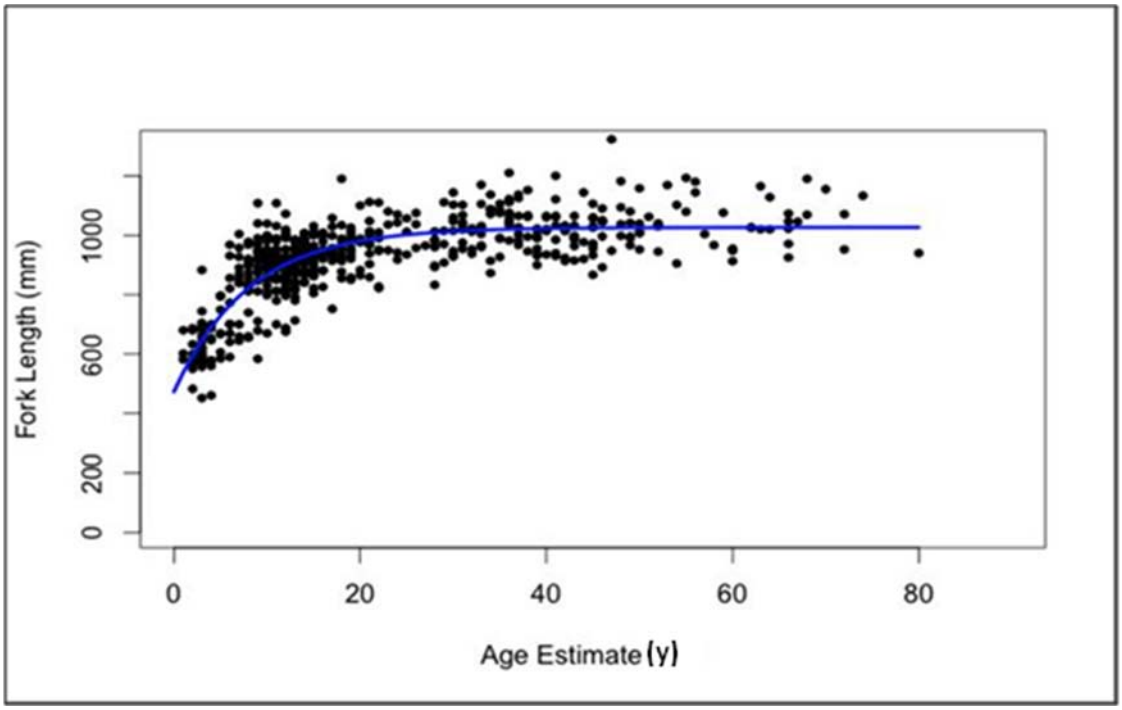
Adjournment

The Chairs thanked the Assessment Team for their work and cooperation during the review, and thanked everyone for their contributions and efforts.

With no further comments, the Wreckfish Assessment Review Webinar adjourned at 4:00pm on March 18, 2014.

Appendix A

Age at length data and Von Bertalanffy growth curve from Lytton (2014).



Appendix B

Variability of age at length data provided to the Assessment team for exploration of the additional runs # 2 and 6 (see text above). Data provided by Adam Lytton based on Lytton (2014).

5 yr Age Bins

Age Bin (yr)	Sample Size	Average FL (mm)	SD of FL
0-4	45	617.6	76.1
5-9	61	826.4	128.1
10-14	160	902.5	70.8
15-19	75	939.0	65.5
20-24	29	975.7	80.7
25-29	19	977.4	68.0
30-34	32	1022.8	73.5
35-39	34	1031.7	73.3
40-49	57	1019.9	79.3
50-59	20	1054.9	83.0
60-69	17	1031.9	78.3
70+	5	1050.2	100.1

Varying Age Bins

Age Bin (yr)	Sample Size	Average FL (mm)	SD of FL
1-3	36	617.5	76.4
4-6	26	695.3	116.9
7-9	44	861.1	116.7
10	33	902.8	69.3
11	24	895.2	85.2
12	44	891.2	77.3
13	31	899.5	66.2
14	28	929.5	46.8
15	28	920.9	56.6
16-18	34	947.7	74.1
19-22	35	962.1	73.5
23-28	22	982.0	65.8
29-33	30	1018.8	67.7
34-38	32	1047.4	76.3
39-43	35	1001.9	63.4
44-48	25	1028.8	97.8
49+	47	1041.8	78.9