CHAIR REPORT ON THE

SEDAR 7 REVIEW WORKSHOP

APRIL 4–7, 2005

NEW ORLEANS, LOUISIANA

Prepared by

Patrick Cordue
Fisheries Consultant
New Zealand

for

University of Miami
Independent System for Peer Review

29 April 2005

EXECUTIVE SUMMARY

The SEDAR 7 Review Workshop for Gulf of Mexico red snapper was held in New Orleans from 4-7 April 2005. The SEDAR process normally involves a Data Workshop, an Assessment Workshop, and a Review Workshop. For red snapper, the process involved two Assessment Workshops and spanned more than 12 months. This was due to the complex nature of the red snapper assessment and because of problems encountered with the original choice of assessment method.

The draft agenda was reasonably closely followed during the meeting. On the first day, the Assessment Team made their main presentations. The morning of the second day saw discussion of, and agreement on, a set of model runs to be done (working towards a milestone in the draft agenda: "identify preferred model configuration"). Over the remainder of the second day, and during the third day, the Review Panel formally addressed their terms of reference. New assessment results were presented by the Assessment Team and discussed by the meeting as they became available. On the last day, the Panel reviewed preliminary drafts of the Consensus Summary Report (prepared by the Panel) and the Advisory Report (prepared by the Assessment Team). Also, further results were presented and discussed when they were available. After the meeting, via email, the Consensus Summary Report was completed by the Panel and the Advisory Report was completed by the Assessment Team.

Two issues of process arose during the meeting. First, there was a conflict between the draft agenda and the Review Panel's instructions. The Panel's written instructions strongly implied a "review only" role, but the draft agenda implied an active role in choosing a base case assessment. The issue was discussed at the meeting and it was concluded that it was better to follow the agenda, even if it lead to a somewhat altered assessment. The alternative appeared to be reconvening the Review Workshop at a later date.

The second issue was that the Advisory Report was not part of the Review Workshop's terms of reference. This was also discussed at the meeting and it was agreed that the Review Panel should provide some guidance to the Assessment Team on the model runs to include in the Advisory Report.

The model run selected by the Review Panel as a base case assessment differed from the assessment presented to the meeting by the Assessment Team. The second Assessment Workshop had agreed to exclude age-0 red snapper from the assessment despite the bycatch of age-0 (and age-1) red snapper in the shrimp fishery. This is valid if density dependent mortality effects are so strong on age-0 snapper that the bycatch from the shrimp fishery is insignificant. The Review Panel did not accept this argument and selected a base case that included age-0 red snapper. The Advisory Report contains an equal number of model runs with and without age-0 red snapper. The Assessment Team included the age-1 snapper runs as they viewed the Advisory Report primarily as a product of the Assessment Workshops. However, they did indicate the Review Panel's strong preference for the age-0 snapper runs.

There is a need to clarify some aspects of the SEDAR process and in particular the role and authority of the Review Workshop. Clarity of the process, to all parties involved, is perhaps more important than the specific details of the process.

INTRODUCTION

The SEDAR 7 Review Workshop (RW) for Gulf of Mexico red snapper was held in New Orleans from 4-7 April 2005. The SEDAR process normally involves a Data Workshop (DW), an Assessment Workshop (AW), and an RW. For red snapper, the process involved two AWs, and spanned more than 12 months. This was due to the complex nature of the red snapper assessment and because of problems encountered with the original choice of assessment method.

SUMMARY OF MEETING

The meeting convened in New Orleans at 8.30 am on 4 April and concluded at 6.30 pm on 7 April. After convening, there were opening remarks from the SEDAR Coordinator and then the draft agenda was briefly considered. There was a minor change with consideration of possible sensitivity runs at the end of the first day. The draft agenda was reasonably closely followed during the meeting (see Appendix 1). The first day was used for presentations by the Assessment Team. The morning of the second day saw discussion of and agreement on a set of model runs to be done (working towards a milestone in the draft agenda: "Identify preferred model configuration"). Over the remainder of the second day, and during the third day, the Review Panel addressed the RW's terms of reference 1–7 (see Appendix 1). New assessment results were presented by the Assessment Team and discussed by the RW as they became available. On the last day, the Panel reviewed preliminary drafts of the Consensus Summary Report (prepared by the Panel) and the Advisory Report (prepared by the Assessment Team). Also, further new results were presented and discussed when they were available. After the meeting, via email, the Consensus Summary Report (CSR) was completed by the Panel (with help from the Assessment Team, through provision of results and figures) and the Advisory Report was completed by the Assessment Team.

4 April 2005

There were the initial preliminaries: round-the-table introductions, a brief consideration of the draft agenda, and the assignment of writing tasks to the technical members of the Panel. The Assessment Team then made presentations summarizing the DW, the two AWs, previous assessment recommendations, and the current red snapper assessment.

The presentations were well structured, and well delivered. The information presented, and the answers provided to questions, provided a good foundation for the Panel's subsequent deliberations.

Key points with regard to the DW:

- the move from a single-stock to a two-stock hypothesis, east & west of the Mississippi;
- the many and varied data sources, but relatively sparse data;
- compilation of data into appropriate formats for two-stock or previous single-stock models;
- no data prior to the presumed fishing down period (based on previous assessments);
- the high level of estimated steepness (previous assessments) which motivated the construction of an "ultra-historical" catch history (back to the start of the fishery in 1872);

- the key importance of the shrimp fishery due to the bycatch of age-0 and age-1 red snapper;
- the consequent importance of natural mortality at age-0 and age-1, new estimates of which are double previous estimates; and
- the importance of the timing of density dependent mortality.

Key points with regard to the AWs and assessment:

- four different modeling approaches were used;
- an enormous number of model runs were performed;
- there were two AWs, but the agreed assessment was not presented to the second AW - there was only agreement on the assessment specification. the assessment was performed after the second AW;
- the previous assessment model (ASAP) could not cope with the ultra-historical catch history;
- also, ASAP was unstable with some shorter catch histories/data sets;
- the move to CATCHEM was necessary because it could deal with the relative sparseness of the available data and the ultra-historical catch history;
- CATCHEM is a generalization of ASAP, both are age-based, observation error models, using a "best fit" approach (Bayesian in the case of CATCHEM);
- although CATCHEM is age-based, it does generate length frequencies as needed;
- CATCHEM runs take a long time to converge (up to 24 hours if length frequency data are used, and several hours otherwise);
- age-0 red snapper were excluded from the model in the AW base case – assuming density dependent compensation effects override fishing mortality of age-0 snapper;
- inclusion of age-0 snapper qualitatively makes little difference to the assessment results (but could be important in terms of policy decisions on resource allocation);
- the ultra-historical catch history did not reduce the very high steepness in the stock-recruitment relationship; and
- the estimated recruitment since 1985 was, on average, higher than virgin recruitment despite the stock being estimated as highly depleted.

The first day concluded with a brief discussion of possible sensitivity runs that could be started that night (because of the long run times for CATCHEM). There was a suggestion to consider possible changes in catchability for the directed fisheries, which might account for the high estimated recruitment in recent times (i.e., improved technology delivering higher catch rates). This suggestion led to the subsequent "random-walk q" runs (a catchability parameter q is allowed to vary as a random walk over time).

5 April 2005

The main focus of the morning was specification of the CATCHEM runs that needed to be completed during the RW. The option of interval estimation was not available for this assessment, so uncertainty had to be described using a base case together with a number of sensitivity runs. There was agreement that only CATCHEM runs would be used to describe the uncertainty in the assessment. Also, there was agreement that a "continuity run" would be performed using ASAP to illustrate which changes in the assessment results were due to changes in data (and updated parameters) and which were due to changes in model (from ASAP to CATCHEM).

Three dimensions were identified to define a set of CATCHEM runs from which the base case and sensitivities would be chosen. The dimensions were: length of time series; constant or random walk q; and age-0 snapper included or not. In order to restrict the number of runs the first dimension was limited to the 1872-2003 option or the 1984-2003 option. In the former, there is the advantage of the "full" catch history; in the latter, only real data are used. Note that three of the eight runs had already been done.

During the discussion of the potential runs, one member of the Panel alerted the meeting to the possibility that we were overstepping our terms of reference. The question raised was whether we were changing the assessment. In the brief discussion that followed there was general agreement that we needed to look at a range of runs and identify an appropriate base case (as per the agenda: "identify preferred model configuration").

Also, there was discussion about which diagnostics should be produced for each of the runs. The Panel requested that standardized residuals be produced and presented in Q-Q plots (to test distributional assumptions) and that their standard deviations be tabulated (to test for over- or under-fitting relative to their assumed variances).

In the afternoon, the Panel addressed the RW's terms of reference with regard to "scientific soundness" of data and methods, the presentation of results in the Assessment Report, and whether the DW and AW had addressed their terms of reference. The Panel concluded that overall the DW and AWs had done a good job and had more than adequately addressed their terms of reference. Two deficiencies were noted: inadequate diagnostics for the model runs, and insufficient explanation of why age-0 snapper were omitted from the model. The RW was told that the omission of age-0 snapper was a compromise; there were those at the AW who argued that density dependent compensation effects could extend to higher ages, perhaps up to age-2 or even age-3 (so that omission of age-0 *and* age-1 was a possible option).

6 April 2005

During the previous evening, I had reviewed the RWs terms of reference, the Panel's instructions, and the draft agenda. In the morning, I asked the meeting to again consider whether it was appropriate for the RW to choose a base case that might differ from the assessment proposed by the Assessment Team. The Review Panel instructions were quite clear: "… the Chair may request a reasonable number of sensitivity runs…However, the review panel is not authorized to conduct an alternative assessment nor to request an alternative assessment…". Against that, we had an agenda milestone: "identify preferred model configuration".

The Panel discussion was similar to the previous day, but better focused. We apparently had two alternatives. These were to either note the deficiencies in the assessment and reconvene the RW at a later date after remedial actions had been taken, or to address the deficiencies at the current meeting. Since the Assessment Team were able to make the desired changes to the assessment at the current meeting, and they could do so without undue haste, it was agreed that we would proceed with the choice of a base case.

New model results were presented, and the RW chose as the base case the 1872-2003 time series, with a constant q, and the age-0 snapper included. The analogous, 1984-2003 time series run was chosen as a sensitivity test. Projections were requested for three future recruitment scenarios: using the stock-recruitment relationship; using the average of the last 20 years estimated recruitment; and using the (much higher) average from the 1984-2003 run. The idea was to bound

the likely future average recruitment. Different shrimp bycatch options were also to be considered.

Diagnostics were reviewed for the base case. They looked acceptable, but the standardized residuals for catch-at-age data were yet to be produced. I consulted further with the Assessment Team to explain how to use the normal approximation to the binomial to check the multinomial assumption for the catch-at-age data.

In the afternoon, the Panel considered the RW's remaining terms of reference: projections and benchmarks, and research recommendations. We also "previewed" the Advisory Report. This was another area where the agenda was in conflict with the terms of reference. The Advisory report was not mentioned in the terms of reference, but there was an agenda item to review a draft. Since the RW had made changes to the assessment and recommended sensitivity runs it seemed appropriate that we agree with the Assessment Team what would appear in the Advisory report, hence the "preview".

7 April 2005

During the day, results from requested analyses or runs were presented as available. This included the continuity run, which showed that the new data and updated parameter values gave similar results to the previous ASAP assessment in 1999. There was also little qualitative difference between the CATCHEM base case and the updated ASAP run in terms of depletion level.

The Panel had written their individual sections for the CSR outside of the normal meeting hours. In the afternoon, the pieces were compiled into a single document for review. Panelists were given some time to read each other's sections, and then we reviewed the document as a group. The objective was to agree on the sense of the text rather than the exact wording.

Diagnostics for the base case were again presented, but this time with the catch-at-age residuals. Most diagnostics were acceptable, but the catch-at-age data were not consistent with the model assumptions of a multinomial distribution with the assumed effective sample sizes. Perhaps this was not a serious problem, but certainly it is something to be looked at for future assessments.

Two sets of projections were presented near the close of the meeting. Qualitatively, the results were very similar to the original assessment presented to the RW on the first day.

11-27 April 2005 (New Zealand)

I revised the preliminary draft of the CSR as soon as possible after the RW. Most sections had to be revised and reorganized to some extent. Text had to be inserted to provide linkage between sections and most of the text describing the Panel's requests of the Assessment Team and the subsequent results had to be written (a section on projection results was provided by the Assessment Team). A tidy draft was circulated to the Panel by email on 15 April (copied to the Assessment Team leader and the SEDAR Coordinator). It included everything except the plots and text for the comparison of the continuity run with the 1999 ASAP run and the RW base case. These were still being prepared by the Assessment Team.

Over the next few days the Panel provided what were mainly editorial suggestions on the tidy draft. There were two substantive issues. First, the reduction in sampling in 2003 reported in the draft was actually a timing issue in that the data had been collected but were not available for the assessment. Second, there was a suggestion to include more results with regard to the RW's base

case. One panelist suggested some text be inserted and another suggested that a table of results be provided for a range of effort allocation scenarios. I was not initially supportive of these suggestions as I considered that the appropriate results would be contained in the Advisory Report.

After several emails, it was established that the Assessment Team were including, in the Advisory Report, runs additional to those recommended by the Panel. The point at issue was the inclusion or not of age-0 snapper in the assessment model. The AW had recommended that the model start with age-1 snapper, whereas the RW had recommended that age-0 snapper be included. The Assessment Team were planning to include equal numbers of age-0 and age-1 runs in the Advisory Report whilst indicating that the preference of the RW was for the age-0 runs. I then felt obliged to include the RW's base case results in the CSR to emphasize the preference of the Review Panel. I requested the results from the Assessment Team.

A revised version of the CSR was circulated on 22 April. Its contents were complete, including the requested assessment results and the plots missing from the previous draft. Parts of the text were revised to ensure consistency with the contents of the Advisory Report, in particular noting the strong preference of the Panel for the inclusion of age-0 snapper. Final editorial revisions were made on 28 April and the CSR (Appendix 3) was distributed (before the 29 April deadline).

VIEWS ON THE MEETING PROCESS

Meeting Process

Two important issues of process arose during the RW. First, there was a conflict between the draft agenda and the Panel instructions. Second, the Advisory report was outside the RW's Terms of Reference.

The Panelists were explicitly instructed that their primary duty was to review the assessment presented (see Appendix 1, "Draft Terms of Reference and Panel Instructions"). They were not to conduct an alternative assessment or to request an alternative assessment from the Assessment Team. If the Panel found that the assessment was unacceptable, then they were to outline, in the CSR, the remedial actions required to address the shortcomings. This was quite at odds with the draft agenda (see Appendix 1), which included a milestone to "identify preferred model configuration" with preliminary items which included, "identify corrections and adjustments".

The RW followed the draft agenda and we identified a base case that was different from the AW's recommendation. The Assessment Team were able to produce results for the new base case during the RW. We therefore proceeded to produce a new assessment, in direct contravention of the Panel Instructions. This caused some anxiety for the Chair and perhaps for some other participants, but the alternative appeared to be that the AW and the RW would need to be reconvened in the future.

The conflict between the draft agenda and the instructions would not have created a problem if the Panel had been in full agreement with the AW recommended assessment. However, the SEDAR process must be able to cope with such disagreements. There needs to be more clarity with regard to the exact role of the RW and the authority of the RW.

The role of the RW implied by the Panel Instructions is of an "accept or reject" nature. The draft agenda, implied an extension of the AW with fine tuning of an existing assessment, which could result in a "new" assessment (i.e., different from the AW assessment). But what is the authority of the RW? If the assessment had been rejected, would it have necessitated reconvening the AW and RW until there was an acceptable assessment, or would an Advisory Report have been produced by the Assessment Team simply noting the RW's concerns? What power does the RW have and indeed what power should it be given?

The fact that the Advisory Report is not currently in the RW's Terms of Reference creates a difficulty, which was encountered during the red snapper RW. The Assessment Team can produce an Advisory Report that ignores, to some extent, the RW's recommendations. The red snapper assessment was changed by the RW, and the Assessment Team produced an Advisory Report that could be seen as containing "competing" assessments: the RW base case and the AW base case. An alternative view is that the extra runs help to capture an appropriate level of assessment uncertainty. Ideally, the latter view will be the basis of any presentations of the Advisory Report to fishery managers. Managers are put in a difficult position if they have to choose between competing assessments. An avoidance of exactly that situation is no doubt partly the reason for the instructions to the Panel.

For management purposes, the ideal output from a stock assessment process is a single base case with an appropriate description of uncertainty. It must be clear in the SEDAR process where the authority to approve an assessment is vested.

It could be given to the AW. An RW would then provide quality control on the documentation, while occasionally eliminating any assessments with serious technical flaws. An Advisory Report would be produced by the Assessment Team with due recognition of comments from the RW, but the assessment would be a product of the AW.

The RW could be given the authority. An Advisory Report would then be a product of the RW and would contain an assessment approved by the RW. The assessment need not be a product of the RW. In general it would still be a product of an AW. One could allow for minor modification of an assessment at the RW along the lines recommended by the red snapper RW.

It is not clear to me which process is better. Either could work well provided that the process is made clear to all participants. There must be provision made in either process for appropriate handling of disagreements between the RW and the AW and it must be made clear who has ownership of the Advisory Report. If disagreements are settled at a later meeting (e.g., SSC), then representatives of the AW and the RW should be allowed to present their arguments.

Outcomes of the Meeting

The red snapper RW was successful in that preliminary drafts of the CSR and the Advisory Report were produced at the meeting and were subsequently finalized within the required deadlines (I assume this was the case for the Advisory Report – I have not seen the finalized version). It remains to be seen whether the meeting was successful in terms of its role in the delivery of appropriate scientific advice to fisheries managers. This will depend on the contents of the Advisory Report and the nature of the presentation of the Advisory Report to the Gulf of Mexico Fishery Management Council. The disagreement between the AW and the RW on the issue of inclusion or exclusion of age-0 red snapper may create a problem.

Materials provided

The materials provided were more than adequate. However, hardcopy is not needed for all documents. The red snapper RW Panelists could not possibly have read all of the documents before the meeting (there were so many of them – see Appendix 2). It would make sense to supply all documents electronically with only essential reading provided as hardcopy.

The provision of the source code for the models was useful. I was able to check the (CATCHEM) equations which were actually used rather than relying on the documentation (which did contain some errors).

Guidance provided to the Chair

Appropriate guidance was available to the Chair as required. The SEDAR Coordinator was at hand to provide advice on a number of issues and did so clearly and efficiently.

OTHER OBSERVATIONS ON THE MEETING PROCESS

There are two related issues on which I would like to briefly comment.

The red snapper assessment had not been updated since 1999. The DW, AWs, and RW to update the assessment have spanned more than a year. The whole process was delayed because of problems encountered with the previous assessment method when new data were added. Had a ”simple” update been possible there would not have been the need for two AW’s, and the full results would have been presented to an AW, rather than only becoming available at the RW. There is perhaps a lesson here. A simple update was not the objective of the first AW given the ambitions of the DW to produce and use an ultra-historical catch history. Simple updates can be done in a timely manner to provide appropriate advice to fisheries managers. However, with such a large gap between assessments, it was unlikely that a simple update would eventuate.

In terms of providing timely scientific advice to fisheries managers, I have long advocated that there should be two asynchronous processes. Management advice should be provided by “simple” updates of stock assessments as required. The development of assessment methods and the substantial modification of data sets should be done in a separate process – it is harder and the timelines cannot be guaranteed. Scientific disagreements can also be dealt with outside of the management process.

APPENDIX 1: STATEMENT OF WORK

Consulting Agreement between the University of Miami and Patrick Cordue

March 7th, 2005

General

South East Data, Assessment, and Review (SEDAR) is a joint process for stock assessment and review of the South Atlantic, Gulf of Mexico, and Caribbean Fishery Management Councils; NOAA Fisheries, SEFSC and SERO; and the Atlantic and Gulf States Marine Fisheries Commissions. SEDAR is organized around three workshops: data, assessment, and review. Input data are compiled during the data workshop, population models are developed during the assessment workshop, and an independent peer review of the data and assessment models is provided by the review workshop. The assessment review panel is composed of stock assessment experts, other scientists, and representatives of councils, fishing industries, and non-governmental conservation organizations. Final SEDAR documents include a data report produced by the data workshop, a stock assessment report produced by the assessment workshops, a review consensus report evaluating the assessment and drafted during the assessment review panel workshop, and the collected stock assessment documents considered in the SEDAR process.

NMFS-SEFSC requests the assistance of two assessment scientists from the Center for Independent Experts (CIE): one to serve as Chair and one to serve as a technical reviewer for the SEDAR 7 Assessment Review Panel that will consider the assessment for Gulf of Mexico red snapper. This stock is within the jurisdiction of the Gulf of Mexico Fishery Management Council and respective southeastern states. No consensus opinion between the two CIE panelists is sought.

The review workshop for SEDAR 7, Gulf Red Snapper, will take place at the Country Inn and Suites in New Orleans, Louisiana, from 8:30 am on Monday, April 4, 2005 through 6:00 pm on Thursday, April 7, 2005. Meeting materials will be forwarded electronically and in hard copy approximately 3 weeks prior to the meeting. Please contact John Carmichael (SEDAR Coordinator; 843-571-4366 or John.Carmichael@safmc.net) for additional details.

SEDAR Assessment Review Panel Tasks

The SEDAR Review Workshop Panel will evaluate the Gulf of Mexico red snapper stock assessment, input data, assessment methods, and model results as put forward in stock assessment reports. (The following list indicates the expected Terms of Reference for the Review Workshop. However, the Terms of Reference may be modified as necessary by the Council and the SEDAR Steering Committee to address particular needs following conclusion of the Assessment Workshop.) The Assessment Review Panel will complete the following tasks.

1. Evaluate the adequacy and appropriateness of all data used in the assessment, and state whether or not the data are scientifically sound.

2. Evaluate the adequacy, appropriateness, and application of the methods used to estimate population parameters such as abundance, biomass, and exploitation; state whether or not the methods are scientifically sound.
3. Evaluate the adequacy, appropriateness, and application of the methods used to estimate population benchmarks (MSY, Fmsy, Bmsy, MSST, MFMT, etc.). State whether or not the methods are scientifically sound.
4. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status and, if appropriate, evaluate stock rebuilding. State whether or not the methods are scientifically sound.
5. Ensure that all available required assessment results (as listed in the SEDAR Stock Assessment Report Outline) are clearly and accurately presented in the Stock Assessment Report and that such results are consistent with the Panel's decisions regarding adequacy, appropriateness, and application of the data and methods.
6. Evaluate the performance of the Data and Assessment Workshops with regard to their respective Terms of Reference, and state whether or not the Terms of Reference for those previous workshops are adequately addressed in the Data and Assessment Sections of the SEDAR Stock Assessment Report.
7. Develop recommendations for future research for improving data collection and the assessment.
8. Review the Draft Advisory Report, which will summarize the stock assessment results and will have been initially drafted during the Assessment Workshop.
9. Prepare a Consensus Summary Report summarizing the peer review panel's evaluation of the Gulf red snapper and addressing the Terms of Reference. (Drafted during the Assessment Review Panel workshop, with a final report due three weeks after the workshop ends: April 29, 2005.)

The Assessment Review Panel's primary duty is to review the assessments presented. In the course of this review, the Chair may request a reasonable number of sensitivity runs, additional details of the existing assessments, or similar items from technical staff. However, the Review Panel is not authorized to conduct an alternative assessment or to request an alternative assessment from the technical staff present. If the Review Panel finds that an assessment does not meet the standards outlined in Items 1 through 6, above, the Panel shall outline in its report the remedial measures that the Panel proposes to rectify those shortcomings.

The Review Panel Report is a product of the overall Review Panel, and is NOT a CIE product. The CIE will not review or comment on the Panel's report, but shall be provided a courtesy copy, as described below under "Specific Tasks." The CIE products to be generated are the Chair's and Reviewer's reports, also discussed under Specific Tasks.

The review workshop for SEDAR 7, Gulf of Mexico Red Snapper, will take place at the Comfort Inn and Suites in New Orleans, Louisiana, from 8:30 am on Monday, April 4, 2005 through 6:00 pm on Thursday, April 7, 2005. Meeting materials will be forwarded electronically and in hard copy. Please contact John Carmichael (SEDAR Coordinator; 843-571-4366 or John.Carmichael@safmc.net) for additional details.

Specific Tasks

The CIE shall provide two members of the SEDAR 7 Stock Assessment Review Panel: a Chair and a Review Panelist. The agenda of the meeting is attached.

Chair's Tasks

It is estimated that the Chair's duties will occupy a total of 17 days - several days prior to the Review Panel meeting for document review; five days at the SEDAR meeting; several days following the meeting to ensure that the final documents are completed, and several days to complete a Chair's report for the CIE.

Roles and responsibilities:

(1) Prior to the Assessment Review Panel workshop the Chair shall be provided with the stock assessment reports and associated documents for Gulf red snapper. The Chair shall read and review all documents to gain an in-depth understanding of the stock assessment under consideration and the data and information considered in the assessment.

(2) Approximately 1 week prior to the workshop the Chair shall participate in a brief conference call with the SEDAR coordiantor and the lead assessment biologists to finalize the meeting agenda, review the workshop Terms of Reference, and become informed of any last minute developments.

(3) During the Assessment Review Panel workshop the Chair shall control and guide the meeting, including the coordination of presentations, discussions, and document flow.

(4) The Chair shall facilitate the preparation and writing of the Peer Review Panel Consensus Summary (Item 9 above; see Annex I "Consensus Summary Outline"). Review panel members, SEFSC staff and stock assessment scientists present at the meeting will assist the Chair as needed. The Chair shall be responsible for the editorial content of the Consensus Summary and for overseeing that the report is produced and distributed to appropriate contacts on schedule (see "Workshop Final Reports" below).

(4) The SEDAR coordinator shall assist the Assessment Review Panel Chair prior to, during and after the meeting to ensure that all final documents with results are distributed in a timely fashion.

(5) No later than April 22, 2005, the Chair shall submit a written Chair Report[1] addressed to the "University of Miami Independent System for Peer Review," and sent to Dr. David Sampson, via e-mail to David.Sampson@oregonstate.edu, and to Mr. Manoj Shivlani, via e-mail to mshivlani@rsmas.miami.edu. See Annex 1 for the contents of the Chair's Report.

Workshop Final Reports:

No later than April 22, 2005, the Chair shall send courtesy copies of the Advisory Report and the Consensus Summary Report to Dr. David Sampson, via e-mail to David.Sampson@oregonstate.edu, and to Mr. Manoj Shivlani, via e-mail to mshivlani@rsmas.miami.edu.

[1] The written Chair's report will undergo an internal CIE review before it is considered final.

The Chair shall also send copies of these reports by April 22, 2005 (in Word or WordPerfect format and in hardcopy) to:

Dr. Nancy Thompson, NMFS Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, FL 33149 (email, Nancy.Thompson@NOAA.gov)

Larry Massey, 101 Nina Drive #302, Virginia Beach, VA 23462 (email, Larry.Massey@NOAA.gov)

John Carmichael, SAFMC, One Southpark Circle, Suite 306, Charleston, SC 29407 (email, John.Carmichael@safmc.net)

Wayne Swingle, Gulf of Mexico Fishery Management Council, 3018 North U.S. Highway 301, Suite 1000, Tampa, FL 33619-2272 (email, Wayne.Swingle@noaa.gov).

Draft Agenda

SEDAR 7: Gulf Red Snapper

Monday, April 4, 2005

8:30 a.m.	Convene	
8:30 a.m. – 9:00 a.m.	Introductions and Opening Remarks	John Carmichael
	- Agenda Review, Task Assignments	
9:00 am – 12:00 pm	Data Presentation	SEFSC TBD
	- Overview of input data and modifications from AW	
12:00 p.m – 2:00 p.m.	Lunch	
2:00 p.m – 6:00 p.m.	Red Snapper Assessment Presentations	SEFSC TBD
	-Methods and Results Overview	

Tuesday, April 5, 2005

8:30 a.m. – 12:00 p.m.	Red Snapper Assessment Discussions	Chair
	- Focus discussion on preferred model *- Identify corrections and adjustments* *- Identify sensitivity runs* *- Identify projection runs*	
	MILESTONE: Identify preferred model configuration	
12:00 p.m. – 2:00 p.m.	LUNCH	
2:00 p.m. – 6:00 p.m.	Data and Assessment Terms of Reference *- Data Report Review* *- Assessment Methods Review* *- Assessment Report Draft Review*	Chair

Wednesday, April 6, 2005

8:30 a.m. – 12:00 p.m.	Continue Assessment Discussions	Chair
	- Review sensitivity analyses *- Review Projections*	
	MILESTONE: Final Call for Additional modelling requests.	
12:00 p.m. – 2:00 p.m.	LUNCH	
2:00 p.m. – 6:00 p.m.	Continue Terms of Reference Discussion	Chair
	- Projection/benchmark TOR review *- Research Recommendations* *- Review Advisory Report*	

Thursday, April 7, 2005

8:00 a.m. – 11:00 a.m.	Continue TOR Discussions if necessary	Chair

	Review Final Model Results	
	Review additional model runs if necessary	
	Work session to draft consensus summary	
	- Review Panel: Consensus Summary Draft *- Assessment Team: Appendices, Advisory Report*	
11:00 a.m. – 1:00 p.m.	LUNCH	
	MILESTONES: First Draft Consensus Summary	
	Draft Assessment Report with Final Results	
1:00 p.m. – 4:00 p.m.	Work Session	
	- Panel: Review and Edit Consensus Summary	
	- Assessment Team: Review and Edit Assessment Report	
4:00 p.m. – 6:00 p.m.	Final Review of Consensus Summary	Chair
6:00 p.m	ADJOURN	

Annex I. Contents of SEDAR Reports.

Consensus Summary Contents

I. Terms of Reference

List each Term of Reference, and include a summary of the Panel discussion regarding the particular item. Include a clear statement indicating whether or not the criteria in the Term of Reference are satisfied.

II. Additional Comments

Provide a summary of any additional discussions not captured in the Terms of Reference statements.

III. Stakeholder Comments

Stakeholder representatives on the Panel are encouraged to submit brief statements summarizing their opinions regarding stock status, analytical methods, and input data.

IV. Recommendations for Future Workshops

Panelists are encouraged to provide suggestions to improve the SEDAR process.

Contents of Chair Report

1. Synopsis/summary of the meeting – to provide context for the comments rather than to rewrite the summary report. (The latter is a product of the meeting, and is not a CIE product.)

2. Views on the meeting process, including recommendations for improvements on:

The meeting process itself;
The outcome(s) of the meeting;
Materials provided for the meeting, including their timeliness, relevance, content, and quality;
The guidance provided to run the meeting.

3. Other observations on the meeting process.

4. Appendices, including:

Statement of Work;
Bibliography of the materials provided for the meeting;
Summary report (if available at the time of report submission).

APPENDIX 2: DOCUMENTS PROVIDED FOR THE MEETING

Documents from the DW, AWs, and for the RW were provided both electronically and in hardcopy to meeting participants. Electronic distributions included AW data files, source code, and model results. The quantity of documents, data, models, and results, was remarkable. The documents lists for the DW, AWs, and RW are given below (all documents were provided for the RW).

Document Number	Document Title	Authors
SEDAR7-RW 1	Application of the age-structured assessment model CATCHEM to the U.S. Gulf of Mexico red snapper fishery since 1962.	Porch, C. E.
SEDAR7-RW 2	Revised assessments of Gulf of Mexico red snapper during 1984-2003 using a gulf-wide implementation of ASAP	Cass-Calay, S. L. and G. A. Diaz.
SEDAR7-RW 3	Revised assessments of Gulf of Mexico red snapper during 1962-2003 using a gulf-wide implementation of an age-structured assessment program (ASAP).	Cass-Calay, S. L., G. A. Diaz, and J. S. Nowlis.
SEDAR7-RW 4	Assessments of red snapper stocks in the eastern and western Gulf of Mexico using an age structured assessment procedure (ASAP)	Ortiz, M. and S. L. Cass-Calay.
SEDAR7-RW 5	Revised bootstrapping of a gulf-wide implementation of an age-structured assessment procedure (ASAP) for red snapper (*Lutjanus campechanus*) from 1962 to 2003.	Nowlis, J. S. and S. L. Cass Calay.
SEDAR7-RW 6	An age-structured stock reduction analysis (SRA) model for Gulf of Mexico red snapper that accounts for uncertainty over the ages of density-dependent natural mortality.	McAllister, M. K.
SEDAR7-RW 7	Alternate fishery-independent larval indices of abundance for red snapper.	Hanisko, D. S., J. Lyczkowski-Shultz, and W. Ingram.
SEDAR7-RW 8	Alternative estimates of the yield of red snapper from the Gulf of Mexico recreational fishery.	Turner, S. C.

Document #	Title	Authors
SEDAR7-DW-1	Derivation of Red Snapper Time Series from SEAMAP and Groundfish Trawl Surveys	Nichols, S.
SEDAR7-DW-2	Calibration Among the Separate Trawl Survey Programs to Extend the Time Series for Juvenile Snapper Indexes	Nichols, S.
SEDAR7-DW-3	Some Bayesian Approaches to Estimation of Shrimp Fleet Bycatch	Nichols, S.
SEDAR7-DW-4	Behavior and Swimming Performance of red Snapper: Its Application to Shrimp Trawl Bycatch Reduction	Parsons, G.
SEDAR7-DW-5	Observer Coverage of the US Gulf of Mexico and Southeastern Atlantic Shrimp Fishery, February 1992-December 2003 - Methods	Scott-Denton, E.
SEDAR7-DW-6	Discussion of Days Fished Expansion in the Gulf of Mexico Shrimp Fishery	Griffin, W.
SEDAR7-DW-7	Bioeconomic Simulation Analysis of Alternative Bycatch, Commercial, and Recreation Policies for the Recovery of Gulf of Mexico Red Snapper	Griffin, W.
SEDAR7-DW-8	Shark/Snapper/Grouper Longline Surveys	Henwood, T., W. Ingram, and M. Grace
SEDAR7-DW-9	Distribution, Abundance, and Age Structure of Red Snapper (Lutjanus campechanus) Caught on Research Longlines in U.S. Gulf of Mexico	Mitchell, K., T. Henwood, G. Fitzhugh, and R. Allman
SEDAR7-DW-10	Data Summary of Red Snapper (Lutjanus campechanus) Collected During Small Pelagic Trawl Surveys, 1988-1996	Ingram, W.
SEDAR7-DW-11	Assessment of the Distribution and Abundance of Coastal Sharks in the U.S. Gulf of Mexico and Eastern Seaboard, 1995 and 1996	Grace, M. and T. Henwood
SEDAR7-DW-12	Estimation of Prey Biomass Necessary to Maintain the Equilibrium Standing Stock Biomass of Red Snapper (Lutjanus campechanus), at Various Levels, in the Gulf of Mexico	Driggers, W.
SEDAR7-DW-13	The Steepness Stock-Recruit Parameter for Red Snapper in the Gulf of Mexico (Lutjanus campechanus): What Can Be Learned From Other Fish Stocks?	McAllister, M.

SEDAR7-DW-14	The Potential for Incorporating a Larval Index of Abundance for Stock Assessment of Red Snapper, Lutjanus Campechanus	Lyczkowski-Shultz, J., D. Hanisko, and W. Ingram
SEDAR7-DW-15	SEAMAP Reef Fish Survey of Offshore Banks	Gledhill, C. and W Ingram
SEDAR7-DW-16	Retrospective Coding of Dual Size Classes of Size Frequency Data for Red Snapper Collected During SEAMAP Shrimp/BottomFish Surveys	Pellegrin, G., N. Sanders, K. Johnson, and A. DeBose
SEDAR7-DW-17	Partitioning release mortality in the undersized red snapper bycatch: comparison of depth vs. hooking effects	Burns, K.M., N. F. Parnell, and R. R. Wilson
SEDAR7-DW-18	Red snapper movements based on tag recovery data.	Burns, K. M et al.
SEDAR7-DW-19	Estimating Catches and Fishing Effort of the Southeast United States Headboat Fleet, 1972-1982.	Dixon, R.L. and G.R. Huntsman
SEDAR7-DW-20	Overview of State Trip Ticket Programs in the Gulf of Mexico	Donaldson, D.
SEDAR7-DW-21	Fishery independent estimation of abundance, age frequency, growth rates, and mortality of red snapper *Lutjanus campechanus,* in the northeast Gulf of Mexico.	Szedlmayer, S., D. Moss, and M. Maceina.
SEDAR7-DW-22	Estimates of Red Snapper Discards by Vessels with a Federal Permit in the Gulf of Mexico	Poffenberger, J.
SEDAR7-DW-23	Commercial Landings Statistics –Red Snapper in the Gulf of Mexico	Poffenberger, J.
SEDAR7-DW-24	Estimation of Effort in the Offshore Shrimp Trawl Fishery of the Gulf of Mexico	Nance, J.
SEDAR7-DW-25	Using scenario-based population dynamics modeling to prioritize those parameters in Gulf of Mexico red snapper stock assessment where uncertainty should be taken into account	McAllister, M. K.
SEDAR7-DW-26	Using demographic analysis to evaluate the stock resilience implications and plausibility of life history parameter values assumed for Gulf of Mexico red snapper.	McAllister, M. K.
SEDAR7-DW-27	MARINE RECREATIONAL FISHING STATISTICAL SURVEY (MRFSS): One Constituent's Analysis	Zales, R. F. II.
SEDAR7-DW-28	Summary of Fishing Mortality for the Red Snapper Research Project off Alabama	Shipp, R. L.
SEDAR7-DW-29	NOT USED	
SEDAR7-DW-30	NOT USED	
SEDAR7-DW-31	EBLUP Small Area Estimation for Red Snapper Bycatch from the Gulf of Mexico Shrimp Fleet	Jones, B.
SEDAR7-DW-32	Spatial Modeling of Red Snapper Shrimp Fleet Bycatch in the Gulf of Mexico	Jones, B.

SEDAR7-DW-33	Red snapper (*Lutjanus campechanus*) otolith aging summary 1980 & 1991-2002. NOAA, NMFS, Panama City Laboratory. Contribution Series: 04-03.	Allman, R.J., G.R. Fitzhugh, W.A. Fable, L.A. Lombardi-Carlson and B.K. Barnett
SEDAR7-DW-33add	Addendum to Document 33.	
SEDAR7-DW-34	Precision of age estimation in red snapper (*Lutjanus campechanus*). NOAA, NMFS, Panama City Laboratory Contribution Series: 04-04.	Allman, R.J., G.R. Fitzhugh, K.J. Starzinger and R.A. Farsky
SEDAR7-DW-35	Characterization of red snapper (*Lutjanus campechanus)* reproduction: for the 2004 Gulf of Mexico SEDAR. NOAA, NMFS, Panama City Laboratory. Contribution Series: 04-01.	Fitzhugh, G.R., M.S. Duncan, L.A. Collins, W. T. Walling Jr., D.W. Oliver.
SEDAR7-DW-35add	Addendum to Document 35.	
SEDAR7-DW-36	Red snapper otoliths selected for aging at NMFS Panama City Laboratory and discussion of future sampling targets. NOAA, NMFS, Panama City Laboratory. Contribution Series: 04-02	Fitzhugh, G.R., L.A. Lombardi-Carlson, R.J. Allman and B. K. Barnett.
SEDAR7-DW-37	Analysis of Total Fishing Mortality for Gulf of Mexico Red Snapper Contributed by Shrimp Trawl Bycatch and Commercial and Recreational Fisheries (Including Discards)	McAllister, M. K.
SEDAR7-DW-38	Status of bycatch reduction device performance and research in Norh-Central and Western Gulf of Mexico	Foster, D. G. and Scott-Denton, E.
SEDAR7-DW-39	Florida Fishery Dependent Monitoring	Brown, S. E.
SEDAR7-DW-40	History of red snapper management in federal waters of the US Gulf of Mexico, 1984-2004.	Hood, P. and Steele, P.
SEDAR7-DW-41	Alternative catch rate indices for red snapper (Lutjanus campechanus) landed during 1981-2003 by the U.S. recreational fishery in the Gulf of Mexico using MRFSS and Texas Parks and Wildlife Department data sets.	Cass-Calay, S. L.
SEDAR7-DW-42	Standardized catch rates of red snapper (Lutjanus campechanus) from the United States headboat fishery in the Gulf of Mexico during 1986-2002	Brown, C. A. and S. L. Cass-Calay
SEDAR7-DW-43	Some problems with sampling commercial red snapper fisheries in the Gulf of Mexico.	Chih, C-P.
SEDAR7-DW-44	Estimation of species misidentification in the commercial landing data of red snappers in the Gulf of Mexico.	Chih, C-P.
SEDAR7-DW-45	Size frequency distribution of red snapper from dockside sampling of commercial landings in the Gulf of Mexico 1984-2003 (TIP size data)	Diaz, G.A., S. C. Turner, and C-P Chih.

SEDAR7-DW-46	Size frequency distribution of red snapper from dockside sampling of recreational landings in the Gulf of Mexico 1984-2003 (TXPW, MRFSS, and headboats size data)	Diaz, G. A.
SEDAR7-DW-47	Standardized catch rates of red snapper (Lutjanus campechanus) from the United States commercial handline fishery in the Gulf of Mexico during 1996-2003	McCarthy, K. J. and S. L. Cass-Calay
SEDAR7-DW-48	NOT USED	
SEDAR7-DW-49	A priori estimates of natural mortality rates and stock-recruitment curve steepness for Gulf of Mexico red snapper	Sladek Nowlis, J.
SEDAR7-DW-50	An age-structured assessment model for red snapper that allows for multiple stocks, fleets, and habitats.	Porch, C. E.
SEDAR7-DW-51	MSY, Bycatch and Minimization to the "Extent Practicable"	Powers, J. E.
SEDAR7-DW-52	Length and weight conversions for Florida's recreationally important finfish species	Sauls, B., R. Beaver, and J. O'Hop
SEDAR7-DW-53	Comparisons of Relative Fishing Powers of Selected SEAMAP Survey Vessels	Pellegrin, G. Jr N. Sanders Jr; J. Hanifen; R. Waller; M. VanHoose
SEDAR7-DW-54	Update for the Bayesian estimation of shrimp fleet bycatch	Nichols, S.
SEDAR7-DW-55	An evaulation of the first annulus for red snapper off Alabama	Mareska, J.
SEDAR7-DW-56	Some methods of calculating catch at age of the directed fisheries for red snapper in the Gulf of Mexico, 1984-2002	Turner, S. C.
SEDAR7-DW-57	An Update of Shrimp Trawl Bycatch Reduction Efforts in the Gulf of Mexico	Graham, G.
Reference Documents Provided for Data Workshop		
NAJFM 2003 23:581-589 SEDAR7-REF1	Description of a simple electronic logbook designed to measure effort in the Gulf of Mexico shrimp fishery.	Gallaway, B. J., J. G. Cole, L. R. Martin, J. M. Nance, and M. Longnecker
NAJFM 2003 23:7987-809 SEDAR7-REF2	An evaluation of an electronic logbook (ELB) as a more accurate method of estimating spatial patterns of trawling effort and bycatch in the Gulf of Mexico shrimp fishery.	Gallaway, B. J., J. G. Cole, L. R. Martin, J. M. Nance, and M. Longnecker

GoM Science 1998(1):92-104 SEDAR1-REF3	Movement of red snapper, *Lutjanus campechanus,* in the North central Gulf of Mexico: Potential effects of hurricanes	Watterson, J. C., W. F. Patterson III, R. L. Shipp, and J. H. Cowan
TAFS 2001 130:533-545 SEDAR7-REF4	Movement of tagged red snapper in the Northern Gulf of Mexico	Patterson, W. F. III, J. C. Watterson, R. L. Shipp, and J. H. Cowan
MRAG Americas Inc. 1997 SEDAR7-REF5	Consolidated Report of the Peer Review of Red Snapper (*Lutjanus campechanus*) Research and Management in the Gulf of Mexico	anon.
MARFIN Final Report NA87FF0424 SEDAR7-REF6	Stock Structure of red snapper in the Northern Gulf of Mexico: Is there management as a single stock justified based on spatial and temporal patters of genetic variation, otolith microchemistry,and growth rates?	Gold, J. R.
AFS Symp. 36. 2003 SEDAR7-REF7	Red snapper discards in Texas coastal waters—a fishery dependent onboard survey of recreational headboat discards and landings. In:Stanley, D.R., Scarborough-Bull, A. (Eds.), Fisheries, reefs, and offshoredevelopment. American Fisheries Society, Symposium 36, Bethesda, Maryland, pp.155-166	Dorf, B.A.
Fish Bull 2001 99:617-621 SEDAR7-REF8	Age and growth of red snapper, *Lutjanus campechanus*, from an artificial reef area off Alabama in northern Gulf of Mexico	Patterson, W. F. III; J. H. Cowan, Jr; C. A. Wilson, R. L. Shipp
53 GFCI SEDAR7-REF9	Indirect estimatio of red snapper (*Lutjanus campechanus)* and gray triggerfish (*Balistes capriscus*) release mortality	Patterson, W. F. III; G. W. Ingram, Jr.; R. L. Shipp, J. H. Cowan, Jr.
AFS Symp. 2003 36:181-193 SEDAR7-REF10	Site fidelity and dispersion of red snapper associated with artificial reefs in the northern Gulf of Mexico	Patersonm, W. F. III; and J. H. Cowan

Document Number	Document Title	Authors
SEDAR7-AW 1	Growth models for red snapper in U.S. Gulf of Mexico waters estimated from landings with minimum size limit restrictions	Diaz, Guillermo A., Clay E. Porch, and Mauricio Ortiz
SEDAR7-AW 2	Allometric relationships of Gulf of Mexico red snapper	Diaz, Guillermo A.
SEDAR7-AW 3	Estimated conversion factors for calibrating MRFSS charterboat landings and effort estimates for the Gulf of Mexico in 1981-1997 with For Hire Survey estimates with application to red snapper landings	Diaz, Guillermo A and Patty Phares
SEDAR7-AW 4	Revised catch rate indices for red snapper (lutjanus campechanus) landed during 1981-2003 by the U.S. Gulf of Mexico recreational fishery - REVISED	Cass-Calay, Shannon L.
SEDAR7-AW 5	Batch-fecundity and maturity estimates for the 2004 assessment of red snapper in the Gulf of Mexico	Porch, Clay E.
SEDAR7-AW 6	An age-structured assessment model for red snapper that allows for multiple stocks, fleets and habitats	Porch, Clay E.
SEDAR7-AW6a	Calculation of relative length frequencies	Brooks, E.N.
SEDAR7-AW 7	Preliminary Trials Estimating M1 from Fall and Summer Trawl Surveys	Brooks, Elizabeth N. and Clay E. Porch
SEDAR7-AW 8	Red Snapper Compensation in the Stock-Recruitment Function and Bycatch Mortality	Powers, J.E. and E.N. Brooks
SEDAR7-AW 9	Standardized catch rates of red snapper (Lutjanus campechanus) from the United States commercial handline fishery in the Gulf of Mexico during 1996-2003: additional indices	McCarthy, Kevin J. and Shannon L. Cass-Calay
SEDAR7-AW 10	Not used	
SEDAR7-AW 11	A population dynamics model for Gulf of Mexico red snapper that uses a historically extended catch time series and alternative methods to calculate MSY	McAllister, Murdoch K.
SEDAR7-AW 12	Impact on Yield from Density Dependence of red Snapper Juvenile Life Stages	Gazey, W.J.
SEDAR7-AW 13	Brief Review of Red Snapper Data Workshop Report	McAllister, Murdoch K.
SEDAR7-AW 14	Identifying some approaches to formulating prior	McAllister,

	probability distributions for natural mortality rates in age zero and age one Gulf of Mexico red snapper	Murdoch K.
SEDAR7-AW 15	Estimation of Juvenile M for Red Snapper Based on SEAMAP Survey Data	Nichols, Scott, Gilmore Pellegrin Jr. and G. Walter Ingram
SEDAR7-AW 16	Estimates of Historical Red Snapper Recreational Catch Levels Using US Census Data and Recreational Survey Information	Scott, Gerald P.
SEDAR7-AW 17	Documentation on the Preparation of the Database for the Red Snapper Stock Assessment SEDAR Workshop	Poffenberger, John and Stephen C. Turner
SEDAR7-AW 18	Modeled age composition of Gulf of Mexico Red Snapper 1984-2003	Turner, Stephen C., Elizabeth Brooks, Gerald P. Scott and Guillermo Diaz
SEDAR7-AW 19	Gulf of Mexico Red Snapper Observed Catch at Age	Sladek Nowlis, Josh
SEDAR7-AW 20	Estimating Catch at Age for Red Snapper in the Shrimp Fleet Bycatch	Nichols, Scott

Presented at Assessment Workshop II, December 14 – 17, 2004

SEDAR7-AW 21	A Summary of the August Assessment Workshop for Red Snapper	Anonymous
SEDAR7-AW 22	The commercial landings of red snapper in the Gulf of Mexico from 1872 to 1962	Porch, Clay E., Stephen C. Turner, and Michael J. Schirripa
SEDAR7-AW 23	Reconstructed time series of shrimp trawl effort in the Gulf of Mexico and the associated bycatch of red snapper from 1948 to 1972	Porch, Clay E. and Steve Turner
SEDAR7-AW 24	Additional information on modeled age composition of red snapper from the Gulf of Mexico 1984-2003	Turner, Stephen C., Elizabeth Brooks, and Guillermo Diaz
SEDAR7-AW 25	Alternative indices of abundance of juvenile red snapper from the Gulf of Mexico from SEAMAP surveys 1972-2003	Turner, Stephen C., and Clay E. Porch
SEDAR7-AW 26	An age-structured stock reduction analysis (SRA) model for the Gulf of Mexico red snapper that accounts for uncertainty in the age of density-dependent natural mortality	McAllister, Murdoch K.
SEDAR7-AW 27	An alternative assessment of the red snapper (*Lutjanus campechanus*) fishery in the U.S. Gulf of	Porch, Clay E.

	Mexico using a spatially-explicit age-structured assessment model: Preliminary results	
SEDAR7-AW 28	Benchmarks and Estimated Status from a 1-fleet VPA projection for Red snapper (*Lutjanus campechanus*)	Brooks, Elizabeth N. and Steve Turner
SEDAR7-AW 29	VPA Evaluation of Projected SPR resulting from TAC and Bycatch Reduction for Red snapper (*Lutjanus campechanus*) in the Gulf of Mexico	Brooks, Elizabeth N. and Steve Turner
SEDAR7-AW 30	Assessments of Gulf of Mexico red snapper during 1984-2003 using a Gulfwide implementation of ASAP, including continuity cases	Cass-Calay, Shannon L. and Guillermo A. Diaz
SEDAR7-AW 31	Assessments of Gulf of Mexico red snapper during 1962-2003 using a Gulfwide implementation of an age-structured-assessment-program (ASAP)	Cass-Calay, Shannon L., Guillermo A. Diaz, and Joshua Sladek Nowlis
SEDAR7-AW 32	Draft: Bootstrapping a Gulfwide implementation of an age-structured-assessment-procedure (ASAP) for red snapper (*Lutjanus campechanus*) from 1962 to 2003	Sladek Nowlis, Joshua and Shannon L. Cass-Calay
SEDAR7-AW 33	Summary of all model runs and control rule plots	Brooks, Elizabeth N.
SEDAR7-AW 34	Assessments of red snapper stocks in the eastern and western Gulf of Mexico using an age-structured-assessment-procedure (ASAP)	Cass-Calay, Shannon L. and Mauricio Ortiz

Gulf of Mexico Red Snapper
Consensus Summary Report

Prepared by the SEDAR 7 Review Panel for the
Gulf of Mexico Fishery Management Council

Edited by P.L. Cordue for
SEDAR 7, 4-7 April 2005
New Orleans, LA

Executive summary

The SEDAR 7 Review Workshop met in New Orleans, LA from April 4–7, 2005 to review the stock assessment of red snapper in the Gulf of Mexico. The first day consisted primarily of presentations by the Assessment Team covering the Data Workshop, the two Assessment Workshops, and their preferred base case assessment. During the second and third days, the workshop reviewed the assessment by addressing the terms of reference for the Review Workshop, including the consideration of additional model runs. On the final day, preliminary drafts of the Consensus Summary Report and the Advisory Report were reviewed.

The SEDAR for red snapper has extended over more than 12 months, during which time the Assessment Team and other Data Workshop and Assessment Workshop participants have worked towards producing a credible and reliable stock assessment. The red snapper assessment has been more challenging than the original participants could have envisaged. There were many challenges: being able to fully understand and duplicate the methods and data used in 1999 assessment; exploring alternative stock hypotheses and eventually moving from a single stock model to a two stock model; collating and analyzing the many relevant data sources to provide indices appropriate to single stock and two stock models; constructing a catch history (for multiple fisheries, including discard estimates) extending to the "dawn" of the fishery (1872); undertaking numerous assessment runs using four different stock assessment methods; and choosing a base case assessment to further develop and present to the Review Workshop.

The Review Panel was impressed by the quantity and quality of the work which had gone into the red snapper stock assessment. The presentations of the Assessment Team on the first day were well structured and clear. The information provided, through the presentations, and in response to questions, gave an excellent basis for the Panel's subsequent deliberations and collaboration with the Assessment Team.

Two changes to the base case assessment were made during the Review Workshop. These were suggested by the Panel and agreed to by the Assessment Team. First, age-0 snapper were reintroduced into the model. The Panel understood the argument in support of excluding this age class in that density dependent compensation could extend to even higher ages. However, in the scientific judgment of the Panel, it is not prudent to assume that density dependent compensation can completely override the mortality induced by the shrimp fishery on age-0 red snapper.

The second change was to include higher recruitment scenarios in the projections of the base case. Recruitment estimates over the last 20 years are highly variable, but on average are above the level predicted by the stock-recruitment relationship. Three alternative recruitment scenarios were recommended for projections, using either: the spawner-recruitment relationship; recent average recruitment (last 20 years); or an even higher average recruitment level (obtained from a sensitivity run). In terms of predicting short-term future recruitment levels, the Panel preferred, on the balance of probabilities, the use of average estimated recruitment over the last 20 years (with benchmarks recalculated to be consistent with that level).

The Advisory Report was finalized after the Review Workshop by the Assessment Team. Runs without age-0 snapper are included in that report together with the Review Workshop's base case. The Assessment Team included the runs to honor the Assessment Workshop agreement. The Review Panel believe that these runs are useful to illustrate the sensitivity of the assessment results to the exclusion of age-0 snapper but should not be used for the baseline assessment from which management advice is derived.

1. Introduction

1.1 Time and Place

The SEDAR 7 Review Workshop (RW) met in New Orleans, LA from April 4–7, 2005.

1.2 Terms of Reference for the Review Workshop

1. Evaluate the adequacy and appropriateness of all data used in the assessment and state whether or not the data are scientifically sound;

2. Evaluate the adequacy, appropriateness, and application of the methods used to estimate population parameters such as abundance, biomass, and exploitation and state whether or not the methods are scientifically sound;

3. Evaluate the adequacy, appropriateness, and application of the methods used to estimate population benchmarks (*e.g., MSY, Fmsy, Bmsy, MSST, MFMT, or their proxies*) and required management parameters (*e.g., ABC*) and state whether or not the methods are scientifically sound;

4. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status and, if appropriate, evaluate stock rebuilding; state whether or not the methods are scientifically sound;

5. Ensure that required assessment results (*as listed in the SEDAR Stock Assessment Report Outline*) are clearly and accurately presented in the Stock Assessment Report and that such results are consistent with the Review Panel's decisions regarding adequacy, appropriateness, and application of the data and methods;

6. Evaluate the performance of the Data and Assessment Workshops with regard to their respective Terms of Reference, and state whether or not the Terms of Reference for those previous workshops are adequately addressed in the Stock Assessment Report;

7. Review data and assessment workshop research and monitoring recommendations and make any additional recommendations warranted;

8. Prepare a Peer Review Consensus Report summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. (Drafted by the Panel during the Review Workshop with a final report due three weeks after the workshop ends.)

1.3 List of Participants

Panelists	Affiliation
Cordue, Patrick (Chair)	CIE
Babcock, Elizabeth	NGO; Univ. Miami
Blanchet, Harry	GMFMC SAP; LA DFW
Murphy, Mike	GMFMC SAP; FL FWCC
Nugent, Mike	GMFMC AP
Pilling, Graham	CIE
Prager, Michael	NMFS/SEFSC Beaufort
Rose, Kenneth	GMFMC SAP; LSU
Sissenwine, Michael	NOAA Fisheries

Presenters	
Brooks, Liz	NMFS/SEFSC Miami
Cass-Calay, Shannon	NMFS/SEFSC Miami
Nichols, Scott	NMFS/Pascagoula Lab
Porch, Clay	NMFS/SEFSC Miami
Scott, Jerry	SEFSC
Turner, Steve	NMFS/SEFSC Miami

Council Members	Affiliation
Minton, Vernon	GMFMC/Alabama DNR
Walker, Bobbi	GMFMC

Staff	Affiliation
John Carmichael	SEDAR Coordinator
Dawn Aring	GMFMC
Steven Atran	GMFMC
Loyd Darby	SEFSC

Observers	Affiliation
Bailey, Danica	Louisiana Dept. of Wildlife & Fisheries
Crabtree, Roy	NMFS/SERO
Cufone, Marianne	Gulf Restoration Network
Hano, Brett	Louisiana Dept. of Wildlife & Fisheries
Merriner, John	NMFS/Beaufort Lab
Nance, Jim	NMFS/Galveston
Powers, Joseph	NMFS/SEFSC Miami
Steele, Phil	NMFS/SERO
Thompson, Nancy	NMFS/SEFSC Miami
Viles, Aaron	Gulf Restoration Network
Zales II, Bob	Panama City Boatmen's Association

1.4 Review Workshop working papers

Document Number	Document Title	Authors
SEDAR7-RW 1	Application of the age-structured assessment model CATCHEM to the U.S. Gulf of Mexico red snapper fishery since 1962.	Porch, C. E.
SEDAR7-RW 2	Revised assessments of Gulf of Mexico red snapper during 1984-2003 using a gulf-wide implementation of ASAP	Cass-Calay, S. L. and G. A. Diaz.
SEDAR7-RW 3	Revised assessments of Gulf of Mexico red snapper during 1962-2003 using a gulf-wide implementation of an age-structured assessment program (ASAP).	Cass-Calay, S. L., G. A. Diaz, and J. S. Nowlis.
SEDAR7-RW 4	Assessments of red snapper stocks in the eastern and western Gulf of Mexico using an age structured assessment procedure (ASAP)	Ortiz, M. and S. L. Cass-Calay.
SEDAR7-RW 5	Revised bootstrapping of a gulf-wide implementation of an age-structured assessment procedure (ASAP) for red snapper (*Lutjanus campechanus*) from 1962 to 2003.	Nowlis, J. S. and S. L. Cass Calay.
SEDAR7-RW 6	An age-structured stock reduction analysis (SRA) model for Gulf of Mexico red snapper that accounts for uncertainty over the ages of density-dependent natural mortality.	McAllister, M. K.
SEDAR7-RW 7	Alternate fishery-independent larval indices of abundance for red snapper.	Hanisko, D. S., J. Lyczkowski-Shultz, and W. Ingram.
SEDAR7-RW 8	Alternative estimates of the yield of red snapper from the Gulf of Mexico recreational fishery.	Turner, S. C.

2. Terms of Reference

2.1 Background

The RW is usually the third meeting in the SEDAR process. However, for red snapper, the Data Workshop (DW) was followed by *two* Assessment Workshops (AW). The SEDAR for red snapper has extended over more than 12 months, during which time the Assessment Team and other DW and AW participants have worked towards producing a credible and reliable stock assessment. The red snapper assessment has been more challenging than the original participants could have envisaged.

There were many challenges: being able to fully understand and duplicate methods and data used in the 1999 assessment; exploring alternative stock hypotheses and eventually moving from a single stock model to a two stock model; collating and analyzing the many relevant data sources to provide indices appropriate to single stock and two stock models; constructing a catch history (for multiple fisheries, including discard estimates) extending to the "dawn" of the fishery (1872); undertaking numerous assessment runs using four different stock assessment methods; choosing a base case assessment to further develop and present to the Review Workshop.

The Panel was impressed by the quantity and quality of the work which had gone into the red snapper stock assessment. The presentations of the Assessment Team on the RW's first day were well structured and clear. The information provided, through the presentations, and in response to questions, gave an excellent basis for the Panel's subsequent deliberations and collaboration with the Assessment Team.

During the RW some small deficiencies were noted by the Panel in the proposed base case assessment. The Assessment Team were willing and able, during the RW, to make the minor changes to the base case necessary to address the Panel's concerns. The changes were minor in terms of implementation, although potentially quite important for projections and evaluation of management options. The changes to the assessment are discussed in the following section under the appropriate terms of reference.

2.2 Review of the Panel's deliberations

This section addresses, in order, each of the eight Terms of Reference for the RW (see Section 1.2).

1. Evaluate the adequacy and appropriateness of all data used in the assessment and state whether or not the data are scientifically sound;

The RW's overall conclusion was that the SEDAR process had thoroughly considered the full range of potential sources of data. The flexibility of the AW's preferred assessment method, CATCHEM, allows the unusually complex and diverse array of available data to be assimilated within the assessment model. The RW did not identify inappropriate use of data (i.e., in this sense the data are scientifically sound), except with regard to the issue of choice of the youngest age within the model and its justification (see the discussion on the stock-recruitment relationship below).

The red snapper assessment uses information on (1) distribution and stock structure, (2) growth and reproduction, (3) natural mortality, (4) stock and recruitment relationship, (5) fishery

landings and bycatch/discards, (6) age composition of catches and bycatch, and (7) indices of abundance. There is a complex and varied array of data available to address these information categories, but in most cases the available data are incomplete (e.g., in terms of temporal or spatial coverage) such that it is necessary to impute some missing data, and innovative approaches are needed to derive information. In some cases, such derived information is commonly observed for other fisheries, which is preferable (e.g., observations of discards including samples of age composition).

Distribution and stock structure: There are major fishing grounds in the eastern Gulf of Mexico (GoM), western GoM, and Campeche Bank off Mexico. At present, the US fishery is excluded from the fishing ground off Mexico, although historically, it was a major source of US landings. There is sufficient inferential information (e.g., genetics, otolith microchemistry) to support treating these as separate stocks, although the degree of reproductive isolation and mixing of fishes originating from the three areas is unknown.

Growth and reproduction: Since the late 1990s, there has been a tremendous increase in the number of age determinations of red snappers. These data provided a strong basis for estimating a new growth function, which was done taking account of the potential biasing effect of minimum size regulations. However, the relatively short period of time over which a large number of aging samples were collected means that for most years in the assessment, ages needed to be inferred, thus introducing uncertainty. Relatively few of the age samples collected for 2003 were available for inclusion in the assessment.

Another concern is that age sampling, in some years, may not be sufficiently representative of the catch. Also, a portion of the age and length sampling, in some years, has been taken on an opportunistic basis, rather than as part of a program to broadly and representatively sample the overall harvest. Effects of changes in sampling regimes as well as the ability of opportunistic sampling to characterize the size or age of harvest in a fishery have not been closely examined in this process.

Since the previous assessment, new data have been produced on the fecundity of red snapper, although older fish are poorly represented. Little difference between the eastern and western GoM was detected. A single fecundity at age function was fitted and used in the assessment.

Natural mortality: The assessment used instantaneous natural mortality rates of 1.0, 0.6 and 0.1 for ages 0, 1, and 2 years old and older (2+). The 2+ estimate is based on the longevity of the species (over 50 years) and has not changed in the current assessment. The DW reviewed new analyses on the mortality rate of age-0 and age-1 fish. While none of these analyses were conclusive, the DW agreed that the evidence was sufficient to use natural mortality rates for age-0 and age-1 fish (as given above) that are double the rates used in the previous assessment. While the RW accepted the rationale for increasing the estimates of age-0 and age-1 natural mortality, it noted that these changes were important as they lessen the impact of bycatch of young fish relative to the impact of directed fishing.

Stock-recruitment relationship: As is almost always the case, the stock-recruitment (S-R) relationship is empirically estimated by fitting to derived estimates of spawning stock size (S) and recruitment (R). In the case of the red snapper assessment, the fitting is done within the CATCHEM model, with several assumptions (consistent with previous assessments) to constrain the fit. However, it is necessary to specify the age at which recruitment occurs. The AW specified the age at recruitment as age 1 (compared to age 0 for previous assessments). The AW report (page 13, Methods) states that this approach "essentially assumes that the bycatch mortality rate

is negligible compared to mortality rate owing to natural density-dependent processes during the first year of life." The DW did not identify data that was relevant to this assumption, nor does the AW report justify it. However, the RW was informed that there is evidence that the period of density dependent compensation extends through age 0 and possibly age 1. Thus treating mortality during age 0, but not age 1, as part of the compensatory recruitment process was considered a compromise. However, the RW included the age-0 bycatch in the base case due to the factors discussed under RW-TOR 2 below.

Fishery landings and bycatch/discards: Commercial landings and recreational catches have been reasonably well documented by systematic data collection programs since 1963 and 1981, respectively. In response to a recommendation of the DW, sporadic sources of commercial landings data were used to construct a catch history beginning in 1872 when the fishery is presumed to have begun. Recreational catches prior to 1981 were inferred by assuming that catches were proportional to human population in coastal areas, estimated from census data from 1900. In the assessment model, recreational catches were assumed to begin in 1946. While estimates prior to systematic data collection programs are particularly uncertain, the RW accepted them as being plausible and useful, and it did not suggest any alternatives.

It is noteworthy that shrimp fishing effort data is usually not available at the relatively precise depth and location scales necessary for direct bycatch estimation, which means that effort must be estimated using catch per unit effort data from interviewed fishing trips. The recent decline in the number of interviews and differences of the spatial distribution of the fishing trips those interviews cover over time is a concern. Also, it appears that estimates of fishing effort and fishing power are confounded such that it is difficult to estimate trends in the latter, although they have almost certainly occurred.

Unfortunately, there is relatively little data on discards, such as from scientific observers aboard fishing vessels. Closed season logbook data in 2001-2002 was deemed to provide some useful information on discards, although the quality of data from "self reporting" is difficult to judge. Data on recreational discards is routinely collected by interviewing "intercepted" anglers (also a form of self reporting). In general, discard estimates for commercial finfish and shrimp fisheries had to be derived from a relatively sparse set of data on discards based on assumptions that are difficult to verify. However, the RW accepted the estimates as a necessary and appropriate use of the data in order to take account of discards in the assessment.

Age composition of catches and bycatch: Age composition data have been collected sporadically, with a large number of samples collected during 1998-2002. The available data were used in the assessment. Fortunately, CATCHEM is flexible enough to not require complete age composition data. Thus, age compositions are derived within the model constrained by data when and where it is available. The RW accepted this approach and expressed concern that the extent, representativeness, and efficiency of the current sampling design should be examined.

Indices of abundance: Three fishery independent (larval survey, trawl survey, video survey) and two fishery dependent (recreational fishery, commercial longline fishery) indices of abundance are currently available. An additional longline survey was available for only a limited time period, so was not included in the base model. Separate indices were constructed for the western and eastern GoM. Trawl survey data for the eastern GoM is limited because of "hard bottom" that is not suitable for trawling. Thus, alternative fishery independent indices are desirable for the east. Fishery dependent indices were standardized using a commonly used General Linear Modeling framework. The RW agreed that the indices were appropriate for use in the assessment. However, it noted that the true uncertainty in the relationship between the larval

index and spawning stock size is likely to be larger than is captured by the sampling coefficient of variation.

General comment about data collection: The RW noted that there are many sources of useful data, and that recent enhancements to data collection programs are encouraging. Unfortunately, it also noted that relatively short term data collection efforts (e.g., it appears that enhancements begun in the late 1990s may be dissipating) are less valuable than long term systematic commitments to building the time series that are the backbone of assessments. Fortunately, a flexible modeling framework is available for the red snapper assessment. In effect, missing data is imputed within the assessment model. However, data based on direct observations are more reliable. The lack of observer data on discards is a particular concern.

2. Evaluate the adequacy, appropriateness, and application of the methods used to estimate population parameters such as abundance, biomass, and exploitation and state whether or not the methods are scientifically sound;

The Panel generally endorsed the methods used in the assessment and considered them to be scientifically sound. The one important exception was the decision of the AW to omit age-0 red snapper from the assessment model (see shrimp bycatch discussion below). The Panel was impressed by the large number of runs which had been performed and the use of multiple assessment methods.

The AW considered results from four different assessment methods: ASAP, SRA, VPA, and CATCHEM. The SRA and VPA models were primarily used in exploratory analysis. ASAP was used in previous red snapper assessments and the original intention of the AW was to update the assessment using a modified version of ASAP. Modifications to ASAP were needed to accommodate new data, and in particular the "ultra-historical" catch series (i.e., starting in 1872). Unfortunately, ASAP exhibited instability when it used the ultra-historical catch series and to a lesser extent the shorter time series (1962-2003 and 1984-2003). Further modifications to ASAP, reduced, but did not eliminate the instability. The AW chose CATCHEM to provide the base case stock assessment.

CATCHEM is in many ways a generalization of the ASAP approach, with more flexibility, better mathematical rigor due to internalizing the catch-at-age fitting, and the ability to model geographic substructure. In particular, it can deal with multiple time series with limited spatial and temporal coverage. Parameter estimates are obtained from a modified maximum likelihood best fit to the data. When fully developed, it is anticipated that CATCHEM will be able to provide fully Bayesian stock assessments for red snapper (with interval estimates obtained from marginal posterior distributions). However, the current assessment provided only point estimates (from the mode of the joint posterior distribution).

The AW report contained relatively few diagnostics and several of the Panel's requests to the Assessment Team related to the provision of further diagnostics (see Section 3 and Appendix A).

Two stock model: The AW chose to adopt a two-stock model with separate eastern and western stocks. No mixing is assumed between the stocks. This is a model assumption that may be violated, but there is little data currently available for estimating mixing rates.

Goodness-of-fit: Fishery landings were closely matched by the model, an expected feature due to the low CVs of most of these data sets. In general, the model provided good fits to the fishery-dependent and fishery-independent abundance indices, although the shrimp by-catch was not fitted well in early years when CVs were high; and larval indices were generally poorly fitted.

Stock-recruitment relation: The RW shared the concern of the AW over the reliability of the estimated relationship between spawners and recruits, given that estimates of recruitment are highest when the stock is thought to be most depleted. The RW speculated that the stock recruitment function could be quite different today than it was 100 years ago.

Capture (fishing) rates: The estimated age composition of the catch was highly truncated in all but the longline fishery samples. The assessment model attributed much of this to strongly peaked selectivities in all but the longline fishery that displayed a logistic selectivity pattern. The RW investigated estimates of age- and year-specific fishing rates for each of the fisheries to inspect if they were at realistic levels to explain the age composition data. Discussions about the age-composition and fishing rates included thoughts about whether older fish were historically found in near shore waters and were vulnerable to the fishery during the ultra-historic period or whether there is a natural ontogenetic movement of fish to deeper water as they age.

Shrimp by-catch of age-0 fish: The base case recommended by the AW did not include age-0 red snapper. The RW examined the effect of including these fish in the analysis. The logic behind the decision to include or exclude these from the analysis is based on beliefs about the timing and strength of density dependent effects on survival. The RW was unable to comment on the age at which compensatory recruitment processes are complete. However, even if there were data that provided sound evidence that compensation occurs throughout age 0, it would be inappropriate to conclude that bycatch mortality of age-0 fish is insignificant. Doing so, not only requires that compensatory recruitment processes extend through age 0, but also that these processes assert such strong control that the fit of the S-R function would be expected to be extremely tight. Clearly, this is not true for red snapper (probably not for any species). Furthermore, it assumes that S is in the asymptotic region of the S-R function where density dependent compensation is strong, not at low levels of S where compensation is weak. The RW also noted that it is not aware of any other assessment where the possibility that density dependent compensatory processes occurring simultaneously with density independent mortality from fishing (either discards or retained catch) was considered justification for treating the mortality from fishing as insignificant, nor is there a reason to think that the red snapper situation is unique. The RW concluded that the base case model should include age-0 snapper. The RW recommends that future assessments model post-recruitment density dependent mortality, as this is critical for determining the impact of shrimp trawl bycatch on red snapper rebuilding.

3. Evaluate the adequacy, appropriateness, and application of the methods used to estimate population benchmarks (e.g., MSY, Fmsy, Bmsy, MSST, MFMT, or their proxies) and required management parameters (e.g., ABC) and state whether or not the methods are scientifically sound;

The RW agreed that the methods used to derive population benchmarks by the AW were appropriate and scientifically sound. The RW endorsed the AW's view that the actual benchmarks are an emergent property of the harvest strategy; the value of MSY is conditional on selectivity patterns of the gears used in the fishery. Choices about selectivity and benchmark construction lead to some of the biggest differences in statements on stock status in the results. As a result, it is necessary to state clearly what the selected benchmark values are conditional upon.

MSY and SPR benchmarks for the RW base case are provided in the Advisory Report. The RW noted that the particular population benchmarks to be applied are policy dependent. The strategies defined by the Gulf of Mexico Fishery Management Council as possible or practical, and how the Council allocates quota among competing user groups, will define the final benchmarks to be calculated for assessment.

The RW concurred with the conclusion of the AW that, due to uncertainties over the true underlying stock-recruitment function and the underlying patterns in the fishery, spawner per recruit (SPR) benchmark levels may be more robust to these uncertainties. 30%SPR, which has already been employed by the Council, is relatively insensitive to benchmarks derived from a stock-recruitment function. Note, SPR benchmarks are consistent with MSY concepts as estimates of both F_{MSY} and B_{MSY} can be inferred from an SPR.

There is a need to test whether selected or alternative benchmarks are robust to sources of uncertainty within the process. The use of management strategy evaluation would be useful to identify alternative robust red snapper population benchmarks. See recommendations for future work.

4. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status and, if appropriate, evaluate stock rebuilding; state whether or not the methods are scientifically sound;

The AW report presented a number of projections from the CATCHEM base case. Only deterministic projections were presented, calculated at the mode of the joint posterior distribution, and using the estimated S-R function to predict future recruitments. These projections were done with several scenarios about the amount of future effort in the shrimp trawl fishery: (1) no shrimp, implying that there would be no snapper bycatch in the shrimp trawl fishery; (2) linked, implying that the effort in the directed and bycatch fisheries would remain at their current proportions; and (3) current shrimp, implying that the effort in the shrimp trawl fishery and the closed season handline fishery would remain at current levels, while the directed fisheries would be reduced proportionally. For isopleth calculations, additional levels of shrimp bycatch reduction were considered, including a 40% reduction in the shrimp effort.

The methods used to project population status and evaluate rebuilding were adequate, appropriate and scientifically sound, and were presented clearly. Ideally, the projections should be stochastic, so that it is possible to estimate probabilities of rebuilding and other performance indicators, but the RW recognizes that the stochastic and deterministic projections generally result in similar management advice. The AW did not calculate an Acceptable Biological Catch (ABC) for each stock as required by their terms of reference. However, the RW considers that it will not be possible to calculate the ABCs without clear guidance from the Council on the level of shrimp trawl bycatch that should be assumed in the calculations. In evaluating rebuilding, the AW should also have recalculated the mean generation time with the new biological information available since the last assessment.

The RW considered that the greatest source of uncertainty in the projections was the assumption that was made about future recruitments. The assessment estimated recruitments that were higher than the estimated pristine recruitment (R_0) in recent years when the spawning stock biomass was very low. Thus, using the estimated S-R function to predict future recruitments implies that future recruitments will be lower than the recruitments seen in the last two decades. To address this

uncertainty, the Panel requested that projections be done with three different assumed stock recruitment relationships: (1) R_0 predicted from the base case model fit; (2) R_0 set equal to the average of recruitments from 1984–2003; (3) R_0 set equal to the value estimated in the sensitivity analysis run which began in 1984. In each case, steepness should be kept at the value estimated in the base case. Scenarios 2 and 3 are intended to address the possibility that the recent high recruitments were caused by a long-term shift toward higher productivity of red snapper. To be consistent, the benchmarks were calculated based on the assumed S-R function in each scenario. The Panel considered that the scenario based on recent average recruitments was most likely, and should be considered the base case for the projections. However, the RW was not confident that the actual stock recruit dynamics are well represented by any of the scenarios. Therefore, these projections should only be considered plausible in the short time frame (5 to 10 years). The three scenarios should provide reasonable bounds on the uncertainty about future recruitments.

5. Ensure that required assessment results (as listed in the SEDAR Stock Assessment Report Outline) are clearly and accurately presented in the Stock Assessment Report and that such results are consistent with the Review Panel's decisions regarding adequacy, appropriateness, and application of the data and methods;

The RW commends the AW for a clear and well-written report that concisely reflected a very complicated set of analyses and a complex set of deliberations.

The AW report generally followed the suggested report outline. The RW noted that the report was well-written and was mostly clear in what decisions were made and the rationales for these decisions. The AW report was concise, considering the complexity of the assessment workshop deliberations, and clearly cited the supporting documents at appropriate places. The report appeared to be well-balanced.

The Panel had several minor editorial comments about the Stock Assessment Report. These minor comments included: the need for more detailed discussion related to the use of SPR rather than biomass-based benchmarks, more information on why age-0 red snapper by-catch was not explicitly included, a simple statement of recommended ABC, and a clear explanation of how (effective) spawning biomass was computed. The RW also noted that the research recommendations were scattered among various sections, with only those related to shrimp by-catch explicitly noted in the table of contents.

The RW noted that the wording of RW-TOR 5 was somewhat confusing. Above, we have addressed whether the AW report followed the SEDAR Stock Assessment Report Outline, and "clearly and accurately presented" stock assessment results. The remainder of TOR 5, requires that we address if "such results are consistent with the Review Panel's decisions regarding adequacy, appropriateness, and application of the data and methods". However, the assessment results presented in the AW report pre-date the decisions of the RW. We suggest that TOR 5 be reviewed (see Section 5).

6. Evaluate the performance of the Data and Assessment Workshops with regard to their respective Terms of Reference, and state whether or not the Terms of Reference for those previous workshops are adequately addressed in the Stock Assessment Report;

Data Workshop Terms of Reference

The DW participants compiled and reviewed a truly voluminous amount of information on red snapper biology and fisheries in the GoM. Their report discussed in detail the appropriate terms of reference. They discussed the quality and reliability of the available data, considered alternative assessment methods, and provided research recommendations. The details of the workshop process overall were well-documented in the DW Report. Given the diverse sources and forms of information available and the time allotted, the consensus of the RW was that the DW report adequately addressed its Terms of Reference.

Each DW term of reference is considered below.

1. Evaluate stock structure and develop a unit stock definition.

The life history sub-group of the DW supported development of a two-stock model for GoM red snapper, supported by evidence from several sources. That discussion is well-documented in the DW report.

2. Evaluate the quality and reliability of life-history information (age, growth, natural mortality, reproductive characteristics); develop models to describe growth, maturation, and fecundity by age, sex, or length as appropriate.

This was generally well done. The RW noted that the derivation of the ultra-historical time series was motivated by trying to obtain better contrast to estimate steepness in the S-R function. Assuming constant life history parameters over such an extended timeframe is of course problematic, as is estimating natural mortality for ages 0 and 1.

3. Evaluate the quality and reliability of fishery-independent measures of abundance; develop indices of population abundance by appropriate strata (e.g., age, size, and fishery) for use in assessment modeling.

The RW noted that the indices of abundance seemed to treat variability only as sample variability, not considering other sources of variation. The RW mentioned the changing geographic range of the SEAMAP survey as one potential source – it is preferable that surveys cover the entire range of the species, so that variability across the range can be captured, as well as density values in specific portions of the range.

4. Evaluate the quality and reliability of fishery-dependent measures of abundance; develop indices of population abundance by appropriate strata for use in assessment modeling.

The DW did not directly address issues regarding changes in catchability due to technological improvement in recreational or commercial fisheries over time, which the RW considered to be a potentially significant factor. Sensitivity runs during the RW were not able to resolve the importance of this factor, but it is taken to be a subject for future research.

5. Evaluate the quality and reliability of commercial and recreational fishery-dependent data for determining harvest and discard by species; develop estimates of total annual catch including both landings and discard removals.

The DW participants spent considerable energy constructing a reasonable long term history of catch in the fishery to help assess the status of the current stock against the unfished condition. The RW noted that fishery-dependent data on discards is problematic, since it is self-reported except in the cases of direct observer data. Self-reporting can be biased in either direction, and for many causes.

6. Evaluate the quality and reliability of data available for characterizing the size and age distribution of the catch (landings and discard); characterize commercial and recreational landings and discards by size and age.

This was done. The available data from recreational and commercial fisheries were compiled for the assessment.

7. Evaluate the quality and reliability of available data for estimating the impacts of management actions.

This term of reference was not directly addressed in the DW report and it was not entirely clear to the RW how it should have been. Clearly, management actions can affect data and its interpretation (e.g., changes in minimum sizes affect interpretation of size and age frequencies and must be accounted for in an assessment model), but it is less clear what type of data, by itself, can be used to estimate the effects of management actions. Certainly, an assessment model, using whatever data are available, can be used to investigate whether management actions have had a measurable impact on a stock. However, in order to be able to measure the effects of a management action, it is necessary for the action to have greater effect than the noise in the signal. In the presence of noisy data, that may require management actions with a larger impact than have been seen in the past.

The effect of management actions on the shrimp fishery, with the introduction of BRDs, was noted as one data set relevant to this term of reference. The DW had identified this and the model used fleets with and without BRDs.

8. Recommend assessment methods and models that are appropriate given the quality and scope of the data sets reviewed and management requirements.

This was adequately, though not explicitly, covered in the DW report. The RW noted that the DW and AWs were part of a "continuum" – data and methods are inextricably linked.

9. Provide recommendations for future research (research, sampling, monitoring, and assessment).

Three recommendations were noted in the DW report by the RW.

10. Prepare complete documentation of workshop actions and decisions, and generate a data workshop report (Section II. of the SEDAR assessment report).

The RW noted that the DW report was adequate in respect of this rather ambitious term of reference ("complete" is never really achieved).

Assessment Workshop

The AW participants collectively spent more effort and utilized more information in the current analysis than has been done for any prior red snapper assessment, and possibly for any assessment of any kind in the GoM. The details of the workshop process overall were well-documented in the AW Report and the excellent accompanying Proceedings document. Several alternative models were developed and reviewed, with reports available in the AW documents. Given the diverse sources and forms of information available and the time allotted, the consensus of the RW was that the AW report more than adequately addressed the Terms of Reference. A few minor editorial changes were suggested for the report, but that was not seen as a significant factor.

Each AW term of reference is considered below.

> *1. Select several appropriate modeling approaches based on: 1) available data sources, 2) parameters and values required to manage the stock, and 3) recommendations of the Data Workshop – especially including consideration of possible eastern and western stock units; develop and solve population models incorporating the most recent scientifically sound data.*

The RW was impressed with the range of methods considered and employed during the AWs.

> *2. Select a preferred model approach that will be used to provide estimates of population parameters and stock status; provide complete justification for the selected model as well as a review of those methods pursued but ultimately rejected as a preferred approach.*

The selected model is based on well-developed theory and was reviewed by several independent assessment experts during the two AWs and the RW. The RW noted that CATCHEM, the method used in base case assessments, was not fully developed. It preferred that development of the model be more complete (e.g., including standard diagnostics and stochastic projection options) before being used in an actual stock assessment. However, the RW accepted that in the current case and circumstances it was necessary to use CATCHEM since alternative models had unacceptable limitations, such as being unstable when the entire history of the fishery was included in the analysis.

Past assessments concluded that the status of the stock had varied little in the recent time period, the period from which the majority of information was available for input into stock assessments. The AW participants evaluated several methods to construct a reasonable assessment of the status of the current stock against the unfished condition. The limited information available for the early period of these fisheries was found to create problems for the ASAP model used in prior assessments. Another approach, stock reduction analysis (SRA) was attempted, but was not recommended for use when making management recommendations. Rather, it was seen as a useful exploration tool for testing alternative assumptions. The preferred model, CATCHEM, is a more generalized form of ASAP, with greater ability to include information from multiple sources and to include different fleets fishing at different rates on different segments of the stock. The AW preferred this model because, among other properties, it was able to reasonably model the fishery over the entire history without additional ad hoc inputs.

3. Provide measures of model performance, reliability, and goodness of fit.

Standardized residuals were not provided in the AW report, but some information was provided at the RW. The multinomial assumption for catch at age data appeared to be violated. This should be addressed in future assessments. Reliability of model output needs to be based on reliability of estimation procedures, and how usable it is for providing estimates of future stock structure. (Simulation studies could improve measures, but some sensitivities have been run during the RW to measure stability relative to some input assumptions.) In the view of the Panel the existing AW report was somewhat deficient with regard to diagnostics.

4. Estimate values for and provide tables of relevant stock parameters (abundance, biomass, fishery selectivity, stock-recruitment relationship, etc; include values by age and year where appropriate).

This was adequately done in the AW report.

5. Consider sources of uncertainty related to input data, modeling approach, and model configuration. Provide appropriate and representative measures of precision for stock parameter estimates.

The first part of this term of reference was well addressed by the AWs. However, interval estimates were not provided for parameters. The current implementation of CATCHEM is somewhat inefficient and given the current speed of available computers it is not possible, in a reasonable timeframe, to provide marginal posterior distributions (and hence creditability intervals) for parameters.

6. Prepare sensitivity runs or consider other modeling approaches to examine the reliability of input data sources.

This term of reference perhaps needs to be reworded to clarify how model runs can test the "reliability" as opposed to the "consistency" of input data. However, the RW comment with regard to the AW performance on this term of reference follows.

It is important to understand which indices and other data have greatest influence on the outputs. If precision is poor, but outputs are strongly influenced by that input, then there should be reservations about those outputs. Sensitivity runs to examine the robustness and reliability of the estimates with respect to the input data sets are important. A paragraph or two that stated why the data provided the results they did would have been useful in the AW report.

7. Provide Yield-per-Recruit and Stock-Recruitment analyses.

This was done.

8. Provide complete SFA criteria: evaluate existing SFA benchmarks, estimate values for alternative SFA benchmarks if appropriate, and estimate SFA benchmarks (MSY, Fmsy, Bmsy, MSST, and MFMT) if not previously estimated; develop stock control rules.

The AW report went to some pains to describe implications of different selectivities on SFA benchmarks, ABC, and future stock conditions. There were three sets of SFA benchmarks provided. While the information on the implications of these benchmarks was provided in the report in the form of isopleth diagrams, the RW felt that tabular formulation of a subset of

benchmarks would also be useful. The rebuilding schedule is dependent on policy decision on appropriate reference points. Policy decisions make important differences in terms of distribution of TAC. If projections had been developed, they would need to have been done for each possible policy selection, which was thought to be beyond the purview of the AW. Full development of rebuilding plans would have been inefficient prior to selection of appropriate reference points by the Council, and is easily and swiftly done after that selection.

> *9. Provide declarations of stock status relative to SFA benchmarks: MSY, Fmsy, Bmsy, MSST, MFMT (or their proxies if appropriate).*

This was adequately addressed.

> *10. Estimate the Allowable Biological Catch (ABC) for each stock if appropriate.*

This was addressed. No singular value was estimated, but several acceptable catch scenarios were presented, including an infinite number in isopleth diagrams.

> *11. Estimate probable future stock conditions and develop rebuilding schedules if warranted; include estimates of generation time. Calculate rebuilding analyses under the following future exploitation possibilities: F=0, F=current, F=current*0.25, F=current*0.5, F=current*0.75.*

In the AW base case, future recruitment was modeled deterministically at the level of the estimated S-R function. Rebuilding plans were not explicitly examined, but were implicit in the isopleth diagrams for the many scenarios which were evaluated. Rebuilding schedules are dependent on policy decision and their associated reference points. Full development of a rebuilding plan would have been inefficient prior to a policy decision, but is easily done after that selection. Mean generation time was not re-calculated (but will be).

The Panel was satisfied that this term of reference was adequately addressed, but did request that projections be done at two alternative higher levels of mean recruitment (and evaluated relative to benchmarks consistent with the higher recruitment levels).

> *12. Evaluate the impacts of current management actions, with emphasis on determining progress toward stated management goals.*

Current policies were included as one of the many scenarios evaluated in the AW report.

> *13. Provide recommendations for future research and data collection (field and assessment); be specific if possible in describing sampling design and recommended sampling intensity.*

The RW noted various recommendations in the AW report.

> *14. Provide thorough justification for any deviations from recommendations of the Data Workshop or subsequent modification of data sources provided by the Data Workshop.*

Deviations were adequately documented.

> *15. Fully and completely document all activities in writing:*
> *Draft Section III of the SEDAR Stock Assessment Report;*

Provide required tables of estimated values;
Prepare a first draft of the Advisory Report based on the Assessment Workshop's recommended base assessment run for consideration by the Review Panel

All reports and documentation were fully accomplished, except that development of the first draft of the Advisory Report was continued during the RW. This was to accommodate extra work performed after the second AW and during the RW.

7. Review data and assessment workshop research and monitoring recommendations and make any additional recommendations warranted;

The RW reviewed recommendations of the DW and AW, and has also made its own recommendations for research that could improve future assessments. The RW joins the AW in emphasizing that it is critical that suitable planning be done before large-scale research programs are conducted. Initial planning workshops and simulation studies can ensure that subsequent research will contribute the information most needed to resolve important questions in red snapper assessment. The more complex or expensive the proposed research, the more important this recommendation becomes.

Some of the following research recommendations are marked [D] or [A] or both. The symbol indicates that all or part of the corresponding recommendation was adapted from recommendations of the SEDAR 7 Data Workshop or Assessment Workshop.

1. *Data on shrimp fishery*. The RW recognized the importance of obtaining better estimates of fishing effort in the shrimp fishery, which might be done through vessel monitoring systems, electronic logbooks, or otherwise [A]. Also, the RW recommends that the statistical design and extent of the shrimp-trawl observer program be reviewed to ensure that the bycatch data collected are appropriate and sufficient for stock assessment.

2. *Independent estimates of mortality rates*. Direct estimation of mortality rates through tagging would reduce uncertainty in future assessments [A].

3. *Fishing power*. Research is recommended to estimate (independently of any stock assessment) changes in catchability q by gear over time. The RW believes that the introduction of GPS and marine chart-plotting equipment is likely to have increased fishing power substantially for some modes of fishing. Independent collection of data on fishing effort would provide valuable data for assessment and relieve the need to estimate catchability changes.

4. *Stock structure*. Research (e.g., tagging, otolith analysis) is recommended to better describe stock structure and mixing rates. Research should include a review of oceanographic data to see whether transport from the Campeche Banks could reasonably be supplying important numbers of larvae to the western Gulf stock [A].

5. *Spawning-stock index*. Given the many factors that can mask relationship of larvae to spawners, the value of the larval indices should be reviewed.

6. *Spatial distribution at age*. The RW recommends study of the age structure observed from longlines (survey and fishery), to clarify geographic distribution of fish as they age.

7. *Density dependence*. Research could clarify the magnitude and timing of density dependent compensation in juveniles by estimating survival (from age-0 to age-1 year) at different densities of juvenile abundance [A].

8. *Ecosystem concerns*. The RW recommends that the management objectives for the fishery complex (shrimp, red snapper, vermilion snapper, etc.) be formalized. Simulation studies could usefully identify and evaluate appropriate management strategies (including use of various reference points) and corresponding assessment modeling approaches. Research could also test the hypothesis that red snapper production is enhanced in some way by increased shrimp trawling [A].

9. *Assessment modeling*. The RW's recommendations for assessment modeling are made while recognizing that technology is currently limiting (the power of current small computers is marginal for the given model complexity). (a) Future assessments should include interval estimates on parameters and status indicators. (b) More diagnostic and output information should be provided in future assessment reports (e.g., plots or tables of F at age and plots of standardized residuals). (c) Extensive simulation tests of assessment models are recommended to examine accuracy, precision, and robustness [A].

10. *Age sampling*. The RW recommends that representative sampling of age- and length-composition of red snapper be conducted consistently across area, time, and gear.

11. *Fecundity at age*. The RW noted that few fecundity samples were available from older fish, and recommends that more such samples be collected.

12. *Model implementation*. The RW recommends that the assessment model's recruitment submodel be generalized to allow various options on the timing of bycatch mortality relative to density dependent compensation (see AW-8).

8. Prepare a Peer Review Consensus Report summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. (Drafted by the Panel during the Review Workshop with a final report due three weeks after the workshop ends.)

A first draft was completed during the RW. All Panel members contributed sections and the Assessment Team provided text and plots related to requests during (and after) the RW (see Appendix A). The report was finalized by email after the RW.

3. Additional comments

Model runs which excluded age-0 snapper were included in the Advisory Report, after the RW, by the Assessment Team. The Panel wished to emphasize their preference for the inclusion of age-0 snapper in the assessment and requested results for the RW's base case for inclusion in the Consensus Summary Report. These results are briefly discussed below.

The benchmarks are dependent on the assumed effort allocation and this must be kept in mind when considering the RW's base case results (Table 1). Note, the benchmarks have been calculated, and projections have been done, assuming that recruitment is equal to the average of the base case estimates from 1984–2003. Under the linked effort scenario, the SPR at F_{MSY} is 27% and hence the 30%-SPR results are very similar to results for runs where MSY was the

benchmark (Table 1). For the current shrimp scenario and the 40% shrimp effort reduction, the rebuild to MSY levels occurs much more quickly than for the linked scenario (Table 1). However, this is because the target levels are much lower (5-10% SPR compared to 27% SPR, see Table 1). Note, SPR values of 30% or higher can only be achieved under the linked scenario.

The RW noted that although there were periods of time when there was good sampling coverage from a range of sources and fisheries, this was generally not the rule for red snapper (e.g., patchy age data with missing years). The consistent and sustained collection of data for stock assessment purposes is a generic issue for GoM species. Good quality data over an extended timeframe needs to be available for monitoring purposes and for stock assessment as the need arises. We understand that work is currently underway to address sampling needs for a range of species. The RW supports such statistical studies to provide sampling specifications to data providers, so that sufficient age- and length-composition data are available for assessments. It may also be timely to review protocols for ensuring random (representative) sampling in the various fisheries and monitoring programs.

The Panel made several requests of the Assessment Team for additional analyses, including some additional model runs. The requests are listed below. Further details, the results, and discussion of the results are given in Appendix A.

Model runs

1. Initial base case with high virgin recruitment and constrained directed catch history

2. ASAP run with revised and expanded input data (1984 time series) and revised parameters but the same approach as the 1999 assessment

3. All remaining runs for combinations of:

{1872 time series, 1984 time series} ×{const q, random q} ×{age 0, age 1}

The shorthand "random q" refers to allowing a random walk in the catchability coefficients of the directed fisheries; "const q" denotes constant catchability in the directed fisheries. For x = 0 or 1, "age x" denotes age-x red snapper as the minimum age class in the model. Three of these runs had already been completed. The remaining runs were prioritized with the two runs "1984 time series – random q – { age 0, age 1}" given the lowest priority.

4. Projections from the base case using higher average future recruitment

The Panel requested additional projections for the base case where future recruitment and MSY calculations were predicated on higher values for R_0 than the estimated value. The requested alternative values for R_0 were (a) the average of the estimates from 1984 to 2003 and (b) the value estimated with the 1984 time series. Two sets of deterministic projections, based on recruitment scenario (a), were completed in time to be shown to the group prior to the close of the RW meeting.

Diagnostics

1. Standardized residuals: Q-Q plots and standard deviation of standardized residuals

2. Capture rate (catch + discards) at-age trajectories

3. Spawner-recruitment relationship

Miscellaneous requests

1. Mature biomass trajectories in contrast to effective-spawner trajectories

2. Virgin predicted selected age frequencies (by fishery) contrasted with average observed age frequency

There were two minor analyses which were undertaken by Panel members.

1. The absence of a plus-group, at the maximum age of 30 years, in the population model was of concern because of the relatively low assumed adult natural mortality (0.1). It was possible that the cumulative number of fish aged 31 years or older might be sufficiently large to unduly bias estimates of ratios involving the virgin stock. However, when this was checked, for effective spawners, the bias was found to be only 10%, which is inconsequential for the current assessment.

2. The figures and tables in workshop documents presenting catch-at-age estimates were not adequate for the purpose of checking, by eye, for the presence of consistently strong or weak cohorts. To alleviate the workload of the Assessment Team, a Panel member produced bubble plots of age vs cohort and presented them to the RW. By eye, it was difficult to detect any consistently strong or weak cohorts. The presentation was ideal, and illustrated the strongly domed selectivity pattern in the main fisheries. However, a domed selection pattern reduces the number of times that a cohort is seen in a fishery and this obscures consistent strength or weakness. That said, it was not obvious that the observed data were entirely consistent with the highly variable pattern of recruitment estimates in the assessment runs. There is a case for further investigation of residual patterns for the catch-at-age data to check, amongst other things, that recruitment estimates are being driven by appropriate time series (i.e., not by random fluctuations in abundance times series).

4. Stakeholder comments

As an industry representative of the for-hire fishery to the Review Panel and chairman of the GMFMC's Red Snapper Advisory Panel, here are my non-scientific feelings about the meeting.

The most disturbing thing that I encountered was the fact that the AW had decided to use a model that failed to include age-0 red snapper. The rationale was that due to high natural mortality rates of age-0 fish it was best, from a modeling standpoint, to begin the process with age-1 red snapper. The problem that I, and other non-scientists, have with this approach is that for the past twenty years we have been told that due to the high (80%) rate of shrimp by-catch mortality inflicted on the age-0 red snapper, rebuilding the stock could never be accomplished without very significant shrimp trawl by-catch reduction, regardless of what the directed fishery did or did not do.

Because of this, I am totally opposed to an assessment being released that omits the age-0 fish. The reason being that no matter how little effect age-0 omission would have on the actual model, it has the potential to have a huge effect on user group allocations when the Council begins using assessment to manage the red snapper stock.

Another thing that puzzles me as a non-modeler is the steepness of the recruitment curve. In an effort to understand and/or deal with or modify this recruitment steepness, there have been numerous runs and re-runs with different things factored in. The one thing that was never brought up is that maybe the stock has more spawners in it than are being accounted for and hence, at least in my mind, maybe the stock is in better condition then the model is showing. One of the Panel observed that it was hard for him to acknowledge the presence of an overfished stock with the recruitment steepness being shown by the model.

Another thing that I would like to speak about is the shrimp effort and/or by-catch reduction. While it is evident that BRD reduction rates are much lower then was hoped for and predicted, it seems to me that we must, somehow, find a way to incorporate the massive reductions (25%) of effort because of the economic upheavals in the shrimp fleet. These factors being high fuel costs, low shrimp prices, low performances of BRDs and the market glut of foreign and pond-raised shrimp. It seems to me that with the myriad of things that can be formulated and injected into the model, that this effort reduction can be computed as well.

Another concept that I feel is worthy of consideration is that possibly a reduction or elimination of minimum lengths might provide enough benefits in bycatch reduction and therefore by-catch mortality, particularly in the recreational sector, to offset the increased harvest that might result from such an action.

Mike Nugent, Chairman
Red Snapper Advisory Panel

5. Recommendations for future workshops

The RW has two major and two minor recommendations for future SEDARs. The recommendations are listed below followed by their justification.

1. *Change the Review Panel instructions to specifically allow minor changes to the assessment in collaboration with the Assessment Team.*

During the RW the Panel identified what were, in their opinion, deficiencies in the assessment. A strict interpretation of the Panel's instructions would have required that the shortcomings be noted in the Consensus Summary Report together with suggested remedial actions. According to their instructions the Panel was not able to request an alternative assessment. However, the remedial actions were minor in nature, and the Assessment Team were willing to make the changes during the RW. The alternative of reconvening the AW and the RW in the future would have been inefficient in terms of time and money.

The RW acknowledges that by opening the door to "minor changes" that a grey area is introduced. However, the Panel believe that future Review Panels should be attributed with sufficient common sense to allow them some latitude. They should always be guided by whether changes to the assessment can be made "safely" (without an undue possibility of errors being made), are in the spirit of the assessment (i.e., not using a different method or model), and are agreed to by the Assessment Team and the SEDAR Coordinator.

2. Review RW Term of Reference 5 to bring the Advisory Report back into the RW Terms of Reference.

The RW Term of Reference 5 has two parts. First, there is a check that the "Stock Assessment Report" is consistent with the required outline. Second, there is a check that the results are consistent with the Panel's decisions regarding adequacy and appropriateness. The second part creates some problems if an RW finds any deficiencies with the assessment which are addressed during the RW. Should the Assessment Report be revised to include the new results? This Term of Reference makes more sense if an RW is not a workshop, but simply an "accept" or "reject" forum.

The assessment goes forward into the Advisory Report, but an RW does not consider the Advisory Report in any of its Terms of Reference. During this RW, the base case and sensitivity runs to be presented in the Advisory Report were recommended by the Panel and agreed to by the Assessment Team (although the Assessment Team also included runs in the Advisory Report that the AW had agreed upon). The RW spent some time reviewing the Advisory Report (although the full set of results were not available). We took this approach because it seemed appropriate that an RW's decisions are necessarily reflected in the Advisory Report. That is, the possibility of a disjunction between an RW's decisions and the Advisory Report should be minimized.

3. Clarify Data Workshop and Assessment Workshop Terms of Reference

The RW had some difficulty in understanding the exact purpose and meaning of some of the DW and AW terms of reference. We suggest a brief review of these terms of reference.

4. Send documents as electronic copies, with hard copies of the main reports only.

This would provide some cost savings without detracting from the information available to participants. If a participant really does require all documents in hardcopy, they could still be provided on request.

Appendix A: Summary of Assessment Team results in response to Panel requests

Model runs

1. Initial base case with high virgin recruitment and constrained directed catch history

The Panel wanted some confirmation of why the input data necessarily lead to high current depletion. In an attempt to clarify this issue we requested a model run which fixed virgin recruitment at a much higher level than was estimated in the initial base case. The CVs on the directed catch history were modified to force the directed catches to be taken. The expectation, of some Panel members, was that there would be a bad fit to some, or most, of the abundance indices (showing that the indices were incompatible with a much larger virgin stock size).

The model found a best fit to the data by estimating a long series of poor recruitment from the beginning of the fishery (1872) up to near the beginning of the available abundance data. Predicted shrimp bycatch was reduced but the fit to other data was similar to the initial base case. The Panel did not pursue further runs aimed at understanding why the data were producing the high current depletion. We concluded, that with flat or increasing abundance indices in recent times, that fishing down had to have occurred before the period of the abundance indices, and that recent high catches were necessarily supported by good recruitment. The level of depletion was probably dictated by the extent of truncation in the catch-at-age data.

2. ASAP run with revised and expanded input data (1984 time series) and revised parameters but the same approach as the 1999 assessment

The Panel wanted to understand what the primary differences were between the previous assessment results in 1999, and the current assessment results, and whether the differences were due to a change of model or data. A single extra run was proposed, termed the "continuity run". This was specified to incorporate all input data (1984 time series) and parameter changes adopted in the current assessment, but to use the model (ASAP) and "logic" of the 1999 assessment.

There are a number of difficulties when making comparisons with the 1999 assessment results. First, there were "low" and "high" recruitment scenarios considered in 1999. For the continuity run, the same logic was applied, as in 1999, to derive low and high recruitment runs for comparison. However, the logic of 1999 delivered different values of R_0, than those obtained in 1999, for "low" and "high" recruitment. Secondly, ASAP and CATCHEM have different definitions of effective spawners. Comparisons between ratios are appropriate, but absolute values cannot be compared. For this reason, absolute comparisons were made using mature biomass. Lastly, the CATCHEM base case has eastern and western stocks, but in 1999 there was a single stock assumption. Comparisons are made, where appropriate, by summing eastern and western estimates.

The continuity run with high recruitment gave almost identical estimates of depletion to the 1999 high recruitment run (Figure 1). The low recruitment runs gave similar estimates of depletion, in an absolute sense, but showed different trends (Figure 1). When considered relative to an S_{MSY} benchmark the continuity runs are somewhat different to the 1999 runs, in an absolute sense, but show very similar trends (Figures 2 & 3). The CATCHEM base case shows less depletion than the ASAP runs, ranging from 1–8% of virgin effective spawners (Figure 4). However, all of the runs show high levels of depletion (less than 10% of virgin effective spawners, see Figures 1 & 4). In terms of mature biomass, large differences are seen between the 1999 ASAP runs, the

continuity runs, and the CATCHEM base case (Figure 5). The CATCHEM run shows the lowest estimated levels (from 1989 onwards), with the 1999 ASAP runs being higher by a factor of 3–4 (Figure 5). About half of the difference is accounted for by the change in the maturity and mean weight-at-age vectors (see Figure 6).

3. All remaining runs for combinations of:

{1872 time series, 1984 time series} x {const q, random q} x {age 0, age 1}

The shorthand "random q" refers to allowing a random walk in the catchability coefficients of the directed fisheries; "const q" denotes constant catchability in the directed fisheries. For x = 0 or 1, "age x" denotes age-x red snapper as the minimum age class in the model. Three of these runs had already been completed. The remaining runs were prioritized with the two runs "1984 time series – random q – { age 0, age 1}" given the lowest priority.

The three dimensions of the eight runs were identified as the primary "dimensions of choice", and the RW agreed that one of these runs would be selected as a base case (such a selection was a milestone in the draft RW Agenda). The length of the time series (primarily catch history) is an important choice because it must be acknowledged that the early catch history, although based on best available data, has uncertainties associated with it which cannot adequately be captured by assigning relatively arbitrary (but high) CVs. The 1984 time series option uses only actual observations. The random walk q was investigated as there undoubtedly have been changes in catchability (due to technology improvements). There was concern that the higher recent recruitment estimates could be an artifact of the model assumption that restricted catchability to a constant level. The issue of age-0 fish being included or not is clearly important (see Section 2.2).

The two random q runs with the long catch history were found to be very similar to the constant q runs. While these sensitivities suggested that catchability may have been changing, any conclusions are weak because of the lack of direct observations on fishing effort. The sensitivity runs made no substantial difference in the estimated recruitment pattern. Because of these results, the request for the two low priority runs was withdrawn

The length of the time series made some difference to the absolute level of biomass (and hence long term yields) but gave similar results with regard to depletion level. The previously observed instability of the solution to the 1984 time series was still present, and the likelihood surface was perceived as being much "flatter". The omission or not of the age-0 red snapper in the model made little difference to a qualitative assessment of the results. The RW chose as a base case the 1872 time series, with constant q, and inclusion of the age-0 red snapper. The 1984 time series, with constant q, and inclusion of age-0 red snapper was recommended as a sensitivity run to be taken forward to the Advisory Report.

4. Projections from the base case using higher average future recruitment

The Panel requested additional projections for the base case where future recruitment and MSY calculations were predicated on higher values for R_0 than the estimated value. The requested alternative values for R_0 were (a) the average of the estimates from 1984 to 2003, to reflect the possibility that the more recent values may provide a better reflection of recruitment in the near future, and (b) the value estimated with the 1984 time series, ostensibly as an upper bound. These requests required non-trivial changes to the existing code, which were accomplished towards the end of the meeting. Two sets of deterministic projections, based on recruitment scenario (a), were completed in time to be presented to the meeting.

The first set assumed a 40% reduction in shrimp bycatch rates beginning in 2007 and various levels of constant catch from the directed fishery. The results indicated that the stock could recover to MSY levels by as early as 2017 even with the current TAC, provided shrimp bycatch is in fact reduced by 40% (and provided post-settlement compensatory mortality effects are unimportant relative to shrimp bycatch). The second set of projections assumed current shrimp bycatch rates would continue into the future and the effort of the directed fisheries would be reduced to F_{MSY}. Under those conditions the stock could recover to MSY levels by 2025, but the initial TAC would have to be reduced to about 7 million pounds.

Diagnostics

1. Standardized residuals

The original assessment was rather weak on the provision of diagnostics. The Panel was interested in whether the residuals were consistent with the model's assumed (and estimated, through a common variance term) CVs and the statistical error structures: lognormal for catch, effort, and abundance indices; and multinomial for catch-at-age.

The production of quantile to quantile (Q-Q) plots was requested for the RW base case together with the standard deviations of the standardized residuals (sdsr). If the assumptions of the model are satisfied then Q-Q plots should show the residual distribution near the y=x line, and the sdsr values should be near to 1.

Most Q-Q plots showed good agreement with the lognormal assumption. The multinomial assumption for the catch-at-age data did not appear to be satisfied (Figure 7). The distribution of catch-at-age residuals was skewed with a standard deviation much greater than 1 (Table 2). Most other time series had residuals consistent with their CVs, the exceptions being the two handline time series (which were fitted too well relative to their CVs) and the larval-E time series (which was fitted badly relative to the CVs).

The Panel did not consider these results to be a problem for this assessment. Rather, they viewed the further development of diagnostics as work for the future.

2. Capture rate (catch + discards) at-age trajectories

The Panel debated what would be a useful diagnostic for a reality check on the estimated catch levels. The question is whether estimated catch levels are credible given the available biomass. The Panel requested time trajectories of (instantaneous) capture rate (catch plus discards) at age by stock.

The two stocks showed different patterns at age as would be expected given different levels of shrimp bycatch and the somewhat different selectivity patterns of the fisheries (Figure 8). The eastern stock had lowest rates on ages 0–2 years, with highest rates on ages 3–5 years (Figure 8a). In contrast, the western stock had its highest rate on age-1, with lowest rates on the oldest age classes; the age-0 red snapper had rates similar to ages 3-7 years (Figure 8b). The credibility of any of these rates was not addressed by the RW as there is currently insufficient understanding of the distribution of age classes relative to the effort in the fisheries.

3. Spawner-recruitment relationship

The Panel requested, for this report, a plot of the estimated recruitment used in the RW base case, together with the predicted average future recruitment from the S-R function (Figure 9). This plot illustrates, for both stocks, that the past and future recruitment from the S-R function is lower than average estimated recruitment over the last 20 years. This is why, on the balance of probabilities, the Panel prefer the use of mean estimated recent recruitment to predict future recruitment levels.

Miscellaneous requests

1. Mature biomass trajectories in contrast to effective-spawner trajectories

The Panel wanted some idea of the effect of increasing egg-production at age on the perception of stock depletion. That is, what proportion of the high level of depletion in the total egg production (as measured by effective age-30 spawners), was due to the loss of older, larger, fish (females), and what was due to depletion of mature biomass.

The Assessment Team produced plots of mature biomass trajectories (as a proportion of virgin) for each stock which were based on mean weight-at-age from catch data, which was only available up to age 15. The comparison of mature biomass with effective spawners showed a divergence between the trajectories for the western stock early in the time frame (1870–2003) which was not present for the eastern stock. The RW concluded that the stock difference may have been an artifact of the use of mean weights from catch data. A more appropriate method of calculating mature biomass was pursued after the RW.

2. Virgin predicted selected age frequencies (by fishery) contrasted with average observed age frequency

The Assessment Team suggested it would be useful to contrast age frequencies for selected biomass in the virgin population with the average observed age frequency. The Panel agreed that this could provide some insight into how the observed age frequencies were influencing the estimates of depletion.

There is strong contrast between the virgin and exploited age frequencies even for the fisheries with highly domed selectivity patterns (Figure 10).

Table 1. Summary of results for the eastern and western stocks for the RW base case (age 0 included, 1872-2003 time series, R_0 = average recruitment from 1984-2003) for F_{MSY} and $F_{30\%}$ under the current shrimp effort, a 40% reduction in shrimp effort, and the current effort proportions ("linked"). SPR values of 30% or higher could not be achieved for the current shrimp and 40% shrimp reduction scenarios.

		Effort allocation schedule		
Area	Benchmark statistic	Current shrimp	40% shrimp reduction	Linked
East	MSY (mp)	4.6	5.4	6.6
	F_{2003}/F_{MSY}	2.3	2.1	3.8
	S_{2003}/S_{MSY}	0.34	0.34	0.12
	S_{2010}/S_{MSY}	0.7	0.67	0.42
	year $S/S_{MSY} = 1$	2020	2020	2027
	SPR at F_{MSY}	10%	10%	27%
	Yield at $F_{30\%}$ (mp)			6.6
	$F_{2003}/F_{30\%}$			4.1
	$S_{2003}/S_{30\%}$			0.11
	$S_{2010}/S_{30\%}$			0.39
	year $S/S_{30\%} = 1$			2027
West	MSY (mp)	7.1	12.1	19.9
	F_{2003}/F_{MSY}	2.3	2.1	3.8
	S_{2003}/S_{MSY}	0.26	0.17	0.04
	S_{2010}/S_{MSY}	0.62	0.42	0.24
	year $S/S_{MSY} = 1$	2025	2027	2032
	SPR at F_{MSY}	5%	7%	27%
	Yield at $F_{30\%}$ (mp)			19.8
	$F_{2003}/F_{30\%}$			4.1
	$S_{2003}/S_{30\%}$			0.04
	$S_{2010}/S_{30\%}$			0.22
	year $S/S_{30\%} = 1$			2032

Table 2. Standard deviation of the standardized residuals for each index and for all catch-at-age residuals. There are east (E) and west (W) series for each index (HL=hand line; LARV=larval survey; REC=recreational; TRW0=trawl survey age-0; TRW1=trawl survey age-1; VID=video survey).

Index	Standard deviation of standardized residuals
HL-E	0.53
HL-W	0.54
LARV-E	1.98
LARV-W	1.51
REC-E	0.71
REC-W	0.84
TRW0-E	1.47
TRW0-W	1.32
TRW1-E	1.08
TRW1-W	1.08
VID-E	0.81
VID-W	0.80
Catch-at-age	3.48

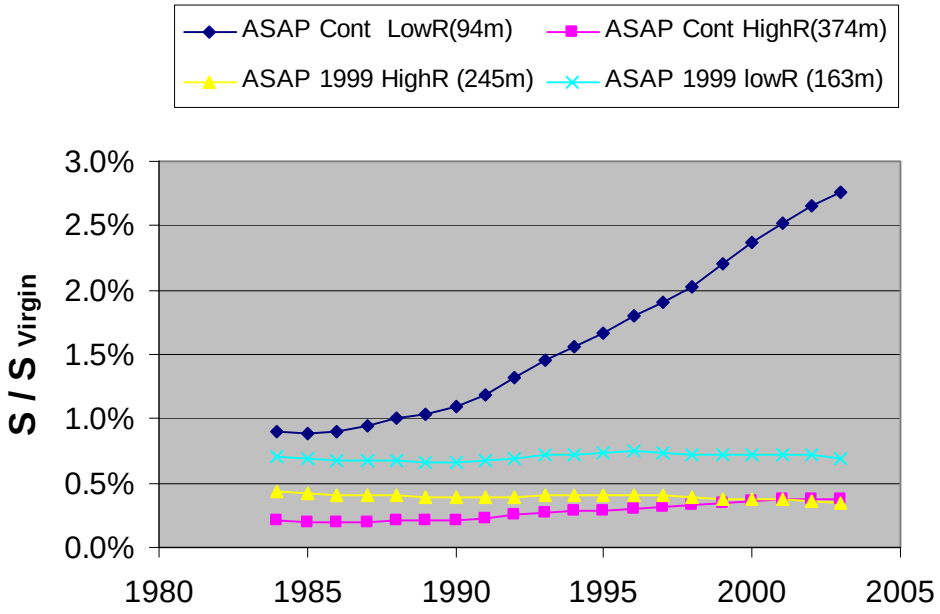


Figure 1: Effective spawners as a percentage of virgin from 1984–2003 for the 1999 ASAP assessment (ASAP 1999) and the RW continuity run (ASAP Cont). There are low and high recruitment scenarios for each case. Values of R_0 for the continuity run were derived using the same logic as the 1999 assessment.

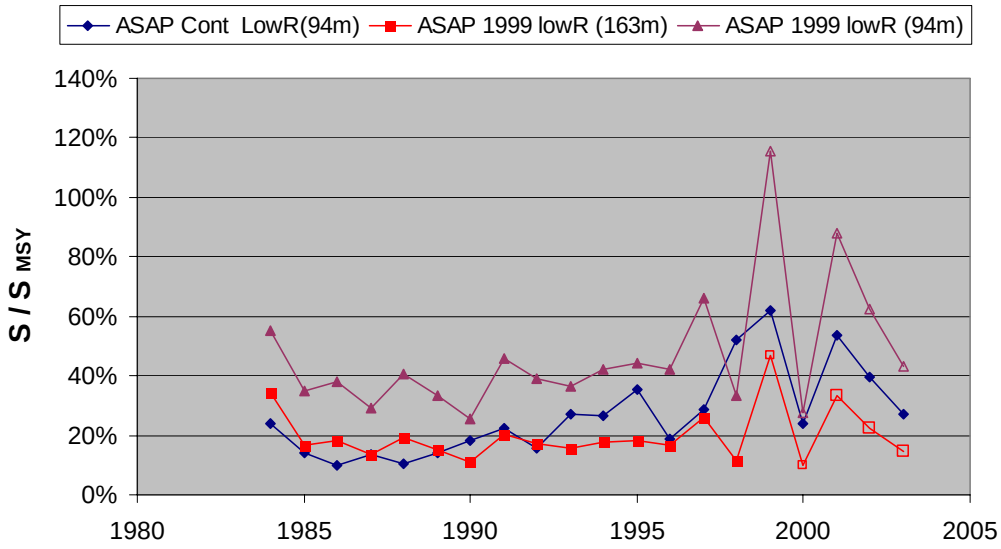


Figure 2: Effective spawners as a percentage of S_{MSY} for low recruitment cases. ASAP 1999 values for 1999–2003 are from a projection using observed directed yield and shrimp bycatch (indicated by open symbols).

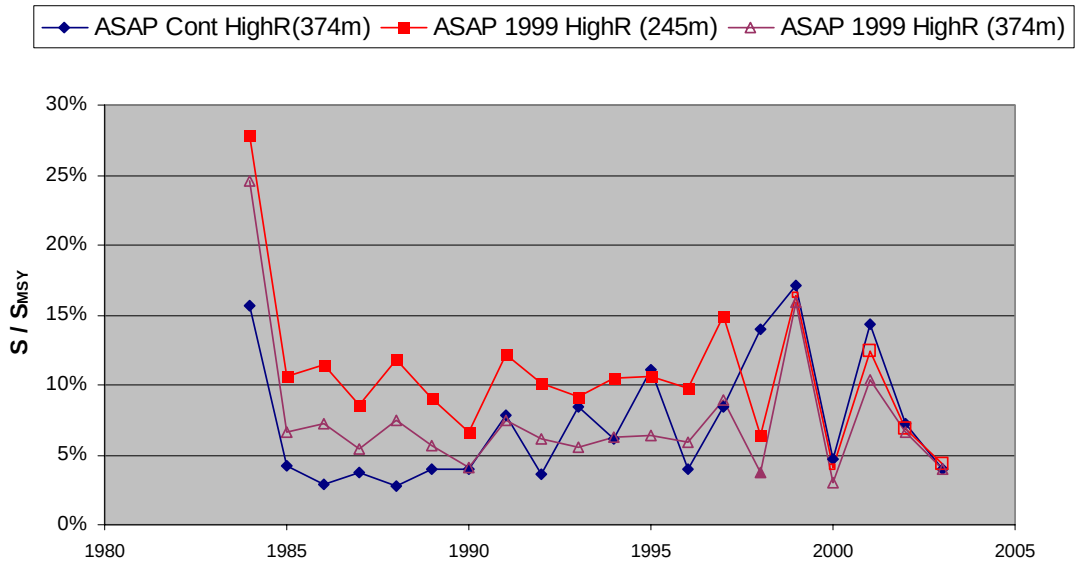


Figure 3: Effective spawners as a percentage of S_{MSY} for high recruitment cases. ASAP 1999 values for 1999–2003 are from a projection using observed directed yield and shrimp bycatch (indicated by open symbols).

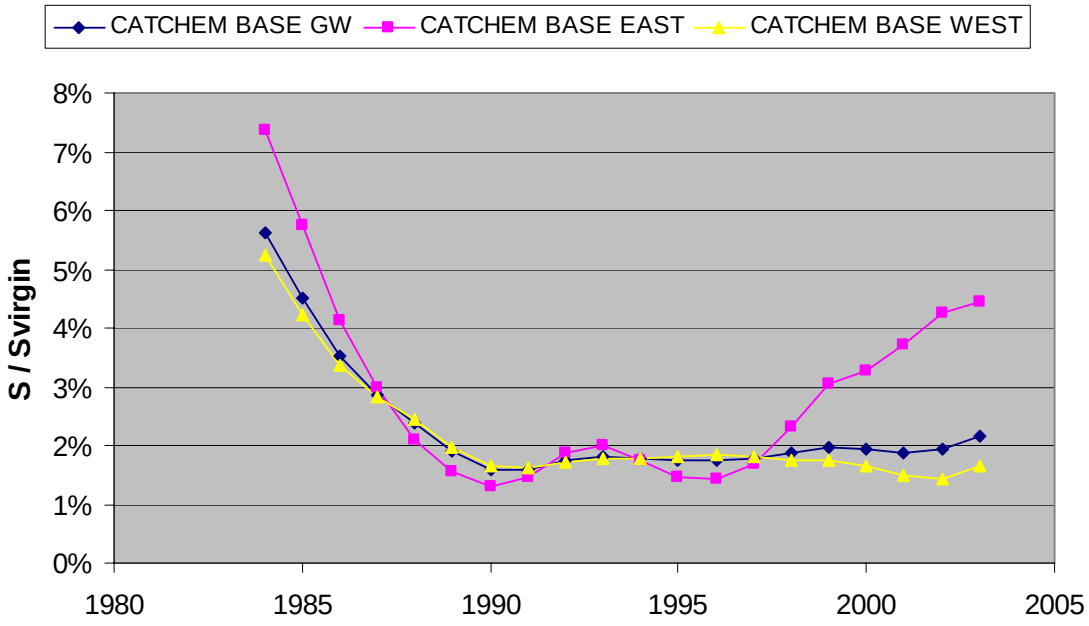


Figure 4: Effective spawners as a percentage of virgin from 1984–2003 for the CATCHEM RW base case. Results are shown for the eastern and western stocks separately and for the sum of the two stocks (GW).

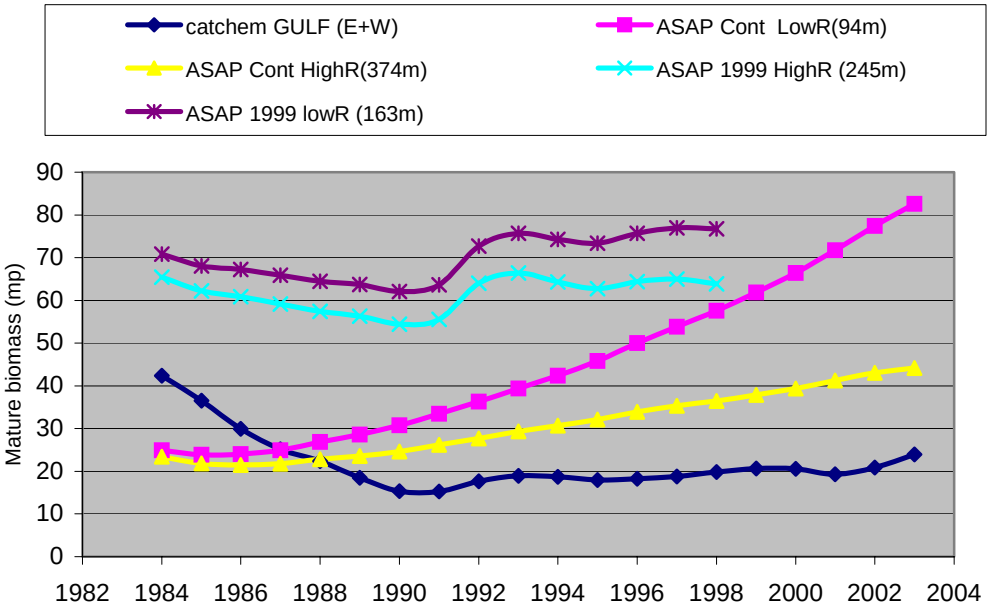


Figure 5: Mature biomass from 1984–2003 for the CATCHEM and ASAP continuity runs and for 1984–1998 for the 1999 ASAP low and high recruitment runs. Maturity and mean weight-at-age vectors used for the 1999 ASAP runs were consistent with assumptions in 1999.

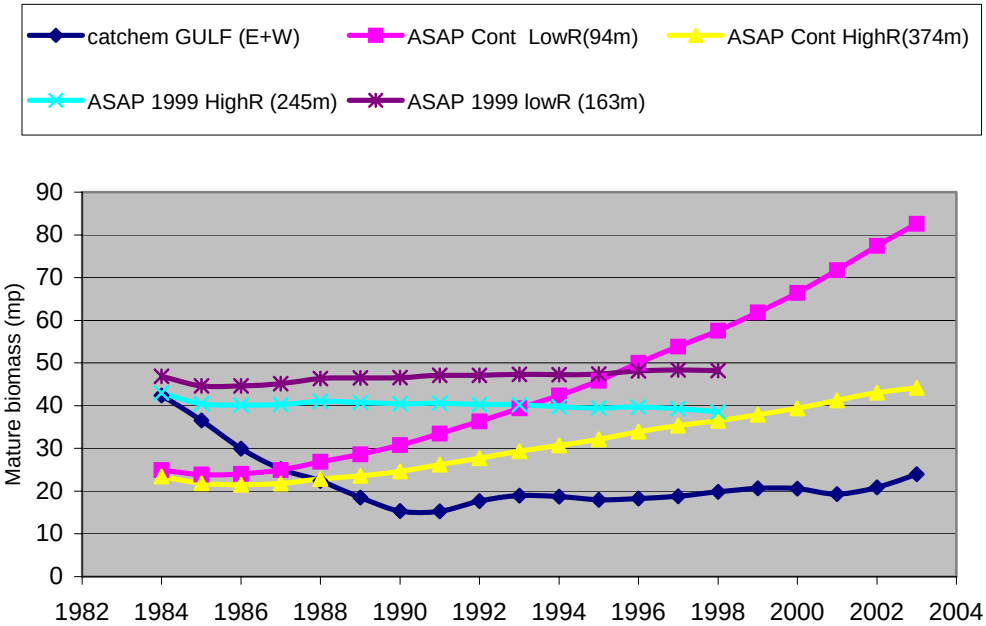


Figure 6: Mature biomass from 1984–2003 for the CATCHEM and ASAP continuity runs and from 1984–1998 for the 1999 ASAP low and high recruitment runs. The CATCHEM maturity and mean weight-at-age vectors were used for all runs.

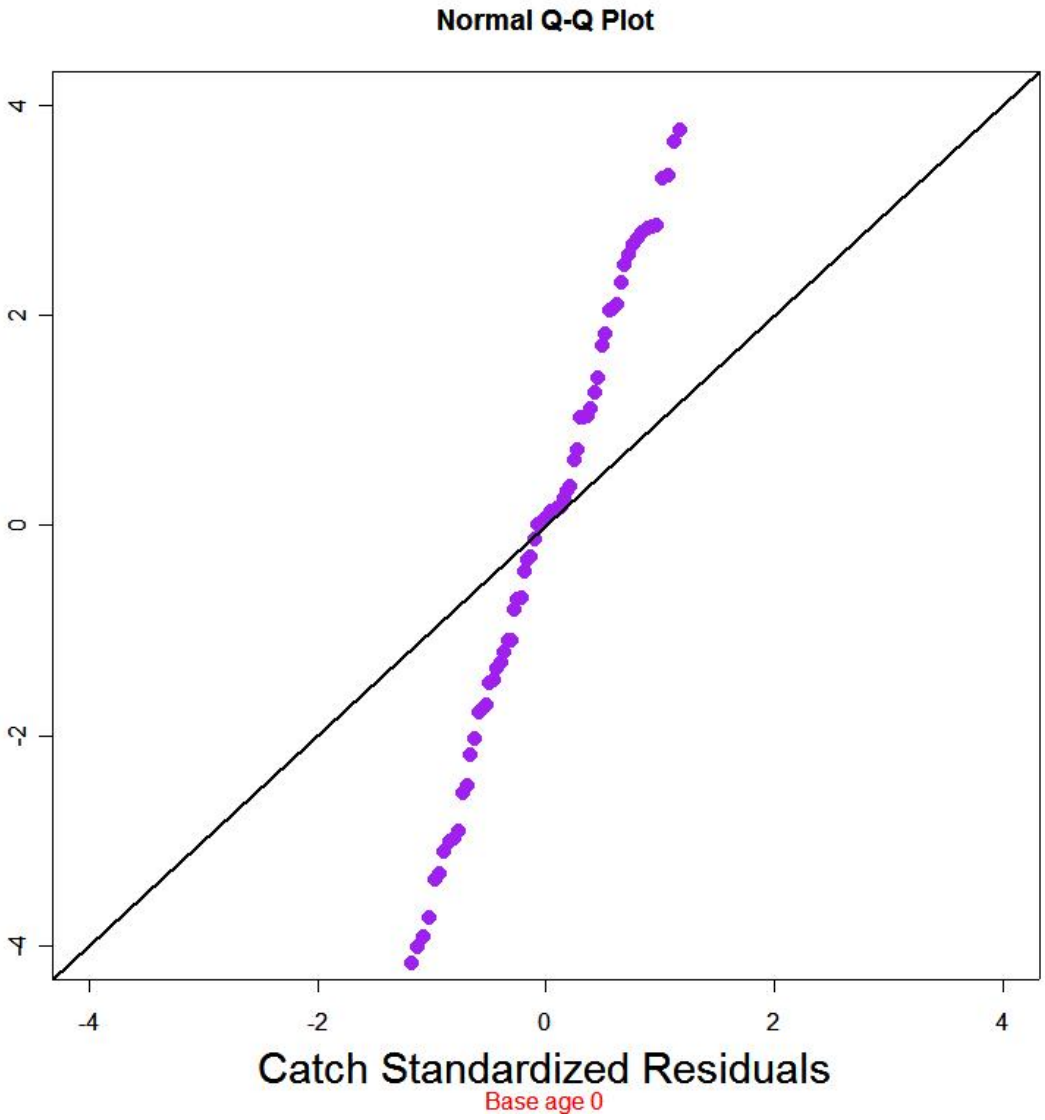
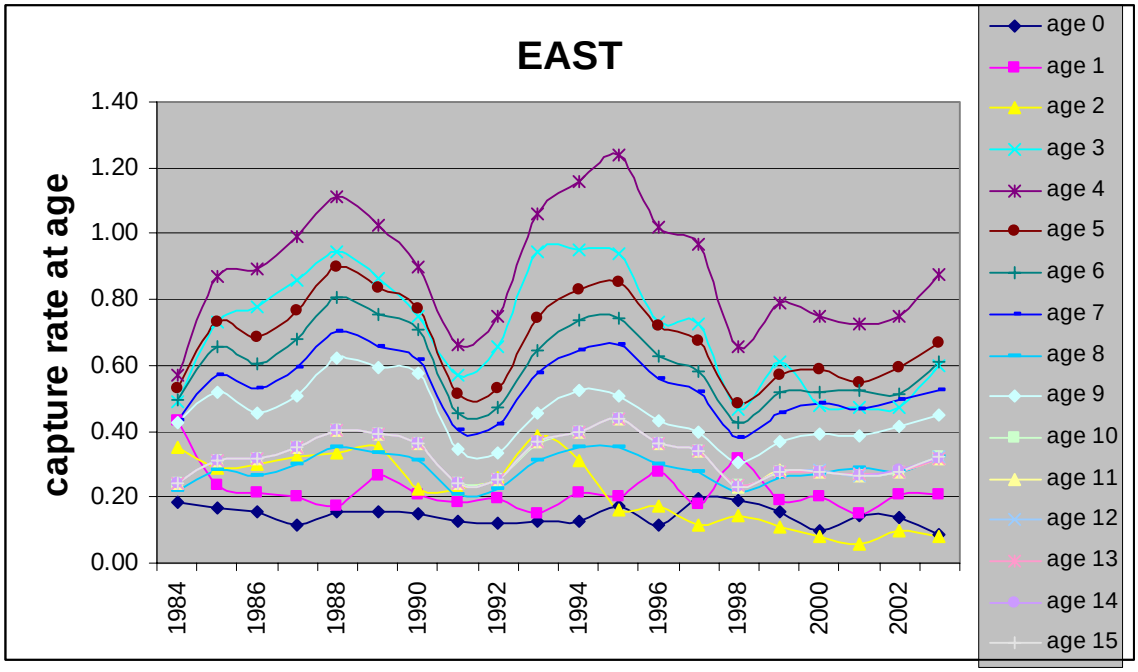


Figure 7. Q-Q plot of standardized residuals for the RW base case fit to observed catch-at-age (mean = -0.084, standard deviation = 3.48) showing highly skewed and over-dispersed residuals

(a)



(b)

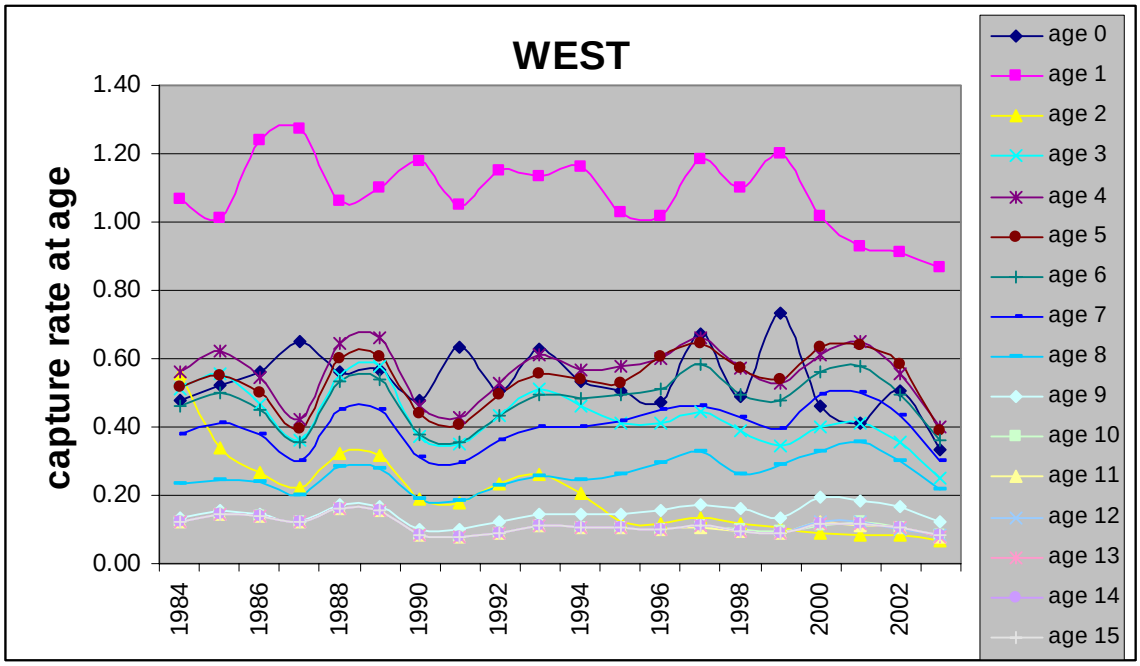
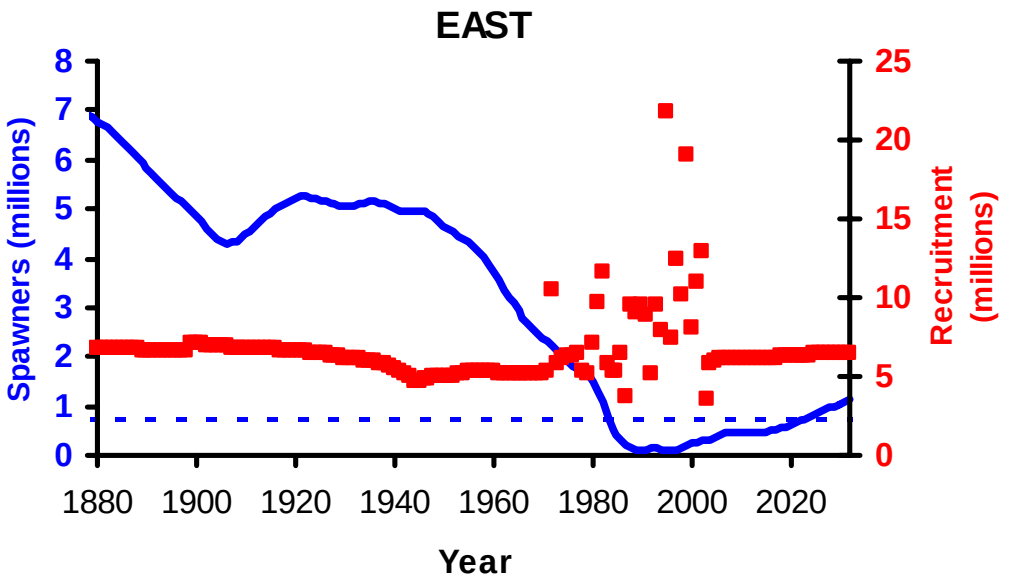


Figure 8. Capture rate at age in the east (a) and west (b) from 1984-2003. Capture rate reflects the instantaneous rate for fish that were caught (this includes landings as well as discards due to size limits and closed seasons). Age 15 is a plus group.

(a)



(b)

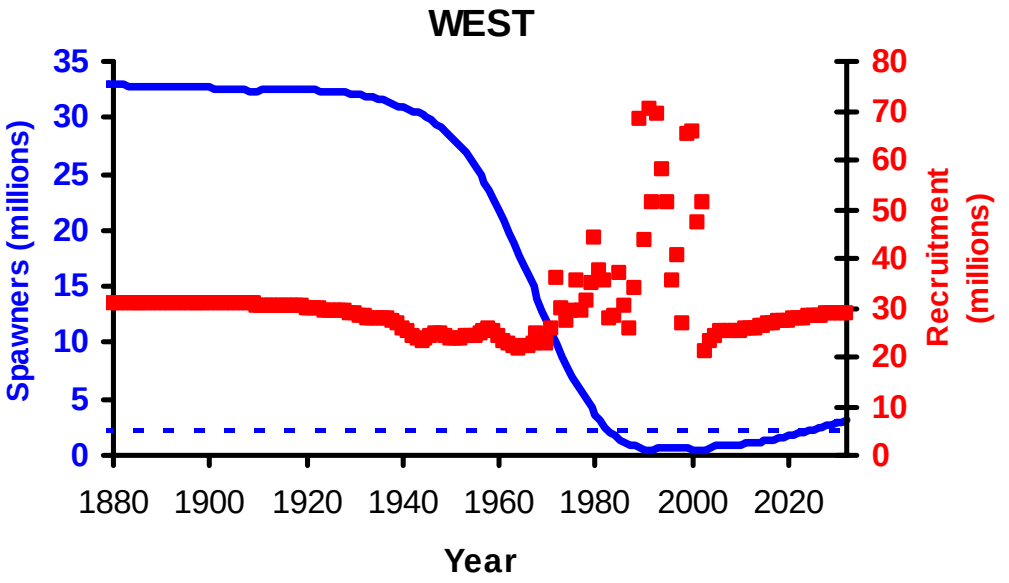
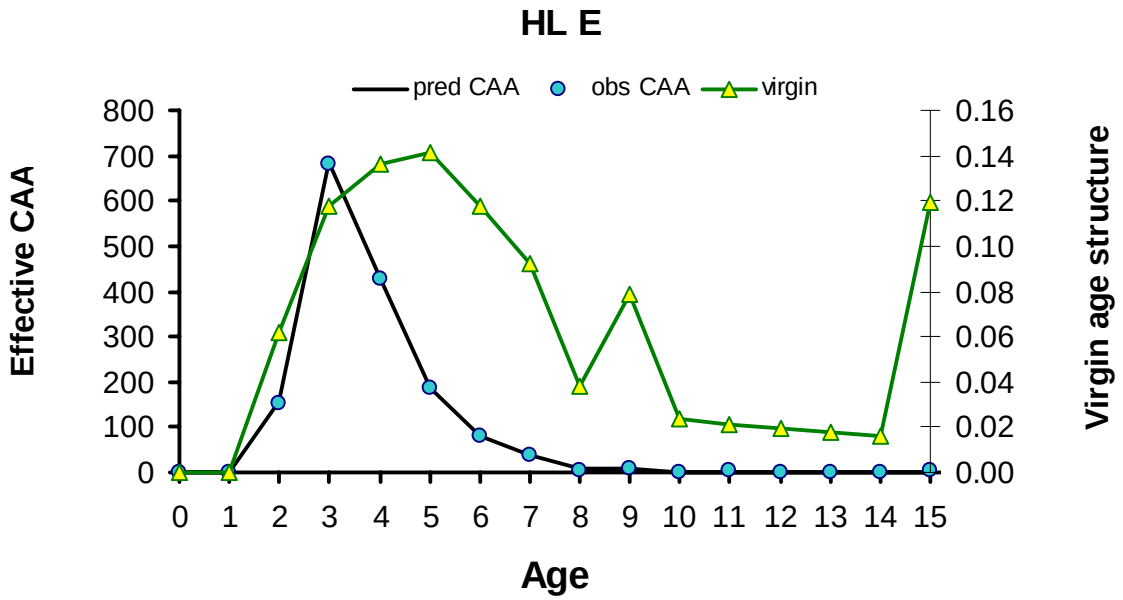


Figure 9. Trajectory of estimated effective spawners and predicted recruits in the east (a) and west (b) from 1872-2032. The dashed line is the effective spawners corresponding to 30%SPR.

(a)



(b)

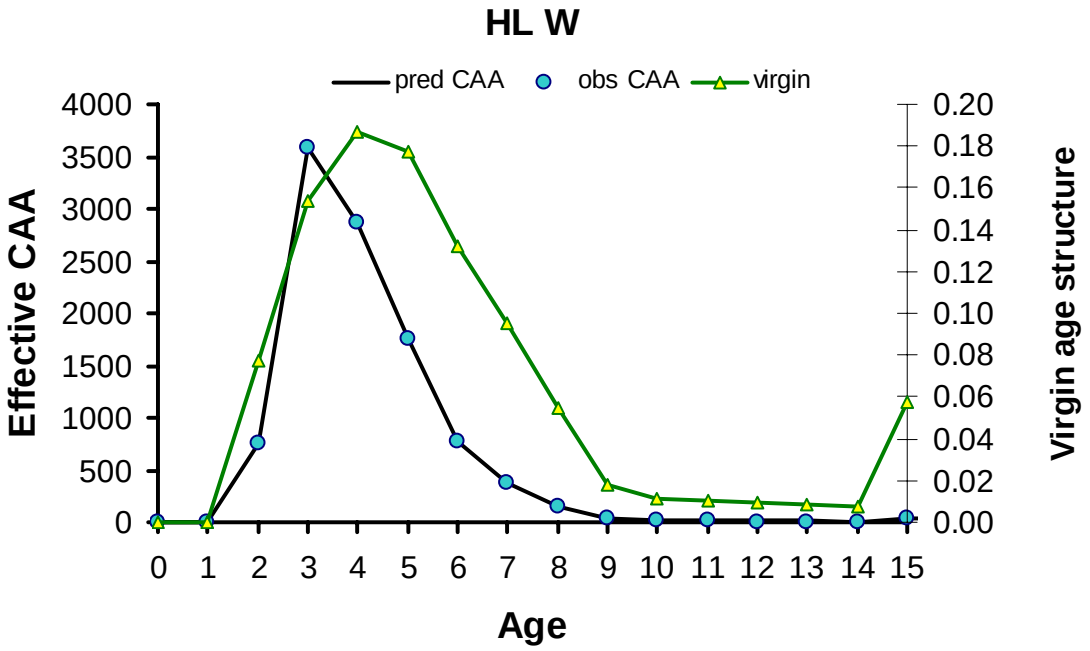


Figure 10. Unexploited age frequency (virgin) versus exploited age frequency (observed averaged across years, and predicted averaged across years) for the handline fisheries in the east (a) and west (b). Age 15 is a plus group.