Review Report

SEDAR 12: Gulf of Mexico Red Grouper

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Centre for Independent Experts

Table of Contents

EXECUTIVE SUMMARY **3**

1. BACKGROUND **5**

2. REVIEW ACTIVITIES **5**

3. SUMMARY OF FINDINGS AND RECOMMENDATIONS **6**

CONSENSUS REPORT 6
FORWARD PROJECTIONS AND RECRUITMENT 6
REPRODUCTION 8
AGE ESTIMATION 9
DISCARDS 10
DRY TORTUGAS MARINE RESERVE (DTMR) 13
CATCHABILITY 13
ECOSYSTEM AND ENVIRONMENTAL DATA 14

4. SEDAR PROCESS **15**

APPENDIX 1: DOCUMENT LIST - SEDAR12 GULF OF MEXICO RED GROUPER **16**

APPENDIX 2: TERMS OF REFERENCE - SEDAR 12 REVIEW WORKSHOP **19**

APPENDIX 3: PARTICIPANTS - SEDAR 12 REVIEW WORKSHOP **20**

APPENDIX 4: DRAFT AGENDA **23**

APPENDIX 5: CIE STATEMENT OF WORK **25**

Executive Summary

The 12th South East Data, Assessment and Review (SEDAR 12) meeting was designed to review the Gulf of Mexico Red Grouper fishery. The assessment reports were provided by email from the SEDAR Co-ordinator (John Carmichael) before the SEDAR 12 meeting. In addition, other reports from the Data and Assessment meetings were downloaded from www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=12 A list of these documents is provided in Appendix 1. The meeting was held from 29th January to 2 February 2007 in Atlanta, Georgia.

Since the previous assessment in 2002 there have been a number of improvements in both the data inputs and the model structure. The review panel assessed the 2006 assessment to evaluate the adequacy, appropriateness, and application of the data, model, outcomes and future scenarios according to the Terms of Reference provided (Appendix 2). A Consensus Report addressing each of the items in the Terms of Reference is provided separately and this CIE report is aimed at providing increased detail regarding issues and recommendations raised in the Consensus Report. While each of the review panel contributed to all sections of the Consensus Report, summary tasks were delegated to different panel members based on their expertise. The author was asked to focus on the life history components.

The 2006 red grouper assessment is a significant improvement on the previous (2002) assessment. In particular, the addition of longer time series of indices has improved estimates of long term trends, direct age composition data has greatly improved estimates of year-to-year changes in recruitment and has allowed modification of the estimated level of natural mortality. As expected from an assessment update, the assessment is now able to track more recent recruitments, notably the large recruitment from the 1999 year class. However, lack of a pre-recruit survey prevents detection of recruitment fluctuations past 2002. Some revision of historical stock status estimates has occurred, and the magnitude of these changes is not unexpected given the degree of uncertainty in the estimates.

The stock in 2006 is estimated to be at a sustainable level of abundance and the current level of total catch is consistent with keeping the stock near this level of abundance. The stock is estimated to be fully rebuilt and overfishing is not occurring. Management measures and other factors that influence the level of fishing activity, and therefore fishing mortality (*F*), have resulted in recent levels of *F* that are quite close to the *F* level that would produce optimum yield (*OY*). This *F* level is set to 75% of the overfishing level in the FMP covering red grouper. This conclusion is derived from model results that are clearly supported by the stable or upward trends in the fishery CPUE and survey indicator data, and in the fishery age composition data which indicate a broad age distribution with an increasing number of older fish appearing in the fishery and continued occurrence of new recruits.

While there is confidence in the current estimates, caution needs to be considered in future projections of the model as the rebuilding between 2002 and 2006 is largely dependent on a large and possibly anomalous recruitment event.

Recommendations in addition to the Consensus Report include:

(i) Improvement in the derivation of fecundity and age estimates. As red grouper is a protogynous hermaphrodite, it appears that more sophisticated data analyses is required that accounts for the sex change;
(ii) The fate of discarded fish is a major concern for the fishery as approximately a third of fish caught are discarded with a third of these discarded fish being pre-recruits. The model currently has difficulty in matching observed discards to estimated discards and greater effort in understanding the magnitude and fate of discards is required;
(iii) Improved estimates of catchability (effective effort). Although it is difficult to measure it is a cause of considerable uncertainty in the model as demonstrated by the sensitivity analyses.
(iv) While there had been significant improvements in the assessment through the improved collection and analyses of fishery specific data, there was a lack of any environmental or ecosystem data or data reports combining biological trends (e.g. recruitment) or data analyses (e.g. growth) across similar species. Such information is becoming increasingly important as fisheries begin to address ecosystem based fishery management objectives and to assist in interpreting the process responsible for the interannual patterns observed (e.g. range extensions and improved catches in the northwest, recruitment patterns).

The SEDAR 12 process was organised professionally and progressed smoothly. The NMFS-SEFSC's assessment team members were professional and efficient in their presentations and in meeting the requests of the review panel. The review process benefited from the diversity of backgrounds of the reviewers that provided expertise from modelling to biological interpretation. The following recommendations are listed for consideration for future reviews:

(i) A diversity of backgrounds in the review panel is encouraged
(ii) It is recommended for future reviews that a person familiar with the data analyses is included.
(iii) Greater participation by the key stakeholders should be encouraged.
(iv) The timing of future reviews should be determined from a need rather than a time commitment.

1. Background

The South East Data, Assessment and Review (SEDAR) is a process for stock assessment development and review conducted by 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. SEADR is organised around three workshops. A data workshop evaluates the data inputs into the assessment, an assessment workshop evaluates models used to undertake an assessment of the fishery and, a review workshop undertakes independent peer review of the data, assessment methods and assessment outputs.

There were 17 data workshop documents, 8 assessment workshop documents, one review workshop document and 10 reference documents provided as background for the review (Appendix 1). The assessment was provided by email prior to the review workshop.

The review was held from the 29th January to the 2nd February 2007 at the Doubletree Buckhead Atlanta in Atlanta, GA.

In addition to the assessment team, the workshop also included observers representing different sectors that have an interest in the Gulf of Mexico Red Grouper resource (Appendix 3).

2. Review Activities

The review panel consisted of Dr Richard Methot from the Northwest Fisheries Science Center, NOAA and three Center for Independent Experts reviewers: Dr John Casey from the Centre for Environment, Fisheries and Aquaculture Science, UK; Dr Paul Medley, a private consultant, UK; and the author.

The meeting closely followed the draft agenda (Appendix 4).

Day 1 focused on presentations of the input data including biological data (e.g. growth, reproduction) and fishery dependent commercial and recreational data including indices of abundance.

Day 2 continued with presentations of the fishery independent methods being used (and developed) for estimating abundance. Later in Day 2 presentations were made of the ASAP model.

Day 3 focused on model inputs, particularly the estimates of natural mortality, discard mortalities and catchability. Sensitivity runs were requested on these parameters.

Day 4 discussed in more detail the historical data series and the fishery independent indices. Based on the sensitivity runs undertaken prior to day four, the review panel focused on a final configuration of the model (base model) and an associated set of sensitivity runs.

Day 5 included the final presentation of the model runs.

During the workshop the review panel meet briefly each morning to discuss and summarise the previous day's outcomes. Although all panel members participated in each component of the workshop, the review panel split tasks between panel members to match their backgrounds and interests so as to maximise outputs. Each panel member produced a summary of the specific task and this was reviewed by the other panel members prior to inclusion in the consensus report.

Dr Richard Methot reviewed the Assessment Model, Dr John Casey reviewed the Indices of Abundance, Dr Paul Medley reviewed the Fishery Data and the author reviewed the Life History Data.

A consensus report on the Gulf of Mexico Red Grouper is provided as a separate document. This report provides elaborations on points raised in the Consensus Report and observations/analyses/recommendations made by the author that should be considered for future assessments.

3. Summary of Findings and Recommendations

Consensus Report

The Consensus Report on the Gulf of Mexico Red Grouper developed during the review and finalised after the review has been circulated to the review panel. It is an accurate record of the findings of the Review Panel and contains a full record of items discussed and concerns raised for each of the Terms of Reference. The Consensus Report is provided as a separate document. These following summary points are elaborations on issues raised in the Consensus Report and observations, analyses and recommendations made by the author that should be considered for future assessments.

Forward projections and recruitment

The forward projections from the new base model indicate that the current instantaneous fishing mortality (F) is around the optimal level of 0.75 F_{MSY}. It is recognised that part of the improved performance in the fishery since the last assessment in 2002 has been due to a large and positive recruitment pulse that was age 1 in 2000 and a smaller recruitment pulse three years earlier (i.e. age 1 in 1997) (Figure 1). With a weight based TAC capping total catch, the additional biomass associated with above average recruitment provides biomass benefits to the fishery for many years after recruiting to the fishery. This is because the uncaught fish contribute to future catches both in numbers and annual growth increments.

With a relatively short time series for use in the Beverton-Holt stock recruitment analysis, these two peaks have leverage in establishing the SSR relationship. Over the 17 year time series (1986 -2002, there is no data to be able to estimate recruitment from 2003-2005), estimated recruitments were below the average recruitment in 11 occasions suggesting that, on average, there is a 66% chance that recruitment will be below the average used in the model. The two recruitment peaks in 1997 and 2000 are the only time that the estimated recruitments were above the average in the last 12 years.

If recruitment follows a similar pattern to previous recruitment estimates then there is a high probability that lower than average recruitments could be expected over the next few years. This will begin to move F_{OY} to F_{MSY} until the next recruitment peak arrives. In the short time series available there was a 5 year period (1992-1996) of estimated recruitments that were below the average. Providing recruitment peaks of similar magnitude continue to occur the buffer provided by using F_{OY} should minimise the probability of overfishing occurring during years of lower recruitment. While there is no reason to suggest that such peaks will not continue to occur, it is worth noting that the Assessment Workshop Report classified the 2000 recruitment as an anomaly in the SRA model runs. The magnitude of the peak was substantially larger than any other recruitment events described by the SRA model.

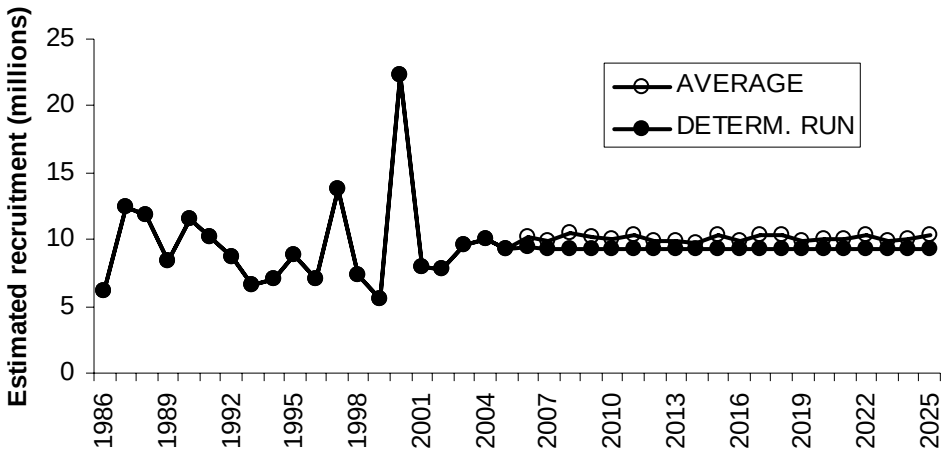

Figure 1. Estimate recruitment at age 1 (1986 – 2002) and model projections for average recruitment and the deterministic run.

The cause of these recruitment events is unknown. Dr Stu Kennedy (GMFMC) showed me a plot of both gag and red grouper estimated recruitments. Recruitment peaks in both these species occurred either during the same year or within 12 months of each other. Although the data set is short, the similarity in timing of positive recruitment peaks would suggest that environmental events may be key drivers for recruitment in both these species. Although no environmental/ ecosystem data were presented in either the data workshop documents or the review, it would be worthwhile exploring if other species that occur in the gag-red grouper complex have similar recruitment patterns. The recruitment index should also be correlated with environmental variables (eg, El Nino/La Nina periods, surface sea temperature (satellite imagery) to indicate cooler or warmer years, etc.).

Recommendations:
(1) Recruitment indices be developed for the fishery
(2) Recruitment indices are linked between species and with environmental variables

Reproduction

As noted in the consensus report there was concern regarding the gonad weight and percentage female metrics used to determine the relative fecundity relationship used in the model.

The gonad weight to age relationship was based on the entire data set and thus heavily weighted towards the smaller ages that represented the majority of samples collected. In most age-fecundity relationships there is a substantial increase in gonad weight as the fish increase in size and age. This relationship was present in the upper 25-50% of the values but there were a consistent number of large females with very small gonads (e.g. 831mm with 20.64g gonad; 830mm with 108.1g gonad; 884mm with 98.7g gonad). It seems unrealistic that these animals are substantially contributing to reproduction. In querying the data, Dr Robert Muller (Florida Fish & Wildlife Research Institute) drew my attention to the histological comments recorded in the data table that indicate that a fish is in the process of transition (identified as "sperm" in comments column) or was "skip spawning" for that year (identified as "plug" in comments column).

Extracting these data (courtesy of Dr Muller) did not explain the low gonad weights for the larger animals but did show a consistent pattern with age (Figure 2) suggesting a strong correlation between skip spawning and sex transition.

In the current analysis these fish contribute to the relative fecundity estimate both as inclusions in the proportion female and the gonad weight. While there may be appropriate reasons for including these females, it would appear that they are not contributing to relative fecundity. I believe that this highlights the need for further research into the reproductive biology of red grouper with particular emphasis on the transition period and the decision rules for inclusion of partial males, inactive females and females with low GI's in the relative fecundity calculations. For example, the lack of development of ovaries in the larger females may be associated with fish that commence transition but never complete the process, females that can "skip" moult without the need for the "plug" or possibly the presence of a disease/parasite that prevents gonad development.

Recommendations:

(1) Development of 'new' models to describe reproduction that account for gonad development and associated fecundity estimates in protogynous hermaphrodite fish.

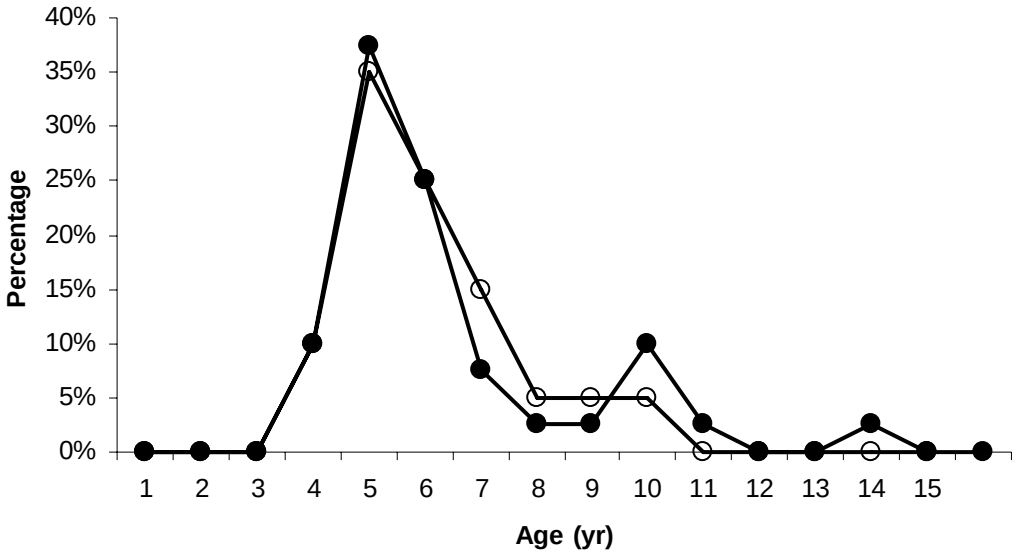

Figure 2. Comparison between female red grouper with sperm present (closed circle) and inactive females (plug present- open circles).

Age estimation

On of the major improvements in the current assessment was the use of observed (age estimated from otoliths) age data. As suggested in the consensus report, there is the opportunity to improve the growth relationship as described in DW03 by accounting for the sex transition period. Investigation of Figure 12b of DW03 suggests that the estimated growth curve underestimates growth of fish less than 8 years old; fish from 8-13 appear to have a flatter trajectory than predicted from the growth curve and fish greater than 14 years appear to be underestimated. The estimate *Linf* from the growth curve is 854mm, which is substantially lower than observed maximum (>1000mm). Although the number of fish observed greater than *Linf* was relatively small, their occurrence in the size frequency distributions (900+ size bin) appeared consistent across years, regions and fishing gears.

From Figure 12b of DW03, it would appear that the 8-13 age group might relate to fish in transition. Transiting from one sex to another may use additional energy reserves that limit growth; however, this does not appear to match the above data (Figure 2). While other explanations may be plausible, a more detailed and possibly novel investigation into growth of protogynous hermaphrodite fish is required. Similarities, particularly for the younger fish are also observed in the gag grouper data workshop report on growth.

In addition to the sensitivity of the model to the age structure, *Linf* and *K* also affect the estimation of *M* used in the model.

Recommendations:
(1) Development of 'new' models to describe growth that account for different growth periods associated with female, transition and male growth periods in protogynous hermaphrodite fish.
(2) Improved estimation of Linf (hopefully from 1).

Discards

The consensus report highlighted the concern over the information pertaining to discarded red grouper. Over a third of the red grouper caught are discarded and the fate (survival) of these is unknown (Figure 3). Of the discarded fish, over 90% originate from the longline (52%) and recreational (41%) fisheries. Research to estimate survival of discards should target these two sectors. It is considered that the discarded fish from the longline fishery have a higher mortality due to being captured in deeper water (i.e. greater barotrauma problems) and this sector is given a higher mortality value than recreationally discarded fish in the model.

The recreational fishery discards a greater proportion of smaller fish and thus has a greater potential to affect recruitment to the legal size (Figure 4). In both the longline and recreational fisheries discards are 41% and 43% of the total red grouper caught by the respective sectors. Research into ways of minimising the catch of discards or decreasing the mortality of discards (e.g. education (recreational) and codes of practice (commercial)) should be encouraged.

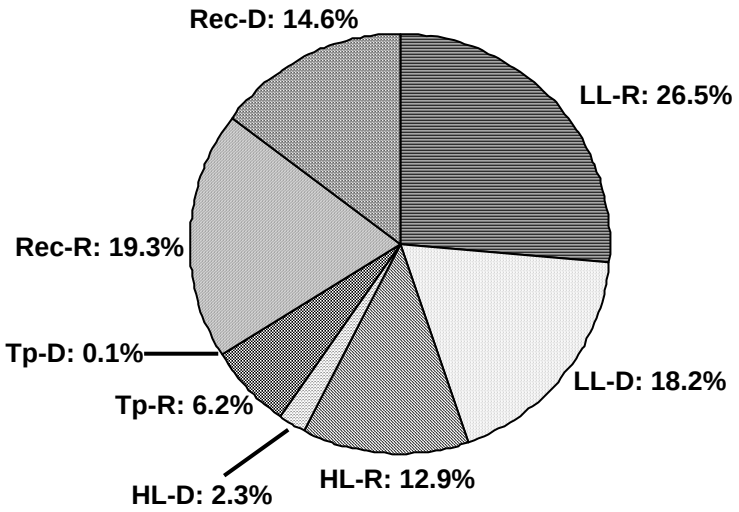

Figure 3. Percentage of longline (LL), handline (HL), trap (Tp) and recreational (Rec) red grouper retained (R) and discarded (D).

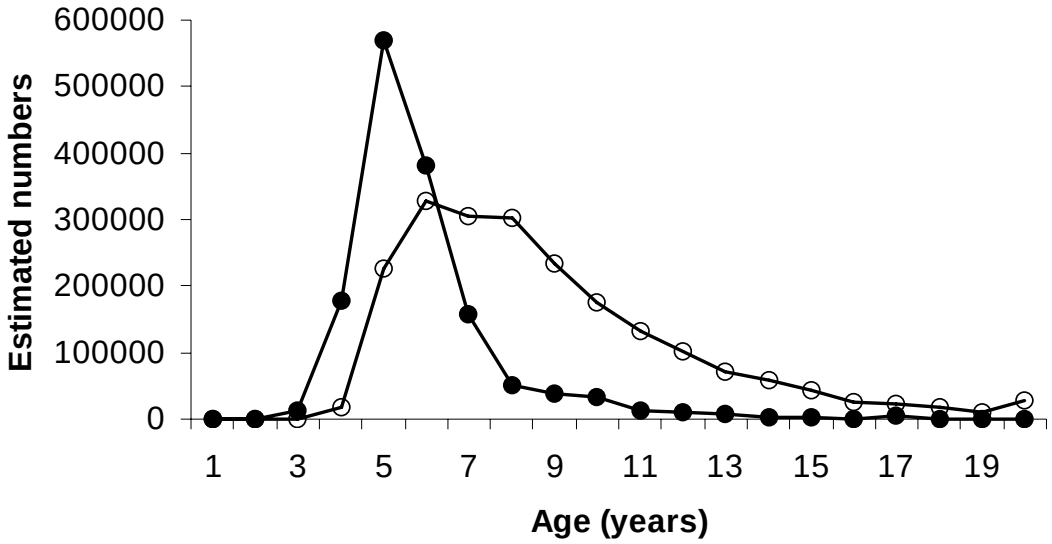

Figure 4. Estimated age structure of recreational (closed circles) and longline (open circles) red grouper discarded.

Comparisons between observed and estimated discards (residuals) from the base case run demonstrates that the model estimates are consistently lower than observed estimates for both sectors (Figure 5). Whereas the model has relatively consistently overestimated the longline discards by approximately 20% since the mid-1990s, the recreational residuals show a distinct cyclic pattern. This pattern may present opportunities for improved understanding of the discards as it could be related to environmental events (e.g. weather, water temperature etc.), biological events (e.g. recruitment) or fisher behaviour.

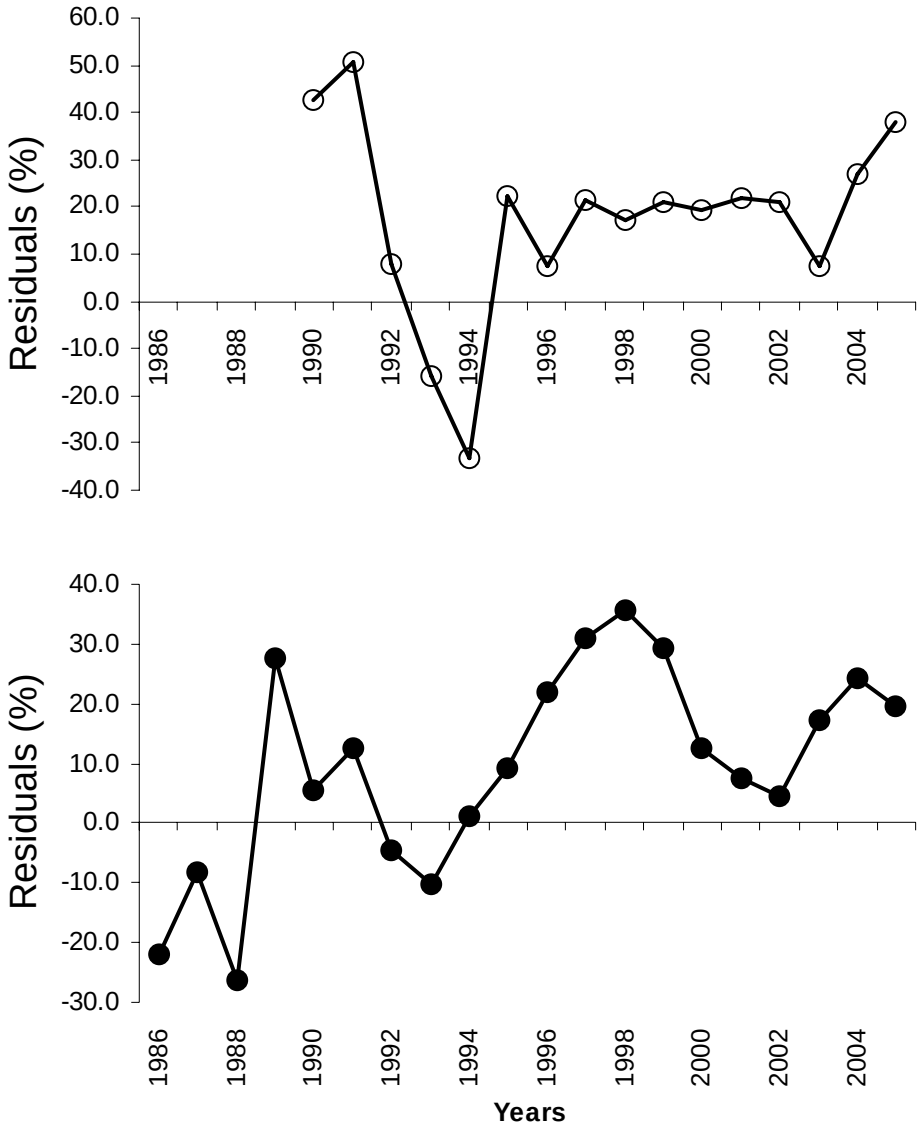

Figure 5. Annual changes in the residuals (%) for the longline (upper graph, open circles) and recreational (lower graph, closed circles).

Research into the fate of discards is difficult although several of the latest developments in mark-recapture analyses are proving to be useful in fisheries (e.g. see Program MARK at www.phidot.org/software). Tagging operations can be undertaken as part of the fishery independent longline survey or observers on commercial fleets. Currently a variety of metrics are collected and others can be added. For example, whether the fish actively swam away or "floated" when discarded, the extent of barotrauma, the depth it was caught, the time on deck and any damage (e.g. jaw broken), etc. These metrics can then be correlated with mark-recapture analyses to look at relative survival. Results from such studies can also assist in demonstrating the impact of different fishing practices and assist in developing a fisher's "code of practice" to minimise mortalities. Although there are assumptions that need to be considered in both cage trials and tagging, tagging does allow for additional sources of mortality such as post-release predation. At the workshop, the fishermen's representative indicated that cetaceans were an issue in certain areas and barracuda were also mentioned as observed discarded fish predators. Dr Ken Pollock, Professor

of Statistics, North Carolina State University and Dr John Hoenig, Professor of Marine Science, Virginia Institute of Marine Science both have extensive backgrounds in the latest developments in mark-recapture analyses in fisheries and could be consulted.

Recommendations:
(1) Improved estimates of the commercial longline and recreational fishery discards.
(2) Improved estimates of the fate of discards from commercial longline and recreational fisheries.

Dry Tortugas Marine Reserve (DTMR)

Concerns were mentioned during the workshop over the use of indices collected from this region, as it was not representative of the spatial variability associated with the entire fishing region. Thus indices, such as the longline index that covered the broad extent of the fishery, were suggested as the most promising for further research investment.

It should be stressed that the DTMR does provide other opportunities for estimating parameters important to the fishery as it is the only non-fished region.

While several of the multi-year mark-recapture models do enable fishing and natural mortality to be separated, in practice the estimates of *M* are difficult. Both tagging studies and age-based catch-curves can be used to estimate *M* without the complication of fishing activity (i.e. the total mortality estimate (*Z*) equals natural mortality (*M*)).

It is likely that fisheries will need to address ecosystem impacts (see below) to meet consumer expectations and accreditation schemes. As fisheries shift into an ecosystem based fisheries management framework, marine reserves have been vital for providing the contrast between fished and non-fished regions.

Recommendations:
(1) Projects addressing the impacts of fishing and estimating natural mortality be incorporated into future research projects in the Dry Tortugas Marine Reserve.

Catchability

Catchability was seen as being a parameter to which the model was sensitive. The form of catchability being considered was associated with effective effort. The Review Panel (RP) considered that it was unlikely that there had been no increase in the effectiveness of a unit of fishing effort to catch red grouper since the late 1980's. Technology, particularly the use of GPS, bottom expansion echo-sounders, and computer visualisation packages are considered globally to have made a unit of effort more efficient. The RP chose a figure of 2% compounding annually as an educated guess but recognised that it could be substantially different. The RP also noted that gear efficiency was unlikely to increase uniformly but rather as specific technologies became available. While there was no information available to provide any form of a stepped efficiency approach, the RP considered that a uniform trend was more

realistic than no allowance for increases in catchability. A fisher at the workshop considered that technology could have had an impact greater than the 2% used. Obtaining estimates of gear efficiency is difficult. Methods that have been suggested include:

(a) Interviewing fishers and selecting the mean from the ensuing distribution of estimates.
(b) Determining the approximate time that new technology became available and finding a group of fishers who used the technology and another group that didn't use the technology until later. Compare the pre- and post- catch rates of the fishers who took up the technology against those who didn't.

Recommendations:
(1) Develop a project to improve the estimation of catchability through increased fishing efficiency. It is envisaged that such a project would cover all species being fished.

Ecosystem and environmental data

As mentioned in several areas above and the consensus report, there appeared to be trends in data that may be explained by environmental signals (e.g. recruitment, range extensions, trends in recreational discard residuals). The lack of any environmental data or linking of data to environmental variables appeared to be a weakness of the current analyses.

Universally there is a move towards ecosystem based fisheries management and while there is still uncertainty as to the detail required, many fisheries are, at a minimum linking biological events (e.g. recruitment, variability in growth rates etc.) to basic environmental variables (e.g. temperature, productivity etc).

There is also an increasing consumer awareness of sustainable fisheries from an ecosystem perspective rather than from the traditional target species approach (as undertaken in this assessment). For example, while visiting the Georgia Aquarium during the morning prior to my departure I was handed a *Seafood Watch, Southeast Seafood Guide 2006*, produced by Monterey Bay Aquarium. I had to line up in a queue to receive one of these cards and my estimate was that at least half of the people who listened to the presentation requested a card. While I am not advocating this concept or the fish listed under the different categories (I am uncertain what criteria they use), the point to be made is that consumers are taking note. The card had groupers listed in the avoid column! This status may change when this assessment demonstrates that red grouper are no longer overfished.

With the increasing consumer expectation that fish are harvested with limited impact on the ecosystem there may be a need for industries to adopt specific accreditation schemes (e.g Marine Stewardship Council or equivalent) to meet specialised markets. If not already doing so, then I would recommend that at least the fishery independent longline fishery collect environmental and ecosystem data. Similarly, data collection projects using the Dry Tortugas Marine Reserve should also consider the need for using the reserve to demonstrate the effects of fishing.

Recommendations:
(1) That scientists explore opportunities to collect environmental data as part of ongoing fishery dependent and independent sampling.
(2) That data workshop should include environmental and ecosystem data summaries.

4. SEDAR Process

Fortunately the review panel had a range of backgrounds that ranged from modelling to biological data interpretation. As such, this skill base was able to thoroughly examine the assessment from a number of perspectives including: the data analyses that provided the input data, the model used (including the manner in which the model handled and manipulated the data) and, the model outputs. Thus, in addition to ensuring that the mechanics of the model (model performance) was working appropriately the panel was also able to ensure that model outputs matched biological reality.

The participation of the commercial fisher representative was very valuable and it was unfortunate that there was only one representative from the commercial fishery as the panel sought the advise of this fisher on a number of issues (discards, discard mortality, effort creep etc).

As highlighted in the consensus report, the panel felt that it would have been beneficial to have a representative from the data workshop present, as there were a number of questions raised about the analysis of the data that could not be answered by the assessment team. With a large range of data workshop documents, it would not be possible to have a person representing each. However, it appears that one scientist (Dr L.A. Lombardi-Carlson) is associated with DW1-6 and may have been able to provide support to the assessment team in addressing the data analysis questions.

During several occasions during the review workshop there were references made to previous workshops that dealt with similar species, particularly the gag grouper assessment and, to a lesser extent, the vermilion snapper assessment. It would be beneficial for model and data outputs that would be similar between species (e.g. recruitment indices) to be summarised in a data workshop report.

As discussed in the consensus report, the need for future reviews should be determined from a need rather than a time commitment. Major changes in the type or analyses of data, the model being used or the model outcomes (especially if different from those predicted) should be indicators of major review rather than [say] five years from now.

Recommendations:
(1) A diversity of backgrounds in reviewers should be encouraged.
(2) Increased participation by key stakeholders (commercial, recreational and environmental(?)) should be encouraged.
(3) A person familiar with the data analysis should be available as a member of the assessment team.
(4) It would be beneficial for model and data outputs that would be similar between species (e.g. recruitment indices) to be summarised in a data workshop report.

(5) *Future reviews should be determined from a need for the reviews themselves rather than because of pre-arranged timeframes.*

Appendix 1: Document list - SEDAR12 Gulf of Mexico Red Grouper

Data Workshop Documents

SEDAR12-DW1 The use of an otolith reference collection to monitor age reader precision for red grouper (Epinephelus morio). Palmer, C. L., Farsky, R. A., Gardner, C., and Lombardi-Carlson, L. A.

SEDAR12-DW2 Bottom longline fishery bycatch of red grouper from observer data. Hale, L.

SEDAR12-DW3 Temporal and spatial trends in red grouper (Epinephelus morio) age and growth from the northeastern Gulf of Mexico: 1979-2005. Lombardi-Carlson, L., C. Palmer, C. Gardner and B. Farsky

SEDAR12-DW4 An update of Gulf of Mexico red grouper reproductive data and parameters for SEDAR 12. Fitzhugh , G.R., H.M. Lyon, W.T. Walling, C.F. Levins, and L.A. Lombardi-Carlson

SEDAR12-DW5 Catch rates, distribution and size/age composition of red grouper, *Epinephelus morio*, collected during NOAA Fisheries Bottom Longline Surveys from the U.S. Gulf of Mexico. Ingram, W., M. Grace, L. Lombardi-Carlson and T. Henwood

SEDAR12-DW6 SEAMAP Reef Fish Survey of Offshore Banks: Yearly Indices of Abundance for red grouper (*Epinephelus morio*). Gledhill, C. T., G. W. Ingram, Jr., K. R. Rademacher, P. Felts, B. Trigg, and L. Lombardi- Carlson

SEDAR12-DW7 Research Trawl and Shrimp Bycatch Results Relevant to Red Grouper. Nicholls, S.

SEDAR12-DW8 Spatial and temporal patterns in demographics and catch rates of red grouper from a fishery-independent trap survey in the northeast Gulf of Mexico, 2004-2005. De Vries, D.

SEDAR12-DW9 Length frequency distributions for red groupers caught by commercial fisheries in the Gulf of Mexico from 1984 to 2005. Chih, C-P.

SEDAR12-DW10 Selected sampling issues regarding the length/age frequency distributions of red groupers caught by commercial fisheries in the Gulf of Mexico from 1984 to 2005. Chih, C-P.

SEDAR12-DW11 Quantitative Historical Analysis of the United States and Cuban Gulf of Mexico Red Grouper Commercial Fishery. Saul, S.

SEDAR12-DW12 Length Frequency Analysis of the Gulf of Mexico Recreational Red Grouper Fishery. Saul, S.

SEDAR12-DW-13 Trends in Red Grouper Mortality Rates Estimated from Tag Recaptures (1990-2006). Porch, C. E.

SEDAR12-DW-14 Recreational Survey Data for Red Grouper in the Gulf of Mexico Matter, V. M.

SEDAR12-DW-15 Backcalculation of recreational catch of red grouper from 1945 to 1985. Walter, J. F.

SEDAR12-DW-16 Standardized catch rates for red grouper from the United States Gulf of Mexico handline, longline, and trap fisheries, 1990-2005. McCarthy, K. and S. Cass-Calay

SEDAR12-DW-17 Calculated red grouper discards by vessels with Federal permits in the Gulf of Mexico. McCarthy, K.

Assessment Workshop Documents

SEDAR12-AW01 <<< NOT USED >>>>>

SEDAR12-AW02 Standardized Catch Rates of Red Grouper (*Epinephelus morio*) from the U.S. Headboat
Fishery in the Gulf Of Mexico, 1986-2005. SFD-2006-036. Cass-Calay, S

SEDAR12-AW03 Standardized Catch Rates of Red Grouper (*Epinephelus morio*) from the U.S. Recreational Fishery in the Gulf Of Mexico, 1986-2005. SFD-2006-037. Cass-Calay, S

SEDAR12-AW04 Discard Calculations McCarthy, K.

SEDAR12-AW05 Construction of a fisheries independent index of red grouper using data from the Dry Tortugas National Park, 1994-2004. anon

SEDAR12-AW06 Derived and observed catch at age from the Gulf of Mexico red grouper stock. Nowlis, J. S. & 5 coauthors

SEDAR12-AW07 Age data evaluation. Lombardi-Carlson, L

SEDAR12-AW08 Comparison of ALK and RAS methods for deriving age frequency distributions of red grouper caught by commercial fisheries in the Gulf of Mexico. Chih, C-P.

Review Workshop Documents

SEDAR12-RW01 Gulf Council RFSAP report excerpts regarding red grouper assessments, 1999-2002. anon.

Reference Documents

SEDAR12-RD01 2006 FishBull 104:343-349. Depredation of catch by bottlenose dolphins (*Tursiops truncatus* in the Florida king mackerel (*Scomberomorus cavalla*) troll fishery. Zollet, E. A. and A. J. Read

SEDAR12-RD02 2002 SFD-01/02-175rev. Draft status of red grouper in United States waters of the Gulf of Mexico during 1986-2001. SEFSC anon

SEDAR12-RD03 2002. PCL Cont. 2002-06. Red Grouper age-length structure and description of growth from the eastern Gulf of Mexico: 1992-2001. Lombardi-Carlson, L. A., G. R. Fitzhugh, and J. J. Mikulas

SEDAR12-RD04. 1991SFD 90/91-86. The red grouper fishery of the Gulf of Mexico Goodyear, C. P., and M. J. Schirripa.

SEDAR12-RD05 1999 SFD 98/99-56. The red grouper fishery of the Gulf of Mexico: Assessment 3.0 Schirripa, M. J., C. M. Legault, and M. Ortiz.

SEDAR12-RD06 ICCAT SCRS/1998/058. A flexible forward age-structured assessment program Legault, C. M. and V. R. Restrepo

SEDAR12-RD07 MIA 92/93-75. 1993. The red grouper fishery of the Gulf of Mexico. Goodyear, C. P. and M. J. Schirripa.

SEDAR12-RD08 MIA 93/94-60. 1994. Biological reference points for red grouper: uncertainty about growth. Goodyear, C. P

SEDAR12-RD09 SFD 98/99-57 1999. Trends in red grouper mortality rate estimated from tagging data Legault et al

SEDAR12-RD10 unpub. SEFSC manu. no date. Red grouper mean size at age: An evaluation of sampling strategies using simulated data Goodyear, C. P.

SEDAR12-RD11 SEFSC Pan. City Lab. Cont. # 2002-07 2002. Characterization of red grouper reproduction from the Eastern Gulf of Mexico. Collins, L. A. and 5 coauthors.

Appendix 2: Terms of Reference - SEDAR 12 Review Workshop

1. Evaluate the adequacy, appropriateness, and application of data used in the assessment*.
2. Evaluate the adequacy, appropriateness, and application of methods used to assess the stock*.
3. Recommend appropriate estimates of stock abundance, biomass, and exploitation*.
4. Evaluate the methods used to estimate population benchmarks and management parameters (*e.g., MSY, Fmsy, Bmsy, MSST, MFMT, or their proxies*); provide estimated values for management benchmarks, a range of ABC, and declarations of stock status*.
5. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status; recommend appropriate estimates of future stock condition* (e.g., exploitation, abundance, biomass).
6. Evaluate the adequacy, appropriateness, and application of methods used to characterize uncertainty in estimated parameters. Provide measures of uncertainty for estimated parameters*. Ensure that the implications of uncertainty in technical conclusions are clearly stated.
7. Ensure that stock assessment results are clearly and accurately presented in the Stock Assessment Report and that reported results are consistent with Review Panel recommendations**.
8. Evaluate the SEDAR Process. Identify any Terms of Reference which were inadequately addressed by the Data or Assessment Workshops; identify any additional information or assistance which will improve Review Workshops; suggest improvements or identify aspects requiring clarification.
9. Review the research recommendations provided by the Data and Assessment workshops and make any additional recommendations warranted. Clearly indicate the research and monitoring needs that may appreciably improve the reliability of future assessments. Recommend an appropriate interval for the next assessment.
10. Prepare a Peer Review Consensus Summary summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. Prepare an Advisory Report summarizing key assessment results. (Reports to be drafted by the Panel during the review workshop with a final report due two weeks after the workshop ends.)

* The review panel may request additional sensitivity analyses, evaluation of alternative assumptions, and correction of errors identified in the assessments provided by the assessment workshop panel; the review panel may not request a new assessment. Additional details regarding the latitude given the review panel to deviate from assessments provided by the assessment workshop panel are provided in the *SEDAR Guidelines* and the *SEDAR Review Panel Overview and Instructions.*

** The panel shall ensure that corrected estimates are provided by addenda to the assessment report in the event corrections are made in the assessment, alternative model configurations are recommended, or additional analyses are prepared as a result of review panel findings regarding the TORs above.

Appendix 3: Participants - SEDAR 12 Review Workshop

Review Panel Participants
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Appendix 4: Draft Agenda

SEDAR 12: Gulf of Mexico Red Grouper
January 29 - February 2, 2007

Monday

1:00 p.m.	**Convene**
1:00 p.m. – 1:30 p.m.	**Introductions and Opening Remarks**
	- Agenda Review, TOR, Task Assignments
1:30 p.m. – 3:30 p.m.	**Assessment Data Presentation TBD**
3:30 p.m. – 4:00 p.m.	**Break**
4:00 p.m. – 6:00 p.m.	**Continue Presentation/Discussion Chair**

Tuesday

8:30 a.m. – 11:30 a.m.	**Assessment Presentation Chair**
11:30 a.m. – 1:30 p.m.	**Lunch Break**
1:30 p.m. – 3:30 p.m.	**Panel Discussion TBD**
	- Assessment Methods
	- identify additional analyses, sensitivities, corrections
3:30 p.m. – 4:00 p.m.	**Break**
4:00 p.m. – 6:00 p.m.	**Panel Discussion Chair**
	- Continue deliberations
	- Review additional analyses

***Tuesday Goals*:** Initial presentation completed, sensitivities and modifications identified.

Wednesday

8:30 a.m. – 11:30 a.m.	**Panel Discussion Chair**
	- Review additional analyses, sensitivities
	- Consensus recommendations and comments
11:30 a.m. – 1:30 p.m.	**Lunch Break**
1:30 p.m. – 3:30 p.m.	**Panel Discussion TBD**
3:30 p.m. – 4:00 p.m.	**Break**
4:00 p.m. – 6:00 p.m.	**Panel Discussion Chair**

Wednesday Goals: Final sensitivities identified, Preferred models selected, Projection approaches approved, Consensus report drafts begun
NOTE: CIE requested a general discussion between Staff and Appointed reviewers regarding the overall
review process, CIE's role, and suggestions for improvement. A conference call will be scheduled with CIE
representatives, likely Wednesday afternoon.

Thursday

8:30 a.m. – 11:30 a.m.	**Panel Discussion Chair**
	- Final sensitivities reviewed.
	- Projections reviewed.
11:30 a.m. – 1:30 p.m.	**Lunch Break**
1:30 p.m. – 3:30 p.m.	**Panel Discussion or Work Session Chair**
3:30 p.m. - 4:00 p.m.	**Break**
4:00 p.m. - 6:00 p.m.	**Panel Work Session Chair**
	- Review Consensus Reports
	- Discuss Advisory Reports Contents

Thursday Goals: Complete assessment work and discussions. Final results available. Drafts of Consensus
Reports and Advisory Reports Reviewed.

Friday

8:30 a.m. – 1:00 p.m.	**Panel Work Session Chair**
1:00 p.m.	**ADJOURN**

Appendix 5: CIE Statement of Work

Statement of Tasks for CIE Reviewers:

Roles and responsibilities:

1. Approximately 3 weeks prior to the meeting, the CIE reviewers shall be provided with the stock assessment reports, associated supporting documents, and review workshop instructions including the Terms of Reference. Reviewers shall read these documents to gain an in-depth understanding of the stock assessment, the resources and information considered in the assessment, and their responsibilities as reviewers.
2. During the Review Panel meeting, reviewers shall participate in panel discussions on assessment methods, data, validity, results, recommendations, and conclusions as guided by the Terms of Reference. The reviewers also shall participate in the development of a Peer Review Consensus Summary report and the Peer Review Advisory Reports, as described in Annex I. Reviewers may be asked to serve as an assessment leader during the review to facilitate preparing first drafts of review reports.
3. Following the Review Panel meeting, the reviewers shall work with the chair to complete and review the Peer Review Panel Reports. Reports shall be completed, reviewed by all 3 panelists, and comments submitted to the Chair by February 16, 2007.
4. Following the Review Panel meeting, each reviewer shall prepare an individual CIE Reviewer Report. These reports shall be submitted to the CIE no later than February 23, 2007, addressed to the "University of Miami Independent System for Peer Review," and sent to Dr. David Sampson, via email to David.Sampson@oregonstate.edu, and to Mr. Manoj Shivlani, via email to mshivlani@rsmas.miami.edu. See Annex II for complete details on the report outline.

   The duties of each Review Panelist shall occupy a maximum of 12 workdays; several days prior to the meeting for document review; five days at the SEDAR meeting, and several days following the meeting to ensure that final review comments on documents are provided to the Chair and to complete a CIE review report.