SEDAR 7 - AW 21

A Summary of the August Assessment Workshop for Red Snapper

The first portion of the SEDAR Assessment Workshop (AW) for red snapper was held at the SEFSC Miami facility Aug 16-20, 2004. The meeting began by reviewing issues from the April Data Workshop (DW). Twenty new papers were submitted, most of them either making recommendations on points left undecided at the DW, or presenting results of additional analyses recommended at the DW. Preliminary assessment model runs using ASAP were conducted, directed at examining properties of individual factors prior to establishing a 'base run' assessment. An overview of a spatially separate assessment model under development was provided. Other models discussed included McAllister's Gaming Model, and Walters' VPA investigation. Both of these models included exploration of 'prehistoric' information – landings and effort estimates derived from the years prior to the current data collection programs for fisheries statistics. It is hoped that this consideration of the full history of exploitation could provide additional insight into some of the problem areas in interpreting past assessments. The meeting began with brief presentations on the new papers, with each presentation followed by open discussion of any topics inspired by the paper. The order here follows the order of presentation at the workshop.

Summary of Contributed Papers

AW-17 reported on an investigation of discrepancies in gear assignments of TX landings between past assessments and the current landings data files. A portion of the landings once attributed to the shrimp industry had been reclassified as longline (LL) landings in the commercial data files in the years since the CPUE index based on shrimper-landed snapper was first developed. Discussion revealed that there may well have been an expansion of the LL landings around that time, but no record supporting the reclassification of any particular amount of the catch to LL was ever found. The recommendation was that Texas data from the 1980-84 period be treated as unclassified as to gear, and the 1980-1984 period should be removed from the CPUE index derived from snapper landings by the shrimp fishery. Subsequent discussion touched on possible inclusion of landings from outside the US (believed by SEFSC scientists to have been adjusted in accord with all available evidence several years back); the allocation of the 2003 catch between commercial handline (HL) and LL (currently based on logbook proportions); the conversion factor between gutted and whole weight (currently 1.11 is used); and whether catches from outside the US are considered to come from a different stock (currently treated as coming from another stock.). Discussion later in the week reported on an AW recommendation to compare age composition in the purported shrimp trawler landings with trawl survey composition; it did appear there was an overlap. The allocation of catches between HL and LL came up at several times later in the meeting. The group recommendation was to investigate impacts of any possible misreporting by matching portions of the reported HL landings to LL size or age frequencies.

AW-3 reported on the calibration between 'old' and 'new' procedures for estimating charter boat catch in MRFSS. Questions arose about how Texas data fit into this issue. Texas has its own program, separate from MRFSS. The Texas system provides charterboat catch estimates, but these do not enter the ratios used to adjust MRFSS, and Texas catches are not adjusted using the MRFSS procedure. Uncertainties around the (estimated) adjustment ratios are not propagated forward into the estimates of uncertainty for MRFSS charterboat catches.

AW-2 updated the estimates of allometric conversion factors. Contrary to what was expected, significant differences were not found between east and west. There were also no significant differences from the factors used in the Goodyear assessments. The recommendation was to retain the size conversions used in the previous assessments.

AW-1 presented new growth results. Size at age has been clearly influenced by minimum size regulations, and the approach in this paper attempts to correct for that effect analytically. No east / west differences were evident in growth curves developed from data from any of the fisheries (commercial LL, HL; Recreational), so use of one Gulfwide curve was recommended. The parameter K was estimated to be somewhat higher than the value estimated in previous assessments (0.22 vs 0.16). This change appeared to

be a consequence of the large increase in data available in recent years, rather than a change in growth pattern over time.

AW-5 addressed fecundity and maturity estimation. This topic encompasses some of the largest biological differences from past assessments, and there are some real differences that result from choice of analytical method. Fecundity and maturity could be considered as direct functions of length, or as direct functions of age. Currently available modeling procedures ultimately require age-based functions, which means that if a direct function of length is assumed, an unbiased growth curve is a necessity. Or, a direct dependence on age could be assumed, bypassing the length to age conversion. The data base for reproductive biology was expanded considerably over the last few years. Results from two separate data sets were presented to the DW. The two sets analyzed separately led to somewhat different reproductive patterns, quite probably dominated by sampling differences. The DW recommended that simple combination of the two sets for a single analysis would be the best procedure. This has now been done. Analysis of the combined data found no east / west differences in either batch fecundity or fecundity*maturity, which was a bit of a surprise. However, the most important differences with the reproductive biology from past assessments (which assumed direct dependence on length) appear to be related to the new (AW-1) growth curve. With the new curve, smaller fish are estimated to be more productive than in the previous stock assessment. However, a direct reproductive potential vs age function is now available also, so the AW has a choice. It was pointed out during discussion that separate age dependent and length dependent components might exist, and that relative strengths of the two possible components might differ among species. As this appeared to be a topic of some importance, without clear evidence within the data for which method to favor, the AW felt that extensive sensitivity work might be necessary here. Discussion also mentioned the lack of information at present about frequency of spawning.

AW-16 considered use of U.S. Census data to lengthen the time series for recreational effort. A (log transformed) GLM related recreational catch to human population size, state, type of fishing, and year class strength (SEAMAP trawl survey), with interactions. Resulting parameters were used to predict catches prior to 1981.

AW-18 reviewed Goodyear's "probabilistic aging" method. The probabilistic procedure is known not to be mathematically rigorous (i.e. there is no mathematical basis to expect convergence as the number of iterations are increased), and modern assessment models do not require age composition vectors to match every catch. However, age data for the earlier years (1980s) are so sparse that incorporating probabilistic age estimates up front might have an advantage over leaving estimation of missing age compositions to an internal fitting in the assessment model. The analysis presented in AW-18 ran the Goodyear procedure for 3 iterations, and compared the results to direct age frequencies available for recent years via bar graphs age composition as cumulative percent. Two stock structures were considered. The effect of the new (AW-1) growth curve appeared evident, particularly in the age 1 estimates.

AW-19 summarized the status of existing age composition data, and assembled age composition as matrices for 6 fisheries: commercial handline east (1991-2003), commercial handline west (1992-2003, less 1996-1997), commercial longline east (1991-2002), commercial longline west (1993, and 1998-2002), recreational handline east (1991-2003), and recreational handline west (1991-2003, less 1996-1997).

At this point in the meeting, Clay Porch led a discussion of the Goodyear probabilistic aging method and the ASAP model. The discussion that followed covered a wide range of strategic issues for assessment models. Foremost was a debate over the virtue of stepwise incorporation and evaluation of changes from the 1999 assessment vs wholesale incorporation of new data, new estimation techniques, and modeling advances; with evaluation of differences to follow. The AW participants seemed to fall into two camps on this issue. However, as the ASAP model used in the previous assessment was known to require a number of isolated changes of 'hardwired' features to accommodate new information, a more stepwise approach was ultimately favored. A second important issue considered was the potential for misidentifying changes in abundance as changes in selectivity over time in age-structured models. Protections offered included considering a VPA analysis as a check, and constraining changes in selectivity during model fitting. However, this was a contentious area, and will likely require some time in evaluating future model performance.

AW-20 covered the analysis recommended by the DW to develop age composition estimates for the shrimp fleet bycatch. The analysis showed considerable interannual variation in the age composition vector, a variation that was largely not present in the years available to assessments in the late 1990s. Some differences were noted in the amount of data used in AW-20 and in the data files held by LGL. These differences were found to be due to observations on trawls experimenting with or conducting certification testing on uncertified BRDs. As these BRDs were not in general use in the fishery, and in the case of certification testing, may have involved trawling selectively in areas of high snapper concentration, these trawls should not be considered representative of the overall fishery.

AW-15 presented an estimate for M at age 1 based on analysis of SEAMAP trawl survey data, using a method largely following a classical regression of Z vs effort. (This paper also covered the methods and data used in extracting separate CPUE indexes for age 0 and age 1 from the SEAMAP data.) AW-7 also considered estimation of M from the trawl survey data, based on an MLE programmed in AD model builder. It turned out that estimation was possible only by combining Fall-to-Summer and Summer-to-Fall estimates of Z in a single analysis, per AW-15. Without considering both seasons, there was insufficient contrast in the shrimp effort data to permit estimation. Later in the week, the AW group recommended using the 0.6 value derived in AW-15 as the point estimate of M at age 1. However, there may be as much of a message in the large confidence interval from AW-15 as in the point estimate itself.

AW-14 also considered juvenile M, in the sense of generating prior pdfs. This approach was recommended more for subsequent assessments rather for use on the time scale available for the current assessment. During discussion, the allometric strategy proposed by Lorenzen was also introduced.

Papers AW-8 and AW-12 addressed possible density dependence in juvenile M. AW-8 provided a formal structure to incorporate the timing of density dependent effects in a Beverton-Holt context, and the effects of different timings on a set of equilibrium population statistics. AW-12 presented yield curves based a particular set of assumptions with and without post-recruitment density dependence. (AW-12 also addressed the issue of linking F's from separate fisheries in MSY calculations.) Discussion of potential impacts of post-recruit density dependence occurred occasionally throughout the week. Those who had experimented with models incorporating "prehistoric" data noted that it appeared difficult if not impossible to derive a realistic exploitation history without invoking additional density dependence. However, the group as a whole noted that there appeared to be no route available to estimate density dependence, or even decide upon is structure, based on existing data. Most all agreed that at the likely current levels of abundance, density dependent effects would not be immediately important in predicting population trends over the near future. However, the role, timing and strength of any density dependent effects could be very important over the longer term, particular regarding optimal allocation strategies.

There were some additional papers not covered by oral presentations during the paper presentation sessions. AW-4 and AW-9 presented updated indexes of abundance for the recreational and commercial handline fisheries, respectively, based on recommendations of the DW. There was also a short update paper on relative length frequency methods (AW-6a). The results from these papers were used in later discussions of indexes in the assessment models. Paper AW-13 was a commentary on the DW results, and many of the points came up in discussions throughout the week. Papers AW-6 and AW-11 covered modeling issues, and were addressed in the portion of the workshop looking at modeling results, so consideration of these papers appears in the next section. An additional 'paper' was available only in .ppt format; this material was also covered during the discussion of modeling results.

Summary of Initial Modeling Results

The modeling efforts during the workshop began by establishing a 'continuity case' – a case matching as closely as possible the methods of the assessments of the 1990s, but including the data developed since that time. This analysis used the ASAP program, as did the most recent assessment. This continuity run was followed by considering a series of 'single step' changes, modifying items like fishery definitions, inclusion or exclusion of indexes, fixing and floating various parameters or constraints, considering

alternative treatments that generate input data, etc, as suggested by the group. This process was aimed a getting an understanding the properties of the models and data prior to deciding on a 'base case' for the current assessment. Most of this effort was by necessity limited to the ASAP framework, but we were also able to consider results of a 'Gaming model' approach, and a classical VPA. Discussion of the data items in the submitted papers resulted in some new suggestions for analytical treatments, and the stepwise modeling changes proved time-consuming. By midweek, it was clear that one week would not be enough time to finish the assessment. The group continued investigation of modeling alternatives, but less driven toward reaching a full assessment or even a 'base case' by week's end, and more geared toward setting up what could be done prior to a second assessment workshop. The presentation of results here to capture only the more general discussions and results, in anticipation that a number of the runs presented during the week will be superceded by new material produced between the two workshops.

A recurrent, significant finding was that the ASAP model could not reliably fit both the Steepness and Rmax stock recruitment parameters if both were allowed to float freely, at least if only the modern data were considered.' The reason why was obvious: there has been a large range in recruitment over the modern period, but an almost trivial range to spawning stock sizes. This was not a new discovery. The same problem has been discussed since at least the early 1990s. Although recruitment and spawning stock estimations are now available for many more years, it appears the spawning stock size has still not changed enough over that time for a reliable stock recruitment curve to be established. Many of the participants retained hope that inclusion of the "prehistoric" data might provide some insight. There was hope the Steepness and Rmax might mainly impact the long term rebuilding issues – what the stock might be capable of producing near MSY. Shorter term advice may be less affected.

Another significant issue was the existence of differing directions of trends among several of the recent CPUE indexes. There was some measure of conflict noted between fishery dependent vs independent, and east vs west. There was general agreement that one should not simply include conflicting indexes in hopes the model fitting would sort things out. Results then would be driven by index weightings, and under most choices the result would be a flat 'average' that would be 'flat wrong.' There was a suggestion to contrast model runs containing only the upward trending indexes with runs containing only the downward trending indexes to bracket the uncertainty in the CPUE signals. This proposal seemed to obtain general support. There was an extended discussion of the extent of preference to be given to fishery independent information, with some participants preferring to use only fishery independent indexes when both independent and dependent indexes were available, and others recommending inclusion of both types. Consensus was less clear on this issue, but discussion ultimately trended more toward inclusion than exclusion. There was also some hope that the spatially structured model being developed could sort out differences that might be due to real east / west differences. However, it may be that the durations of the trends have not been sufficient to sort out true abundance changes in the most recent years from other possible causes.

Carl Walters expanded on results mentioned earlier in the meeting (no accompanying AW paper) using a classical VPA approach. Walters has been concerned that forward projecting age structured models may write off abundance changes as selectivity changes, especially with a dome-shaped selectivity pattern. His analysis found the expected peak in F at early ages, but also found traces of transient targeting of older fish. He felt that both factors present problems to models allowing fitting of selectivity. Waters also incorporated 'prehistoric' data, and suggested that it would very difficult to provide a plausible trajectory over the entire history of the fishery without adding additional dynamics like post-recruitment density dependence.

AW-6 laid out the structure for an assessment model that would 'internalize' the probabilistic aging procedure in a more rigorous fashion, and allow consideration of multiple stocks, with movement among them. (At some point after the first AW, this model came to be known as CATCHEM.) There was discussion about the ability to model any local depletions during development of the longline fishery, and for handling any changing vulnerabilities like those of Waters VPA by loosening selectivity constraints.

AW-11 summarized Murdoch McAllister's Gaming Model approach, with results from some trial runs. Additional results were shown at the meeting, including incorporating density dependence at age 2. This

model incorporated estimates of catch back to 1880. This model also had difficulty producing a trajectory going from an unfished state to current conditions with a single stock / recruitment function; adding post-recruitment compensation made the trajectories seem more plausible.

Approximately 3 dozen ASAP runs were completed during the course of the meeting. Most runs explored inclusion or exclusion of sets of CPUE indexes. These runs also explored the tension between Rmax and Steepness by alternating fixing and fitting in the course of including indexes. Several of the runs looked at inclusion of data from the period prior to the current statistics programs. Four runs also incorporated the higher point estimates of juvenile M recommended during the meeting. . In general, inclusion or exclusion of any particular CPUE index did not change the results appreciably. Any model's evaluation of the status of the stock rested heavily on the treatment of steepness used.

The stock / recruitment problem remained a constant theme right to the close of the meeting. Model estimates of recruitment (or inferences from CPUEs) suggest a large range for recruitments since the 1970s, with stretches of several years with persistently higher or lower levels. Past discussions of evidence suggested recruitment may have been highest early in and just preceding the 'historical' period, but it now seems that ascribing any decline since then solely to changes in spawning stock size is incompatible with the lack of range of spawning stock during the historical period. Models using 'prehistoric' data suggested that it is difficult to get a time series of F that makes sense – smooth progressions with plausible assumptions about effort are either unresponsive, or too responsive, over some portion of the time series. The long age span of red snapper implies the adult population could be very sluggish when abundant, yet the stock has seemed to become almost absent in the eastern portion of its historical range. In ASAP, fixing steepness in the range expected based on other species usually led to results suggesting an almost trivial level of current F; allowing steepness to be fit usually suggested very serious depletion. In sum, the results have not been internally consistent. Adding additional dynamics might help, but there are multiple possibilities (e.g. post-recruitment density dependence, impacts of larger snapper on smaller snapper anywhere in the age range, M variation over time due changes in predator stock sizes, changing stock / recruitment parameters over time, grossly different selectivities over time). Most discussion at the meeting focused on compensation around age 2, but there is precious little evidence for or against that, or for or against any of the other possibilities at this time. We shall see if spatial subdivision and further development of the 'prehistoric' line of inquiry provide any new insight.

Document List from the August Meeting

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 probability distributions for natural mortality rates in age zero and age one Gulf of Mexico red snapper	McAllister, 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