Gulf of Mexico Fishery Management Council
Standing and Special Mackerel SSC
Review of SEDAR 28 – Gulf of Mexico Cobia
Tampa, Florida
March 27, 2013

The agenda was adopted and the summary minutes of the July 26-27, 2011 Mackerel SSC meeting were approved as written.

SEDAR 28 Cobia Benchmark Assessment

Jakob Tetzlaff presented the cobia benchmark assessment. He used an integrated statistical catch-at-age model, Stock Synthesis version 3.4d. Data inputs included commercial landings in pounds whole weight from 1926-2011, recreational landings in numbers of fish from 1950-2011, discard estimates in numbers of fish for the commercial, recreational and shrimp bycatch components, indices of abundance (number caught per angler hour) from MRFSS and from the headboat survey, length composition data from the commercial, recreational and shrimp bycatch components, and age composition data from the commercial and recreational components.

For recreational landings, MRFSS/MRIP data was available for the years 1981-2011. For the years 1950-1980, the assessment used U.S Fish and Wildlife Service 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation Survey (FHWAR) catch and effort data. However, the FHWAR survey has a known reporting bias that results in overestimates of both the catch and effort estimates. To correct for this bias, an adjustment was applied to the FHWAR data. This adjustment is described on page 107 of the SEDAR 28 Cobia Data Workshop report.

The base model run used a Lorenzen natural mortality function that scaled the age-based estimates of natural mortality for ages 3-11 to a point estimate of M = 0.38. The model also estimated the steepness of the stock-recruit function rather than use a fixed value.

Uncertainty in parameter estimates was investigated using a parametric bootstrap approach in which Stock Synthesis uses the error assumptions and sample sizes from the input data to generate new data sets. The model was refit to 1000 bootstrapped data-sets and the distribution of the parameter estimates was used to represent the uncertainty in the parameters and derived quantities of interest.

Sensitivity runs were made using alternative estimates of natural mortality, fixed stock-recruit steepness levels of 0.7 and 0.8, and variations in the abundance indices.

Using an MSY proxy based on 30% SPR, the results of the base model run indicated that the cobia stock was neither overfished nor experiencing overfishing.

Three reviewers from the Center for Independent Experts (CIE) reviewed the assessment. The reviewers felt that 1) the assessment did not address uncertainty in hindcast estimates of landings; 2) CPUE indices were not defensible due to low proportions of successful trips; and 3)

Composition data was not weighted appropriately. At the suggestion of the CIE reviewers, several additional sensitivity runs were made. One finding from these additional runs was that removing all abundance indices from the model had a large influence on model results. Consequently, the assessment likely requires indices of abundance. Most of the other suggested sensitivity runs had little impact on the model results.

The analysts did not produce the probability distribution functions (PDF) needed for OFL and ABC recommendations because a number of questions remained on the use of certain parameters. The assessment workshop group sought advice from the SSC on these questions.

- Should we use F_{MSY} (0.51) or $F_{SPR30\%}$ (0.38) as a proxy for management metrics
    - F_{MSY} is dependent on stock-recruitment relationship
- Should we do projections with a fixed steepness or an estimated steepness
    - If fixed, what level of steepness?
- Current projections do not incorporate uncertainty in natural mortality rate
    - Can incorporate uncertainty in M in pdf of forecasted yield by weighting alternative models with different values for M

Although the assessment model produced an actual estimate of F_{MSY}, the SSC felt that there was a large amount of uncertainty as to the shape of the stock-recruit relationship. When the model was allowed to estimate steepness, the original estimated value was 0.92, with sensitivity runs producing estimates from 0.72 to 0.99. Consequently, the SSC concluded that an MSY proxy based on 30% SPR should continue to be used, and that the steepness value should be fixed rather than estimated by the model. The SSC also felt that, to account for uncertainty, a PDF should be constructed as a weighted average of PDFs produced from three levels of natural mortality, with the weighing factors based on the probability levels of each of the M values.

The SSC by consensus recommends that:

- **the MSY reference point used for the cobia benchmark assessment be the 30% SPR proxy;**
- **the steepness value used for generating recruitment values for projections be fixed at 0.8;**
- **uncertainty be represented by combining PDFs constructed using the range of natural mortality values recommended by the assessment review panel (M=0.26, 0.38, and 0.50); and**
- **the weighting for the combined PDFs be the probabilities for each of the M values. For low and high, both probabilities are 28%, and for the base M, 44%.**

Projections runs based on the above parameters need to be run before the SSC can recommend levels of OFL and ABC. In addition, since the SEDAR stock assessment report is not yet completed, the SSC is unable to either accept of reject the assessment. These determinations will be made at a future SSC meeting when the completed analysis is presented.

Although the SSC cannot yet provide recommendations for OFL and ABC, they were able to proceed through the ABC control rule Tier 1 spreadsheet to determine a level of P*, which will be applied to the PDF function to determine an ABC. The spreadsheet uses a point system that evaluates several characteristics of the assessment to determine a P* value within the range of 0.30 to 0.50 (representing a 30% to 50% probability that the selected ABC exceeds the true value of OFL). These characteristics are 1) level of quantitative information and whether proxies or actual estimates of reference points are used, 2) the degree to which uncertainty of important inputs has been accounted for, 3) whether a retrospective analysis has been conducted and shown to result in significant biases, and 4) whether known environment covariates have been accounted for. The spreadsheet results are shown below. They resulted in a P* of 0.434.

$$P^* = \exp\left[-a - b \sum_{i\ \text{dimension}} \text{Dimension score}_i\right]$$

P* = 0.434

Maximum Risk **0.50**	S_{hi}= 3.998	
	a= 0.693	$a = -\ln(0.50)$
Minimum Risk **0.30**	b= 0.1277703	$b = -\frac{a + \ln(0.30)}{S_{hi}}$

S_{hi} = *highest possible score*

Element scores are scaled from zero to a maximum. In this example the maximum is 2.00, but this can be changed

Dimension	Dimension Wt	Tier No.	Tier Wt	Element Score	Element	Score it	Element Result	Tier Result	Dimension Result
Assessment Information	**1**	1	1	0.00	Quantitative, age-structured assessment that provides estimates of exploitation and biomass; includes MSY-derived benchmarks.		0.67	0.67	0.67
				0.67	Quantitative, age-structured assessment provides estimates of either exploitation or biomass, but requires proxy reference points.	x			
				1.33	Quantitative, non-age-structured assessment. Reference points may be based on proxy.				
				2.00	Quantitative assessment that provides relative reference points (absolute measures of status are unavailable) and require proxies.				
Characterization of Uncertainty	**1**	1	.333	0.0	The OFL pdf provided by the assessment model includes an appropriate characterization of "within model" and "between model/model structure" error. The uncertainty in important inputs (such as natural mortality, discard rates, discard mortality, age and growth parameters, landings before consistent reporting) has been described with using Bayesian priors and/or bootstrapping and/or Monte Carlo simulation and the full uncertainty has been carried forward into the projections.		1.33	0.4429	0.44
				0.67	The OFL pdf provided by the assessment model includes an approximation of observation and process error. The uncertainty in important inputs (such as natural mortality, discard rates, discard mortality, age and growth parameters, landings before consistent reporting) has been described with ***SENSITIVITY RUNS*** and the full uncertainty has been carried forward into the projections.				
				1.33	The OFL pdf provided by the assessment model includes an incomplete approximation of observation and process error. The uncertainty in important inputs (such as natural mortality, discard rates, discard mortality, age and growth parameters, landings before consistent reporting) has been described with ***SENSITIVITY RUNS*** but the full uncertainty ***HAS NOT*** been carried forward into the projections.	X			
				2.0	The OFL provided by the assessment ***DOES NOT*** include uncertainty in important inputs and parameters.				
		2	.333	0.0	Retrospective patterns have been described, and are not significant.	X	0.0	0	
				1.0	Retrospective patterns have been described and are moderately significant.				
				2.0	Retrospective patterns ***have not*** been described ***or*** are large.				
		3	0				0	0	
					NOT USED				
						z			
		4	.333	0.0	Known environmental covariates are accounted for in the assessment.	X	0.0	0	
				1.0	Known environmental covariates are **partially** accounted for in the assessment.				
				2.0	Known environmental covariates ***are not*** accounted for in the assessment.				

The following is from the May 2013 Gulf Council SSC meeting.

SEDAR 28 Cobia Benchmark Assessment Results

The SSC reviewed the cobia assessment at its previous meeting in March. However, at that time, the analysts did not produce the probability distribution functions (PDF) needed for OFL and ABC recommendations because a number of questions remained on the use of certain parameters. These included what proxy to use for F_{MSY}, what value to use for the stock-recruit function's steepness parameter, and how to incorporate uncertainty about the natural mortality rate into the PDF. In March, the SSC decided to $F_{SPR30\%}$ as the F_{MSY} proxy, fix the steepness value at 0.8, and to average the PDFs from model runs under different natural mortality rate assumptions, weighting for the combined PDFs based on the probabilities for each of the M values. For low M and high M, both probabilities are 28%, and for the base M, 44%. The SSC also worked through the ABC control rule's P* spreadsheet for Tier 1 (data rich stocks), and concluded that, for cobia, P* = 0.434. These same parameters were requested for the Spanish mackerel projections.

Jakob Tetzlaff presented the analysis and yield projection runs for cobia based on the parameters specified by the SSC in March and a P* value of 0.434. He provided projections from 2013 to 2019 for Gulf of Mexico cobia under three alternative natural mortality rate scenarios (M base=0.38, M low=0.26, M high=0.54), as well as a projection run for the combined weighted average.

The results projected landings slightly higher than those observed in recent history. Dr. Tetzlaff attributed this to three factors. 1) The model is estimating an increase in abundance in the most recent years. 2) There have been decreases in shrimp effort and corresponding removals by shrimp trawls. 3) The average recruitment used in the model is slightly higher than what has been seen in the most recent years.

Following the presentation of the assessment results, Luiz Barbieri noted that the SSC had been unable to accept the cobia or Spanish mackerel assessments at the previous meeting because the Review Panel report was not yet ready. The Review Panel report for cobia is now available, and it reflects the discussions and additional analysis requests made by the Panel. However, the Spanish Mackerel Review Panel report is still being put together. That report will be available in time for the next SSC meeting in August.

With the cobia assessment materials now complete, the SSC was able to vote on whether to accept the assessment. Most of the discussion on the methodology had occurred at the previous meeting. With the additional presentation given at this meeting, the SSC passed the following motion.

> **By a vote of 13 to 0, the SSC moves to accept the cobia assessment as the best available scientific information.**

The above motion refers to the assessment itself, i.e., the structure of the model, the data inputs, and the estimates of OFL, but not the projections.

Following passage of the motion, the SSC proceeded to discuss the projections based on the assessment. One SSC member expressed concern about the future recruitment levels used to make the projections. The level used was based on the average recruitment from 1982-2011. However, a plot of the recruitment levels (Figure 1) indicates a downward shift of recruitment beginning in 1997. As a result, the recruitment levels used in the projections are above the average recruitment during 1997-2011, and may have resulted in overestimates of future abundance.

Table 1. OFL and ABC projection results

Criteria	Definition	Base	Low M	High M	Weighted Average
OFL	Annual Yield @ MFMT				
	OFL 2013	2,547,481	1,375,205	4,364,116	2,727,902
	OFL 2014	2,512,054	1,478,067	3,700,906	2,555,416
	OFL 2015	2,587,804	1,689,828	3,509,415	2,594,422
	OFL 2016	2,649,422	1,902,248	3,418,166	2,655,462
	OFL 2017	2,686,085	2,078,810	3,362,191	2,705,358
	OFL 2018	2,708,682	2,220,473	3,328,285	2,745,472
	OFL 2019	2,723,629	2,332,423	3,308,994	2,777,994
ABC	Annual Yield @ MFMT (P* 0.434)				
	ABC 2013	2,473,157	1,342,202	4,216,226	2,644,549
	ABC2014	2,422,071	1,441,076	3,546,502	2,462,233
	ABC 2015	2,514,822	1,652,869	3,411,915	2,524,661
	ABC 2016	2,593,367	1,866,936	3,345,891	2,600,673
	ABC 2017	2,637,153	2,044,588	3,294,807	2,655,378
	ABC 2018	2,662,178	2,186,643	3,262,373	2,697,083
	ABC 2019	2,677,841	2,298,425	3,243,572	2,730,009

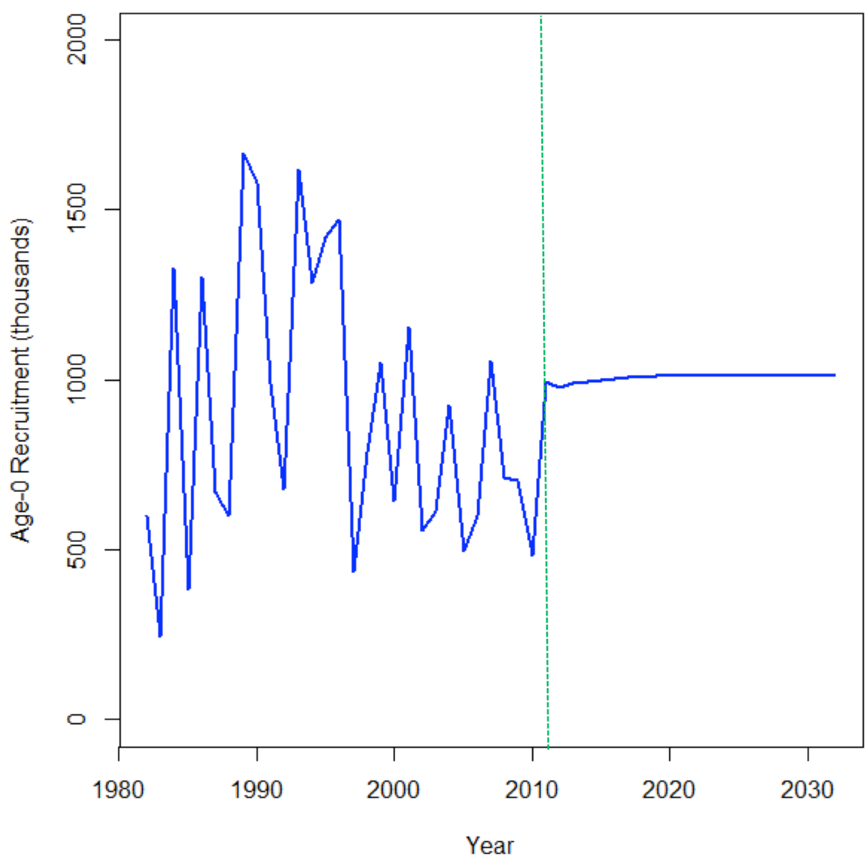

Figure 1. Historical cobia recruitment and average recruitment used for future projections.

Dr. Tetzlaff noted that the approach used to make projections did not consider interannual variation in the future recruitment levels. The projected recruitment was based on the mean recruitment from the stock-recruit curve, which was about the average of the recruitment levels for 1982-2011 plotted in Figure 1. He had the same concerns as expressed above about the future recruitment levels, and therefore tried to develop an alternative method of projecting recruitment that accounted for differences in recruitment going forward. This approach included stochasticity in recruitment variations going forward, and allowed the modeler to specify which years to include in the deviations. There was insufficient time to apply the alternative model to all the scenarios requested by the SSC. However, the approach was applied to the base model. If a lower recruitment was assumed going forward, the resulting OFL values were similar to those in the projections that were presented for 2013-2015, but with a declining pattern going forward.

An SSC member noted that Dr. Tetzlaff had listed three factors responsible for the higher projected landings, with the higher average recruitment being one of those factors, and asked which was considered the most predominant factor. Dr. Tetzlaff responded that the recruitment level had a higher influence than the reduction in shrimp bycatch. However, even with the projection run that assumed a lower recruitment going forward, the projected OFLs and ABCs were higher than recent landings and were not dissimilar to those presented.

Luiz Barbieri suggested that the SSC request additional runs using a more conservative projected recruitment level based on the 1997-2011 average recruitment, but those projections would not be ready until the next SSC meeting. Other SSC members noted that the projections based on a weighted average PDF bracketed uncertainty by incorporating low M and high M projection results along with the base model.

An SSC member noted that one of the factors affecting the abundance estimates was the reduced shrimp bycatch levels, and questioned what would happen if there was a rapid increase in shrimp effort going forward. It was noted that, as part of the red snapper rebuilding plan, shrimp bycatch would be constrained to at least 60% below the baseline, and it was currently below that.

Other suggestions were made that the base model or the low M model provided conservative estimates of landings. However, given that uncertainty has been taken into account in the weighted average projections by bracketing the high M and low M scenarios, and that the projection results based on lower recruitment were not dissimilar for the first few years of the projections, the SSC decided to recommend OFL and ABC based on the weighted average for the next three years. In keeping with past practice, the OFL and ABC values were expressed in millions of pounds whole weight, and rounded to three digits.

By a vote of 13 to 0, the SSC accepts the OFL and ABC yield stream based on the weighted average among the base, high M, and low M for the years 2014-2016.

Year	**OFL**	**ABC**
2014	**2.56 mp**	**2.46mp**
2015	**2.59mp**	**2.52mp**
2016	**2.66mp**	**2.60mp**

Steven Atran noted that, if OFL and ABC were not revisited before 2017, the values would remain at the 2016 levels. Since the projections for these values were increasing, this was a conservative level of OFL and ABC for 2017 and beyond.