Gulf of Mexico Fishery Management Council
Scientific and Statistical Committee

Stock Assessment Review Summary:
SEDAR 42 – Gulf Red Grouper

Dr. Meaghan Bryan presented the SEDAR 42 red grouper assessment. Fishery-dependent data inputs included the NMFS headboat survey, MRFSS/MRIP, commercial longline, commercial vertical line, and headboat observer discard data. The 2005 red tide event was modeled as a fishing fleet which differed from the previous assessment, when it was modeled as a transient natural mortality event. Fish trap catches were also included, but fish traps were prohibited after 2006. Fishery-independent data included SEAMAP Summer Groundfish, NMFS bottom longline, SEAMAP video, Panama City Laboratory video, Panama City laboratory trap survey, FWRI trap survey, and Dry Tortugas reef visual census. The start year for the assessment was 1993, and the terminal year for the data was 2013. A new method for estimating discards was used, which led to larger estimates of discards than in the previous 2009 assessment. Discard mortality rates used in the assessment were recreational - 11.6%; commercial handline - 19%; commercial longline - 43.6%. The assessment model was run using Stock Synthesis 3.

The age of 50% female maturity was estimated at 2.8 years, and the age of 50% male transition was estimated at 11.2 years. Natural mortality at age was modeled using the Lorenzen function with a maximum age of 29 years and an overall natural mortality of M = 0.14. The steepness value of the stock-recruitment relationship was fixed at 0.99, with spawning stock measured as spawning stock biomass in metric tons, and recruits measured as 1,000s of age-0 fish. The stock biomass level has fluctuation above and below MSST since 1993 but is currently above both MSST and the MSY proxy (Figure 1). Fishing mortality rate has been below MFMT since 1996 except for 2005, due to the red tide event (Figure 2). The results of the assessment are shown in Table 1.

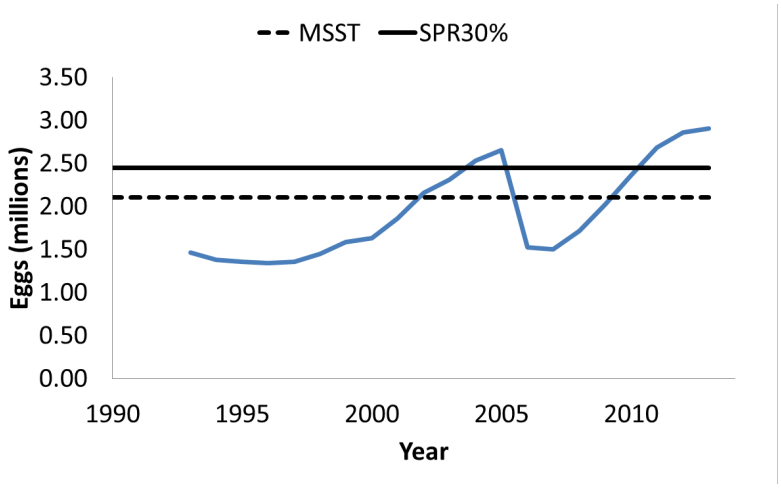

Figure 1. Red grouper SSB relative to MSST and MSY proxy 1993-2013

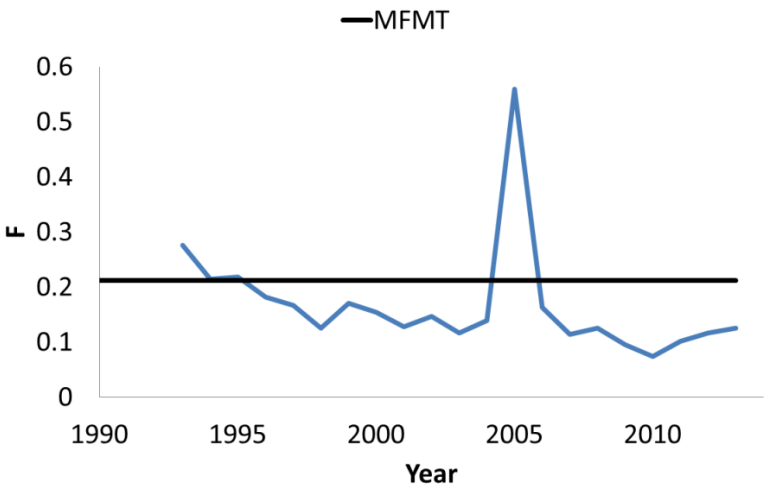

Figure 2. Red grouper fishing mortality rate relative to MFMT 1993-2013

Table 1. SEDAR 42 Red Grouper Assessment Results

Criteria	Definition	Value
Base M		0.144
	Mortality rate criteria	
Fmsy or proxy	F30%	0.212
MFMT	F30%	0.212
Foy	75% of F30%	0.164
Fcurrent	F2013	0.126
Fcurrent/MFMT		**0.594**
Fcurrent/Foy		**0.766**
	Biomass criteria	
SSBmsy (Eggs)	SSB at F30%	2,447,900
MSST	(1-M)*SSB30%	2,095,402
SSBoy		3,081,890
SSBcurrent (Eggs)	Eggs	2,905,630
SSBcurrent/SSB30%		**1.187**
SSBcurrent/MSST		**1.387**
SSBcurrent/SSBoy		**0.943**

Following the recommendation made during the discussion on best scientific information to separate the SSC's functions of peer reviewer and management advisor, the SSC separately passed the following two motions.

> **By a unanimous vote, the SSC accepts the SEDAR 42 Gulf Red Grouper Assessment, including responses to review workshop comments, as the best available science which is sufficient for estimating stock status.**
>
> **By a unanimous vote, the SSC accepts the stock status determination for Gulf red grouper as not overfished and not experiencing overfishing, as of the terminal year of the assessment (2013).**

In order to develop ABC projections, the SSC determined P* using the ABC control rule Tier 1 spreadsheet. The P* analysis for red grouper, shown in Figure 3 resulted in a P* of 0.427, which the SSC rounded off to 0.43.

Given that the red grouper stock is neither overfished nor experiencing overfishing (as of 2013), SSC members felt it was appropriate to provide OFL and ABC recommendations for a 5-year period beginning in 2016. However, a decision was needed on how to handle landings for the years 2014-2015, which are not in the assessment. For 2014, final landings are available and will be used. For 2015 the SSC recommended that the assessment group use landings estimates based on the current quotas and ACLs.

> **By a unanimous vote, the SSC recommends that the annual OFL for Gulf red grouper for years 2016-2020 be set at the 50th percentile of the OFL PDF, assuming estimated landings for 2014 and 2015 fishing years. The annual ABC for years 2016-2020 will be computed as the 43rd percentile of the OFL PDF. Under a constant catch scenario, the mean of these time series for OFL or ABC would be utilized.**

SSC members also asked that the SEFSC provide the equilibrium MSY and OY yields.

The SEFSC computed the OFL and ABC yield streams and equilibrium yields based on the criteria established by the SSC (Table 2).

Table 2. OFL and ABC yield streams and equilibrium yields for Gulf red grouper, using a P* of 0.43.

Year	OFL (millions lbs)	ABC (millions lbs)
2015	21.28	20.93
2016	16.83	16.57
2017	13.15	12.96
2018	10.71	10.54
2019	9.82	9.65
2020	10.05	9.86

- From projections using F30%
- Pstar = 0.43

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

P* = 0.427

S_{hi}= 3.998

Maximum Risk **0.50** a= 0.693

Minimum Risk **0.30** b= 0.1277703

$$a = -\ln(0.50) \qquad b = -\frac{a + \ln(0.30)}{S_{hi}} \qquad S_{hi} = highest\ possible\ score$$

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.		0.67	0.22311	0.56
				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.	x			
				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.				
				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.		1.0	0.333	
				1.0	Known environmental covariates are **partially** accounted for in the asses	x			
				2.0	Known environmental covariates ***are not*** accounted for in the assessment.				

Figure 3. ABC control rule Tier 1 P* analysis for red grouper