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SEDAR 72: US Gulf of Mexico Gag Grouper Operational Assessment

Updated Projections

GMFMC Reef Fish AP
Presentation January 2021

NOAA Fisheries, Southeast Fisheries Science Center,
Sustainable Fisheries Division (SFD)

Modified by Ryan Rindone for the Reef Fish AP



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Fmsy Proxy

- Why ?
 - Source: Turner et al. 2001. Status of Gag in the Gulf of Mexico, Assessment 3.0.
https://www.researchgate.net/publication/265279249_Status_of_Gag_in_the_Gulf_of_Mexico_Assessment_30
 - **“Because the female reproductive-potential function reaches a maximum at age 8, long-term fishing at F30% and F40% will generally result in the relatively low biomass levels of males. A bench mark that maximizes the yield from the entire population, given estimated recruitments, is Fmax. Fmax would achieve greater long-term yields and a higher SPR (43% - 65%) than would policies based on F30% or F40%.”**
 - All contingent on female-only biomass, assuming little potential for decreased fertilization from low % males

Fmsy Proxy

- F_{max} VS. $F_{\%SPR}$
 - 2001 assessment (VPA): $F_{max}^{SSB\ female} \sim F_{45-60\%SPR}$
 - SEDAR 10: $F_{max}^{SSB\ female} \sim F_{31-33\%SPR}$
 - SEDAR 33: $F_{max}^{SSB\ female} \sim F_{40\%SPR}$; $F_{max}^{SSB\ combined} \sim F_{30\%SPR}$
 - SEDAR 33 update: $F_{max}^{SSB\ female} \sim F_{29\%SPR}$
 - SEDAR 72: $F_{max}^{SSB\ female} \sim F_{30\%SPR}$; $F_{max}^{SSB\ combined} \sim F_{13\%SPR}$

Projection Settings

SEDAR 72 – SSB combined

Parameter	Value	Comment
Relative F	Average from 2017 - 2019	Red Tide F excluded
Selectivity	2019	Fleet specific selectivity for 2019
Retention	2019	Fleet specific retention for 2019
Recruitment	Beverton-Holt stock-recruitment relationship	Derived from the model
Interim Landings (2020-2022)	73.79/126.72/126.72 mt (Comm. Vertical Line)	Landings provided for 2020; For 2021-2022, used 3-year average of landings (2018-2020)
	133.69/97.41/97.41 mt (Comm. Longline)	
	2.61/2.54/2.54 thousands of fish (Headboat)	
	37.61/28.66/28.66 thousands of fish (Charter)	
	305.4/271.68/271.68 thousands of fish (Private)	
Allocation Ratio	39:61	Commercial:Recreational

Projection Scenarios – 2021 Red Tide

- Ecosystem model (updated with data up to the end of October) :
 $\hat{M}_{2021_redtide} = 0.103$; 95% CI (0.027, 0.290)
- We take the **mean** estimate as the “Medium Red Tide” scenario and the limits of the **95% confidence interval** as the “Low” and “High” scenarios

Low = 6% the strength of the 2005 red tide

Med = 24% the strength of the 2005 red tide

High = 68% the strength of the 2005 red tide

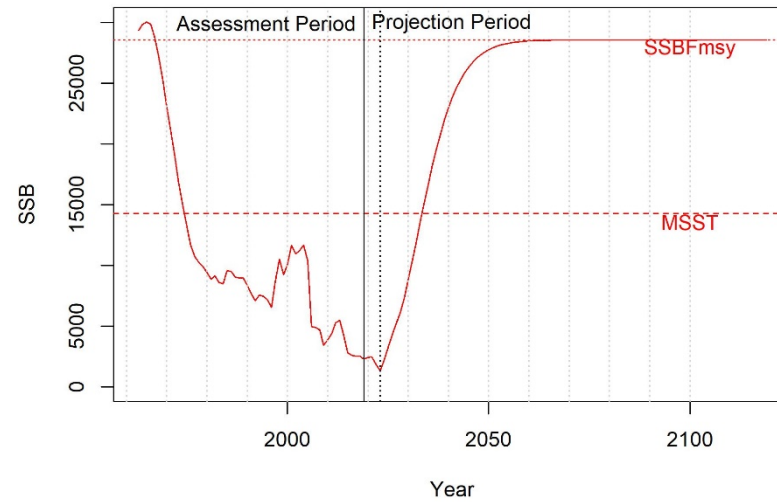
Projection Scenarios

	Fspr30			Fmax		
	LOW	HIGH	MED	LOW	HIGH	MED
Base M	0.159	0.159	0.159	0.159	0.159	0.159
Steepness	0.855	0.855	0.855	0.855	0.855	0.855
R0	14319.2	14319.2	14319.2	14319.2	14319.2	14319.2
Generation Time	7.88	7.88	7.88	7.88	7.88	7.88
SSB0	106178	106178	106178	106178	106178	106178
Proxy	Fspr30	Fspr30	Fspr30	Fmax	Fmax	Fmax
Fmsy proxy	0.148	0.148	0.148	0.328	0.328	0.328
MFMT	0.148	0.148	0.148	0.328	0.328	0.328
%SPR equivalent of Fmsy proxy	30	30	30	13	13	13
Fcurrent	0.412	0.412	0.412	0.412	0.412	0.412
Fcurrent/MFMT	2.784	2.784	2.784	1.256	1.256	1.256
SSBmsy proxy	28559.6	28559.8	28559.4	9956.4	9956.53	9957.26
MSST	14279.8	14279.9	14279.7	4978.2	4978.265	4978.63
SSBcurrent	2296.24	2296.24	2296.24	2296.24	2296.24	2296.24
SSBcurrent/SSBFmsy_proxy	0.08	0.08	0.08	0.231	0.231	0.231
SSBcurrent/MSST	0.161	0.161	0.161	0.461	0.461	0.461
First year mgmt	2023	2023	2023	2023	2023	2023
Yr rebuilt at F=0	2033	2035	2034	2028	2030	2029
SSBcurrent/SSB0	0.022	0.022	0.022	0.022	0.022	0.022
SSByrrebuilt/SSB0	0.139	0.128	0.143	0.038	0.028	0.036

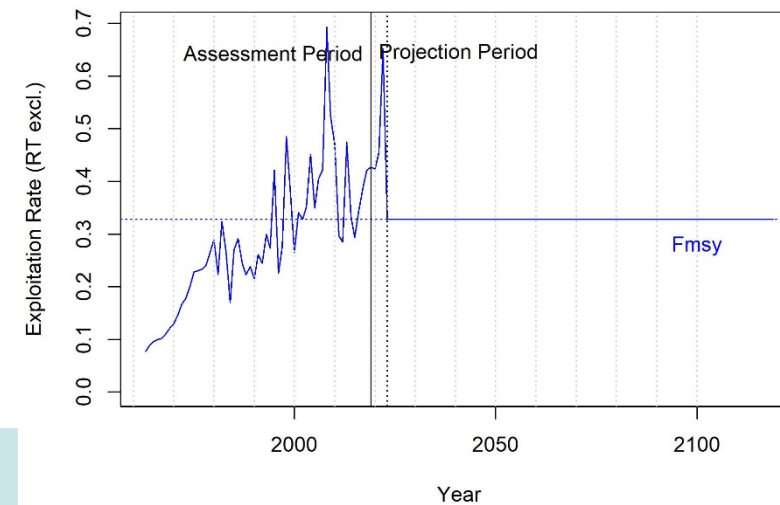
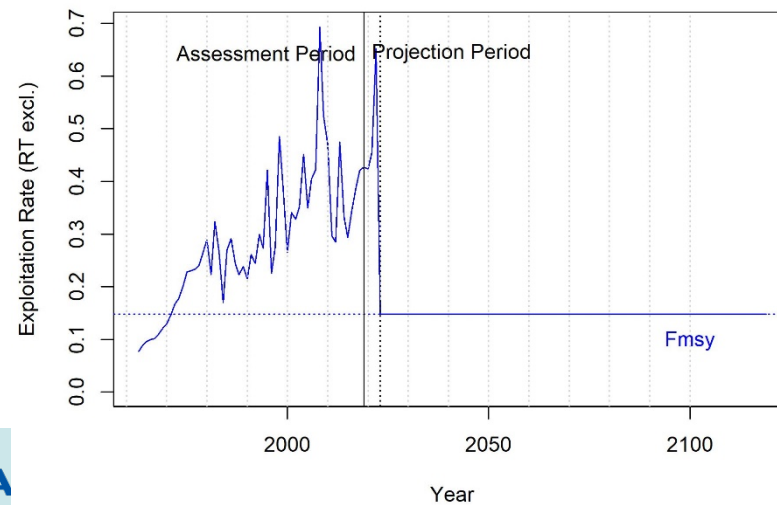
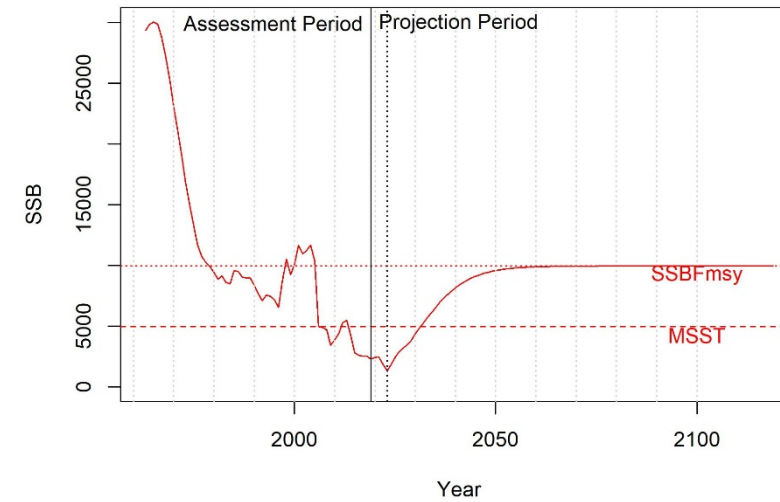
FSPR30%

Fmax

Fmsy_proxy = Fspr30% ; Med 2021 Red Tide



Fmsy_proxy = Fmax ; Med 2021 Red Tide



Frebuild

Calculate **Tmin**, the amount of time the stock is expected to take to rebuild to its MSY biomass level in the absence of any fishing mortality (**F=0**).

Tmin < 10yrs

Tmin
No fishing

10yrs

Halfway in between Tmin and 10 years

Tmin > 10yrs

Tmin*2

Tmin+1 generation time

Amount of time stock expected to take
to rebuild to Bmsy proxy if fished at
75% MFMT

Tmin = 10yrs
No fishing

Fspr30_medRT

F=0

Year	R (1000s)	F	Yield (mp gwt)	SSB (mt)	SSB/ SSBFmsy	SSB/ MSST	F/ MFMT	SSB/ SSB0
2020	5,098	0.424	3.31	2,432	0.09	0.17	2.86	0.02
2021	5,170	0.454	3.10	2,484	0.09	0.17	3.07	0.02
2022	4,221	0.652	3.15	1,849	0.06	0.13	4.40	0.02
2023	3,312	0.000	0.00	1,337	0.05	0.09	0.00	0.01
2024	5,134	0.000	0.00	2,458	0.09	0.17	0.00	0.02
2025	6,927	0.000	0.00	4,057	0.14	0.28	0.00	0.04
2026	8,274	0.000	0.00	5,824	0.20	0.41	0.00	0.05
2027	9,226	0.000	0.00	7,573	0.27	0.53	0.00	0.07
2028	10,035	0.000	0.00	9,591	0.34	0.67	0.00	0.09
2029	10,808	0.000	0.00	12,257	0.43	0.86	0.00	0.12
2030	11,483	0.000	0.00	15,557	0.54	1.09	0.00	0.15
2031	12,029	0.000	0.00	19,340	0.68	1.35	0.00	0.18
2032	12,458	0.000	0.00	23,471	0.82	1.64	0.00	0.22
2033	12,795	0.000	0.00	27,865	0.98	1.95	0.00	0.26
2034	13,061	0.000	0.00	32,449	1.14	2.27	0.00	0.31



Fspr30_medRT

Frebuild Tmin*2

Year	R (1000s)	F	Yield (mp gwt)	SSB (mt)	SSB/ SSBF _{msy}	SSB/ MSST	F/ MFMT	SSB/ SSB0
2020	5,098	0.424	3.31	2,432	0.09	0.17	2.86	0.02
2021	5,170	0.454	3.10	2,484	0.09	0.17	3.07	0.02
2022	4,221	0.652	3.15	1,849	0.06	0.13	4.40	0.02
2023	3,312	0.135	0.66	1,337	0.05	0.09	0.91	0.01
2024	4,753	0.135	1.02	2,190	0.08	0.15	0.91	0.02
2025	6,195	0.135	1.39	3,325	0.12	0.23	0.91	0.03
2026	7,255	0.135	1.65	4,430	0.16	0.31	0.91	0.04
2027	7,974	0.135	1.98	5,370	0.19	0.38	0.91	0.05
2028	8,595	0.135	2.41	6,354	0.22	0.44	0.91	0.06
2029	9,267	0.135	2.92	7,660	0.27	0.54	0.91	0.07
2030	9,912	0.135	3.48	9,244	0.32	0.65	0.91	0.09
2031	10,466	0.135	4.05	10,965	0.38	0.77	0.91	0.10
2032	10,918	0.135	4.64	12,721	0.45	0.89	0.91	0.12
2033	11,288	0.135	5.22	14,477	0.51	1.01	0.91	0.14
2034	11,593	0.135	5.79	16,217	0.57	1.14	0.91	0.15
2035	11,845	0.135	6.33	17,915	0.63	1.25	0.91	0.17
2036	12,053	0.135	6.84	19,536	0.68	1.37	0.91	0.18
2037	12,223	0.135	7.32	21,049	0.74	1.47	0.91	0.20
2038	12,363	0.135	7.75	22,437	0.79	1.57	0.91	0.21
2039	12,477	0.135	8.13	23,691	0.83	1.66	0.91	0.22
2040	12,571	0.135	8.47	24,808	0.87	1.74	0.91	0.23
2041	12,648	0.135	8.77	25,792	0.90	1.81	0.91	0.24
2042	12,711	0.135	9.02	26,649	0.93	1.87	0.91	0.25
2043	12,763	0.135	9.25	27,389	0.96	1.92	0.91	0.26
2044	12,805	0.135	9.43	28,022	0.98	1.96	0.91	0.26
2045	12,840	0.135	9.59	28,560	1.00	2.00	0.91	0.27



Fspr30_medRT

F fixed at 75%MFMT

Year	R (1000s)	F	Yield (mp gwt)	SSB (mt)	SSB/ SSBFmsy	SSB/ MSST	F/ MFMT	SSB/ SSB0
2020	5,098	0.424	3.31	2,432	0.09	0.17	2.86	0.02
2021	5,170	0.454	3.10	2,484	0.09	0.17	3.07	0.02
2022	4,221	0.652	3.15	1,849	0.06	0.13	4.40	0.02
2023	3,312	0.111	0.54	1,337	0.05	0.09	0.75	0.01
2024	4,822	0.111	0.85	2,237	0.08	0.16	0.75	0.02
2025	6,327	0.111	1.17	3,448	0.12	0.24	0.75	0.03
2026	7,441	0.111	1.42	4,656	0.16	0.33	0.75	0.04
2027	8,204	0.111	1.72	5,715	0.20	0.40	0.75	0.05
2028	8,864	0.111	2.11	6,842	0.24	0.48	0.75	0.06
2029	9,560	0.111	2.58	8,333	0.29	0.58	0.75	0.08
2030	10,218	0.111	3.10	10,143	0.36	0.71	0.75	0.10
2031	10,776	0.111	3.64	12,127	0.42	0.85	0.75	0.11
2032	11,230	0.111	4.19	14,177	0.50	0.99	0.75	0.13
2033	11,598	0.111	4.75	16,247	0.57	1.14	0.75	0.15
2034	11,899	0.111	5.30	18,312	0.64	1.28	0.75	0.17
2035	12,146	0.111	5.82	20,336	0.71	1.42	0.75	0.19
2036	12,348	0.111	6.32	22,279	0.78	1.56	0.75	0.21
2037	12,513	0.111	6.78	24,104	0.84	1.69	0.75	0.23
2038	12,648	0.111	7.20	25,788	0.90	1.81	0.75	0.24
2039	12,758	0.111	7.59	27,320	0.96	1.91	0.75	0.26
2040	12,848	0.111	7.92	28,694	1.00	2.01	0.75	0.27



Fspr30_medRT

Frebuild Tmin + 1 generation

Year	R (1000s)	F	Yield (mp gwt)	SSB (mt)	SSB/ SSBFmsy	SSB/ MSST	F/ MFMT	SSB/ SSB0
2020	5,098	0.424	3.31	2,432	0.09	0.17	2.86	0.02
2021	5,170	0.454	3.10	2,484	0.09	0.17	3.07	0.02
2022	4,221	0.652	3.15	1,849	0.06	0.13	4.40	0.02
2023	3,312	0.124	0.60	1,337	0.05	0.09	0.84	0.01
2024	4,785	0.124	0.95	2,212	0.08	0.15	0.84	0.02
2025	6,256	0.124	1.29	3,381	0.12	0.24	0.84	0.03
2026	7,341	0.124	1.55	4,533	0.16	0.32	0.84	0.04
2027	8,080	0.124	1.87	5,527	0.19	0.39	0.84	0.05
2028	8,719	0.124	2.28	6,575	0.23	0.46	0.84	0.06
2029	9,403	0.124	2.77	7,964	0.28	0.56	0.84	0.08
2030	10,054	0.124	3.32	9,648	0.34	0.68	0.84	0.09
2031	10,611	0.124	3.88	11,486	0.40	0.80	0.84	0.11
2032	11,064	0.124	4.45	13,373	0.47	0.94	0.84	0.13
2033	11,433	0.124	5.02	15,267	0.53	1.07	0.84	0.14
2034	11,736	0.124	5.58	17,151	0.60	1.20	0.84	0.16
2035	11,986	0.124	6.12	18,992	0.67	1.33	0.84	0.18
2036	12,192	0.124	6.63	20,753	0.73	1.45	0.84	0.20
2037	12,360	0.124	7.10	22,402	0.78	1.57	0.84	0.21
2038	12,497	0.124	7.52	23,919	0.84	1.68	0.84	0.23
2039	12,610	0.124	7.91	25,292	0.89	1.77	0.84	0.24
2040	12,702	0.124	8.25	26,520	0.93	1.86	0.84	0.25
2041	12,777	0.124	8.55	27,604	0.97	1.93	0.84	0.26
2042	12,839	0.124	8.81	28,552	1.00	2.00	0.84	0.27
2043	12,890	0.148	10.78	29,372	1.03	2.06	1.00	0.28

