Red Grouper Projections II

Prepared by the NOAA/NMFS Southeast Fisheries Science Center, Beaufort Laboratory
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1 Description of projections

This report describes projections requested in a memorandum, dated 18 January 2011, from Dr. Crabtree to Dr. Ponwith. The memorandum requested projections of red grouper (southeast U.S. Atlantic) under fishing mortality rate F_{rebuild}, where F_{rebuild} provides a 70% chance of recovery in eight years (by the end of 2018).

A previous memorandum requested similar projections but with a recovery time of seven years (results described in the report titled, Red Grouper Projections I). Those projections were extended in duration for long enough to provide saturation values. These current projections do the same.

Methods used in these projections are described in the SEDAR-19 report. Projected fishing mortality rate in 2009–2010, prior to the projection fishing mortality rate, was assumed equal to the current fishing mortality rate from the end of the assessment.

For reference, values of management quantities include MSY = 1110 (1000 lb), F_{MSY} = 0.221 (per yr), SSB_{MSY} = 2592 (mt). In the assessment report, MSST was set to $(1 - M)\text{SSB}_{\text{MSY}}$. If instead it were set to $0.5\text{SSB}_{\text{MSY}}$, the value would be MSST = 1296 (mt).

2 Results

Results are tabulated in Table 4.1 and are shown graphically in Figure 4.1.

3 Comments on projections

As usual, projections should be interpreted in light of the model assumptions and key aspects of the data. Some major considerations are the following:

- In general, projections of fish stocks are highly uncertain, particularly in the long term (e.g., beyond 5–10 years).

- Although projections included many major sources of uncertainty, they did not include structural (model) uncertainty. That is, projection results are conditional on one set of functional forms used to describe population dynamics, selectivity, recruitment, etc.

- Fishery sectors were assumed to continue fishing at their estimated current proportions of total effort, using the estimated current selectivity patterns. New management regulations that alter those proportions or selectivities would likely affect projection results.

- The assessment's estimate of F_{current} (2006–2008) was applied in projection years 2009 and 2010. It is expected that the recently implemented four-month grouper closure would affect mortality rates, but for now the realized effect is unknown.

- The projections assumed that the estimated spawner-recruit relationship applies in the future and that past residuals represent future uncertainty in recruitment. If future recruitment is characterized by runs of large or small year classes, possibly due to environmental or ecological conditions, stock trajectories may be affected.

4 Tables and figures

Table 4.1. Projection results under scenario with fishing mortality rate fixed at $F = F_{\text{rebuild}}$. F = fishing mortality rate (per year), Pr(SSB > SSB_{MSY}) = proportion of stochastic projection replicates exceeding SSB_{MSY}, SSB = mid-year spawning stock (mt), R = recruits (1000 age-1 fish), D = discard mortalities (1000 fish or 1000 lb whole weight), L = landings (1000 fish or 1000 lb whole weight), and Sum L = cumulative landings (1000 lb). For reference, estimated benchmarks are F_{MSY} = 0.221 (per yr), SSB_{MSY} = 2592 (mt), and MSY = 1110 (1000 lb). Expected values presented are from deterministic projections (klb = 1000 lb).

Year	F(per yr)	Pr(SSB > SSB_{MSY})	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2009	0.298	0	1888.74	399	32	61	107	1098	1098
2010	0.298	0	1800.36	396	35	70	94	985	2083
2011	0.168	0.01	1783.42	394	20	40	58	580	2663
2012	0.168	0.07	2040.6	394	20	41	66	654	3317
2013	0.168	0.17	2232.97	399	20	41	73	724	4041
2014	0.168	0.3	2407.2	402	20	41	78	787	4828
2015	0.168	0.42	2559.48	405	20	42	82	840	5668
2016	0.168	0.54	2690.09	407	21	42	86	886	6554
2017	0.168	0.63	2799.67	408	21	42	88	924	7478
2018	0.168	0.7	2890.18	410	21	42	90	956	8434
2019	0.168	0.75	2964.55	410	21	43	92	982	9416
2020	0.168	0.79	3025.27	411	21	43	93	1003	10,419
2021	0.168	0.82	3074.82	412	21	43	94	1020	11,439
2022	0.168	0.84	3115.31	412	21	43	95	1034	12,473
2023	0.168	0.86	3148.12	413	21	43	96	1046	13,519
2024	0.168	0.87	3174.3	413	21	43	96	1055	14,574
2025	0.168	0.88	3195.19	413	21	43	97	1062	15,637
2026	0.168	0.89	3211.87	413	21	43	97	1068	16,705
2027	0.168	0.89	3225.16	413	21	43	97	1073	17,778
2028	0.168	0.89	3235.76	413	21	43	98	1077	18,855
2029	0.168	0.9	3244.2	413	21	43	98	1080	19,934
2030	0.168	0.9	3250.92	414	21	43	98	1082	21,016
2031	0.168	0.9	3256.26	414	21	43	98	1084	22,100
2032	0.168	0.9	3260.51	414	21	43	98	1085	23,185
2033	0.168	0.9	3263.89	414	21	43	98	1086	24,272
2034	0.168	0.9	3266.57	414	21	43	98	1087	25,359
2035	0.168	0.9	3268.7	414	21	43	98	1088	26,448
2036	0.168	0.91	3270.4	414	21	43	98	1089	27,536
2037	0.168	0.91	3271.74	414	21	43	98	1089	28,626
2038	0.168	0.91	3272.81	414	21	43	98	1090	29,715
2039	0.168	0.91	3273.65	414	21	43	98	1090	30,805
2040	0.168	0.91	3274.33	414	21	43	98	1090	31,895
2041	0.168	0.91	3274.86	414	21	43	98	1090	32,986
2042	0.168	0.91	3275.29	414	21	43	98	1090	34,076
2043	0.168	0.91	3275.62	414	21	43	98	1091	35,167
2044	0.168	0.91	3275.89	414	21	43	98	1091	36,257
2045	0.168	0.91	3276.1	414	21	43	98	1091	37,348
2046	0.168	0.91	3276.27	414	21	43	98	1091	38,439
2047	0.168	0.91	3276.4	414	21	43	98	1091	39,530
2048	0.168	0.91	3276.51	414	21	43	98	1091	40,621
2049	0.168	0.91	3276.59	414	21	43	98	1091	41,712
2050	0.168	0.91	3276.66	414	21	43	98	1091	42,803
2051	0.168	0.91	3276.71	414	21	43	98	1091	43,894
2052	0.168	0.91	3276.75	414	21	43	98	1091	44,984
2053	0.168	0.91	3276.79	414	21	43	98	1091	46,075
2054	0.168	0.91	3276.81	414	21	43	98	1091	47,167
2055	0.168	0.91	3276.83	414	21	43	98	1091	48,258
2056	0.168	0.91	3276.85	414	21	43	98	1091	49,349
2057	0.168	0.91	3276.86	414	21	43	98	1091	50,440
2058	0.168	0.91	3276.88	414	21	43	98	1091	51,531
2059	0.168	0.91	3276.88	414	21	43	98	1091	52,622
2060	0.168	0.91	3276.89	414	21	43	98	1091	53,713
2061	0.168	0.91	3276.9	414	21	43	98	1091	54,804
2062	0.168	0.91	3276.9	414	21	43	98	1091	55,895
2063	0.168	0.91	3276.9	414	21	43	98	1091	56,986
2064	0.168	0.91	3276.91	414	21	43	98	1091	58,077
2065	0.168	0.91	3276.91	414	21	43	98	1091	59,168
2066	0.168	0.91	3276.91	414	21	43	98	1091	60,259
2067	0.168	0.91	3276.91	414	21	43	98	1091	61,350
2068	0.168	0.91	3276.91	414	21	43	98	1091	62,441
2069	0.168	0.91	3276.91	414	21	43	98	1091	63,532
2070	0.168	0.91	3276.91	414	21	43	98	1091	64,623
2071	0.168	0.91	3276.91	414	21	43	98	1091	65,714
2072	0.168	0.91	3276.91	414	21	43	98	1091	66,805
2073	0.168	0.91	3276.91	414	21	43	98	1091	67,896
2074	0.168	0.91	3276.91	414	21	43	98	1091	68,987
2075	0.168	0.91	3276.91	414	21	43	98	1091	70,078
2076	0.168	0.91	3276.91	414	21	43	98	1091	71,169
2077	0.168	0.91	3276.92	414	21	43	98	1091	72,260
2078	0.168	0.91	3276.92	414	21	43	98	1091	73,352
2079	0.168	0.91	3276.92	414	21	43	98	1091	74,443
2080	0.168	0.91	3276.92	414	21	43	98	1091	75,534
2081	0.168	0.91	3276.92	414	21	43	98	1091	76,625
2082	0.168	0.91	3276.92	414	21	43	98	1091	77,716
2083	0.168	0.91	3276.92	414	21	43	98	1091	78,807
2084	0.168	0.91	3276.92	414	21	43	98	1091	79,898
2085	0.168	0.91	3276.92	414	21	43	98	1091	80,989

Figure 4.1. Projection results under scenario with fishing mortality rate fixed at $F = F_{\text{rebuild}}$.