UNITED STATES DEPARTMENT OF COMMERCE
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JUL 13 2010 F/SER25:JCM

MEMORANDUM FOR: Bonnie Ponwith, Ph.D.
Director, Southeast Fisheries Science Center

FROM: Roy E. Crabtree, Ph.D.
Regional Administrator

SUBJECT: Data Analyses Request for Amendment 24 to the Fishery Management Plan for the Snapper-Grouper Fishery of the South Atlantic Region (Amendment 24)

This memorandum requests data analyses for Amendment 24, which includes actions to end overfishing and establish a rebuilding plan for South Atlantic red grouper.

The amendment proposes a number of rebuilding strategies based on constant fishing mortality projections at 85%F_{MSY}, 75%F_{MSY}, and 65%F_{MSY}. The amendment also includes a rebuilding strategy for red grouper requested by the South Atlantic Fishery Management Council's (Council) Scientific and Statistical Committee that sets F_{OY} equal to $F_{REBUILD}$, and would have a 70 percent probability of rebuilding success in ten years.

At their June 2010 meeting, the Council requested an additional projection, which would rebuild the stock sometime between the minimum amount of time that the fishery can be rebuilt in the absence of fishing (three years) and the maximum amount of time allowed by the Magnuson-Stevens Fishery Conservation and Management Act (ten years) to rebuild an overfished stock.

I request a projection for $F_{REBUILD}$ that would result in the stock being rebuilt in seven years. I also request a rebuilding projection for the yield at $F_{45\%SPR}$, which is the status quo optimum yield. For both projections, please provide the saturated equilibrium values. I would like to have the information by September 3, 2010.

cc: Tom Jamir
Peter Thompson
Theo Brainerd

Red Grouper Projections I

Prepared by the NOAA/NMFS Southeast Fisheries Science Center
Issued: 3 September 2010

1 Description of projections

This report describes projections requested in a memorandum, dated 13 July 2010, from Dr. Crabtree to Dr. Ponwith. Specifically, that memorandum requested projections of red grouper (southeast U.S. Atlantic) under fishing mortality rates $F_{45\%}$ and F_{rebuild}, where F_{rebuild} provides a 70% chance of recovery in seven years (by the end of 2017). It was also requested that projections be run long enough to provide saturation values.

Methods used in these projections are described in the SEDAR-19 report. Several levels of fishing mortality rate were projected:

- Scenario P1: $F = F_{45\%}$
- Scenario P2: $F = F_{\text{rebuild}}$, the maximum fishing rate that allows 0.7 probability of rebuilding to SSB_{MSY} by the end of 2017

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. The value of $F_{45\%}$ was not computed for the assessment report, but was computed for use in these projections. It is $F_{45\%} = 0.1055$.

For reference, values of other management quantities include MSY = 1110 (1000 lb), $F_{\text{MSY}} = 0.221$ (per yr), $\text{SSB}_{\text{MSY}} = 2592$ (mt).

2 Results

Results of the two projection scenarios are tabulated in Tables 4.1–4.2, and are shown graphically in Figures 4.1–4.2.

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 $F = F_{45\%}$ (Scenario P1). 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	0.106	0.01	1783.42	394	12	25	37	374	2457
2012	0.106	0.11	2166.93	394	13	26	44	442	2899
2013	0.106	0.33	2463.37	401	13	26	51	511	3410
2014	0.106	0.57	2745.22	406	13	27	56	575	3984
2015	0.106	0.76	3004.33	409	13	27	60	632	4617
2016	0.106	0.87	3237.78	412	13	27	64	684	5301
2017	0.106	0.94	3443.58	414	13	27	67	730	6031
2018	0.106	0.97	3622.04	415	13	28	69	770	6800
2019	0.106	0.98	3775.6	416	13	28	71	804	7604
2020	0.106	0.99	3906.65	417	13	28	73	833	8437
2021	0.106	0.99	4018.17	418	14	28	75	858	9295
2022	0.106	1	4113.04	419	14	28	76	879	10,173
2023	0.106	1	4193.05	419	14	28	77	897	11,070
2024	0.106	1	4259.54	419	14	28	78	911	11,981
2025	0.106	1	4314.75	420	14	28	78	924	12,905
2026	0.106	1	4360.52	420	14	28	79	934	13,839
2027	0.106	1	4398.42	420	14	28	79	942	14,781
2028	0.106	1	4429.77	420	14	28	80	949	15,730
2029	0.106	1	4455.67	421	14	28	80	955	16,685
2030	0.106	1	4477.05	421	14	28	80	960	17,645
2031	0.106	1	4494.68	421	14	28	80	964	18,608
2032	0.106	1	4509.22	421	14	28	81	967	19,575
2033	0.106	1	4521.19	421	14	28	81	969	20,545
2034	0.106	1	4531.04	421	14	28	81	972	21,516
2035	0.106	1	4539.15	421	14	28	81	973	22,490
2036	0.106	1	4545.82	421	14	28	81	975	23,465
2037	0.106	1	4551.31	421	14	28	81	976	24,441
2038	0.106	1	4555.83	421	14	28	81	977	25,418
2039	0.106	1	4559.54	421	14	28	81	978	26,396
2040	0.106	1	4562.6	421	14	28	81	979	27,375
2041	0.106	1	4565.1	421	14	28	81	979	28,354
2042	0.106	1	4567.17	421	14	28	81	980	29,334
2043	0.106	1	4568.86	421	14	28	81	980	30,314
2044	0.106	1	4570.26	421	14	28	81	980	31,294
2045	0.106	1	4571.4	421	14	28	81	981	32,275
2046	0.106	1	4572.34	421	14	28	81	981	33,256
2047	0.106	1	4573.12	421	14	28	81	981	34,237
2048	0.106	1	4573.75	421	14	28	81	981	35,218
2049	0.106	1	4574.28	421	14	28	81	981	36,199
2050	0.106	1	4574.7	421	14	28	81	981	37,181
2051	0.106	1	4575.06	421	14	28	81	981	38,162
2052	0.106	1	4575.35	421	14	28	81	982	39,144
2053	0.106	1	4575.59	421	14	28	81	982	40,125
2054	0.106	1	4575.78	421	14	28	81	982	41,107
2055	0.106	1	4575.94	421	14	28	81	982	42,089
2056	0.106	1	4576.07	421	14	28	81	982	43,070
2057	0.106	1	4576.18	421	14	28	81	982	44,052
2058	0.106	1	4576.27	421	14	28	81	982	45,034
2059	0.106	1	4576.35	421	14	28	81	982	46,015
2060	0.106	1	4576.41	421	14	28	81	982	46,997
2061	0.106	1	4576.45	421	14	28	81	982	47,979
2062	0.106	1	4576.5	421	14	28	81	982	48,961
2063	0.106	1	4576.53	421	14	28	81	982	49,943
2064	0.106	1	4576.56	421	14	28	81	982	50,924
2065	0.106	1	4576.58	421	14	28	81	982	51,906
2066	0.106	1	4576.6	421	14	28	81	982	52,888
2067	0.106	1	4576.61	421	14	28	81	982	53,870
2068	0.106	1	4576.63	421	14	28	81	982	54,852
2069	0.106	1	4576.64	421	14	28	81	982	55,834
2070	0.106	1	4576.64	421	14	28	81	982	56,815
2071	0.106	1	4576.65	421	14	28	81	982	57,797
2072	0.106	1	4576.66	421	14	28	81	982	58,779
2073	0.106	1	4576.66	421	14	28	81	982	59,761
2074	0.106	1	4576.67	421	14	28	81	982	60,743
2075	0.106	1	4576.67	421	14	28	81	982	61,724
2076	0.106	1	4576.67	421	14	28	81	982	62,706
2077	0.106	1	4576.67	421	14	28	81	982	63,688
2078	0.106	1	4576.67	421	14	28	81	982	64,670
2079	0.106	1	4576.68	421	14	28	81	982	65,652
2080	0.106	1	4576.68	421	14	28	81	982	66,634
2081	0.106	1	4576.68	421	14	28	81	982	67,615
2082	0.106	1	4576.68	421	14	28	81	982	68,597
2083	0.106	1	4576.68	421	14	28	81	982	69,579
2084	0.106	1	4576.68	421	14	28	81	982	70,561
2085	0.106	1	4576.68	421	14	28	81	982	71,543

Table 4.2. Projection results under scenario with fishing mortality rate fixed at $F = F_{rebuild}$ (Scenario P2). 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	0.157	0.01	1783.42	394	18	38	54	545	2628
2012	0.157	0.07	2062.19	394	19	38	63	619	3246
2013	0.157	0.2	2271.54	399	19	39	69	691	3937
2014	0.157	0.34	2462.71	403	19	39	75	755	4692
2015	0.157	0.48	2631.24	406	19	39	79	810	5502
2016	0.157	0.6	2777.02	408	19	40	82	858	6360
2017	0.157	0.7	2900.36	409	19	40	85	898	7258
2018	0.157	0.77	3003.09	411	19	40	87	932	8190
2019	0.157	0.82	3088.16	412	20	40	89	960	9150
2020	0.157	0.86	3158.13	412	20	40	90	983	10,133
2021	0.157	0.88	3215.62	413	20	40	92	1002	11,134
2022	0.157	0.9	3262.91	413	20	40	92	1017	12,151
2023	0.157	0.92	3301.47	414	20	40	93	1030	13,181
2024	0.157	0.92	3332.44	414	20	40	94	1040	14,221
2025	0.157	0.93	3357.32	414	20	40	94	1048	15,269
2026	0.157	0.94	3377.29	414	20	40	95	1054	16,323
2027	0.157	0.94	3393.31	415	20	40	95	1060	17,383
2028	0.157	0.94	3406.16	415	20	40	95	1064	18,447
2029	0.157	0.94	3416.45	415	20	40	95	1067	19,514
2030	0.157	0.95	3424.69	415	20	41	96	1070	20,584
2031	0.157	0.95	3431.28	415	20	41	96	1072	21,656
2032	0.157	0.95	3436.54	415	20	41	96	1074	22,730
2033	0.157	0.95	3440.75	415	20	41	96	1075	23,805
2034	0.157	0.95	3444.12	415	20	41	96	1076	24,882
2035	0.157	0.95	3446.81	415	20	41	96	1077	25,959
2036	0.157	0.95	3448.95	415	20	41	96	1078	27,037
2037	0.157	0.95	3450.66	415	20	41	96	1079	28,116
2038	0.157	0.95	3452.03	415	20	41	96	1079	29,195
2039	0.157	0.95	3453.12	415	20	41	96	1079	30,274
2040	0.157	0.95	3454	415	20	41	96	1080	31,354
2041	0.157	0.95	3454.69	415	20	41	96	1080	32,433
2042	0.157	0.95	3455.25	415	20	41	96	1080	33,513
2043	0.157	0.95	3455.69	415	20	41	96	1080	34,594
2044	0.157	0.95	3456.04	415	20	41	96	1080	35,674
2045	0.157	0.95	3456.33	415	20	41	96	1080	36,754
2046	0.157	0.95	3456.55	415	20	41	96	1080	37,835
2047	0.157	0.95	3456.73	415	20	41	96	1081	38,915
2048	0.157	0.95	3456.87	415	20	41	96	1081	39,996
2049	0.157	0.95	3456.99	415	20	41	96	1081	41,076
2050	0.157	0.95	3457.08	415	20	41	96	1081	42,157
2051	0.157	0.95	3457.15	415	20	41	96	1081	43,238
2052	0.157	0.95	3457.21	415	20	41	96	1081	44,318
2053	0.157	0.95	3457.26	415	20	41	96	1081	45,399
2054	0.157	0.95	3457.29	415	20	41	96	1081	46,480
2055	0.157	0.95	3457.32	415	20	41	96	1081	47,561
2056	0.157	0.95	3457.35	415	20	41	96	1081	48,641
2057	0.157	0.95	3457.37	415	20	41	96	1081	49,722
2058	0.157	0.95	3457.38	415	20	41	96	1081	50,803
2059	0.157	0.95	3457.39	415	20	41	96	1081	51,883
2060	0.157	0.95	3457.4	415	20	41	96	1081	52,964
2061	0.157	0.95	3457.41	415	20	41	96	1081	54,045
2062	0.157	0.95	3457.42	415	20	41	96	1081	55,126
2063	0.157	0.95	3457.42	415	20	41	96	1081	56,206
2064	0.157	0.95	3457.42	415	20	41	96	1081	57,287
2065	0.157	0.95	3457.43	415	20	41	96	1081	58,368
2066	0.157	0.95	3457.43	415	20	41	96	1081	59,449
2067	0.157	0.95	3457.43	415	20	41	96	1081	60,529
2068	0.157	0.95	3457.43	415	20	41	96	1081	61,610
2069	0.157	0.95	3457.43	415	20	41	96	1081	62,691
2070	0.157	0.95	3457.44	415	20	41	96	1081	63,772
2071	0.157	0.95	3457.44	415	20	41	96	1081	64,852
2072	0.157	0.95	3457.44	415	20	41	96	1081	65,933
2073	0.157	0.95	3457.44	415	20	41	96	1081	67,014
2074	0.157	0.95	3457.44	415	20	41	96	1081	68,095
2075	0.157	0.95	3457.44	415	20	41	96	1081	69,175
2076	0.157	0.95	3457.44	415	20	41	96	1081	70,256
2077	0.157	0.95	3457.44	415	20	41	96	1081	71,337
2078	0.157	0.95	3457.44	415	20	41	96	1081	72,418
2079	0.157	0.95	3457.44	415	20	41	96	1081	73,498
2080	0.157	0.95	3457.44	415	20	41	96	1081	74,579
2081	0.157	0.95	3457.44	415	20	41	96	1081	75,660
2082	0.157	0.95	3457.44	415	20	41	96	1081	76,741
2083	0.157	0.95	3457.44	415	20	41	96	1081	77,821
2084	0.157	0.95	3457.44	415	20	41	96	1081	78,902
2085	0.157	0.95	3457.44	415	20	41	96	1081	79,983

Figure 4.1. Projection results under scenario (P1) with fishing mortality rate fixed at $F = F_{45\%}$.

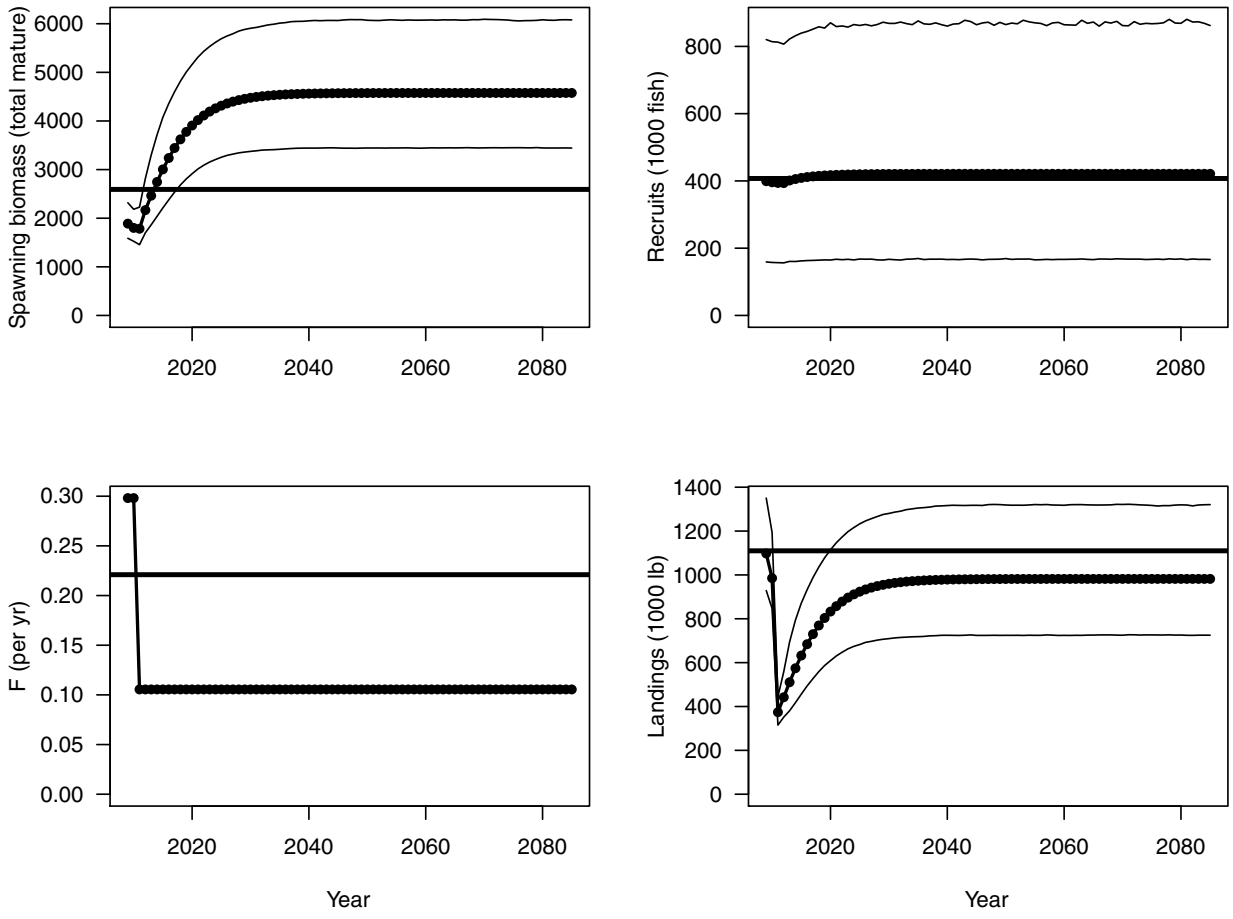

Figure 4.2. Projection results under scenario (P2) with fishing mortality rate fixed at $F = F_{\text{rebuild}}$.