Red Grouper Projections

Prepared by NMFS Southeast Fisheries Science Center

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Introduction

In a memorandum dated June 23, 2017, from Gregg Waugh to Dr. Bonnie Ponwith, The South Atlantic Fishery Management Council requested revised red grouper projections (Appendix 1). This report fulfills that request. Specifically, the requested projection analyses included the following:

1. Yield and stock conditions to 2030 based on fishing mortality rates of F_{MSY} (OFL) and 75%F_{MSY} ($F_{REBUILD}$), with recruitment based on the "low" recruitment scenarios presented in the assessment.

2. Yield and stock conditions projected to the year when the stock is rebuilt ($SSB>SSB_{MSY}$) based on fishing mortality rates of F_{MSY} (OFL) and 75%F_{MSY} ($F_{REBUILD}$), with recruitment based on the predicted values from the Stock-Recruitment relationship.

Methods

Except for modifications to accommodate the request, the projection methods were identical to those used in the SEDAR53 stock assessment of red grouper. In these revised analyses, fishing mortality rates take effect in 2018, and landings in 2016 and 2017 apply the same values used in the original projections. For item 2 above, the $F_{REBUILD}$ scenario achieves rebuilding ($SSB>SSB_{MSY}$) with probability of at least 50% in 2031, and thus these two projections (F_{MSY} and $F_{REBUILD}$) are extended through that year. The four projection scenarios are defined,

- Scenario 1: F_{MSY} with low recruitment, extended to 2030
- Scenario 2: $F_{REBUILD}$ with low recruitment, extended to 2030
- Scenario 3: F_{MSY} with long-term expected recruitment, extended to 2031
- Scenario 4: $F_{REBUILD}$ with long-term expected recruitment, extended to 2031

Results

Results are tabulated in Tables 1–4, and presented graphically in Figures 1–4.

Table 1. Scenario 1 projections results with F= F_{MSY} starting in 2018 and low recruitment. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = landings expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb), D = dead discards expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb), and pr.reb = proportion of stochastic projection replicates with SSB $\geq$ SSB_{MSY}. The extension "b" indicates expected values (deterministic) from the base run; the extension "med" indicates median values from the stochastic projections.

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)	D.b(n)	D.med(n)	D.base(w)	D.med(w)	pr.reb
2016	144	121	0.21	0.23	860	817	33	34	365	368	35	33	70	71	0
2017	144	120	0.23	0.25	797	752	34	35	365	367	38	36	81	78	0
2018	144	120	0.12	0.13	766	718	18	18	188	183	21	18	44	38	0
2019	144	120	0.12	0.13	800	752	19	19	196	191	22	19	46	40	0
2020	144	118	0.12	0.13	841	789	21	20	207	202	22	19	47	42	0
2021	144	119	0.12	0.13	884	826	22	21	219	212	22	19	48	42	0
2022	144	121	0.12	0.13	925	861	23	22	230	223	22	19	48	42	0
2023	144	120	0.12	0.13	963	895	24	23	239	232	22	19	48	42	0
2024	144	120	0.12	0.13	996	926	24	23	248	239	22	19	48	43	0
2025	144	119	0.12	0.13	1024	953	25	24	255	246	22	19	48	42	0
2026	144	121	0.12	0.13	1047	977	25	24	261	252	22	19	48	42	0
2027	144	121	0.12	0.13	1066	999	25	24	266	257	22	19	48	42	0
2028	144	121	0.12	0.13	1082	1017	25	25	270	261	22	19	48	42	0
2029	144	120	0.12	0.13	1095	1031	26	25	273	265	22	19	48	42	0
2030	144	121	0.12	0.13	1105	1044	26	25	276	268	22	19	48	42	0

Table 2. Scenario 2 projections results with F= $F_{REBUILD}$ starting in 2018 and low recruitment. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = landings expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb), D = dead discards expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb), and pr.reb = proportion of stochastic projection replicates with SSB $\geq$ SSB_{MSY}. The extension "b" indicates expected values (deterministic) from the base run; the extension "med" indicates median values from the stochastic projections.

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)	D.b(n)	D.med(n)	D.base(w)	D.med(w)	pr.reb
2016	144	121	0.21	0.23	860	817	33	34	365	368	35	33	70	71	0
2017	144	120	0.23	0.25	797	752	34	35	365	367	38	36	81	78	0
2018	144	120	0.09	0.09	773	725	14	14	143	139	16	13	33	29	0
2019	144	120	0.09	0.09	831	782	15	15	154	150	17	14	36	31	0
2020	144	118	0.09	0.09	897	844	17	16	167	162	17	15	37	32	0
2021	144	119	0.09	0.09	965	906	18	17	181	176	17	15	37	33	0
2022	144	121	0.09	0.09	1032	965	19	18	194	189	17	15	37	33	0
2023	144	120	0.09	0.09	1094	1021	20	19	206	200	17	15	37	33	0
2024	144	120	0.09	0.09	1150	1072	21	20	217	210	17	15	37	33	0
2025	144	119	0.09	0.09	1198	1117	21	21	226	219	17	15	37	33	0
2026	144	121	0.09	0.09	1239	1158	22	21	234	226	17	15	37	33	0
2027	144	121	0.09	0.09	1274	1194	22	21	240	233	17	15	37	33	0
2028	144	121	0.09	0.09	1303	1226	22	22	246	239	17	15	37	33	0
2029	144	120	0.09	0.09	1328	1253	23	22	251	244	17	15	37	33	0
2030	144	121	0.09	0.09	1349	1274	23	22	255	248	17	15	37	33	0

Table 3. Scenario 3 projections results with F= F_{MSY} starting in 2018 and long-term expected recruitment. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = landings expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb), D = dead discards expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb), and pr.reb = proportion of stochastic projection replicates with SSB $\geq$ SSB_{MSY}. The extension "b" indicates expected values (deterministic) from the base run; the extension "med" indicates median values from the stochastic projections.

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)	D.b(n)	D.med(n)	D.base(w)	D.med(w)	pr.reb
2016	323	266	0.21	0.23	860	817	33	34	365	368	56	50	92	89	0.000
2017	318	259	0.23	0.25	839	793	35	35	365	367	77	70	144	134	0.000
2018	315	253	0.12	0.13	884	834	22	21	204	198	45	38	93	79	0.000
2019	320	254	0.12	0.13	1036	974	28	27	244	236	48	40	101	86	0.001
2020	334	268	0.12	0.13	1218	1138	34	33	293	282	49	42	106	90	0.003
2021	346	279	0.12	0.13	1412	1312	39	38	344	331	51	43	109	93	0.008
2022	357	288	0.12	0.13	1604	1481	44	42	393	377	53	45	113	97	0.016
2023	365	299	0.12	0.13	1788	1642	48	46	440	422	55	47	117	101	0.027
2024	372	307	0.12	0.13	1960	1792	51	49	484	463	56	48	120	104	0.041
2025	377	312	0.12	0.13	2117	1930	55	52	524	501	57	49	122	107	0.060
2026	381	316	0.12	0.13	2261	2059	57	55	560	535	58	50	124	109	0.082
2027	385	320	0.12	0.13	2389	2178	60	57	593	566	58	51	126	111	0.104
2028	387	326	0.12	0.13	2503	2290	62	59	622	594	59	51	127	112	0.128
2029	390	327	0.12	0.13	2603	2387	64	61	647	619	59	52	128	113	0.152
2030	391	330	0.12	0.13	2690	2480	65	62	670	642	59	52	129	115	0.174
2031	393	332	0.12	0.13	2766	2561	66	64	689	661	60	53	129	116	0.198

Table 4. Scenario 4 projections results with F= $F_{REBUILD}$ starting in 2018 and long-term expected recruitment. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = landings expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb), D = dead discards expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb), and pr.reb = proportion of stochastic projection replicates with SSB $\geq$ SSB_{MSY}. The extension "b" indicates expected values (deterministic) from the base run; the extension "med" indicates median values from the stochastic projections.

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)	D.b(n)	D.med(n)	D.base(w)	D.med(w)	pr.reb
2016	323	266	0.21	0.23	860	817	33	34	365	368	56	50	92	89	0.000
2017	318	259	0.23	0.25	839	793	35	35	365	367	77	70	144	134	0.000
2018	315	253	0.09	0.09	893	841	17	16	155	151	34	29	70	60	0.000
2019	321	254	0.09	0.09	1075	1012	22	21	191	185	37	31	78	67	0.002
2020	337	270	0.09	0.09	1295	1214	27	26	235	227	38	32	82	70	0.006
2021	351	282	0.09	0.09	1536	1433	32	31	283	273	40	34	86	73	0.019
2022	363	293	0.09	0.09	1782	1653	37	35	331	318	41	35	89	77	0.041
2023	372	305	0.09	0.09	2023	1866	41	39	377	363	43	37	93	80	0.076
2024	379	314	0.09	0.09	2252	2068	44	42	421	405	44	38	95	83	0.122
2025	385	319	0.09	0.09	2468	2262	47	45	463	444	45	39	97	85	0.175
2026	389	324	0.09	0.09	2667	2439	50	48	501	481	45	39	99	87	0.235
2027	393	328	0.09	0.09	2848	2611	52	50	536	515	46	40	100	88	0.300
2028	395	333	0.09	0.09	3012	2768	55	53	567	544	46	41	101	89	0.363
2029	398	335	0.09	0.09	3159	2910	56	54	595	572	46	41	102	91	0.425
2030	399	339	0.09	0.09	3289	3040	58	56	620	597	47	41	103	92	0.484
2031	401	339	0.09	0.09	3403	3159	59	58	642	620	47	42	103	92	0.538

Figure 1. Scenario 1 projections results with F= F_{MSY} starting in 2018 and low recruitment. Expected values (base run) represented by dotted solid lines, medians by dashed lines with open circles, and uncertainty by thin lines corresponding to 5th and 95th percentiles of replicate projections. Solid horizontal lines mark MSY-related quantities; dashed horizontal lines represent corresponding medians.

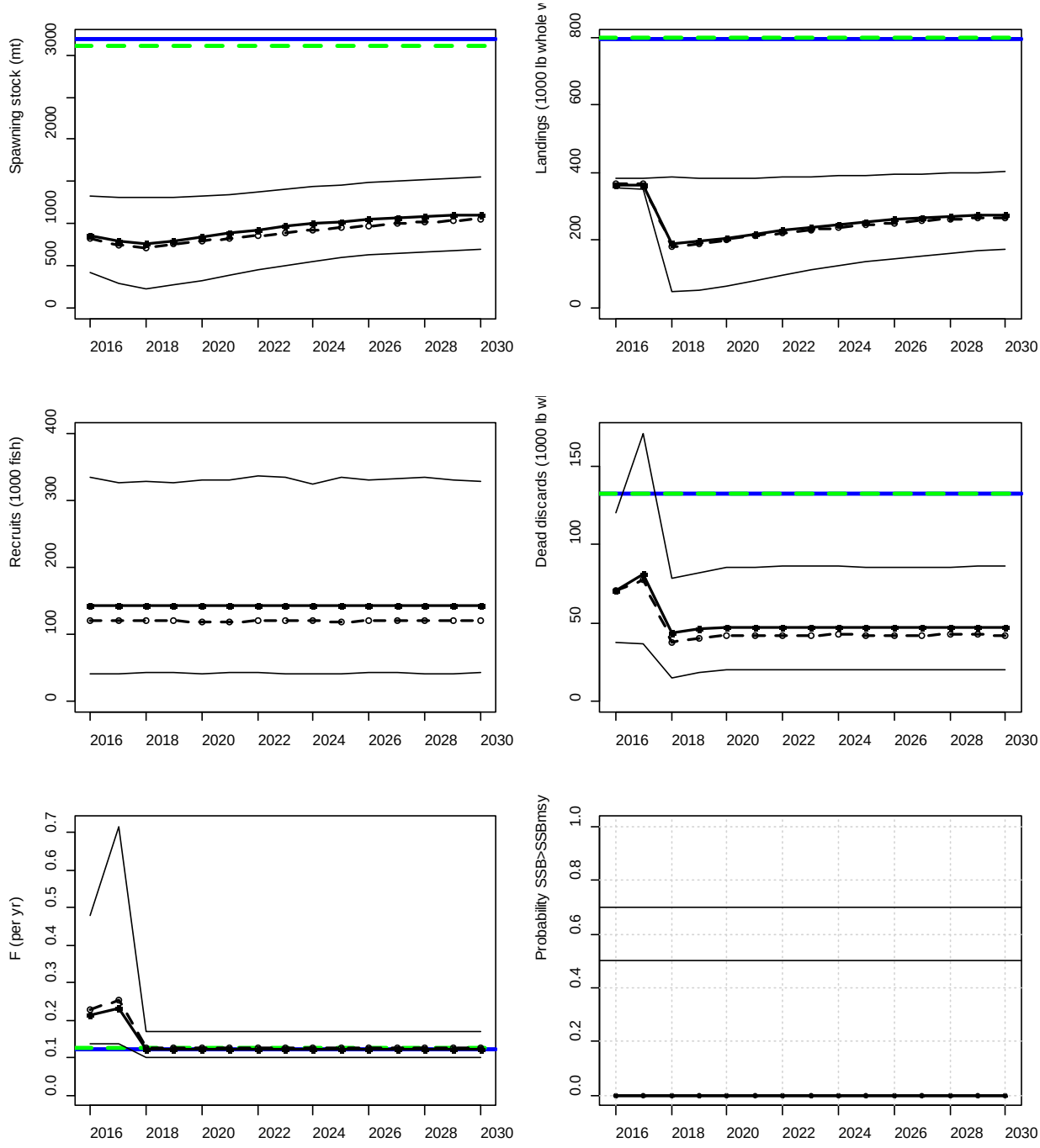


Figure 2. Scenario 2 projections results with F= $F_{REBUILD}$ starting in 2018 and low recruitment. Expected values (base run) represented by dotted solid lines, medians by dashed lines with open circles, and uncertainty by thin lines corresponding to 5th and 95th percentiles of replicate projections. Solid horizontal lines mark MSY-related quantities; dashed horizontal lines represent corresponding medians.

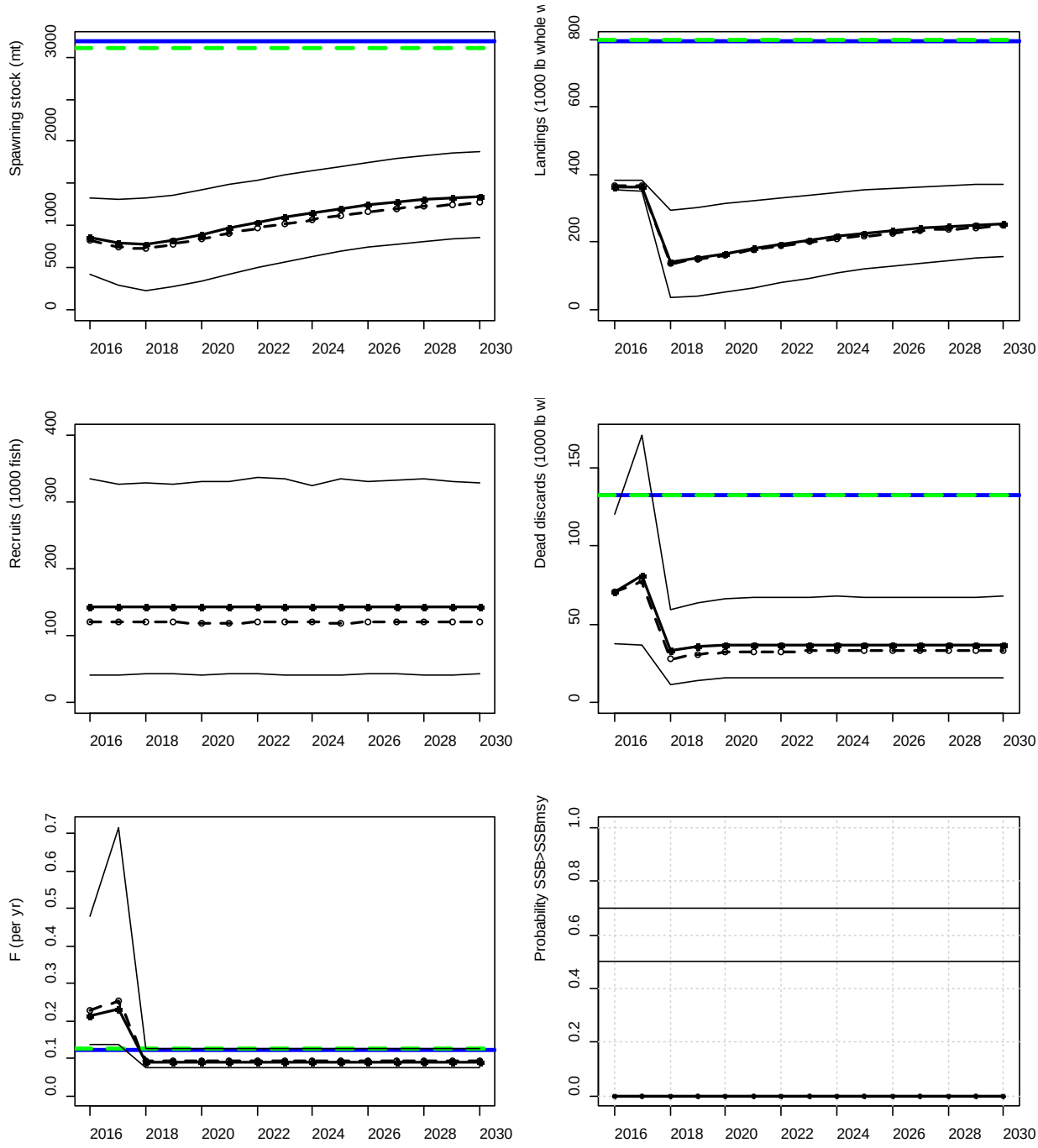


Figure 3. Scenario 3 projections results with F= F_{MSY} starting in 2018 and long-term expected recruitment. Expected values (base run) represented by dotted solid lines, medians by dashed lines with open circles, and uncertainty by thin lines corresponding to 5th and 95th percentiles of replicate projections. Solid horizontal lines mark MSY-related quantities; dashed horizontal lines represent corresponding medians.

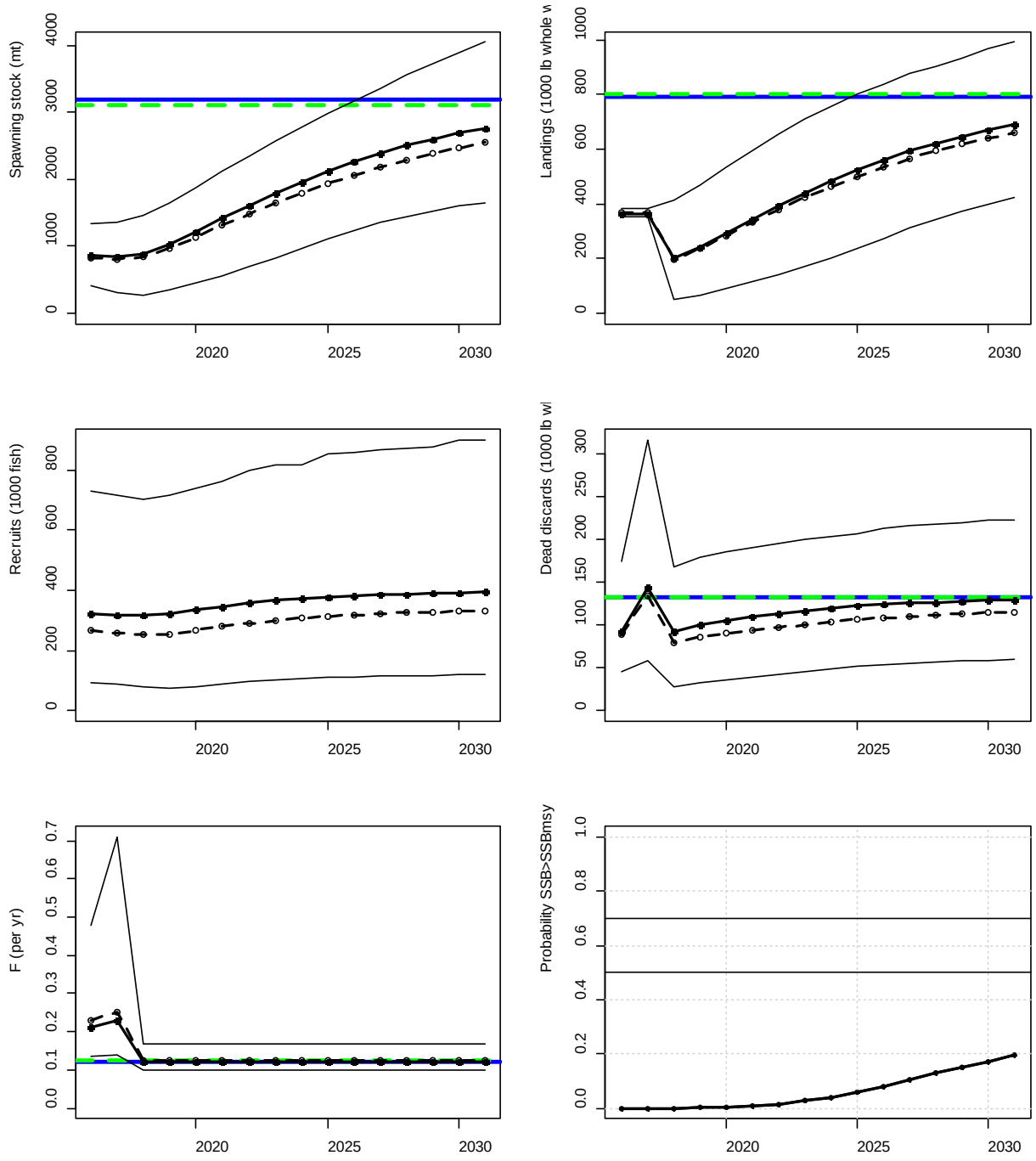
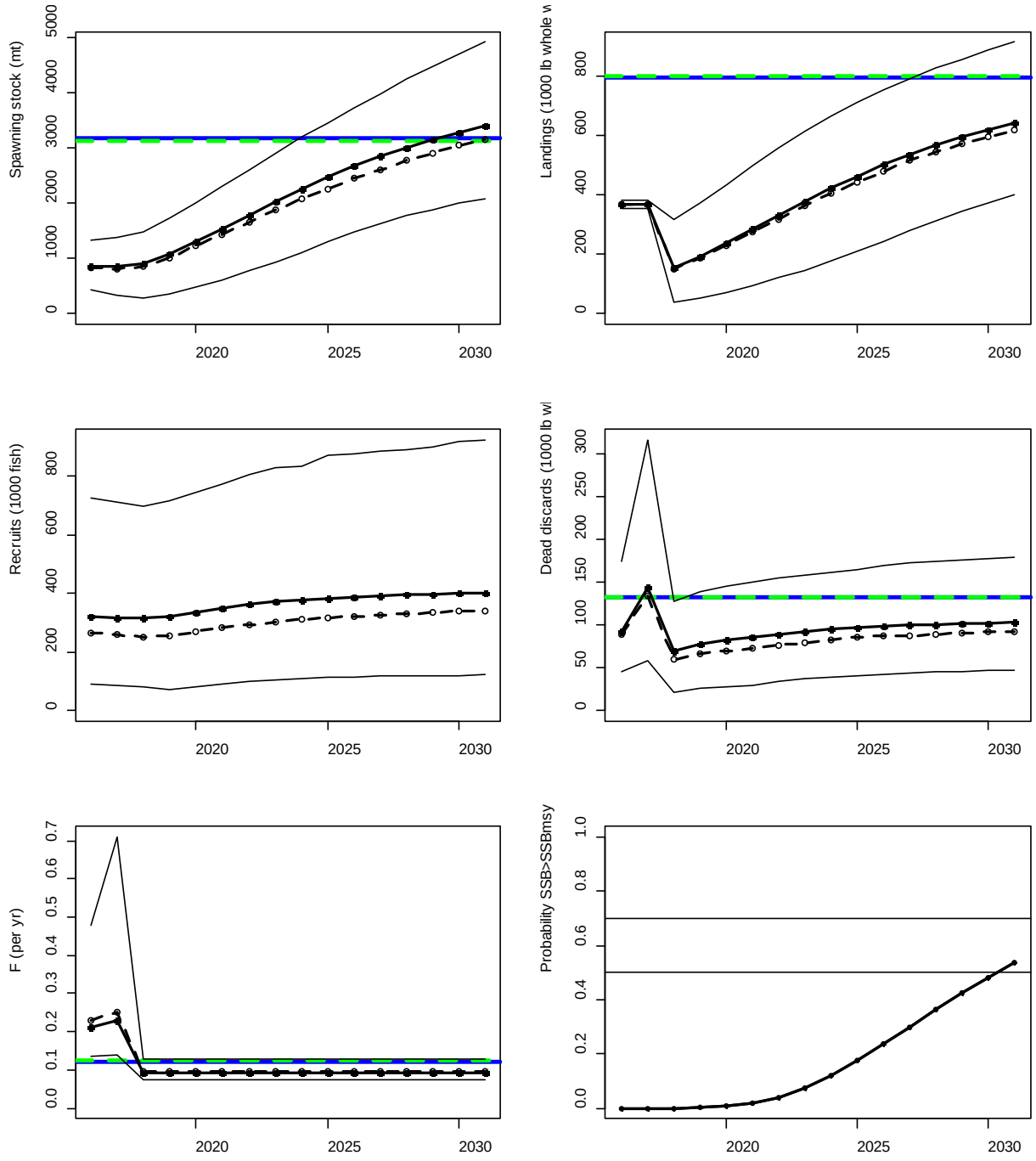


Figure 4. Scenario 4 projections results with F= $F_{REBUILD}$ starting in 2018 and long-term expected recruitment. Expected values (base run) represented by dotted solid lines, medians by dashed lines with open circles, and uncertainty by thin lines corresponding to 5th and 95th percentiles of replicate projections. Solid horizontal lines mark MSY-related quantities; dashed horizontal lines represent corresponding medians.



Appendix 1. Memorandum requesting revised red grouper projections.

SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL
4055 Faber Place Drive, Suite 201, North Charleston SC 29405
Call: (843) 571-4366 | Toll-Free: (866) SAFMC-10 | Fax: (843) 769-4520 | Connect: www.safmc.net

Dr. Michelle Duval, Chair | Charlie Phillips, Vice Chair
Gregg T. Waugh, Executive Director

June 23, 2017

MEMORANDUM

TO: Bonnie Ponwith
FROM: Gregg Waugh *GTW*
SUBJECT: Request for Revised Red Grouper Projections

The South Atlantic Council reviewed stock status and SSC recommendations for Red Grouper at its June 2017 meeting. Projections in the assessment consider management changes taking place in either 2017 or 2019. The Council is considering actions that could implement revised fishing levels in 2018. Therefore, the Council requests updated projections based on management actions taking place in 2018, addressing the following projection conditions:

1. Yield and stock conditions to 2030 based on fishing mortality rates of F_{MSY} (OFL) and 75% F_{MSY} ($F_{REBUILD}$), with recruitment based on the "low" recruitment scenarios presented in the assessment.
2. Yield and stock conditions projected to the year when the stock is rebuilt ($SSB>SSB_{MSY}$) based on fishing mortality rates of F_{MSY} (OFL) and 75% F_{MSY} ($F_{REBUILD}$), with recruitment based on the predicted values from the Stock-Recruitment relationship.
3. These fishing mortality rates will take effect in 2018.
4. For landings in 2016 and 2017, apply the same assumed values used in the original projections.
5. For each recruitment scenario, provide the full suite of projection outputs as provided in the SEDAR 53 stock assessment.

Please provide the requested projections to Council staff by noon on August 21, 2017 for inclusion in the Briefing Book for the September 2017 SAFMC meeting.

We appreciate your assistance in addressing this request. Please contact John Carmichael if you have any questions regarding these items.

cc: Council Members and Staff
Jack McGovern and Rick DeVictor
Monica Smit-Brunello
Theo Brainerd, Trika Gerard, and Erik Williams