Atlantic States Marine Fisheries Commission

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MEMORANDUM

January 27, 2020

To: **South Atlantic State/Federal Fisheries Management Board**

From: **Cobia Technical Committee**

RE: **Recommendations for Atlantic Cobia Harvest Quota**

In January, 2020, a benchmark stock assessment for Atlantic cobia was completed through the Southeast Data, Assessment, and Review (SEDAR) 58 process. Projections of spawning stock biomass, fishing mortality, and removals through 2024 were provided in the assessment report.

Upon review of these projections, the Cobia Technical Committee (TC) requested additional projections from the SEDAR 58 Analytical Team that update the 2018 estimate of removals with harvest data finalized after the assessment's terminal year and re-estimate the 2019 removals as an average of the harvests from 2016-2018. Dead discards were estimated as 13.3% of total harvest, based on a weighted average of annual discard ratios from 2015-2017 (the assessment's 3 terminal years). This discard ratio is recommended for use throughout all projections discussed and was added to the harvest estimates used in the projection to estimate the total removals. Using the updated values for 2018-19 removals, the additional projections include fishing mortalities (F) set at $F_{current}$ (0.15), $F_{40\%}$ (0.65), 75% $F_{40\%}$ (0.49), 50% $F_{40\%}$ (0.33), and 25% $F_{40\%}$ (0.16), as well as constant annual harvests for the projected timeframe set at 2, 2.4, 2.8, and 3.7 million pounds (with total removals calculated as the harvest plus estimated dead discards). Results of each requested run are shown in the Projection Report attached to this memo.

The TC's discussion of additional runs focused on the stochastic projection trends in spawning stock biomass (S.med) and probability of the stock becoming overfished (pr.overfished). Due to the declining trends in spawning stock biomass through the assessment's terminal year, projected continued declines through 2019, and uncertainties outlined within the assessment report, the TC recommends a precautionary approach in selecting a total harvest quota. The TC recommends that the Board give preferred consideration to harvests projected through the $F_{current}$, 25% $F_{40\%}$, and 2 million pound constant harvest runs. In each of these runs, S.med increases throughout the projected timeframe (2020-24). The TC estimated constant harvest under the F-based projections to be the average removals during the projected timeframe minus estimated discards.

The projection with the highest harvest that maintained harvest relatively close to its 2019 level was the constant harvest at 2.4 million pounds, the average of the 2016-2018 harvests. The TC

recommends this harvest level as a maximum for the Board's consideration, noting a slight decrease in S.med and increasing pr.overfished up to 0.25 throughout the projected timeframe.

Finally, the TC recommends that the Board specify the total harvest quota in numbers of fish, then use the average of annual coastwide commercial average weights from 2015-17 (22.8 pounds) to convert the commercial quota from numbers to pounds. Final harvest quotas and allocations to the recreational and commercial fisheries according to Amendment 1 using the recommended projections are shown in the table below.

Projection	**Total Harvest Quota (fish)**	**Recreational Quota (fish)**	**Commercial Quota (pounds)**
$F_{current}$	53,467*	49,190	97,595
25% $F_{40\%}$	57,526*	52,924	105,003
Harvest = 2 mil lb	65,819*	60,554	120,142
Harvest = 2.4 mil lb	80,112	73,703	146,232

*Preferred by TC

To: Mike Schmidtke, ASMFC
From: Katie Siegfried, lead analyst for Cobia, SEFSC
Re: Cobia Projection request

Dear Mike,

In response to your request for additional Cobia projections, we are providing you with the following document. Please let us know if you or the Technical Committee have any questions or require additional assistance.

We have responded to your requests in italics below each bullet:

- Annual ratios of dead discards to landings for the base run. We're trying to estimate how much of the landings in the projection tables are dead discards. In doing this, please also average the ratios for 2015-2017 (current discard ratio).

The attached file, "Calculating discard ratios.xlsx", contains the dead discard rations for each year, and the averaged (over 2015-2017) "current" discard ratio. In the spreadsheet, the weighted discard ratio is highlighted in green. The commercial discards are reported in lb. and the recreational discards are reported in numbers. We used the units each is reported in to calculate the discard ratios. I did calculate the commercial discard ratio in numbers as well, but it is likely less accurate. It's worth noting that discards, especially commercial discards for cobia, are highly uncertain.

- For all requested projections, recalculate landings (landings + dead discards) estimates for 2018 and 2019. For 2018, please use 3,231,501 pounds + current discard ratio * 3,231,501 pounds. For 2019, please use 2,410,848 pounds + current discard ratio * 2,410,848 pounds. The 3.2 million number is the 2018 landings and the 2019 number is the average landings from 2016-2018.

The interim landings adjusted for the discarding ratios are highlighted in blue in the attached spreadsheet.

- Re-run the provided projections (Fcurrent, F40, and 75% F40) with the 2018 and 2019 values in #2.

These runs are called Fcurrent, F40, and 75%F40, and the results are appended below in figures and tables 1, 2 and 3 respectively.

- Additional F-based projections, all with the above 2018 and 2019 landings values: F=50% F40; F=25% F40

These runs are called 50%F40 and 25%F40, and the results are appended below in figures and tables 4 and 5 respectively.

- Constant harvest projections (for all projections, add discards estimated as the annual harvest * current discard ratio): Annual harvest = 2 million pounds; Annual harvest = 2,410,848 pounds; Annual harvest = 2,821,695 pounds; Annual harvest = 3,711,695 pounds

The constant harvest values used in these projections (the annual harvest + discard estimate) are highlighted in orange in the attached spreadsheet. These runs are called "Lconstant-" followed by the number of pounds used in the harvest projection, and the results are contained in figures and tables 6,7,8 and 9 respectively.

- For all projections, please provide similar information as that provided in Tables 18-20 of the Post-Review Report (annual F, SSB, landings, etc.) and Table 2 of the Review Report (proportion of stochastic runs where $SSB<SSB_{F40}$).

All figures and tables are appended below, and the pr.overfished values are the proportion of runs below the $L_{F40\%}$ benchmark.

We would like to add that the error on the constant catch scenarios grows quite large in the last couple years of the projections. With the constant catch scenarios, that model sometimes runs out of fish causing increased uncertainty in the projections. The constant catch scenario results are only robust for a few years following the terminal year of the assessment.

Table 1. Projection results with fishing mortality rate fixed at F = Fcurrent starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb). The extension b indicates expected values (deterministic) from the base run; the extension med indicates median values from the stochastic projections. The pr.overfished indicates the number of runs below the $L_{40\%}$ benchmark.

year	R.base (1000)	R.med (1000)	F.base	F.med	S.base (mt)	S.med (mt)	L.base (1000)	L.med (1000)	L.base (1000 lb)	L.med (1000 lb)	pr.overfished
2018	1796	1399	0.22	0.28	6520	5235	107	109	3664	3664	0.08
2019	1796	1377	0.19	0.24	5874	4969	82	86	2742	2742	0.14
2020	1796	1389	0.1	0.15	5961	5032	45	57	1437	1777	0.14
2021	1796	1382	0.1	0.15	6218	5164	49	59	1525	1832	0.12
2022	1796	1385	0.1	0.15	6418	5293	51	61	1592	1887	0.1
2023	1796	1380	0.1	0.15	6565	5370	52	63	1640	1931	0.09
2024	1796	1383	0.1	0.15	6670	5427	53	63	1674	1960	0.08

Table 2. Projection results with fishing mortality rate fixed at F = F40% starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb). The extension b indicates expected values (deterministic) from the base run; the extension med indicates median values from the stochastic projections. The pr.overfished indicates the number of runs below the $L_{40\%}$ benchmark.

year	R.base (1000)	R.med (1000)	F.base	F.med	S.base (mt)	S.med (mt)	L.base (1000)	L.med (1000)	L.base (1000 lb)	L.med (1000 lb)	pr.overfished
2018	1796	1399	0.22	0.28	6520	5235	107	109	3664	3664	0.21

2019	1796	1377	0.19	0.24	5874	4969	82	86	2742	2742	0.26
2020	1796	1389	0.69	0.65	4949	4293	249	208	7821	6362	0.32
2021	1796	1382	0.69	0.65	4072	3590	204	169	5862	4915	0.41
2022	1796	1385	0.69	0.65	3737	3328	187	156	5109	4290	0.46
2023	1796	1380	0.69	0.65	3611	3228	181	150	4825	4070	0.49
2024	1796	1383	0.69	0.65	3564	3199	179	149	4718	3978	0.5

Table 3. Projection results with fishing mortality rate fixed at F = 75%F40% starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000lb). The extension b indicates expected values (deterministic) from the base run; the extension med indicates median values from the stochastic projections. The pr.overfished indicates the number of runs below the $L_{40\%}$ benchmark.

year	R.base (1000)	R.med (1000)	F.base	F.med	S.base (mt)	S.med (mt)	L.base (1000)	L.med (1000)	L.base (1000 lb)	L.med (1000 lb)	pr.overfished
2018	1796	1399	0.22	0.28	6520	5235	107	109	3664	3664	0.21
2019	1796	1377	0.19	0.24	5874	4969	82	86	2742	2742	0.26
2020	1796	1389	0.52	0.49	5221	4518	198	165	6248	5064	0.29
2021	1796	1382	0.52	0.49	4554	4007	174	145	5142	4294	0.33
2022	1796	1385	0.52	0.49	4255	3784	164	136	4644	3893	0.36
2023	1796	1380	0.52	0.49	4123	3687	160	133	4421	3724	0.37
2024	1796	1383	0.52	0.49	4064	3652	158	131	4322	3655	0.37

Table 4. Projection results with fishing mortality rate fixed at F = 50%F40% starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000lb). The extension b indicates expected values (deterministic) from the base run; the extension med indicates median values from the stochastic projections. The pr.overfished indicates the number of runs below the $L_{40\%}$ benchmark.

year	R.base (1000)	R.med (1000)	F.base	F.med	S.base (mt)	S.med (mt)	L.base (1000)	L.med (1000)	L.base (1000 lb)	L.med (1000 lb)	pr.overfished
2018	1796	1399	0.22	0.28	6520	5235	107	109	3664	3664	0.21
2019	1796	1377	0.19	0.24	5874	4969	82	86	2742	2742	0.26
2020	1796	1389	0.35	0.33	5512	4759	140	117	4447	3592	0.27
2021	1796	1382	0.35	0.33	5144	4513	134	111	4046	3352	0.26
2022	1796	1385	0.35	0.33	4955	4401	130	108	3840	3208	0.25
2023	1796	1380	0.35	0.33	4859	4341	129	107	3732	3137	0.24
2024	1796	1383	0.35	0.33	4809	4320	128	107	3676	3112	0.23

Table 5. Projection results with fishing mortality rate fixed at F = 25%F40% starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000lb). The extension b indicates expected values (deterministic) from the base run; the extension med indicates median values from the stochastic projections. The pr.overfished indicates the number of runs below the $L_{40\%}$ benchmark.

year	R.base (1000)	R.med (1000)	F.base	F.med	S.base (mt)	S.med (mt)	L.base (1000)	L.med (1000)	L.base (1000 lb)	L.med (1000 lb)	pr.overfished
2018	1796	1399	0.22	0.28	6520	5235	107	109	3664	3664	0.21
2019	1796	1377	0.19	0.24	5874	4969	82	86	2742	2742	0.26
2020	1796	1389	0.17	0.16	5825	5015	74	62	2379	1913	0.24
2021	1796	1382	0.17	0.16	5870	5131	78	64	2410	1980	0.2
2022	1796	1385	0.17	0.16	5918	5239	80	66	2440	2025	0.16
2023	1796	1380	0.17	0.16	5956	5307	81	67	2461	2058	0.13
2024	1796	1383	0.17	0.16	5984	5368	81	67	2476	2086	0.1

Table 6. Projection results with fixed total removals = 2,266,817 from 2020 through 2024, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb). The extension b indicates expected values (deterministic) from the base run; the extension med indicates median values from the stochastic projections. The pr.overfished indicates the number of runs below the $L_{40\%}$ benchmark.

year	R.base (1000)	R.med (1000)	F.base	F.med	S.base (mt)	S.med (mt)	L.base (1000)	L.med (1000)	L.base (1000 lb)	L.med (1000 lb)	pr.overfished
2018	1796	1399	0.22	0.28	6520	5235	107	109	3664	3664	0.08
2019	1796	1377	0.19	0.24	5874	4969	82	86	2742	2742	0.14
2020	1796	1389	0.16	0.19	5842	4972	71	74	2267	2267	0.16
2021	1796	1382	0.16	0.19	5917	5014	73	74	2267	2267	0.17
2022	1796	1385	0.16	0.19	5997	5082	74	75	2267	2267	0.18
2023	1796	1380	0.16	0.19	6066	5126	74	75	2267	2267	0.18
2024	1796	1383	0.15	0.18	6123	5195	74	75	2267	2267	0.18

Table 7. Projection results with fixed total removals = 2,732,475 from 2020 through 2024, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb). The extension b indicates expected values (deterministic) from the base run; the extension med indicates median values from the stochastic projections. The pr.overfished indicates the number of runs below the $L_{40\%}$ benchmark.

year	R.base (1000)	R.med (1000)	F.base	F.med	S.base (mt)	S.med (mt)	L.base (1000)	L.med (1000)	L.base (1000 lb)	L.med (1000 lb)	pr.overfished
2018	1796	1399	0.22	0.28	6520	5235	107	109	3664	3664	0.08
2019	1796	1377	0.19	0.24	5874	4969	82	86	2742	2742	0.14
2020	1796	1389	0.2	0.24	5773	4903	86	89	2732	2732	0.18
2021	1796	1382	0.2	0.24	5741	4835	89	90	2732	2732	0.21
2022	1796	1385	0.2	0.24	5736	4815	90	91	2732	2732	0.23
2023	1796	1380	0.2	0.24	5740	4792	90	92	2732	2732	0.24
2024	1796	1383	0.2	0.25	5747	4807	90	92	2732	2732	0.25

Table 8. Projection results with fixed total removals = 3,198,133 from 2020 through 2024, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb). The extension b indicates expected values (deterministic) from the base run; the extension med indicates median values from the stochastic projections. The pr.overfished indicates the number of runs below the $L_{40\%}$ benchmark.

year	R.base (1000)	R.med (1000)	F.base	F.med	S.base(mt)	S.med(mt)	L.base (1000)	L.med (1000)	L.base (1000 lb)	L.med (1000 lb)	pr.overfished
2018	1796	1399	0.22	0.28	6520	5235	107	109	3664	3664	0.08
2019	1796	1377	0.19	0.24	5874	4969	82	86	2742	2742	0.14
2020	1796	1389	0.24	0.28	5704	4833	100	104	3198	3198	0.19
2021	1796	1382	0.25	0.3	5563	4655	104	106	3198	3198	0.24
2022	1796	1385	0.25	0.31	5474	4551	106	108	3198	3198	0.28
2023	1796	1380	0.26	0.32	5414	4457	107	109	3198	3198	0.3
2024	1796	1383	0.26	0.32	5371	4421	108	110	3198	3198	0.32

Table 9. Projection results with fixed total removals = 4,206,866 from 2020 through 2024, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb). The extension b indicates expected values (deterministic) from the base run; the extension med indicates median values from the stochastic projections. The pr.overfished indicates the number of runs below the $L_{40\%}$ benchmark.

year	R.base (1000)	R.med (1000)	F.base	F.med	S.base(mt)	S.med(mt)	L.base (1000)	L.med (1000)	L.base (1000 lb)	L.med (1000 lb)	pr.overfished
2018	1796	1399	0.22	0.28	6520	5235	107	109	3664	3664	0.08
2019	1796	1377	0.19	0.24	5874	4969	82	86	2742	2742	0.14
2020	1796	1389	0.33	0.39	5550	4676	132	137	4207	4207	0.23
2021	1796	1382	0.36	0.44	5175	4261	139	142	4207	4207	0.32
2022	1796	1385	0.38	0.49	4904	3968	143	146	4207	4207	0.39
2023	1796	1380	0.41	0.54	4704	3726	146	150	4207	4207	0.43
2024	1796	1383	0.43	0.58	4553	3586	148	152	4207	4207	0.46

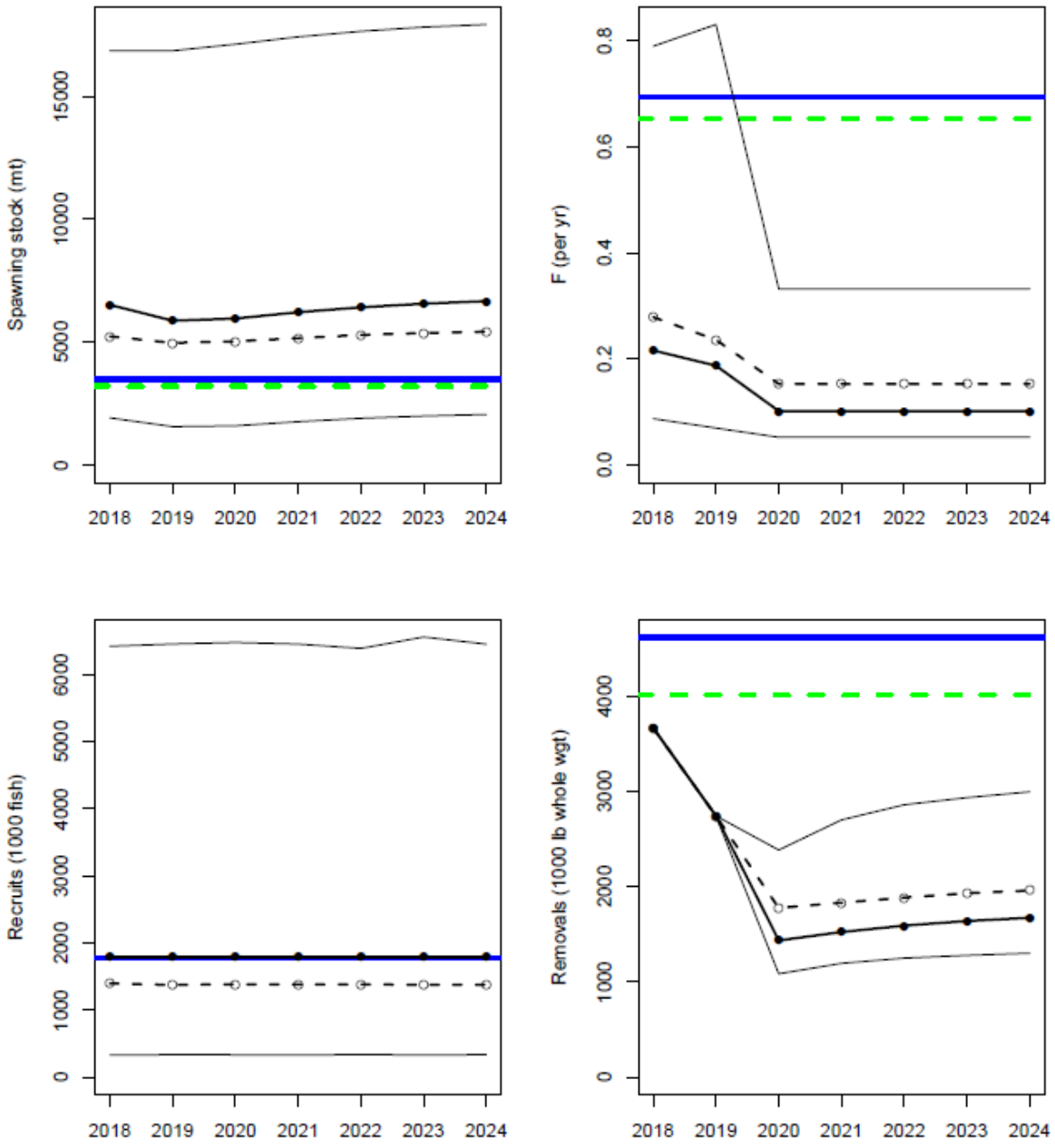

Figure 1. Fishing mortality rate fixed at F = Fcurrent, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5th and 95th percentiles of replicate projections. Horizontal lines mark LF40%-related quantities from the base run (solid blue lines) and medians from the ensemble model runs(dashed green lines). Spawning stock (SSB) is at time of peak spawning.

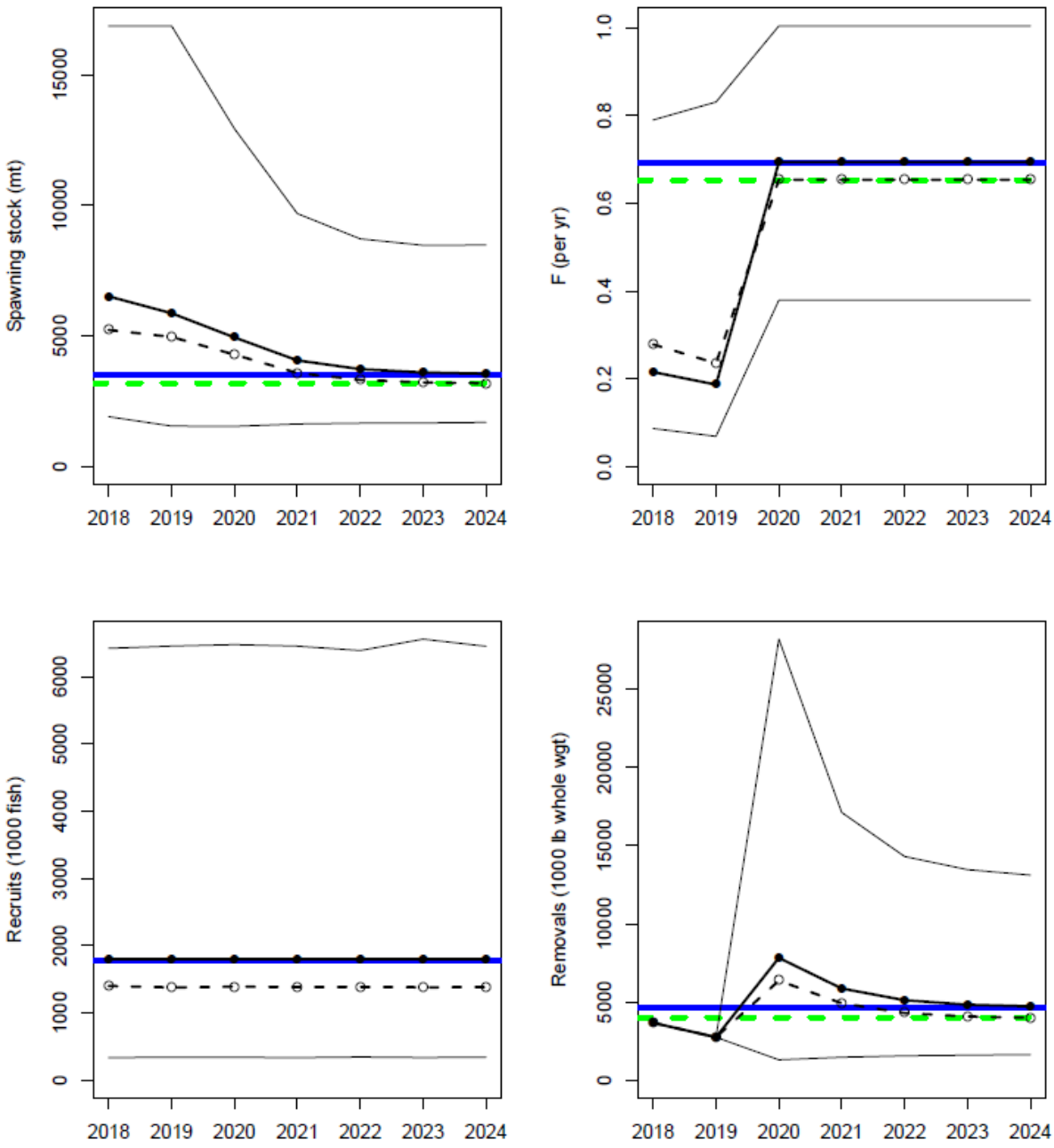

Figure 2. Fishing mortality rate fixed at F = F40%, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5th and 95th percentiles of replicate projections. Horizontal lines mark LF40%-related quantities from the base run (solid blue lines) and medians from the ensemble model runs (dashed green lines). Spawning stock (SSB) is at time of peak spawning.

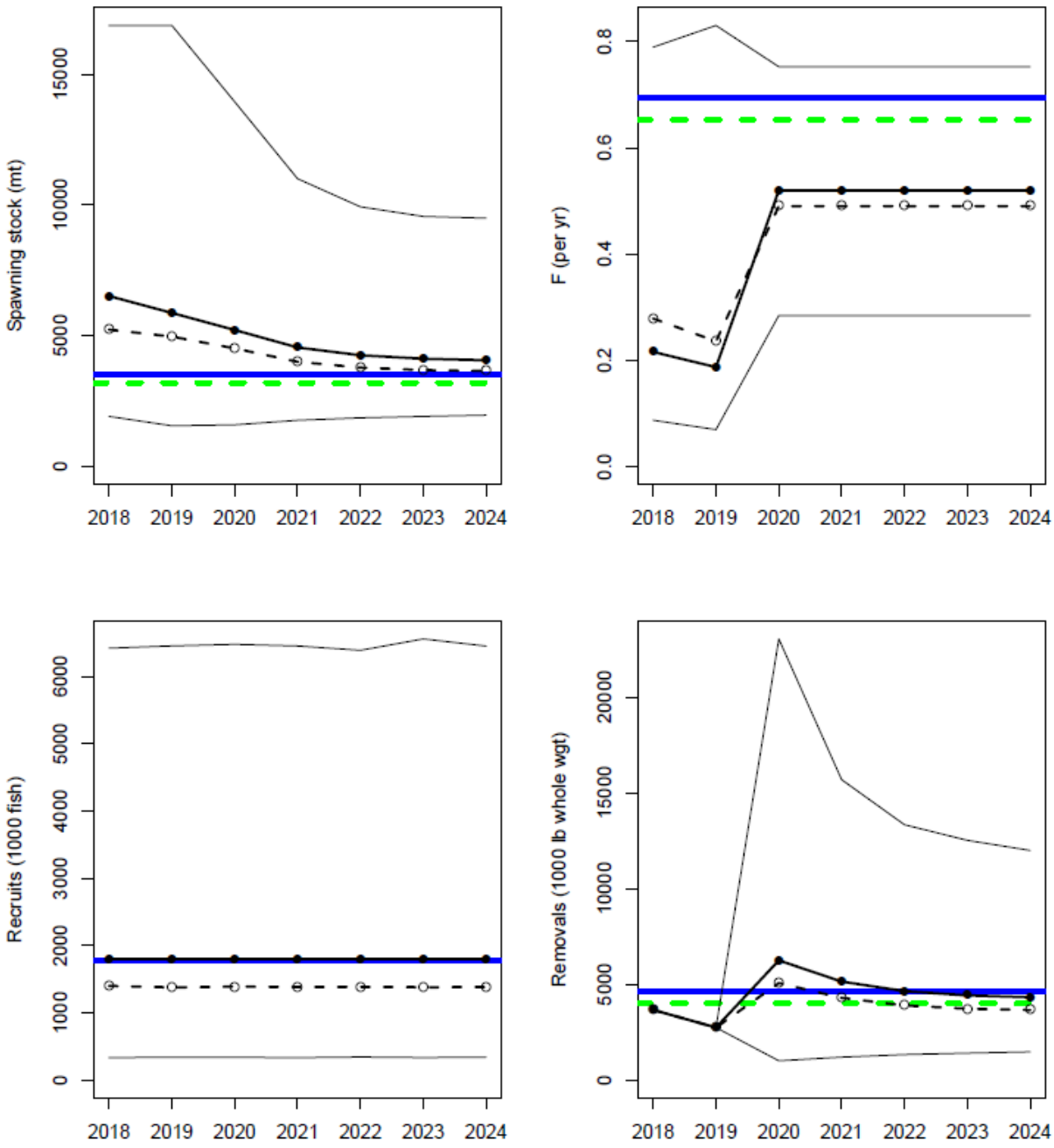

Figure 3. Fishing mortality rate fixed at F = 75%F40%, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5th and 95th percentiles of replicate projections. Horizontal lines mark LF40%-related quantities from the base run (solid blue lines) and medians from the ensemble model runs (dashed green lines). Spawning stock (SSB) is at time of peak spawning.

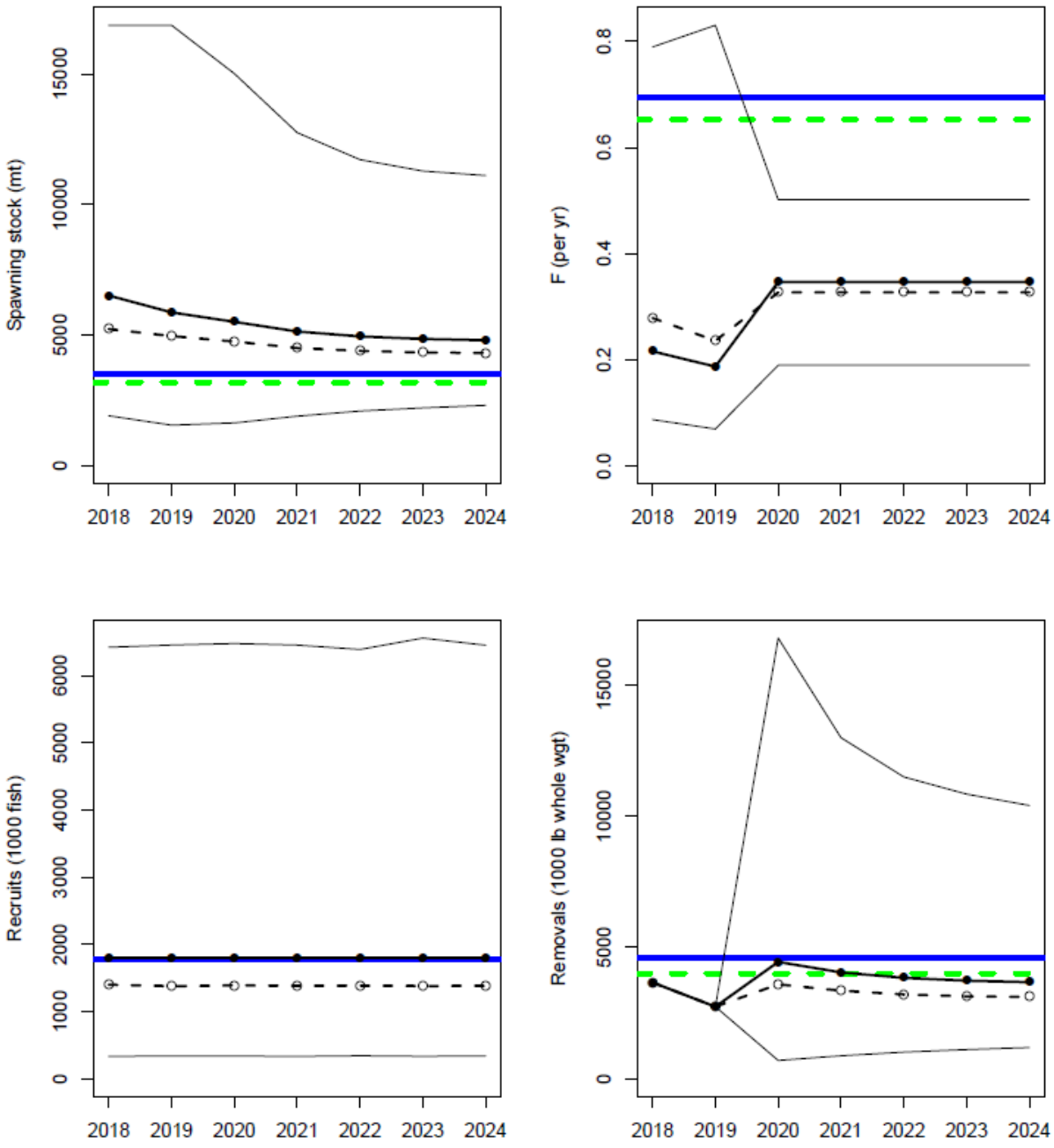

Figure 4. Fishing mortality rate fixed at F = 50%F40%, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5th and 95th percentiles of replicate projections. Horizontal lines mark LF40%-related quantities from the base run (solid blue lines) and medians from the ensemble model runs (dashed green lines). Spawning stock (SSB) is at time of peak spawning.

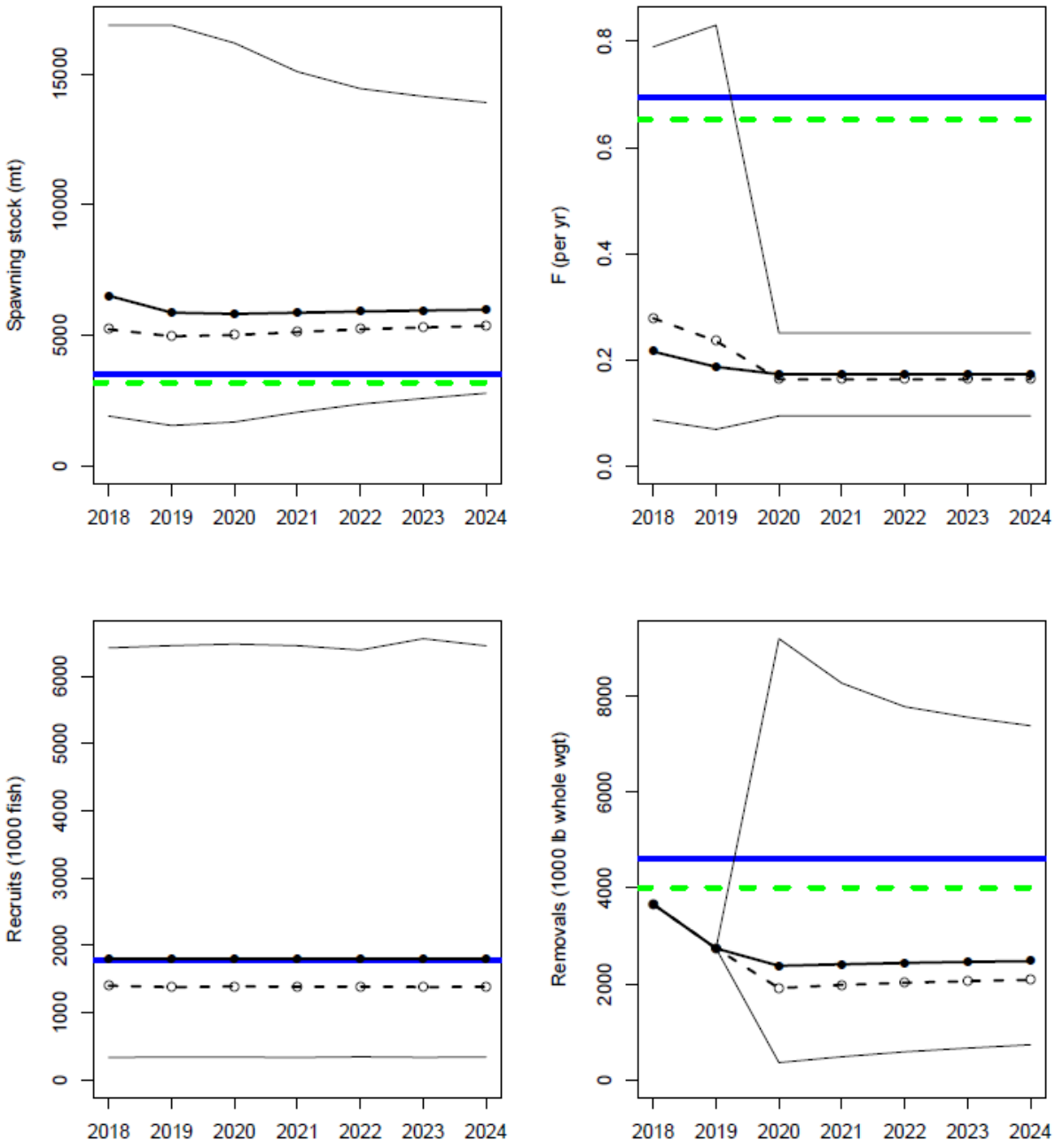

Figure 5. Fishing mortality rate fixed at F = 25%F40%, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5th and 95th percentiles of replicate projections. Horizontal lines mark LF40%-related quantities from the base run (solid blue lines) and medians from the ensemble model runs (dashed green lines). Spawning stock (SSB) is at time of peak spawning.

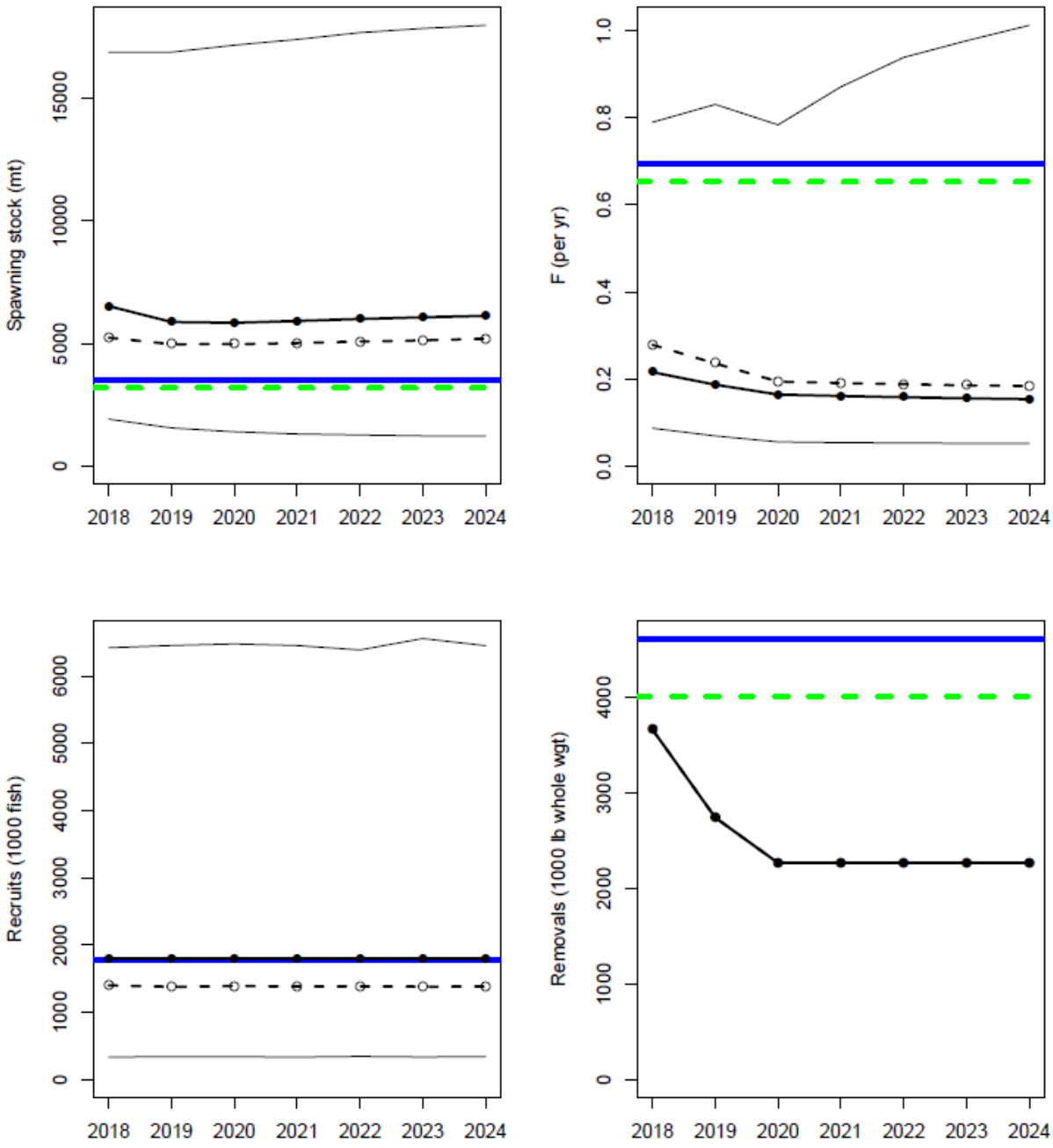

Figure 6. Harvest fixed at total removals = 2,266,817 from 2020 through 2024, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5th and 95th percentiles of replicate projections. Horizontal lines mark LF40%-related quantities from the base run (solid blue lines) and medians from the ensemble model runs (dashed green lines). Spawning stock (SSB) is at time of peak spawning.

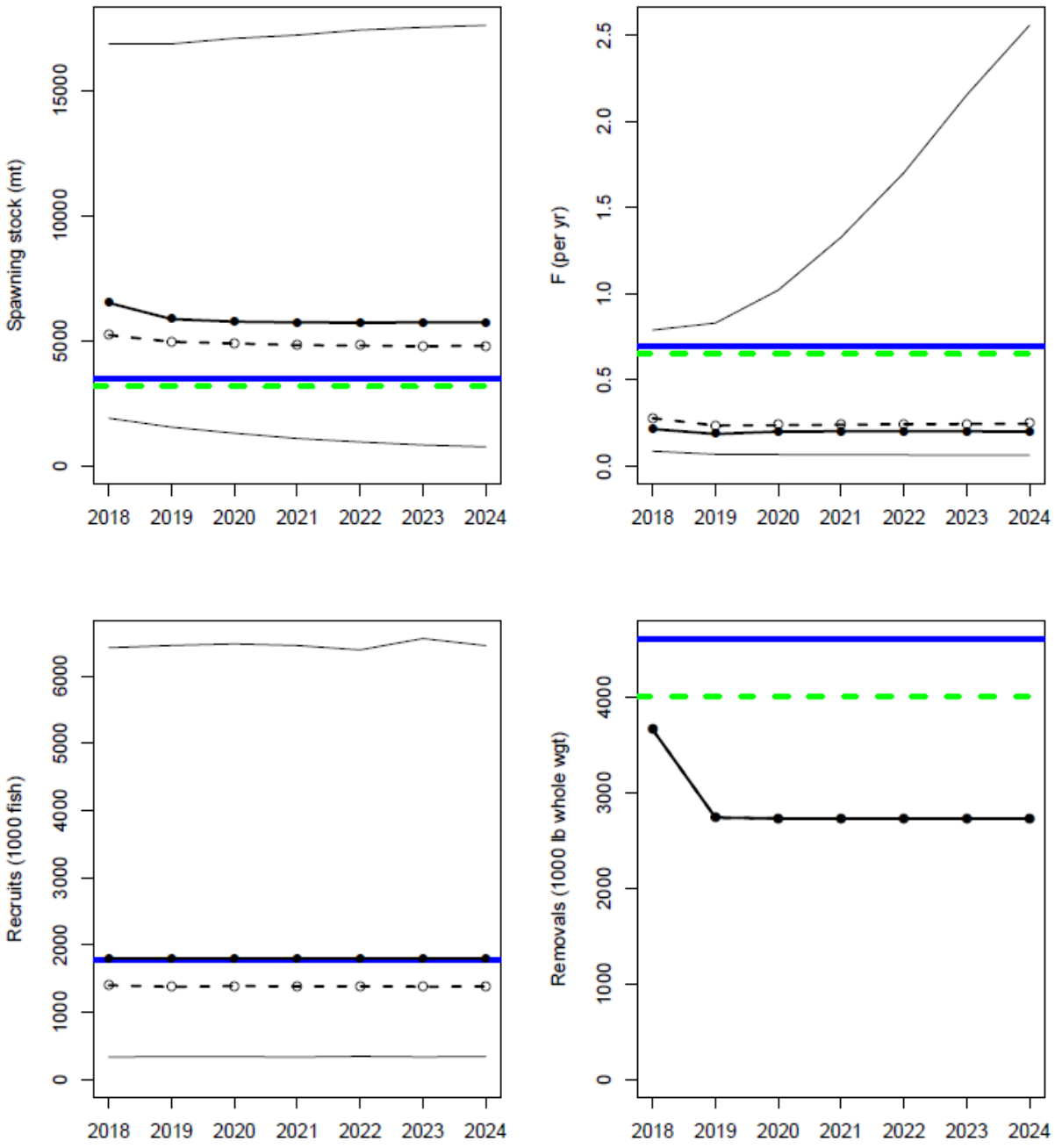

Figure 7. Harvest fixed at total removals = 2,732,475 from 2020 through 2024, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5th and 95th percentiles of replicate projections. Horizontal lines mark LF40%-related quantities from the base run (solid blue lines) and medians from the ensemble model runs (dashed green lines). Spawning stock (SSB) is at time of peak spawning.

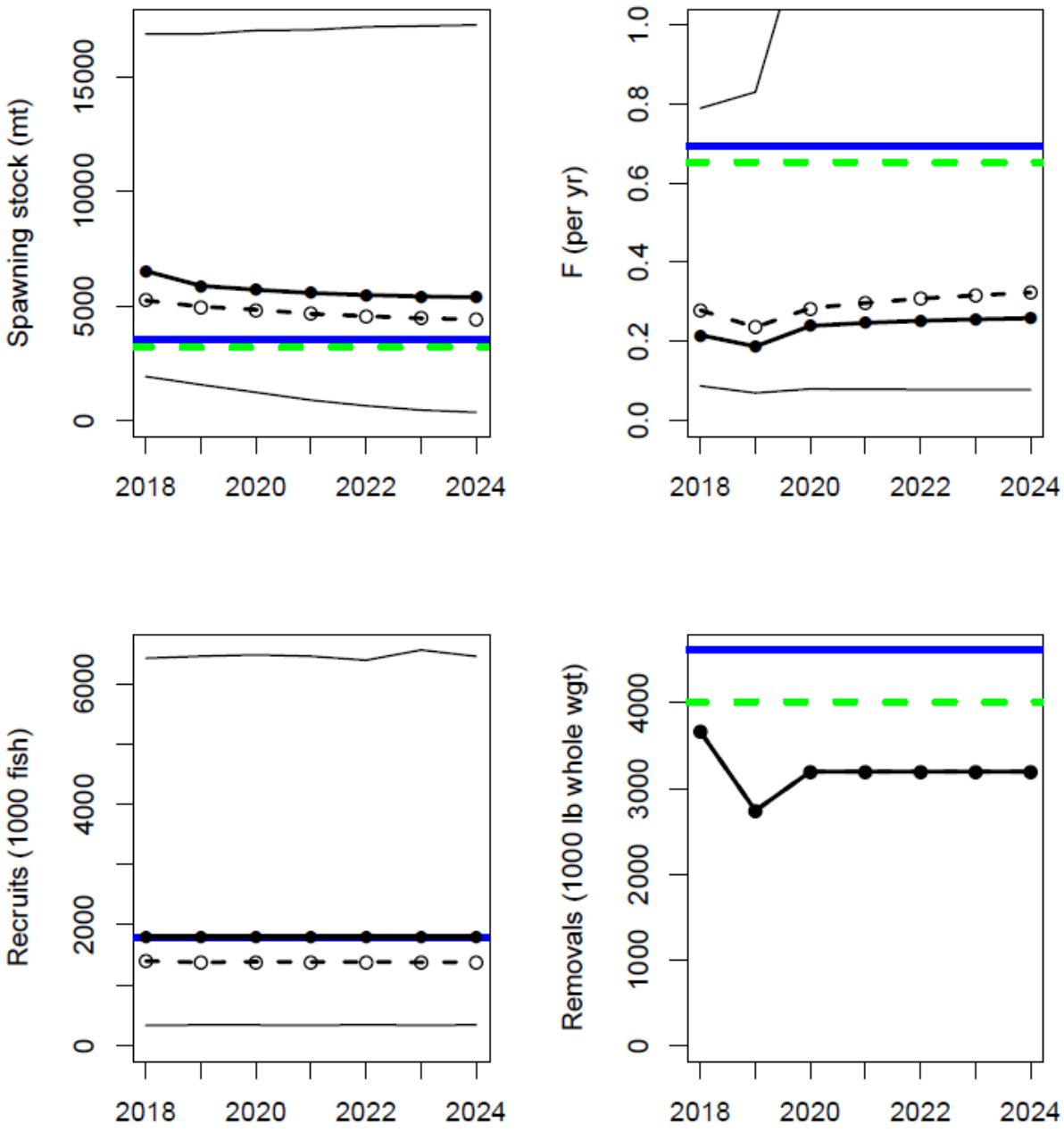

Figure 8. Harvest fixed at total removals = 3,198,133 from 2020 through 2024, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5th and 95th percentiles of replicate projections. Horizontal lines mark LF40%-related quantities from the base run (solid blue lines) and medians from the ensemble model runs (dashed green lines). Spawning stock (SSB) is at time of peak spawning.

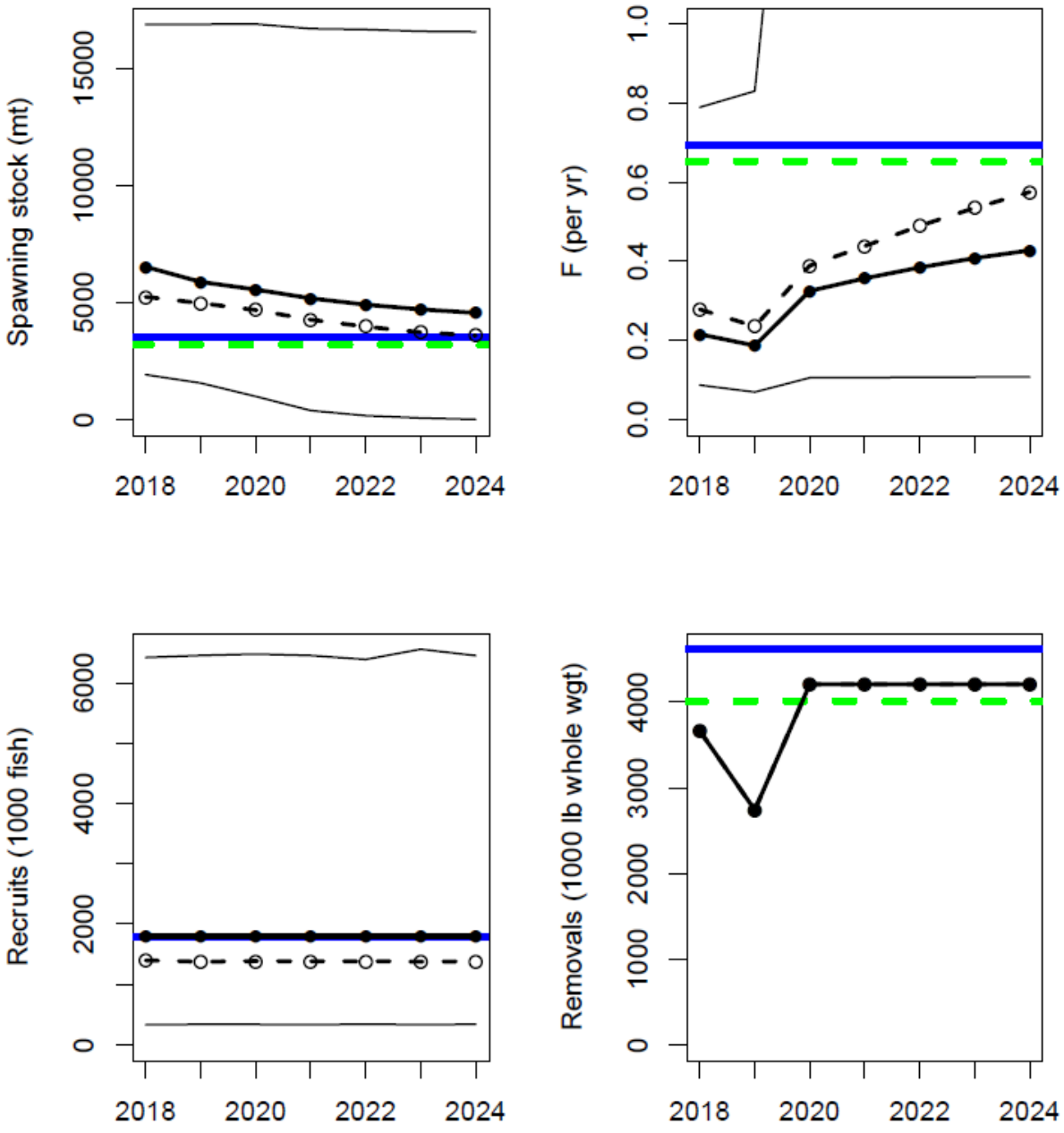

Figure 9. Harvest fixed at total removals = 4,206,866 from 2020 through 2024, with 2020 as the first year of new regulations. The interim years (2018 and 2019) use the values requested by the ASMFC with the added discard estimate. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5th and 95th percentiles of replicate projections. Horizontal lines mark LF40%-related quantities from the base run (solid blue lines) and medians from the ensemble model runs (dashed green lines). Spawning stock (SSB) is at time of peak spawning.