Mid-Atlantic Fishery Management Council
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Michael P. Luisi, Chairman | P. Weston Townsend, Vice Chairman
Christopher M. Moore, Ph.D., Executive Director

MEMORANDUM

Date: December 8, 2022

To: Chris Moore, Executive Director

From: Kiley Dancy, Hannah Hart, and Julia Beaty, Staff

Subject: Updated Recreational Demand Model Results

As described in the summary of the November 15, 2022 Summer Flounder, Scup, and Black Sea Bass Monitoring Committee (MC) meeting, the MC considered the results of two recreational fishery models: the Recreational Demand Model (RDM) with outputs as of November 10, 2022, and the Recreational Fishery Dynamics Model (RFDM) with outputs as of November 15, 2022. The MC identified the RDM as their preferred model for setting 2023 summer flounder recreational measures and the RFDM as their preferred model for setting 2023 recreational black sea bass measures. The majority of the MC preferred the RFDM for setting 2023 scup recreational measures.

The RDM modelers provided updated model results to Council staff on December 6, 2022.. The MC discussed the performance of both models during their November 15 meeting and the RDM modelers subsequently made revisions to improve the performance of their model, as described in more detail in the next section and in the appendix. These updates were not requested by staff or the MC. Given time constraints, the MC and the Advisory Panel have not had the opportunity to meaningfully review or comment on this new information.

Changes to the RDM, updated results, and implications for 2023 measures are described below. As noted below, **the updated results change the outcome of the Percent Change Approach for summer flounder.**

Changes to the Model

NEFSC staff provided the following information as to how and why the model was updated:

"The RDM requires a projected catch-per-trip distribution to calculate the likely number of fish harvested and discarded under a given future regulatory scenario. Prior to the recent updates, the model assumed that projected catch-per-trip followed the same distribution of catch-per-trip found in the 2021 MRIP data (the most recent annual data available), with an adjustment based on projected stock structures. However, using a single year of recent MRIP data to project catch-per-trip leaves the model vulnerable to outlier influence as was discovered after the November 2022 summer flounder, black sea bass, and scup monitoring committee meeting. Specifically, I found that the predictive performance of the model could be improved by using MRIP catch-per-trip data from the most recent five years, rather than a single recent year, to project future catch-per-trip. This change resulted in the 2023 status-quo estimate of summer flounder harvest to increase by

roughly 30% relative to the preliminary model estimate, which is similar to the difference between average catch-per-trip in 2021 and average catch-per-trip from 2018 through 2022."

Updated Model Results

Table 1 includes a summary of the updated model results and 80% confidence intervals in comparison to the RDM results presented to the MC, as well as the RFDM results which have not changed since the November 15 MC meeting. Additional model outputs and performance results (i.e., out of sample analysis results) are included in the appendix.

Implications for Percent Change Approach and 2023 Measures

As previously stated, the RDM was not the MC's preferred model for setting 2023 scup and black sea bass measures. However, even if the RDM was selected as preferred, the updates to the RDM do not impact the resulting percent change required for scup and black sea bass using that model (i.e., a 10% reduction was required under both the previous and revised RDM results). The updated results would only impact the harvest projection from which adjustments are taken (i.e., median estimated 2023 harvest under 2022 measures, which is reduced by 10% to define the coastwide harvest target that measures should achieve).

However, the MC selected the RDM as their preferred model for setting 2023 summer flounder recreational measures, and **the updates to the RDM change the outcome for summer flounder under the Percent Change Approach. Specifically, the values the MC considered resulted in a 10% liberalization; however, the updated values are higher and result in confidence intervals that encompass the 2023 RHL, requiring a 10% reduction under the Percent Change Approach (Table 2).**

The Council and Board should consider this information when recommending 2023 measures for summer flounder, and also for scup and black sea bass in the event that Council and Board prefer to use the RDM for these species as well.

Table 1: Summary of RDM and RFDM model outputs for summer flounder, scup, and black sea bass including recent updates to the RDM outputs. The November 15 MC recommendations for each species are bolded and highlighted in gray. Values are in millions of pounds.

Species	Model used	Estimated 2023 Harvest Under Current Measures	80% Confidence Interval	2023 RHL	Stock Size Category	Resulting Percent Change Bin
Summer Flounder	**RDM: Previous (Nov 10)**	**8.38**	**7.56-9.52**	10.62	Low	**10% liberalization**
	RDM: Current (Dec 6)	10.92	9.23-12.94			10% reduction
	RFDM: Current (Nov 15)	12.77 (with NJ adjustment: 10.45 or 10.18)	7.01-22.26			10% reduction
Scup	RDM: Previous (Nov 10)	17.21	13.56-22.68	9.27	Very High	10% reduction
	RDM: Current (Dec 6)	14.31	9.90-17.40			10% reduction
	RFDM: Current (Nov 15)	**14.42**[a]	**8.95-23.08**[a]			**10% liberalization**[b]
Black Sea Bass	RDM: Previous (Nov 10)	11.05	10.00-11.96	6.74	Very High	10% reduction
	RDM: Current (Dec 6)	7.93	7.17-8.63			10% reduction
	RFDM: Current (Nov 15)	**11.96** [a]	**8.17-16.81**[a]			**10% reduction**

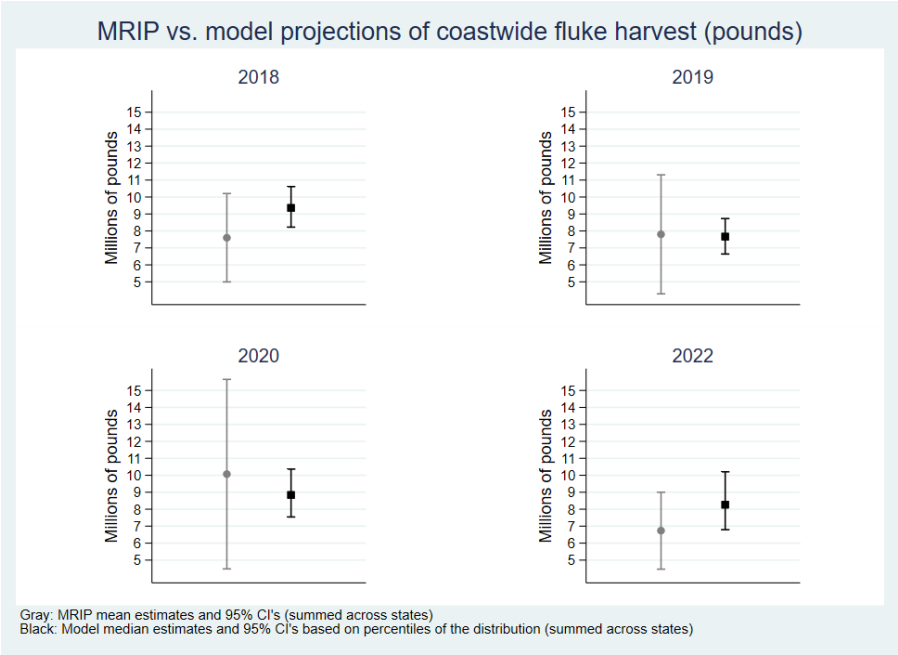
[a] RFDM model results are reported in number of fish and were converted to pounds based on average weight of harvest in 2021 from MRIP.
[b] As described above, a recreational AM has also been triggered for scup indicating that adjustments to measures are needed. **As such, the MC recommended that it is not appropriate to take a liberalization for scup and that measures should remain status quo.**

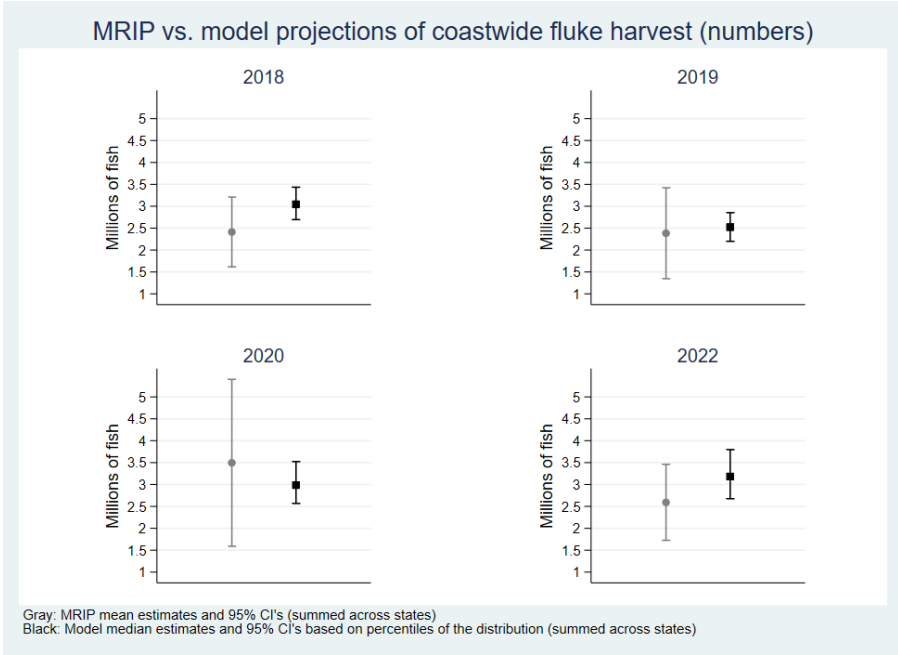
Table 2: Process for determining appropriate percent change in expected harvest when developing measures under the Percent Change Approach, with Nov. 2022 MC recommendations for summer flounder highlighted in red, and summer flounder outcomes based on revised RDM outputs highlighted in blue. The outcomes for scup and black sea bass were unchanged based on the revised RDM results (i.e., 10% reduction under both the prior and revised RDM results).

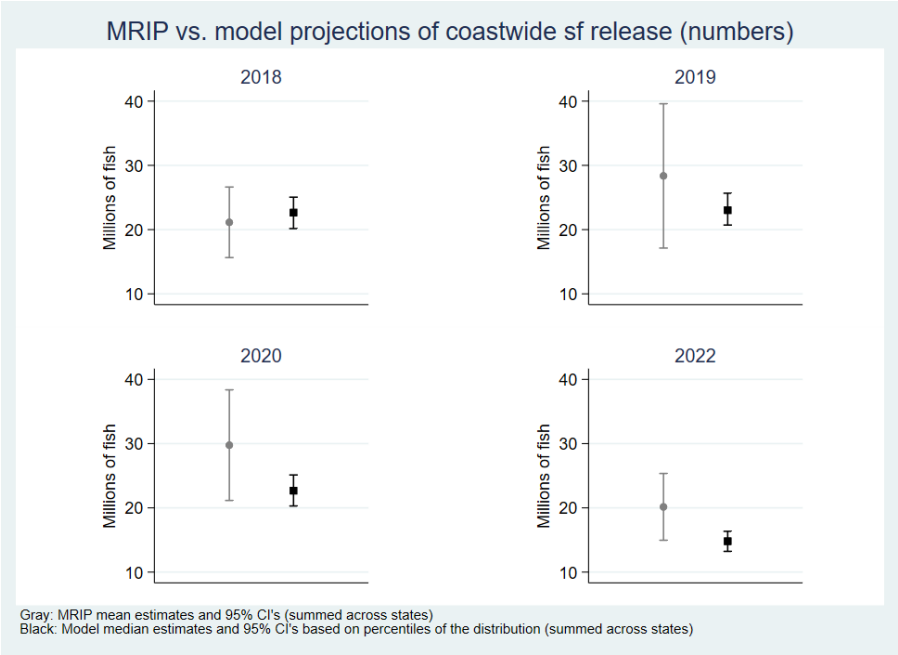
Column 1 **Future RHL vs Estimated Harvest**	*Column 2* **Biomass compared to target level (SSB/SSB_{MSY})**	*Column 3* **Change in Harvest**
Future 2-year average RHL is **greater than** the upper bound of the harvest estimate CI (harvest expected to be lower than the RHL)	**Very high** (greater than 150% of target)	**Liberalization** percent equal to difference between harvest estimate and 2-year avg. RHL, not to exceed 40%
	High (at least the target level, but no higher than 150% of target)	**Liberalization** percent equal to difference between harvest estimate and 2-year avg. RHL, not to exceed 20%
	Low (below the target stock size)	**Liberalization**: 10%
Future 2-year average RHL is **within** harvest estimate CI (harvest expected to be close to the RHL)	**Very high** (greater than 150% of target)	**Liberalization**: 10%
	High (at least the target level, but no higher than 150% of target)	**No liberalization or reduction:** 0%
	Low (below the target stock size)	**Reduction:** 10%
Future 2-year average RHL is **less than** the lower bound of the harvest estimate CI (harvest is expected to exceed the RHL)	**Very high** (greater than 150% of target)	**Reduction:** 10%
	High (at least the target level, but no higher than 150% of target)	**Reduction** percent equal to difference between harvest estimate and 2-year avg. RHL, not to exceed 20%
	Low (below the target stock size)	**Reduction** percent equal to difference between harvest estimate and 2-year avg. RHL, not to exceed 40%

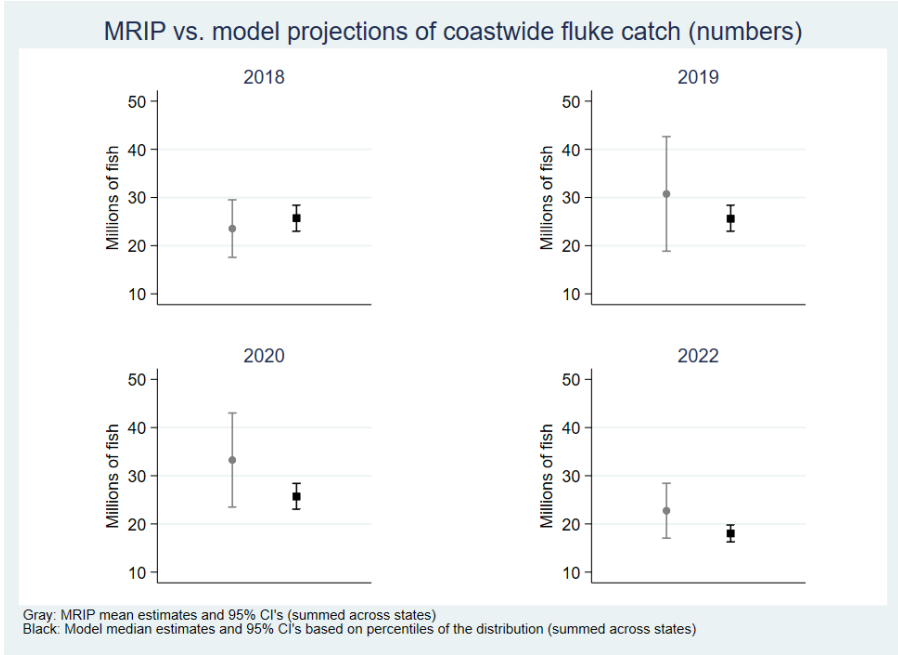
Appendix: Updated RDM Outputs and Out of Sample Predictions

Rec. demand model out-of-sample predictions for fluke









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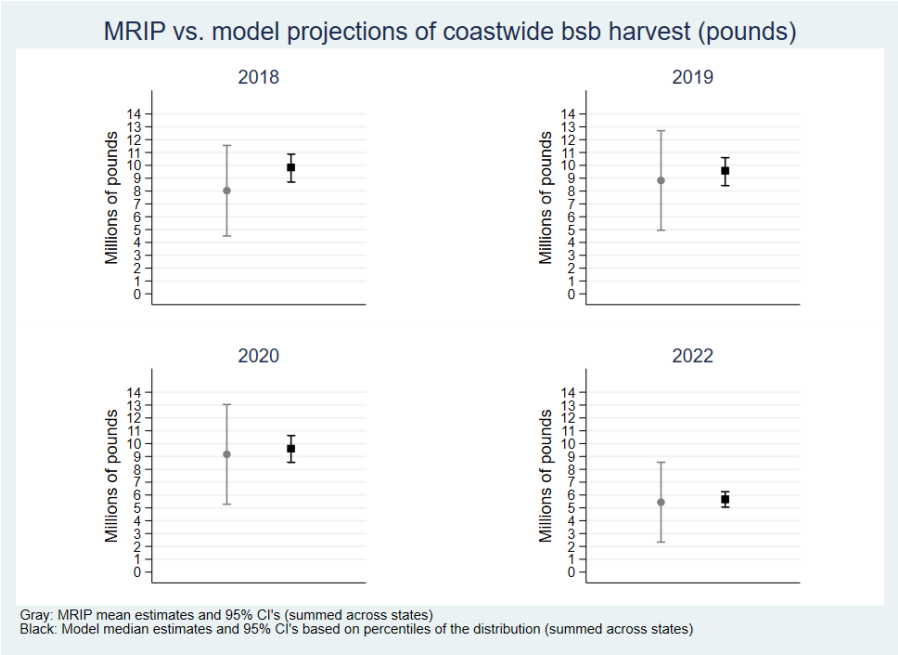
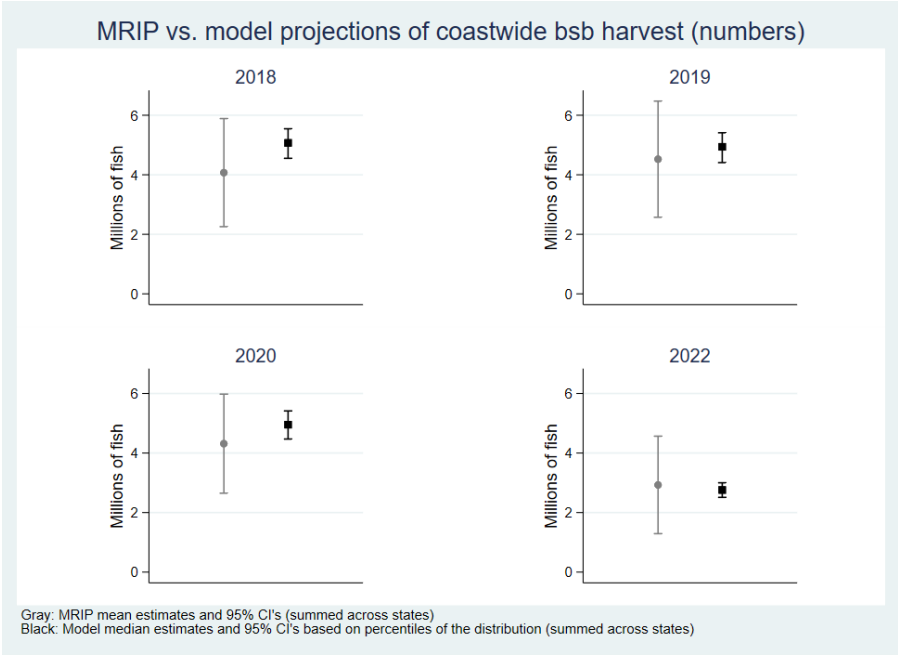
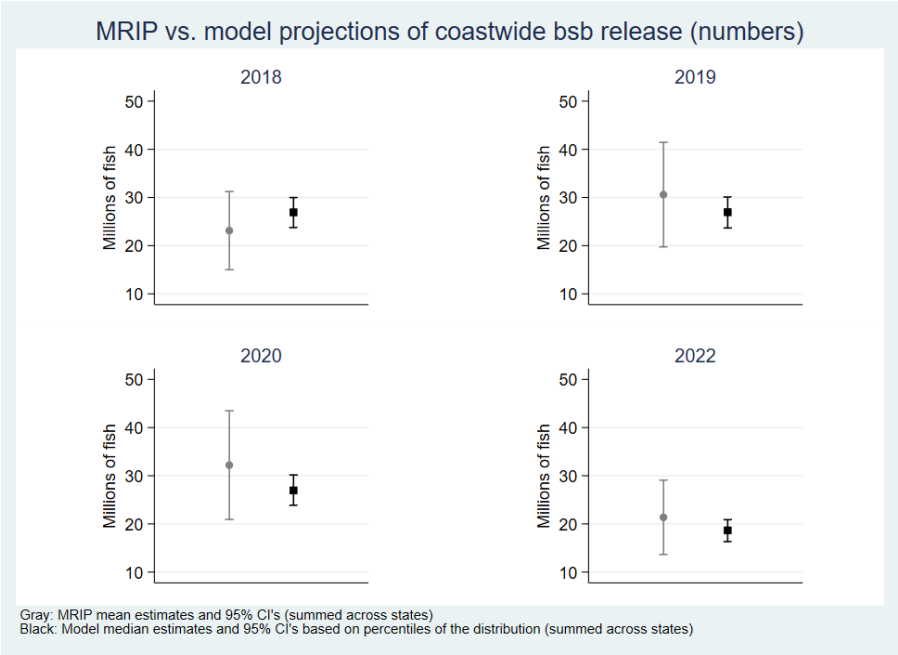
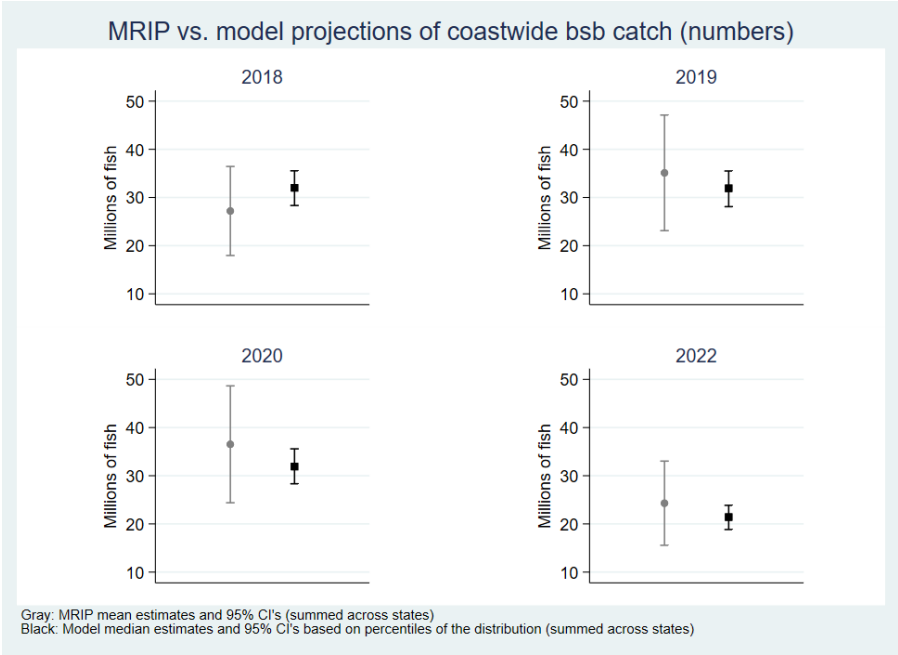
Rec. demand model out-of-sample predictions for black sea bass









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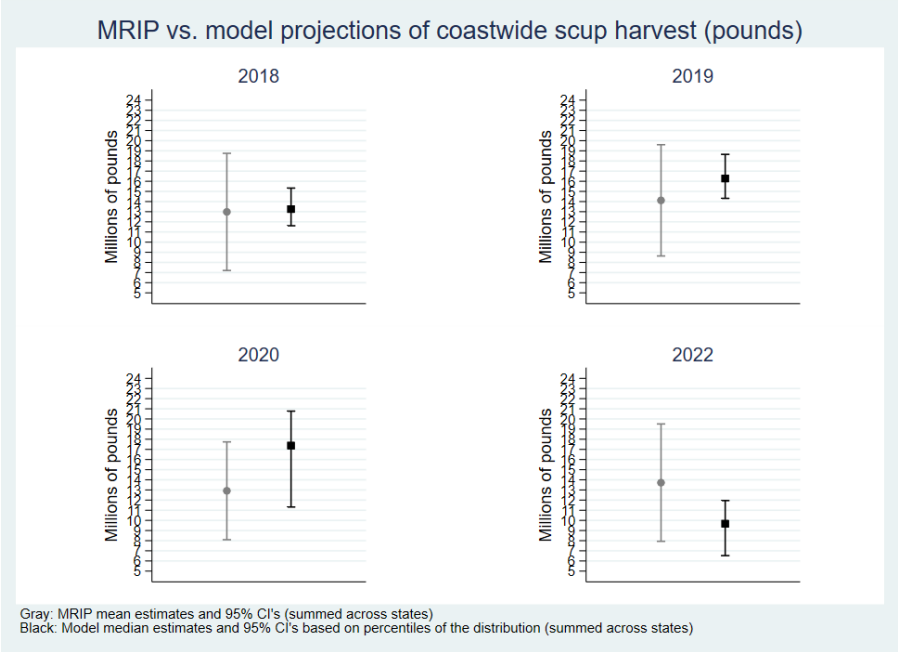
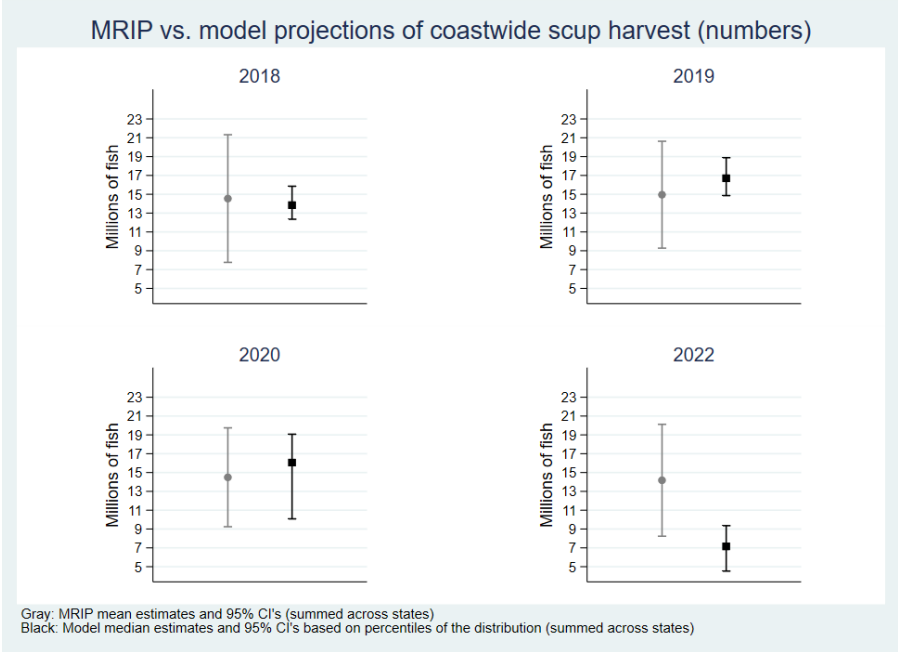
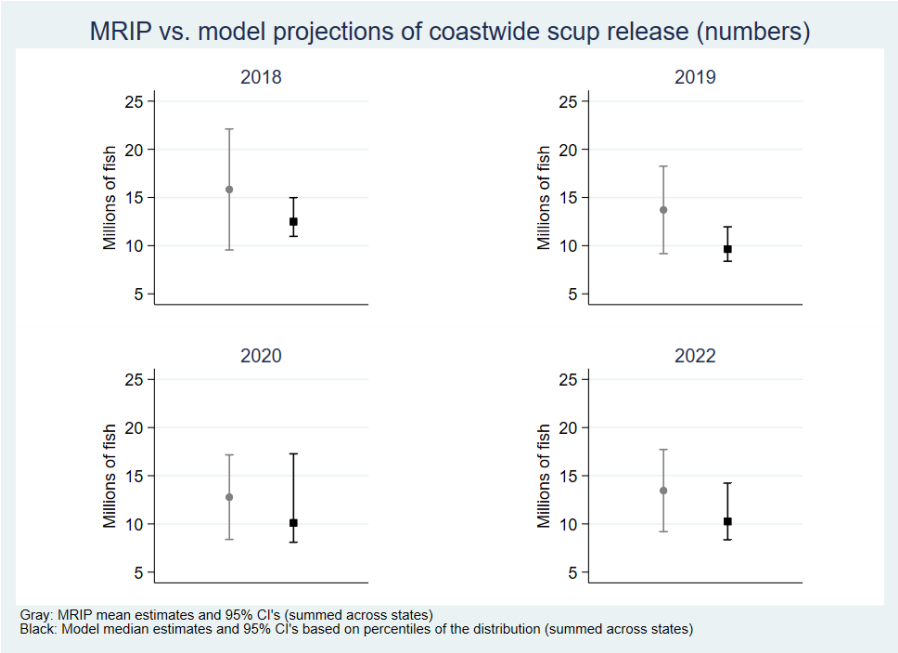
Rec. demand model out-of-sample predictions for scup







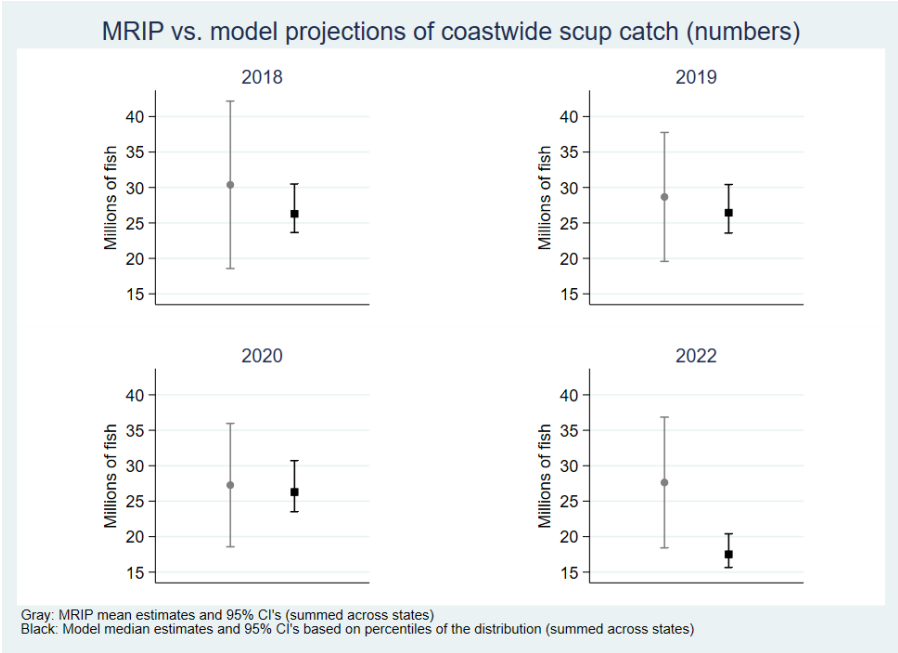


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Table 1. Out of sample model predictions and comparisons with MRIP 2018, 2019, 2020, 2022.

year	species	outcome	Model (millions)	MRIP (millions)	difference	% difference ((model-MRIP)/MRIP)*100
2018	BSB	catch (numbers)	32.004	27.198	4.806	17.671
2019	BSB	catch (numbers)	31.906	35.112	-3.206	-9.129
2020	BSB	catch (numbers)	31.913	36.523	-4.609	-12.621
2022	BSB	catch (numbers)	21.418	24.3	-2.882	-11.86
2018	BSB	harvest (numbers)	5.071	4.072	0.999	24.543
2019	BSB	harvest (numbers)	4.939	4.523	0.415	9.185
2020	BSB	harvest (numbers)	4.953	4.314	0.638	14.79
2022	BSB	harvest (numbers)	2.759	2.928	-0.169	-5.772
2018	BSB	discards (numbers)	26.919	23.126	3.793	16.402
2019	BSB	discards (numbers)	26.952	30.588	-3.636	-11.888
2020	BSB	discards (numbers)	26.954	32.208	-5.254	-16.314
2022	BSB	discards (numbers)	18.662	21.372	-2.71	-12.68
2018	BSB	harvest (pounds)	9.84	8.029	1.811	22.55
2019	BSB	harvest (pounds)	9.58	8.823	0.757	8.581
2020	BSB	harvest (pounds)	9.61	9.165	0.444	4.845
2022	BSB	harvest (pounds)	5.666	5.441	0.225	4.137
2018	SF	catch (numbers)	25.716	23.546	2.17	9.215
2019	SF	catch (numbers)	25.598	30.743	-5.145	-16.736
2020	SF	catch (numbers)	25.696	33.255	-7.559	-22.73
2022	SF	catch (numbers)	18.031	22.746	-4.715	-20.727
2018	SF	harvest (numbers)	3.044	2.413	0.631	26.172
2019	SF	harvest (numbers)	2.525	2.383	0.142	5.939
2020	SF	harvest (numbers)	2.987	3.495	-0.507	-14.515
2022	SF	harvest (numbers)	3.181	2.593	0.589	22.711
2018	SF	discards (numbers)	22.648	21.133	1.515	7.167
2019	SF	discards (numbers)	23.025	28.36	-5.334	-18.809
2020	SF	discards (numbers)	22.676	29.76	-7.084	-23.805
2022	SF	discards (numbers)	14.805	20.153	-5.348	-26.539
2018	SF	harvest (pounds)	9.359	7.601	1.758	23.13
2019	SF	harvest (pounds)	7.666	7.8	-0.134	-1.72
2020	SF	harvest (pounds)	8.839	10.067	-1.228	-12.195
2022	SF	harvest (pounds)	8.265	6.733	1.532	22.748
2018	scup	catch (numbers)	26.288	30.375	-4.087	-13.455
2019	scup	catch (numbers)	26.437	28.666	-2.229	-7.777
2020	scup	catch (numbers)	26.283	27.269	-0.985	-3.614
2022	scup	catch (numbers)	17.5	27.636	-10.136	-36.677
2018	scup	harvest (numbers)	13.843	14.545	-0.703	-4.83
2019	scup	harvest (numbers)	16.701	14.954	1.747	11.682
2020	scup	harvest (numbers)	16.055	14.493	1.562	10.779
2022	scup	harvest (numbers)	7.159	14.178	-7.019	-49.507
2018	scup	discards (numbers)	12.495	15.829	-3.334	-21.064
2019	scup	discards (numbers)	9.644	13.712	-4.068	-29.669
2020	scup	discards (numbers)	10.104	12.775	-2.672	-20.912
2022	scup	discards (numbers)	10.258	13.458	-3.2	-23.778
2018	scup	harvest (pounds)	13.259	12.98	0.28	2.154
2019	scup	harvest (pounds)	16.277	14.119	2.159	15.289
2020	scup	harvest (pounds)	17.373	12.916	4.457	34.505
2022	scup	harvest (pounds)	9.671	13.72	-4.049	-29.514

Appendix: Updated RDM Outputs and Out of Sample Predictions

Definitions associated with the model runs shown on the pages below

1. **Status quo**: 2022 measures for all three species

Summer Flounder

2. **NP1**: 2022 summer flounder conservation equivalency non-preferred coastwide measures
    - 4 fish possession limit, 18.5 inch min size, May 15-Sept 15 open season.
3. **SF1:** 17 inches, 3 fish, May 1 – September 30 in all states
4. **SF2:** The following regulations by state:

State	Minimum Size (inches)	Possession Limit	Open Season
Massachusetts	16	5 fish	May 23-October 9
Rhode Island	18	6 fish	May 3-December 31
Connecticut	18	4 fish	May 4- September 30
New York	18		
New Jersey	17	3 fish	May 24- September 21
Delaware	16	4 fish	January 1- December 31
Maryland			
Virginia			
North Carolina	15	4 fish	January 1-September 3

5. **SF3:** 1 fish from 16-19 inches, 2 fish 19 inches and greater, May 1 - Sept 30 in all states.

Scup

6. **Scup1:** The following regulations by state

State	Minimum Size (inches)	Possession Limit	Open Season
Massachusetts	10	15 fish	Jan. 1 – Dec. 31
Rhode Island	10		Jan. 1 – Dec. 31
Connecticut	10		Jan. 1 – Dec. 31
New York	10		Jan. 1 – Dec. 31
New Jersey	10		Jan. 1 – Dec. 31
Delaware	9		Jan. 1 – Dec. 31
Maryland	9		Jan. 1 – Dec. 31
Virginia	9		Jan. 1 – Dec. 31
North Carolina	9		Jan. 1 – Dec. 31

7. **Scup2:** The following regulations by state

State	Minimum Size (inches)	Possession Limit	Open Season
Massachusetts	11	30	Jan. 1 – Dec. 31
Rhode Island	11	30	Jan. 1 – Dec. 31
Connecticut	11	30	Jan. 1 – Dec. 31
New York	11	30	Jan. 1 – Dec. 31
New Jersey	11	50	Jan. 1 – Dec. 31
Delaware	10	50	Jan. 1 – Dec. 31
Maryland	10	50	Jan. 1 – Dec. 31
Virginia	10	30	Jan. 1 – Dec. 31
North Carolina	10	50	Jan. 1 – Dec. 31

Black Sea Bass

8. **NP2:** 2022 black sea bass conservation equivalency non-preferred coastwide measures
    - 5 fish possession limit, 14 inch min size, May 15 – Sept 21 open season.
9. **BSB1:** 5 fish, 15 inch minimum size, May 15-Sept 21 open season in all states.

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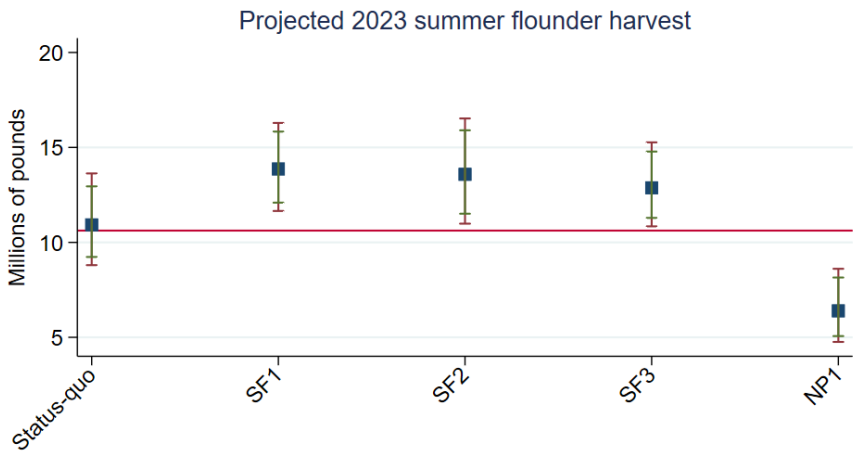
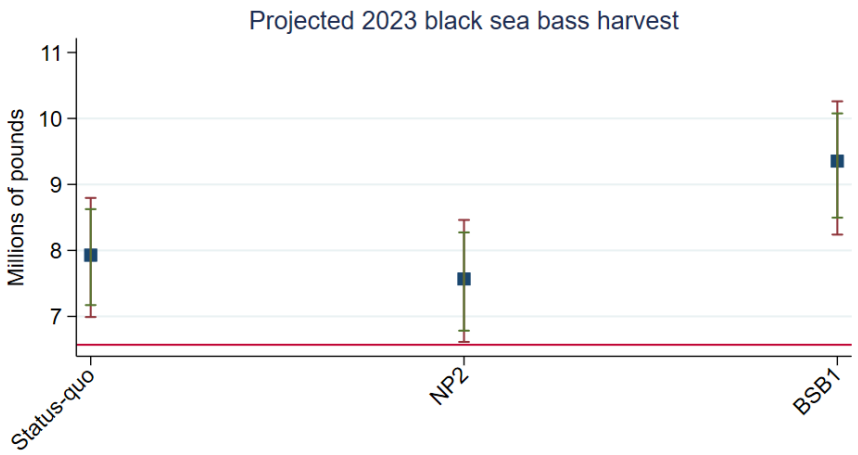


Red line indicates 2023 RHL



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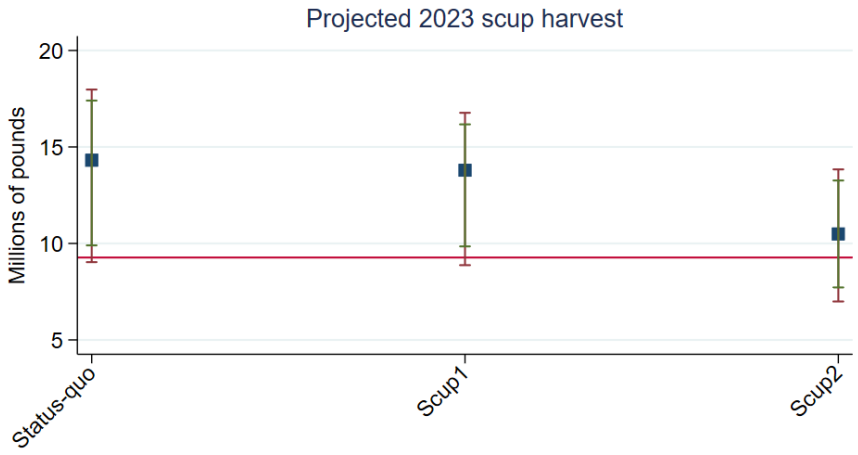

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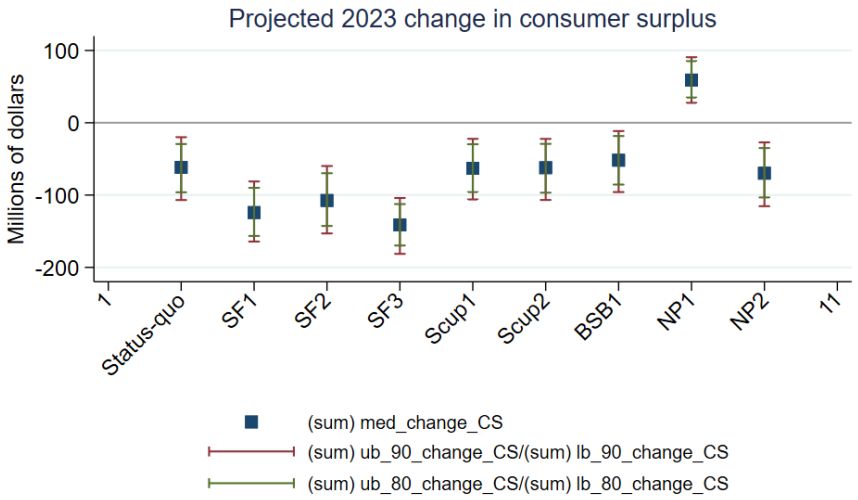

Note: positive changes in CS means anglers are worse off; it can be interpreted as the money anglers would require in compensation for reduced fishing quality relative to 2021 and remain at 2021 fishing utility levels. Conversely negative changes in CS means anglers are better off; it can be interpreted as the amountof money anglers would be willing to forego in order to fish under the new conditions and remain at 2021 fishing utility levels.

Appendix: Updated RDM Outputs and Out of Sample Predictions

Table 2. Model projected harvest (millions pounds) under 2023 management alternatives and confidence intervals based on percentiles of the projected distribution.

2023 regulation	Median estimate	Lower and upper bounds on the 90% confidence interval		Lower and upper bounds on the 80% confidence interval	
Summer flounder					
status quo	10.9224	8.8015	13.6309	9.2311	12.9491
SF1	13.8663	11.6531	16.2894	12.0917	15.8318
SF2	13.5848	10.9861	16.5247	11.5104	15.9017
SF3	12.8742	10.8433	15.2660	11.2890	14.7818
Scup1	10.9050	8.8272	13.5898	9.2058	12.9873
Scup2	10.9415	8.9304	13.5763	9.2428	13.0415
BSB1	10.9015	8.8457	13.5723	9.2156	12.9299
NP1	6.3945	4.7590	8.6091	5.0658	8.1497
NP2	10.9563	8.8709	13.5913	9.2076	12.9748
Black sea bass					
status quo	7.9288	6.9908	8.7955	7.1715	8.6253
SF1	7.9463	7.0185	8.7817	7.2151	8.6156
SF2	7.9622	7.0428	8.8002	7.2017	8.6442
SF3	7.9644	7.0513	8.8147	7.2334	8.6638
Scup1	7.9125	7.0245	8.7901	7.2187	8.6131
Scup2	7.9323	7.0078	8.7533	7.1668	8.6033
BSB1	7.5676	6.6136	8.4616	6.7841	8.2728
NP1	7.8485	6.9495	8.6829	7.1422	8.5362
NP2	9.3532	8.2397	10.2598	8.4964	10.0764
Scup					
status quo	14.3142	9.0310	17.9754	9.8993	17.4031
SF1	14.4225	9.0766	18.1666	9.9696	17.5214
SF2	14.3891	9.1323	18.0770	9.9899	17.3537
SF3	14.4362	9.1128	18.2689	10.0272	17.4793
Scup1	13.7933	8.8734	16.7699	9.8474	16.1704
Scup2	10.4915	6.9925	13.8373	7.7191	13.2615
BSB1	14.2898	8.9457	18.0240	9.8815	17.3367
NP1	14.1664	8.9558	17.8999	9.8244	17.1802
NP2	14.3057	8.9220	18.0098	9.8931	17.3437