Ecological Reference Point Assessment: Additional Analysis

Matt Cieri, ERP WG Chair

May 5, 2020

Outline

- Introduction
- Additional Analysis
- Results
- Uncertainties
- Next Steps
- Questions and Wrap-up

Introduction: TORs

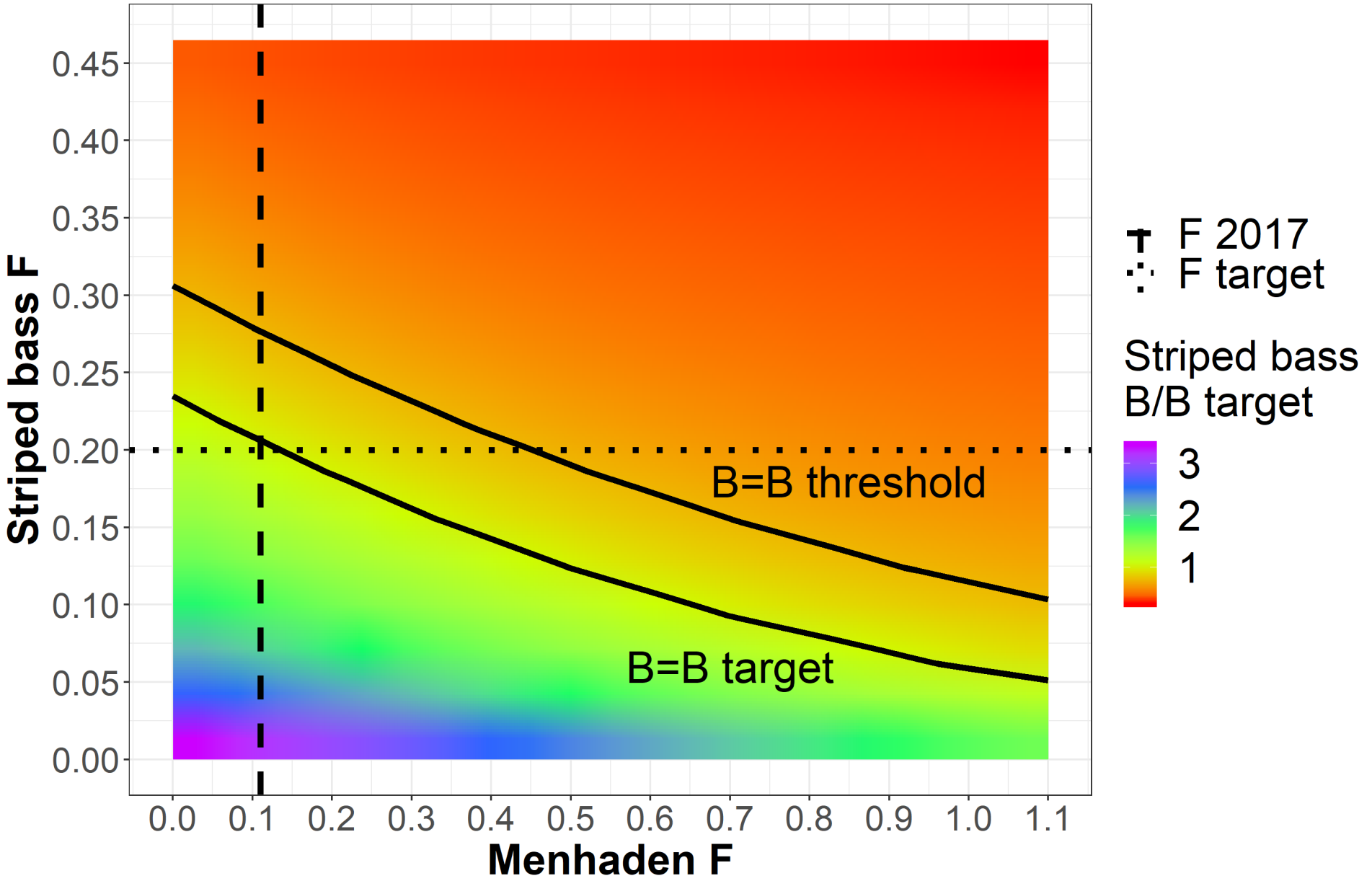
- **Develop models** used to estimate population parameters (e.g., F, biomass, abundance) of Atlantic menhaden **that take into account Atlantic menhaden's role as a forage fish** and analyze model performance.

- **Develop methods** to determine reference points and total allowable catch for Atlantic menhaden **that account for Atlantic menhaden's role as a forage fish.**

Introduction: Advice

- ERP WG recommends a combination of the BAM single-species model and the NWACS-MICE model as a tool for managers to evaluate trade-offs between menhaden harvest and predator biomass to establish reference points and quotas

Introduction



Introduction

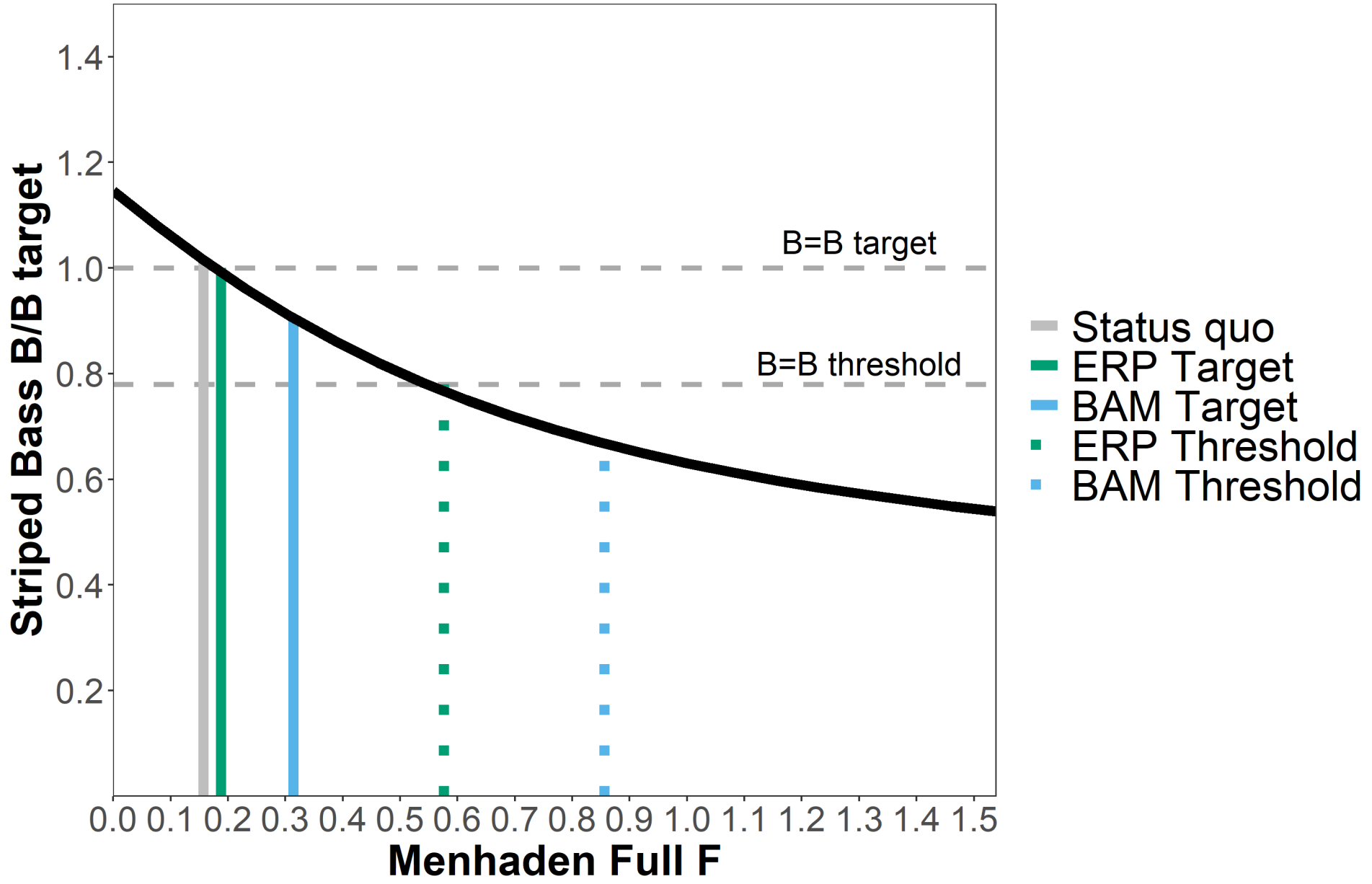
ERP WG developed an example ERP target and threshold based on striped bass

→ **ERP target:** maximum F on menhaden that sustains striped bass at their B target when striped bass are fished at their F target

→ **ERP threshold:** maximum F on menhaden that keeps striped bass at their B threshold when striped bass are fished at their F target

All other ERP species are fished at their status quo (2017 levels) in this example

Introduction



Introduction

Reference Point	ERP	Single Species	F 2017
F Target	0.19	0.31	0.16
F Threshold	0.57	0.86	

- To meet current striped bass management objectives, the F target and threshold for Atlantic menhaden should be lower than the single-species target and threshold

- Current F is below the example ERP target and threshold, indicating the stock is not experiencing overfishing

Introduction

Status quo/2017 conditions

ERP Focal Species	2017 F Status	2017 Biomass Status
Atlantic herring	Not overfishing	Below target, not overfished (yet)
Bluefish	**Overfishing**	**Overfished**
Spiny dogfish	Below F target	Above SSB target
Weakfish	**Total mortality too high**	**Depleted**

Additional Analysis

- The Atlantic Menhaden Board tasked the ERP Work Group (ERP WG) with conducting additional runs of the NWACS-MICE tool to explore the sensitivity of the ERPs to different assumptions about ecosystem conditions.

Additional Analysis

1. All other species are fished at their 2017 status quo level (example ERPs, presented at the 2020 Winter Meeting).
2. All other species are fished at a level that allows them to reach their biomass target.
3. All other species are fished at a level that keeps them at their biomass threshold.
4. Atlantic herring and bluefish are fished at a rate that allows them to reach their biomass target, while spiny dogfish and weakfish are fished at 2017 status quo levels

Additional Analysis

Table 1. ERP Ecosystem Scenarios

ERP Scenario	Striped Bass	Bluefish	Weakfish	Spiny Dogfish	Atlantic herring
1. Example ERPs (2017 status quo)	*F* target	2017 status quo	2017 status quo	2017 status quo	2017 status quo
2. All at *B* target	*F* target	*F* target	*F* target	*F* target	*F* target
3. All at *B* threshold	*F* target	*F* threshold	*F* threshold	*F* threshold	*F* threshold
4. Bluefish & herring at *B* target	*F* target	*F* target	Status quo	Status quo	*F* target

Note that for the other ERP focal species, “F target” and “F threshold” are defined as the F rates within the NWACS-MICE model that let these species approximate their biomass targets and thresholds, respectively.

Results

- *Scenario 1: Example ERPs* - The example ERPs were presented at the 2020 Winter meeting.

Reference Point	ERP
F Target	0.19
F Threshold	0.57

Probability of exceeding ERP target			Probability of exceeding ERP threshold		
2019	2020	2021	2019	2020	2021
60%	71%	66%	0%	0%	0%

Results

- *Scenario 2: All at biomass target* - Negative aspects of rebuilding Bluefish, Spiny dogfish and Weakfish as competitors outweighed by rebuilding of Atlantic herring which serve as an alternate prey source
  - The ERP threshold was undefined. If striped bass was fished at its *F* target and Atlantic herring biomass approached its biomass target, increasing *F* on Atlantic menhaden would not drive striped bass to its threshold over the range of *F* values explored

Results

- *Scenario 2: All at biomass target* -

Reference Point	ERP
F Target	0.31
F Threshold	*

Probability of exceeding ERP target			Probability of exceeding ERP threshold		
2019	2020	2021	2019	2020	2021
0%	3%	6%	0%	0%	0%

Results

- *Scenario 3: All at biomass threshold*- Opposite of "*Scenario 2: All at biomass target*". Positive aspects of reduced competitors on Striped bass outweighed by negative aspects of lower Atlantic herring biomass

Reference Point	ERP
F Target	0.03
F Threshold	0.32

Probability of exceeding ERP target			Probability of exceeding ERP threshold		
2019	2020	2021	2019	2020	2021
100%	99.5%	99.5%	0%	13%	13%

Results

- *Scenario 4: Bluefish and Atlantic herring at target*
  - Nearly identical to "*Scenario 2: All at biomass target".* Negative aspects of rebuilding Bluefish outweighed by rebuilding of Atlantic herring. ERP threshold undefined in this scenario as well.

Reference Point	ERP
F Target	0.35
F Threshold	*

Probability of exceeding ERP target			Probability of exceeding ERP threshold		
2019	2020	2021	2019	2020	2021
0%	5%	7%	0%	0%	0%

Results

Table 2: ERP targets and thresholds under different ecosystem scenario

	Atlantic Menhaden Full F equivalent	
Scenario	**ERP target**	**ERP threshold**
1. Example ERPs	0.19	0.57
2. All at *B* target	0.36	*
3. All at *B* threshold	0.03	0.32
4. Bluefish & herring at *B* target	0.35	*
	Target	**Threshold**
Single species BRPs	0.31	0.86

*: When Atlantic herring were at their biomass target and striped bass were fished at their *F* target, the ERP threshold was undefined, meaning none of the Atlantic menhaden *F* values explored pushed striped bass to their biomass threshold.

Results: Striped Bass

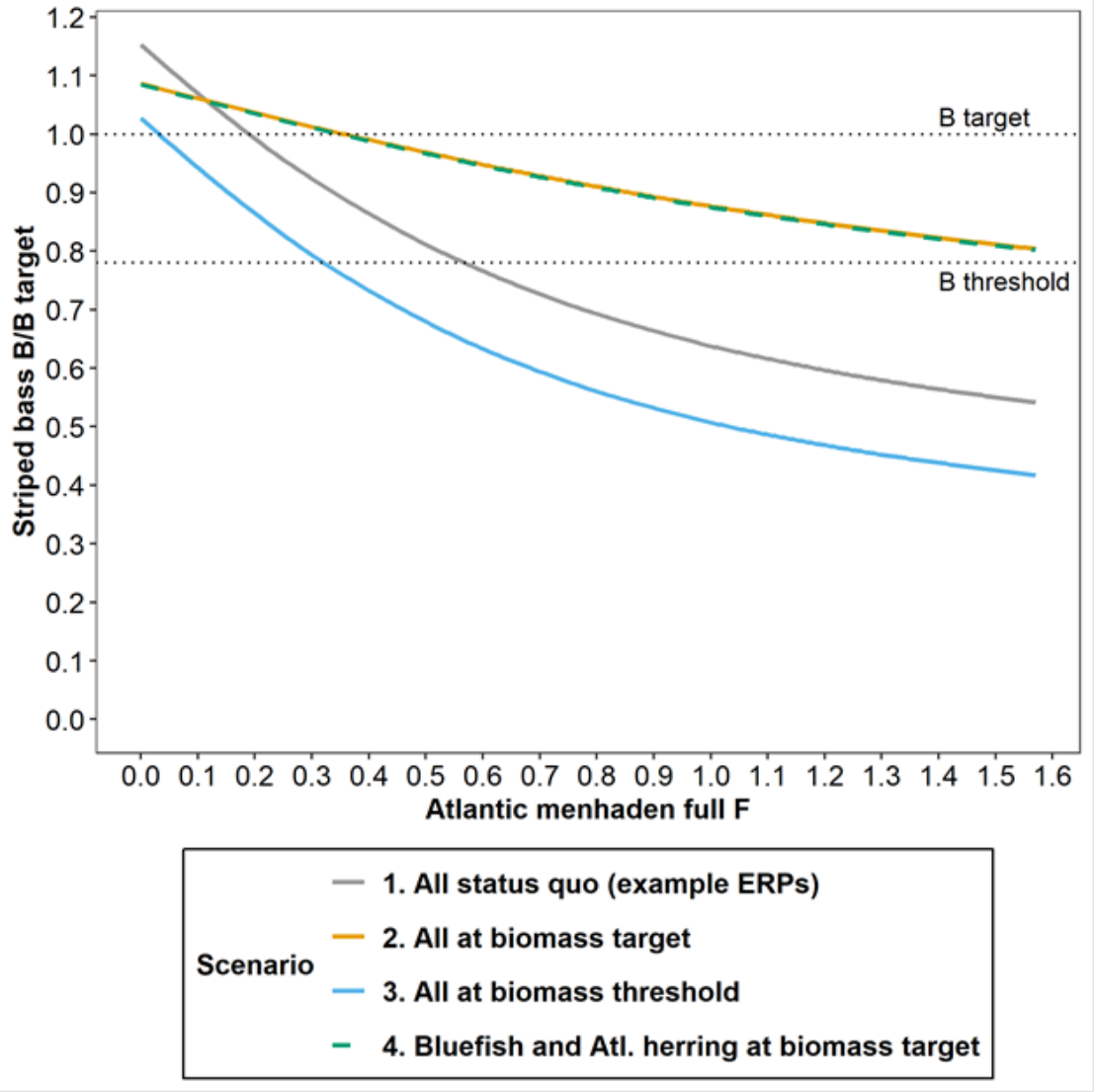


Figure 1: Striped bass biomass levels relative to their biomass target under different levels of Atlantic menhaden *F* for different ecosystem scenarios. Striped bass are fished at their *F* target in all scenarios.

Results: Striped Bass

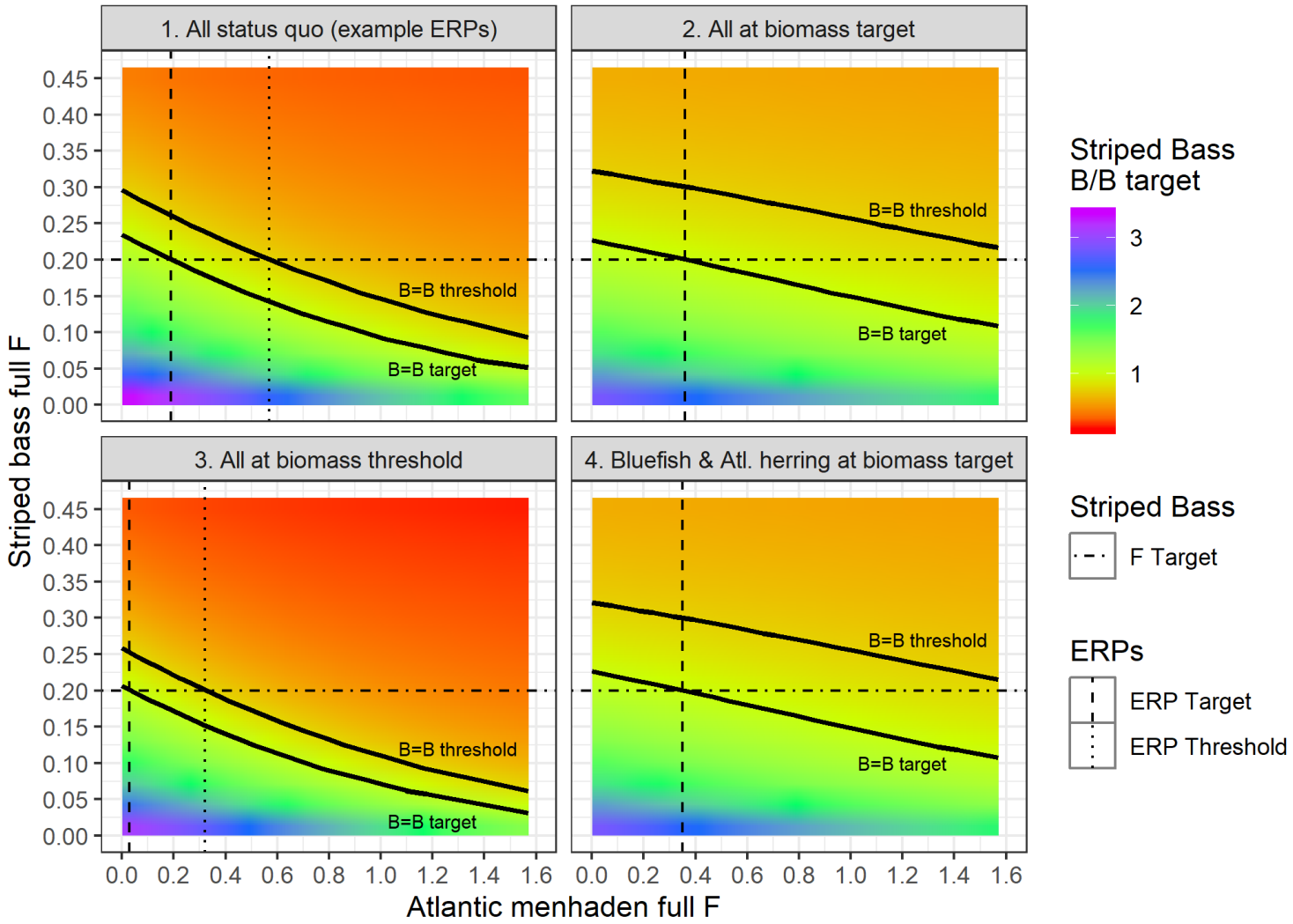


Figure 2. Striped bass surface plots showing the long-term equilibrium striped bass biomass relative to the biomass target under different combinations of Striped bass *F* and Atlantic menhaden *F*.

Results: Bluefish

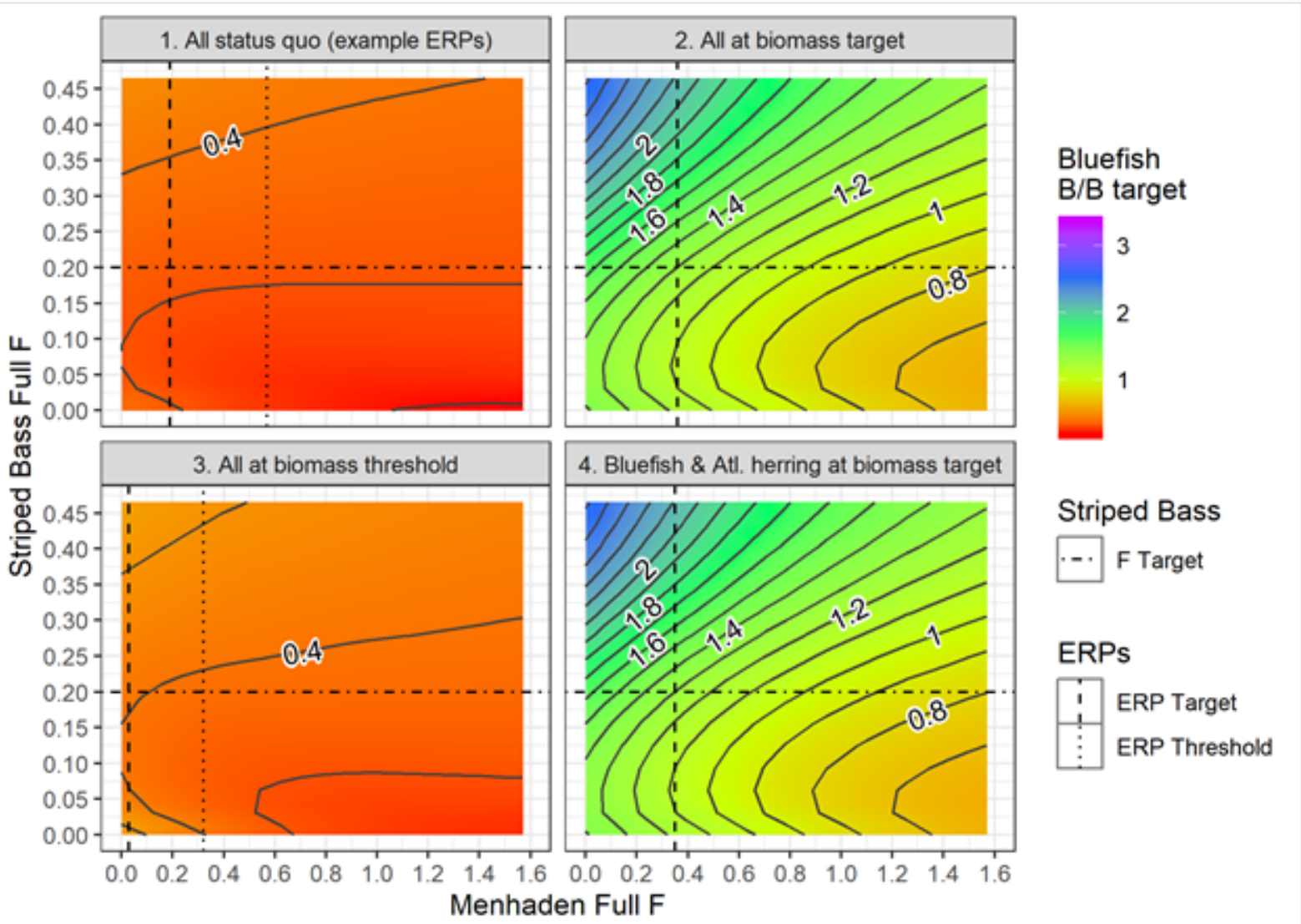


Figure 3. Bluefish surface plots showing the long-term equilibrium bluefish biomass relative to the biomass target under different combinations of Striped bass *F* and Atlantic menhaden *F*.

Results: Weakfish

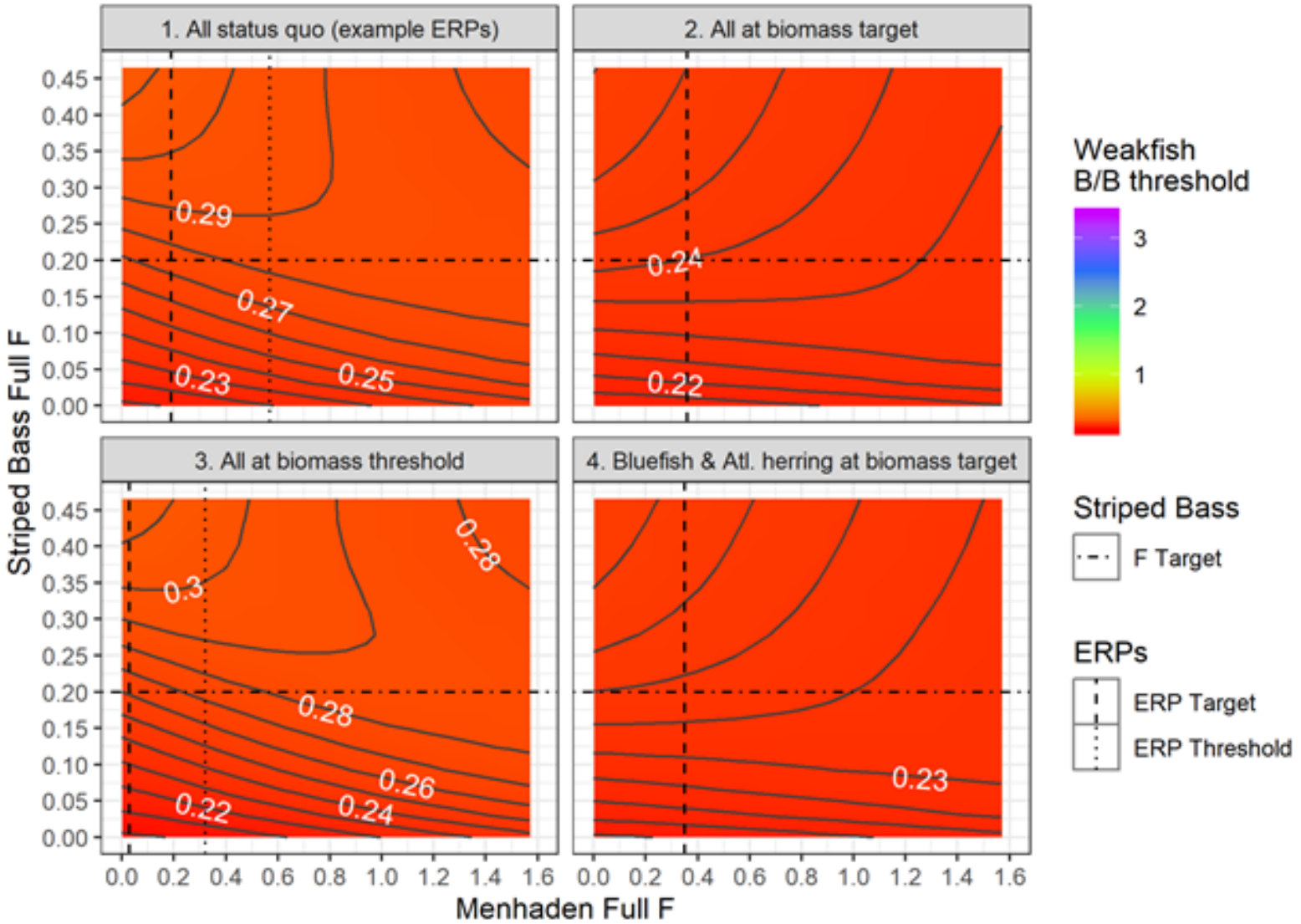


Figure 4. Weakfish surface plots showing the long-term equilibrium weakfish biomass relative to the biomass target under different combinations of Striped bass *F* and Atlantic menhaden *F*.

Uncertainties

- Stocks were fished at rates which allowed them to approximate their threshold or target biomass values. This may not line up with *F* values from FMPs for federally managed stocks. There are also structural differences between the NWACS-MICE model and single-species assessments
- Weakfish under any scenario did not rebuild; in keeping with the high *M* and recent assessment results. This *M* could not be attributed to the predators/prey included here

Uncertainties

- The relationship between Atlantic herring and striped bass was very strong in these runs and was sensitive to the model estimates of Atlantic herring vulnerability
  - Predicted higher consumption of Atlantic herring at high biomass then expected given diet data.
  - While an important component of Striped bass diets, the model may be overestimating the importance of Atlantic herring on a coastwide, annual level. More work needed.

Next Steps

ERP WG recommends additional analyses before the next Board meeting.

- Explore alternate Atlantic herring biomass scenarios given the uncertainty in future recruitment
- Explore sensitivity to model parameterization of the Atlantic herring –Striped bass relationship
- Explore scenarios where other ERP focal species are fished at their single-species *F* reference points

Ecological Reference Points Working Group

Matt Cieri (Chair), Maine Department of Marine Resources
Kristen Anstead, Atlantic States Marine Fisheries Commission
Max Appelman, Atlantic States Marine Fisheries Commission
Mike Celestino, New Jersey Division of Fish and Wildlife
David Chagaris, University of Florida
Micah Dean, Massachusetts Division of Marine Fisheries
Katie Drew, Atlantic States Marine Fisheries Commission
Shanna Madsen, New Jersey Division of Fish and Wildlife
Jason McNamee, Rhode Island Division of Marine Fisheries
Sarah Murray, Atlantic States Marine Fisheries Commission
Amy Schueller, National Marine Fisheries Service
Alexei Sharov, Maryland Department of Natural Resources
Howard Townsend, National Marine Fisheries Service
Jim Uphoff, Maryland Department of Natural Resources

In collaboration with
Andre Buchheister and Max Grezlik, Humboldt State University
Joana Brito, University of the Azores
Genevieve Nesslage and Mike Wilberg, University of Maryland Center for Environmental Science

QUESTIONS