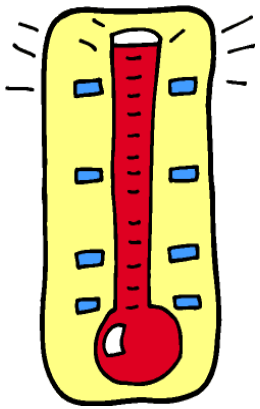
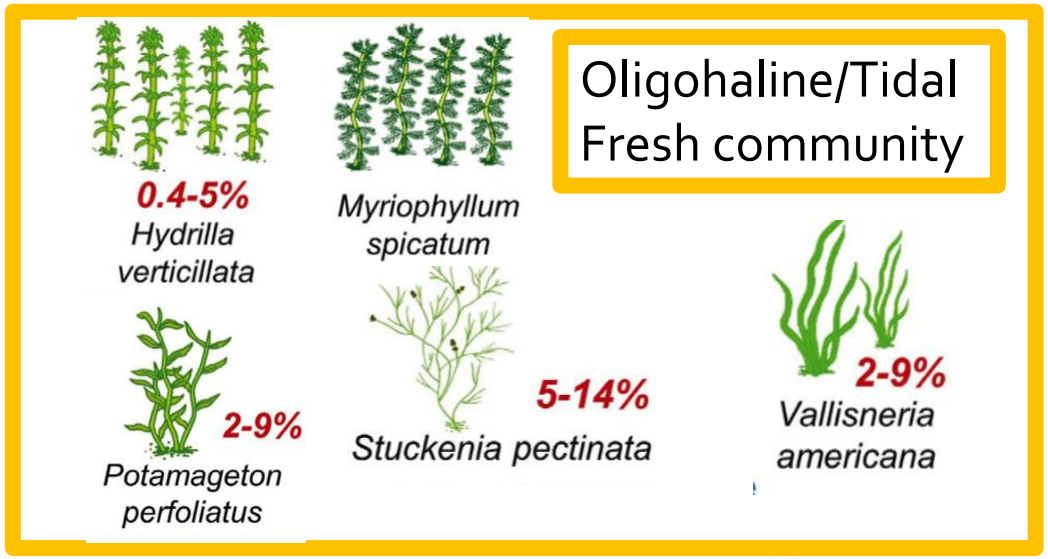
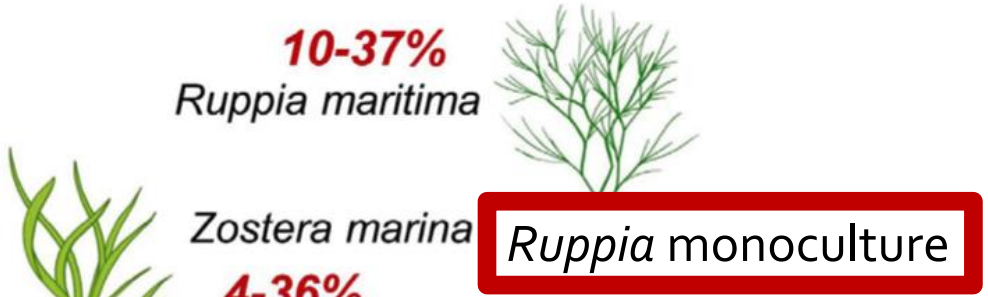
Envisioning the future for Chesapeake Bay seagrasses under climate change

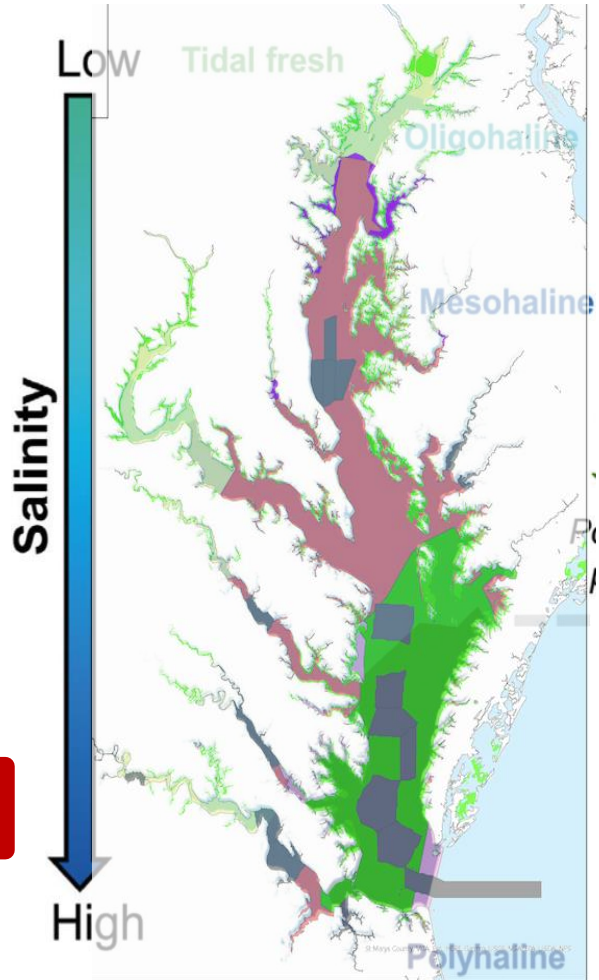
Marc Hensel, Chris Patrick, Jon Lefcheck, and Dave Wilcox

ISBW 2022 8/8

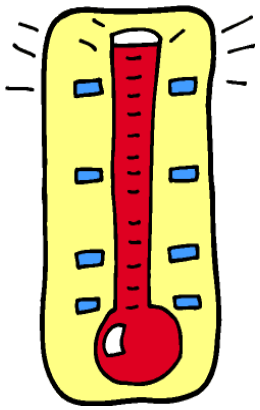


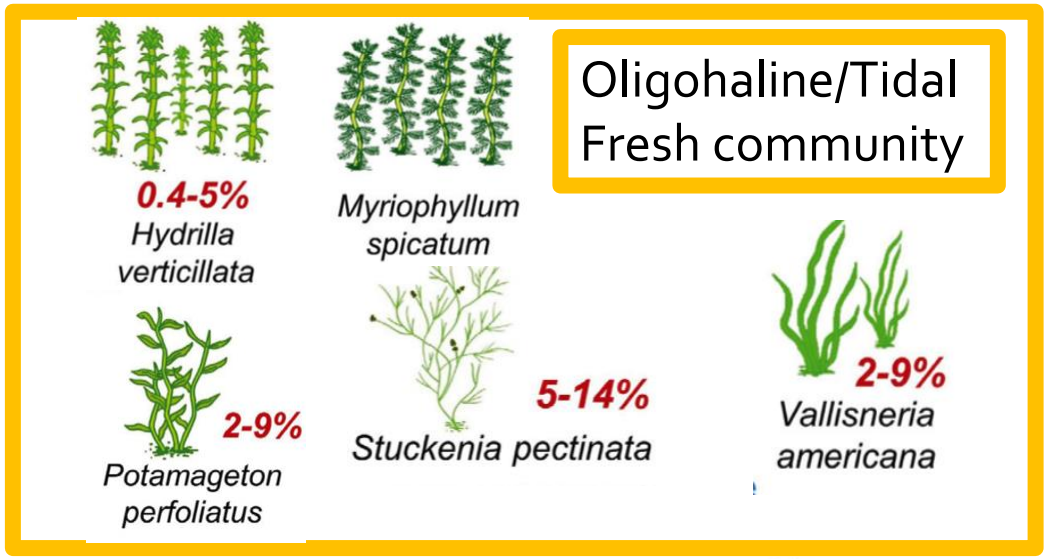


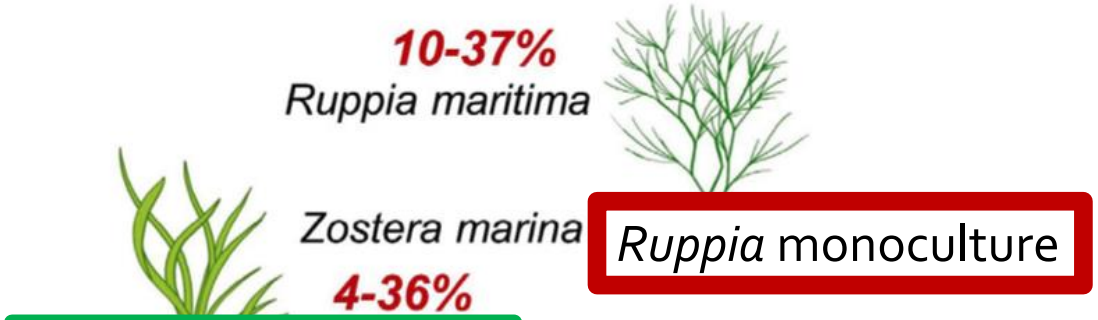


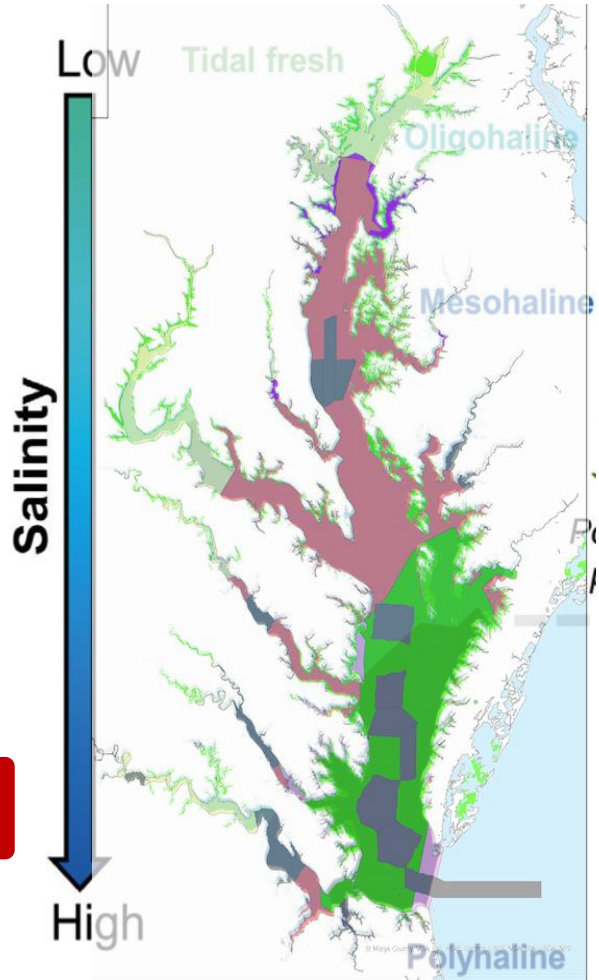


How will climate change and human activities affect the major communities of seagrass and aquatic vegetation in the Chesapeake Bay?









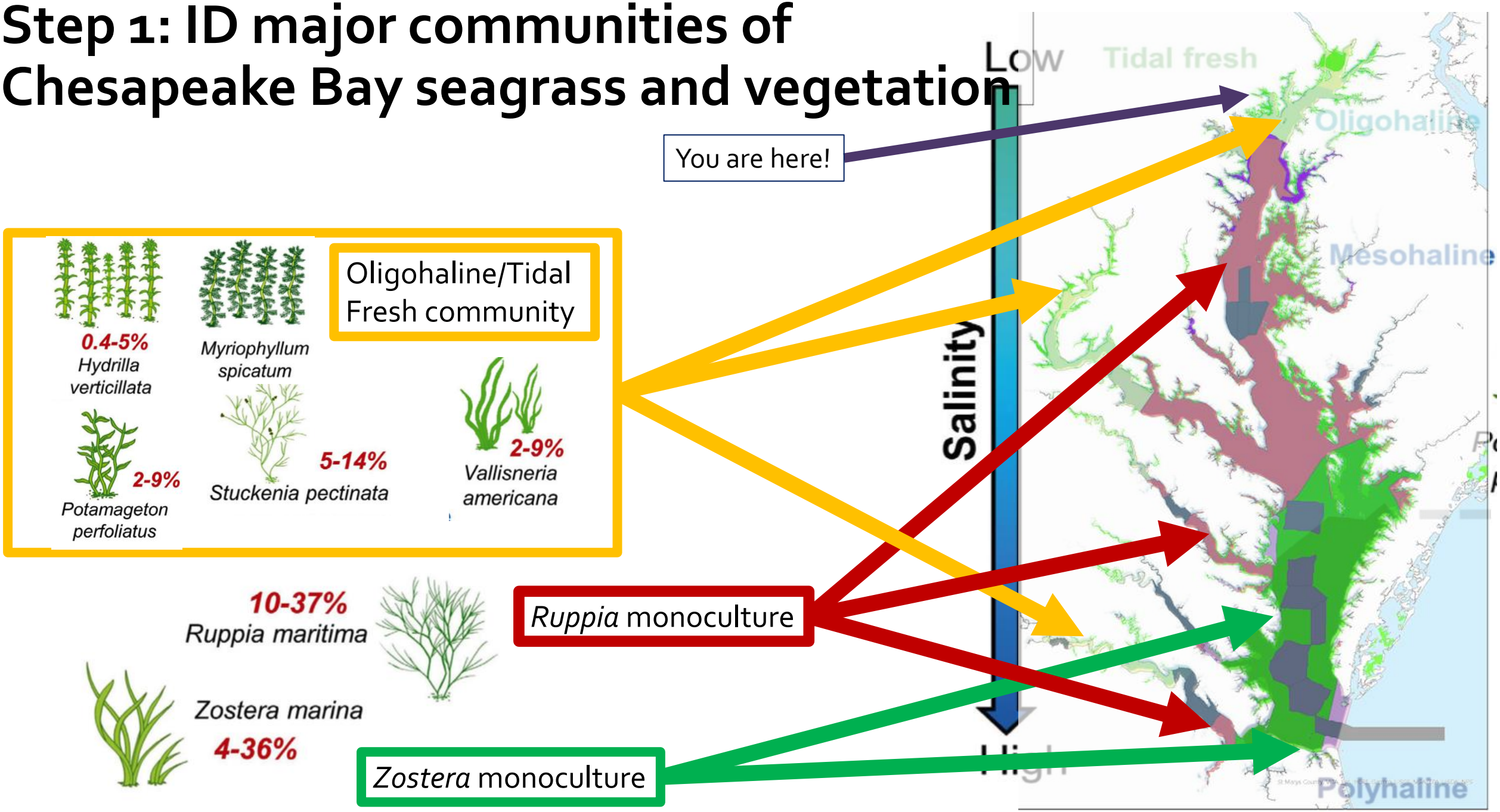
Predicting the future in three steps|

Step 1: How have past environmental conditions affected seagrass communities?

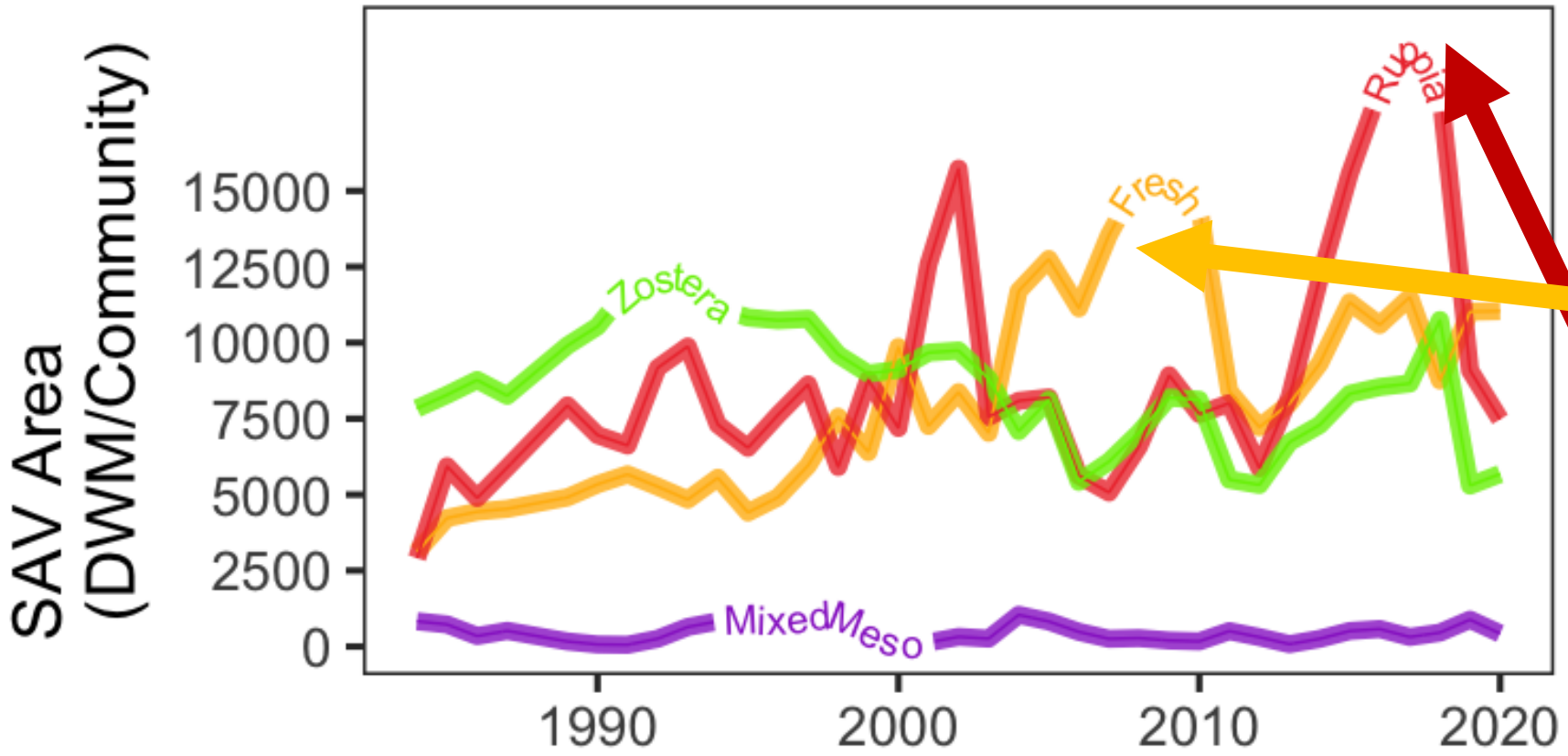
Step 2: How will environmental conditions shift with climate change & with human activities?

Step 3: How will shifting conditions and shifting species affect seagrass meadow coverage into the future?

Step 1: ID major communities of Chesapeake Bay seagrass and vegetation



Step 1: Dominant communities have changed over time in response to climate and management



Tidal fresh and widgeongrass are the dominant communities now

Step 1: Different communities controlled by different seasonal variables, according to SEM from 1984-2020

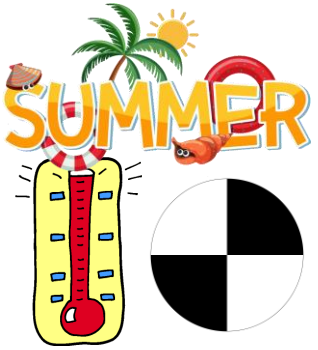
Oligohaline/Tidal Fresh community

Δ Fresh: R^2_m= 0.82

Ruppia monoculture

Δ Ruppia: R^2_m= 0.76

Zostera monoculture



Δ Zostera R^2_m= 0.59

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-New dominants are controlled by flow of nutrients from watershed

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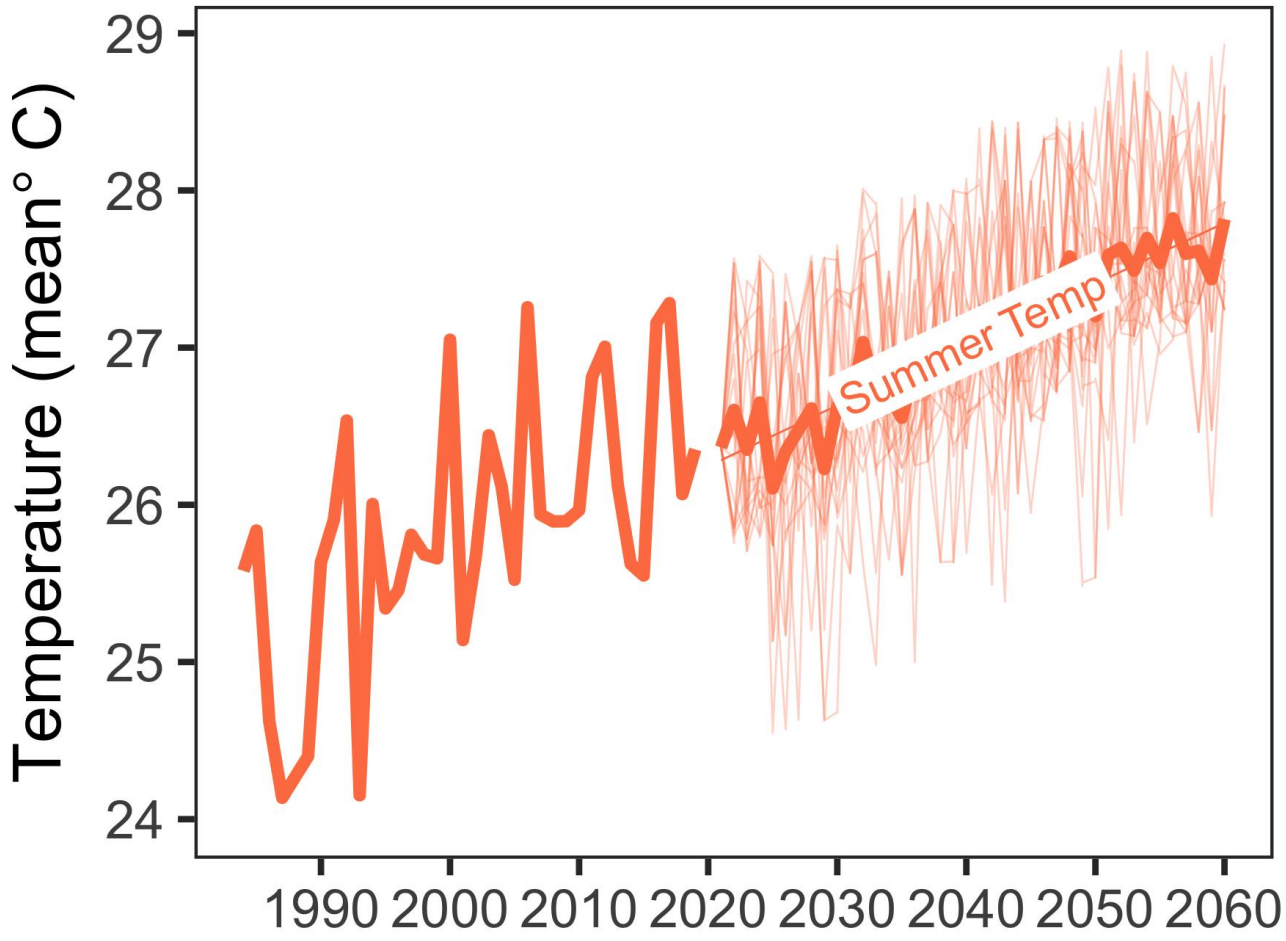
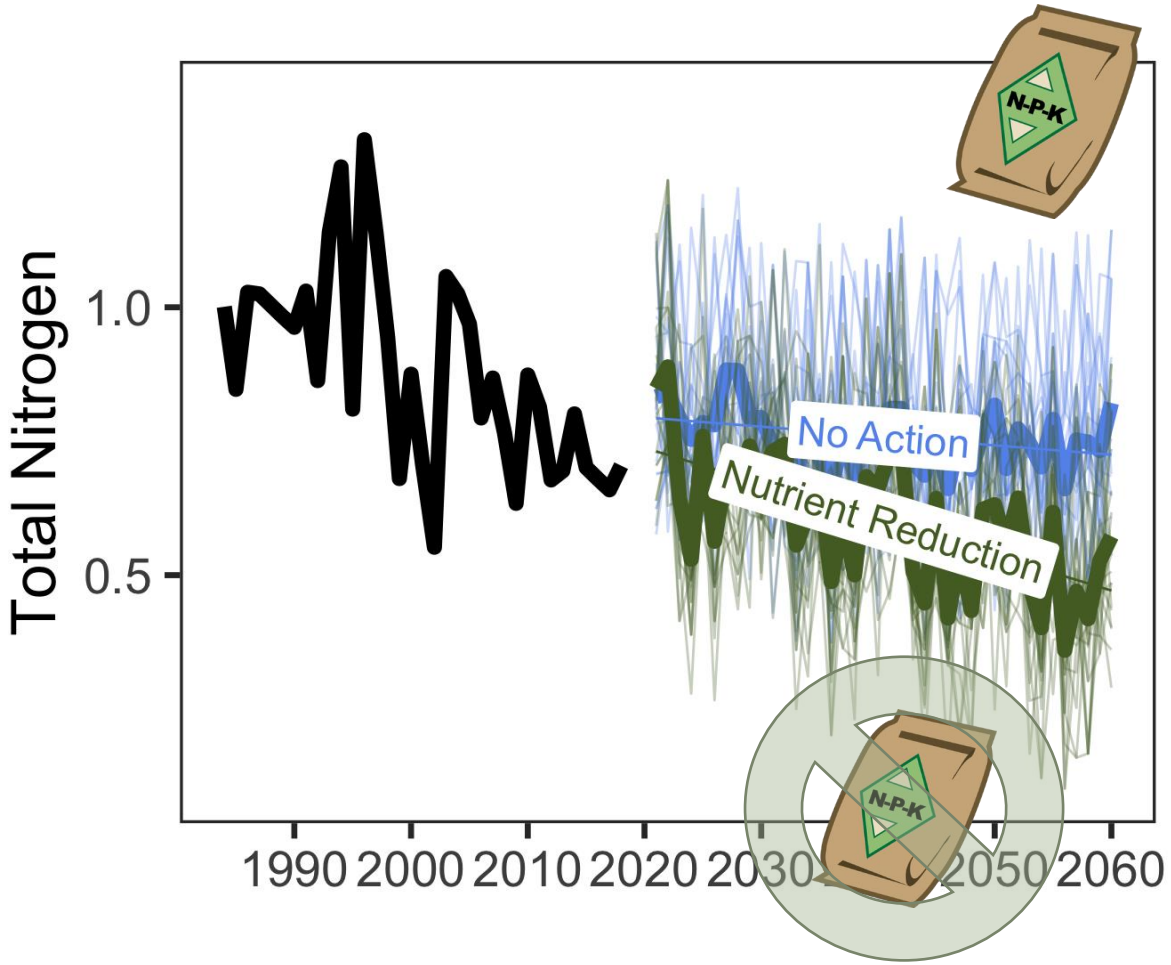
Step 2: Temperature increase, rainfall variation in both scenarios, further nutrient reductions vs no action

~2°C Rise over 40 years





Predicting the future in three steps|

Step 1: How have past environmental conditions affected seagrass communities?

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-Created 2 scenarios: temp increases, rainfall variability, with vs without nutrient reductions

Step 3: How will shifting conditions and shifting species affect seagrass meadow coverage into the future?

Predicting the future in three steps|

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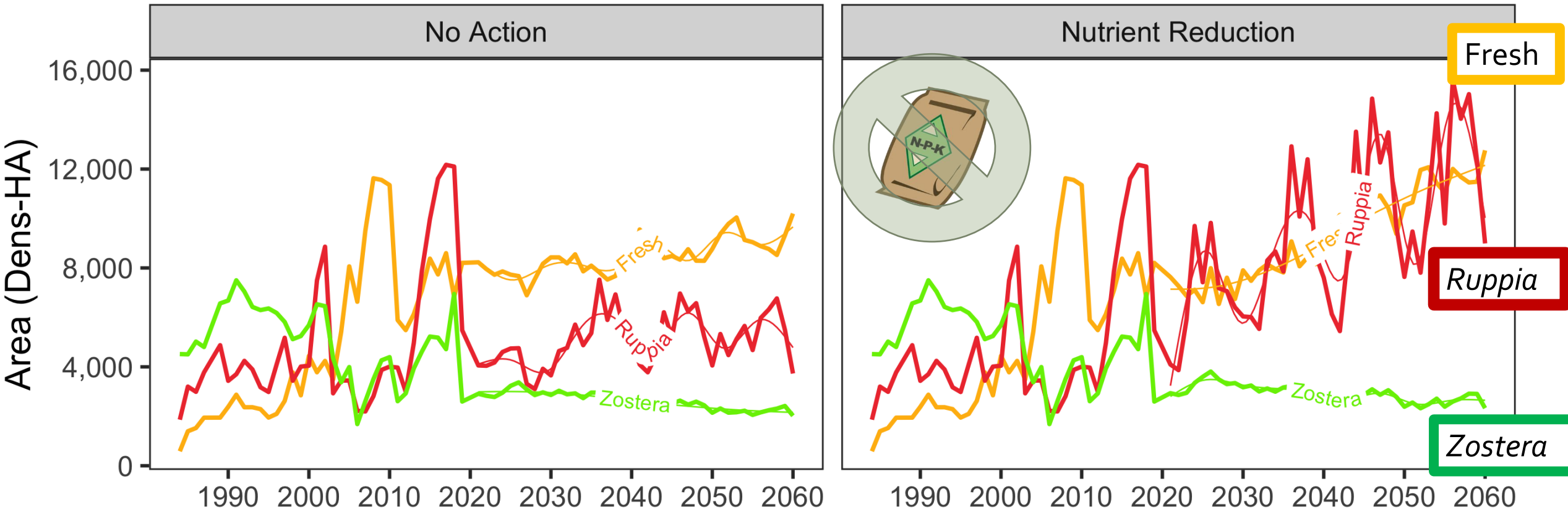
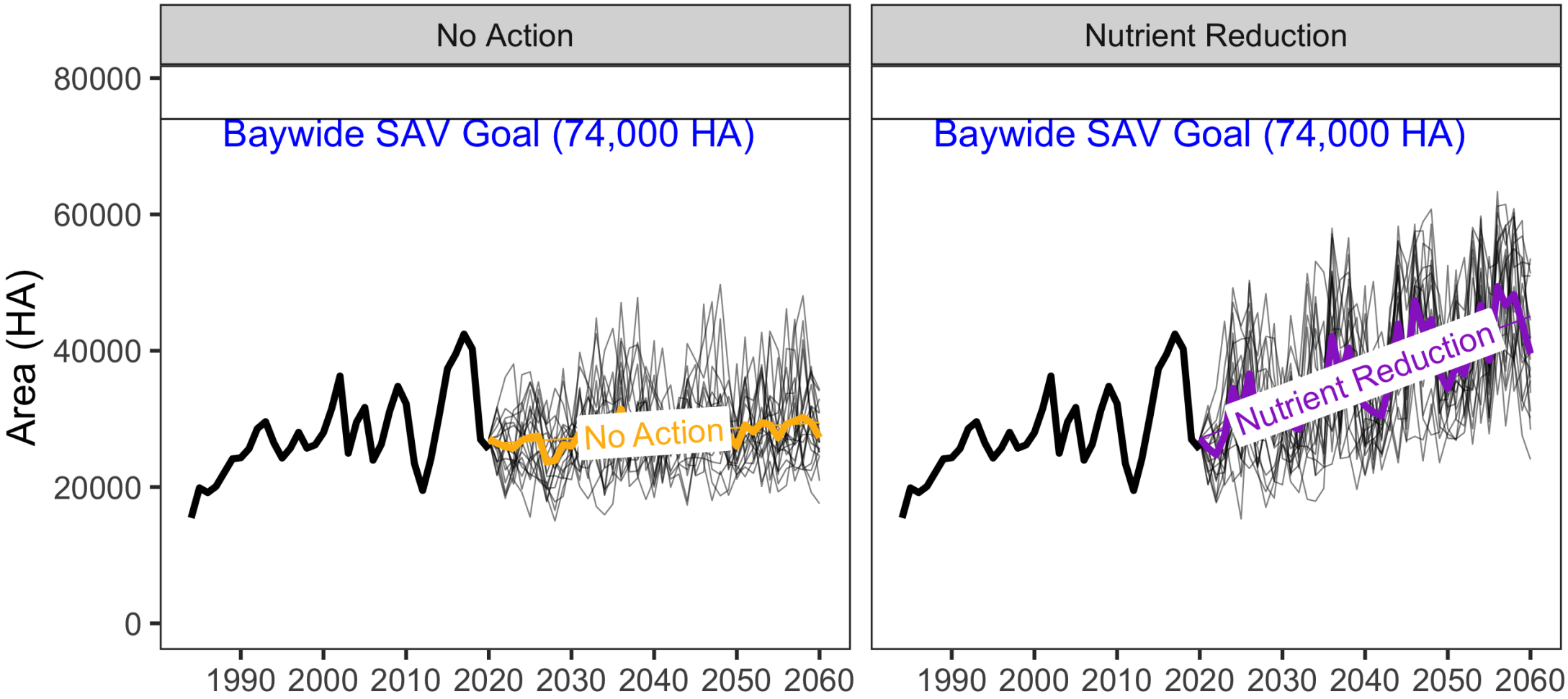
Temperature increases exacerbate shift in dominant species identity (mean of 20 sims visualized)



0% of No Action simulations reach Baywide goals, 0% of Nutrient reduction simulations reach Baywide goals..but get much closer by 2060!



SUMMARY|

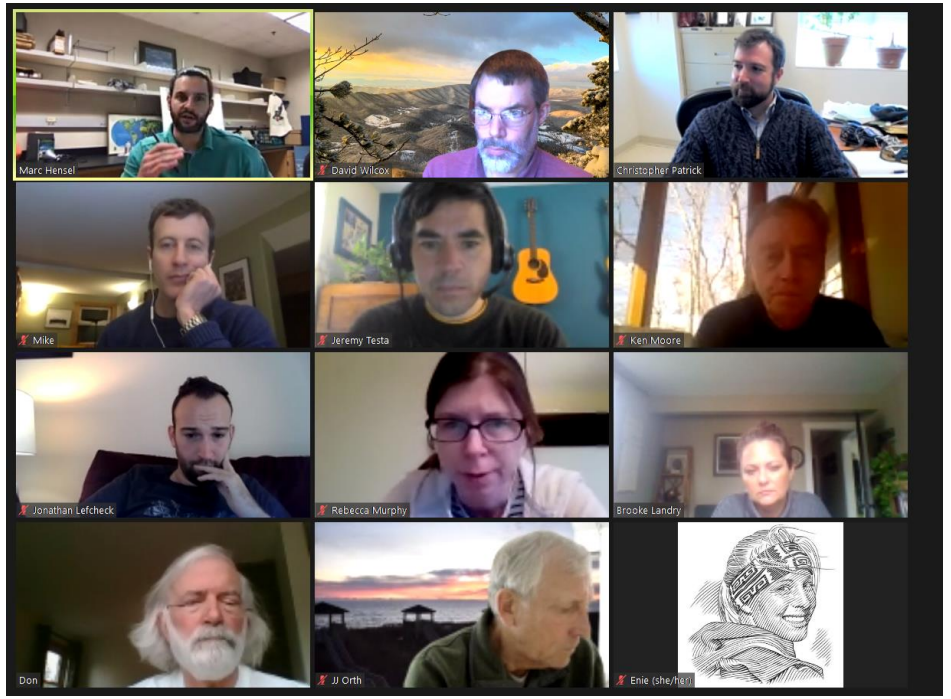
Temperature increases will widen the shift in dominant species, and management must adjust accordingly.

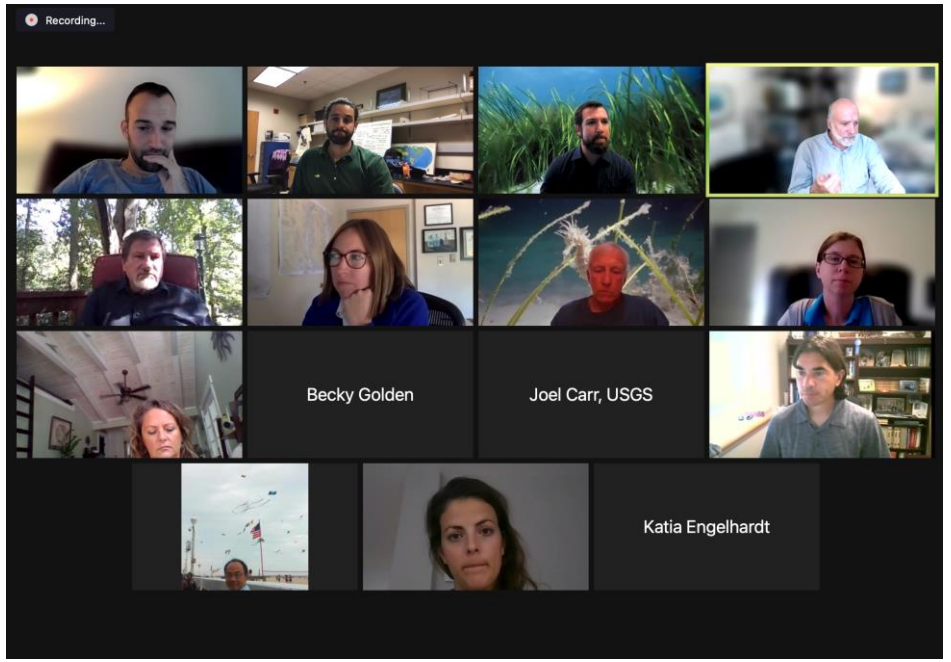
Nutrient reductions in the tidal fresh/oligohaline & *Ruppia* zones are essential, especially because the new dominants respond best to nutrient managements

Mechanistic predictions of no analogue environments is possible! In the meantime, we must start modelling species shifts, food web shifts, and changes in fisheries/BC/services

THANKS to our steering committee!

Robert J. Orth, Bill Dennison, Rebecca Murphy, Jeremy Testa, Matt Fitzpatrick, Katia Engelhardt, Cassie Gurbisz, Karen McGlathery, Aaron Kornbluth, Joel Carr, Lewis Linker, Brooke Landry, Kathrynlynn Theuerkauf, Rebecca Golden





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