



# **New Tools to Synthesize Community Response to Multiple Climate Drivers and Management Strategies**

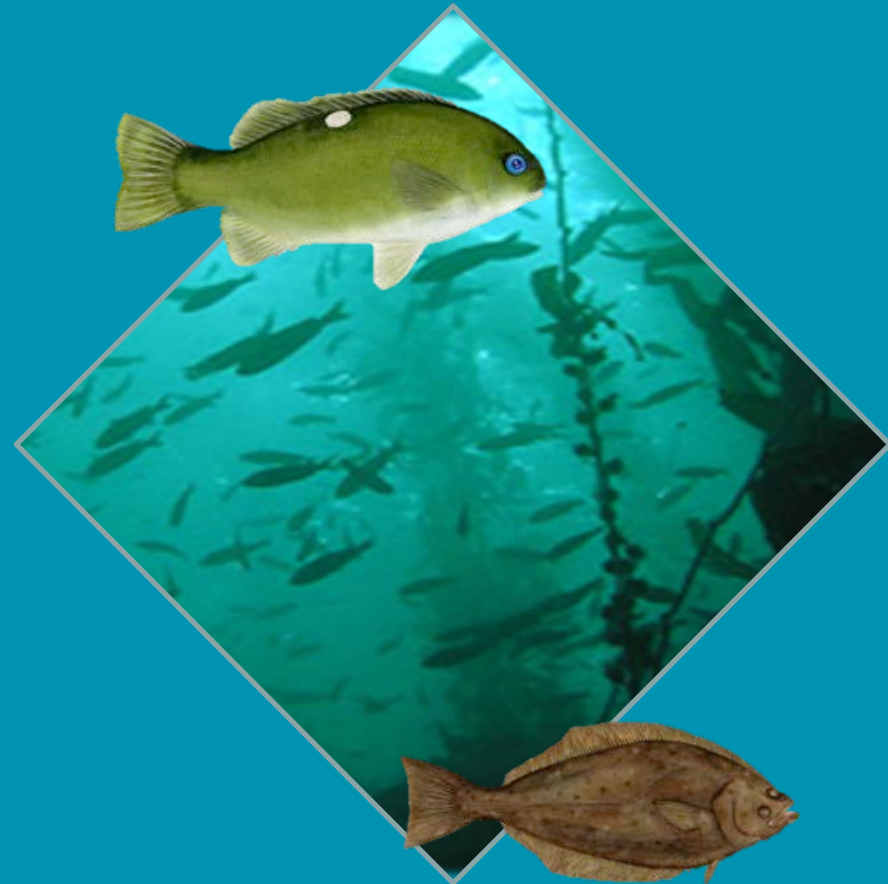
**R. Freedman, C. Caldow, J. Brown and J. Caselle**

**5<sup>th</sup> Ocean Climate Summit**

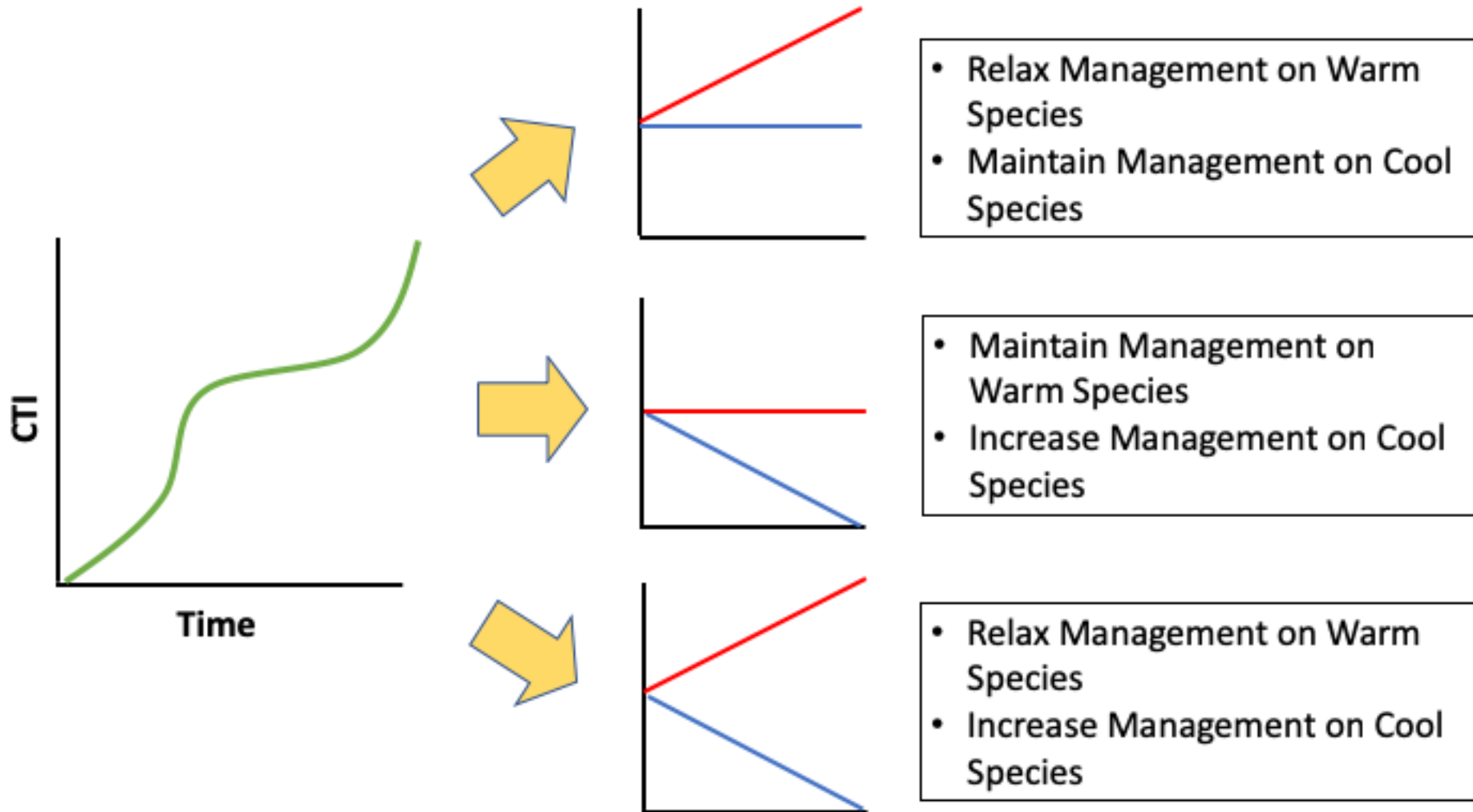
**April 18, 2019**

# Management Need

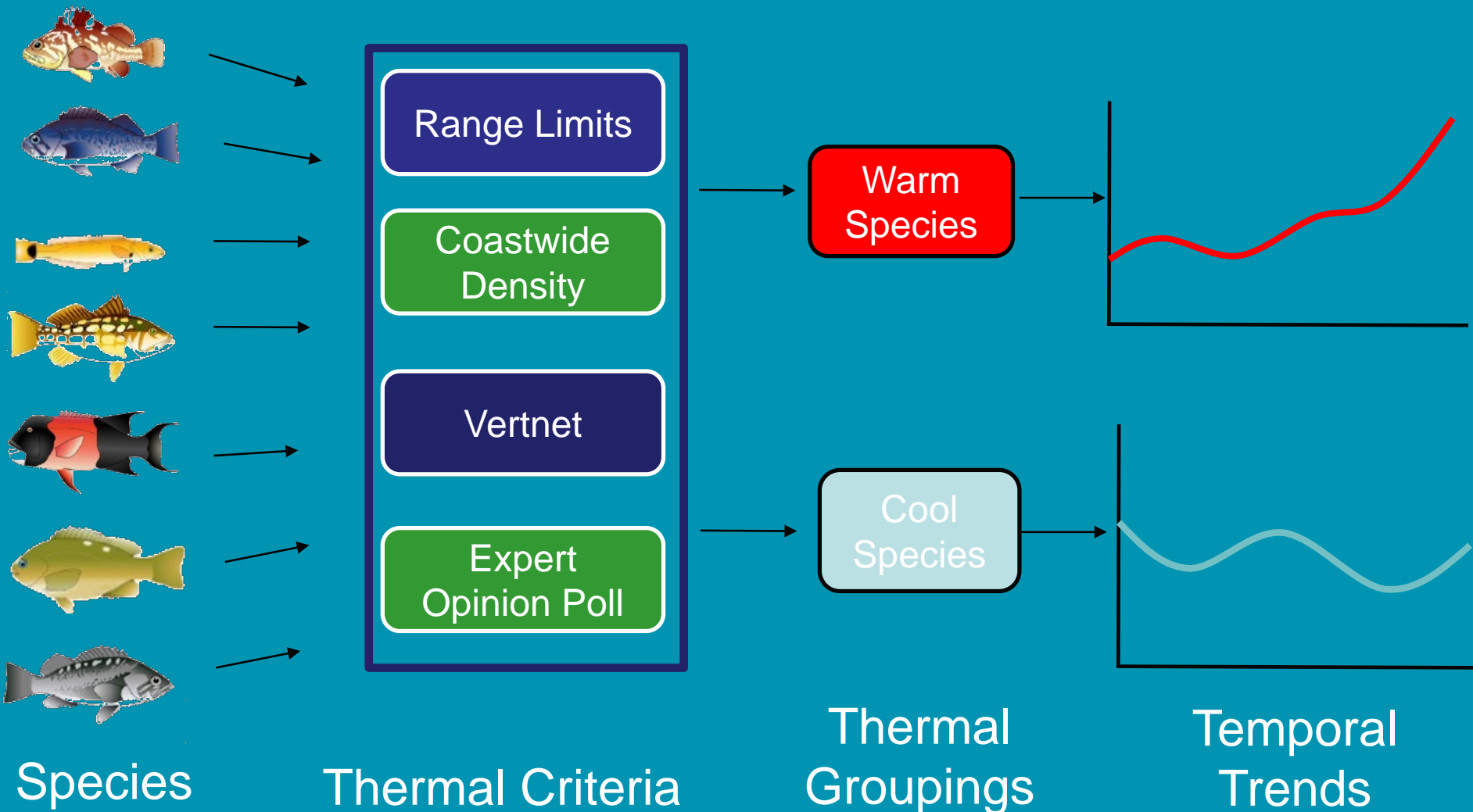
- As climate changes, managers need to understand how their ecosystems change
  - Studies typically focus on single species of concern
- To date, community metrics are limited
  - Based off limited data
  - Tested against thermal envelope only



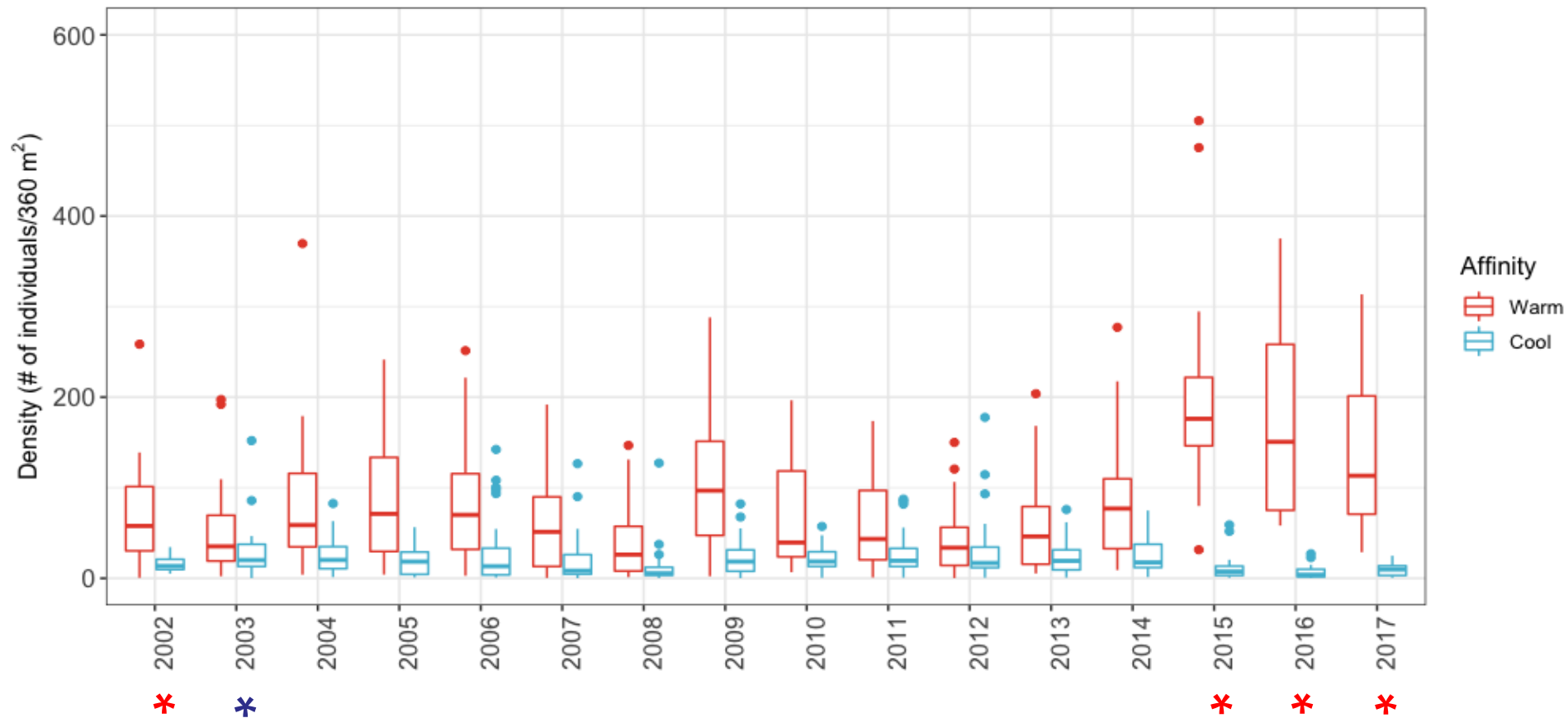
# Existing Indicators



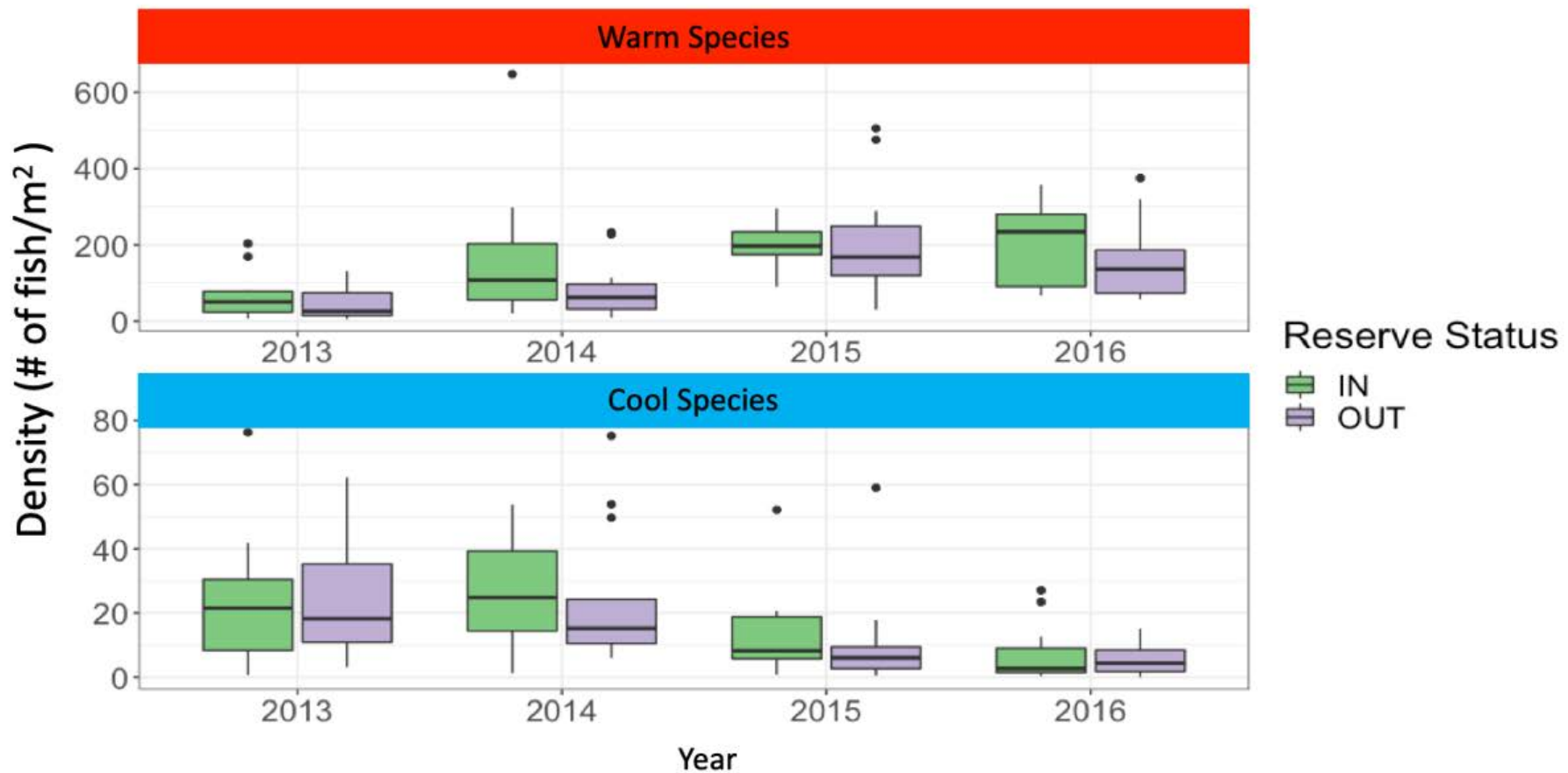
# Creating a New Robust Metric



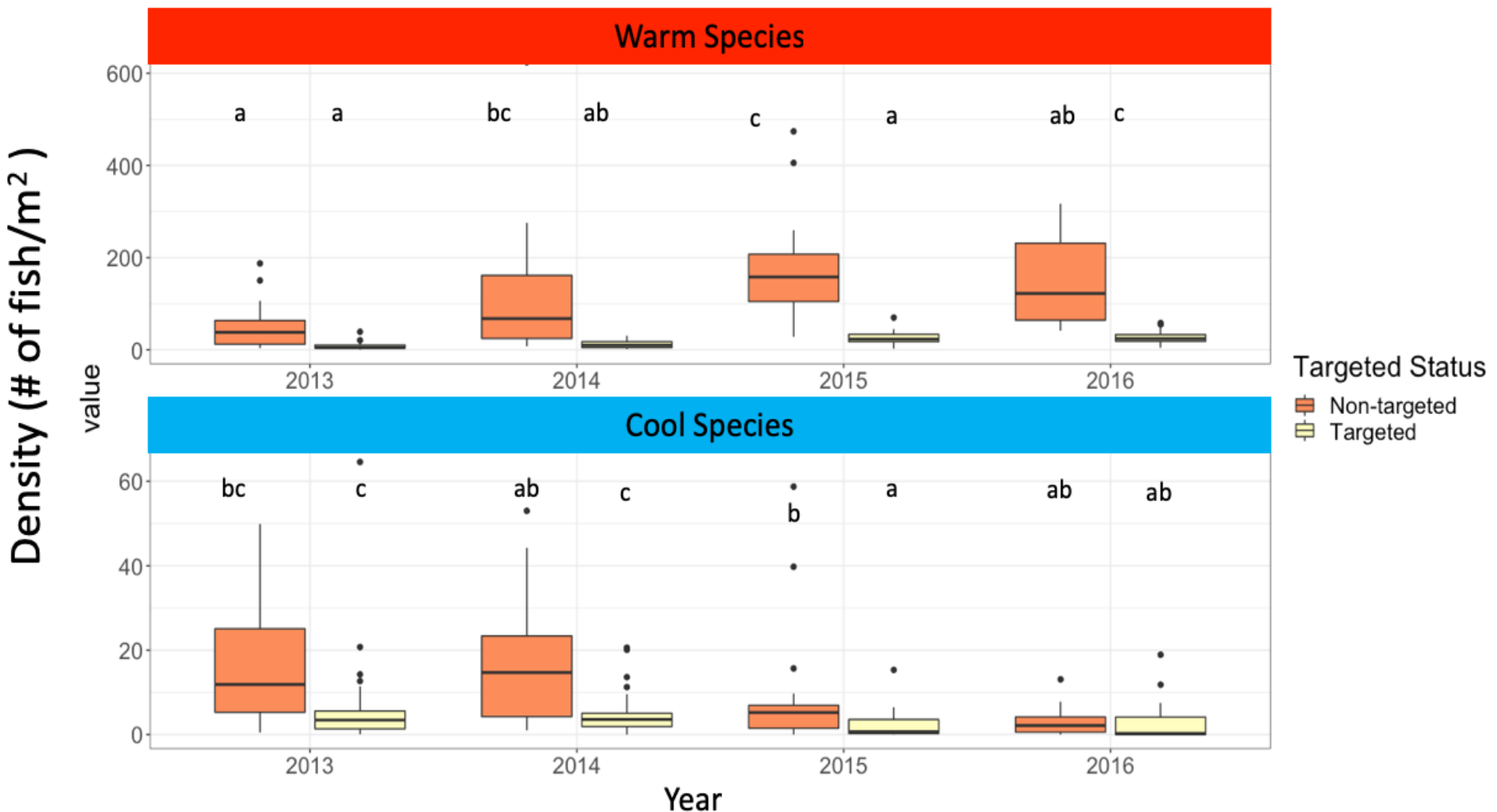
# Acute Climate Stressor Shift Communities....



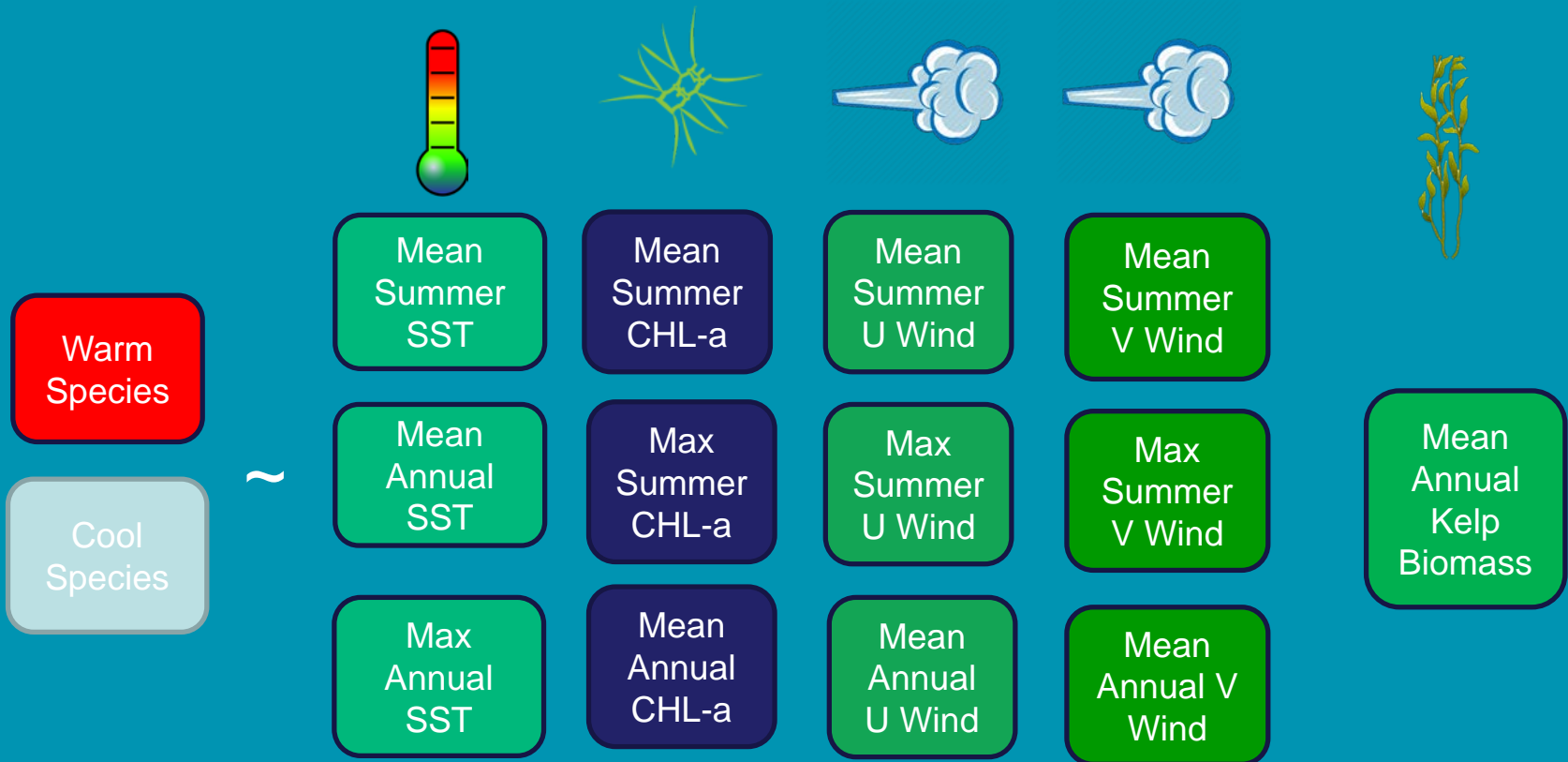
# ... But MPAS don't buffer these changes



# Species Respond Differently by Targeted Status

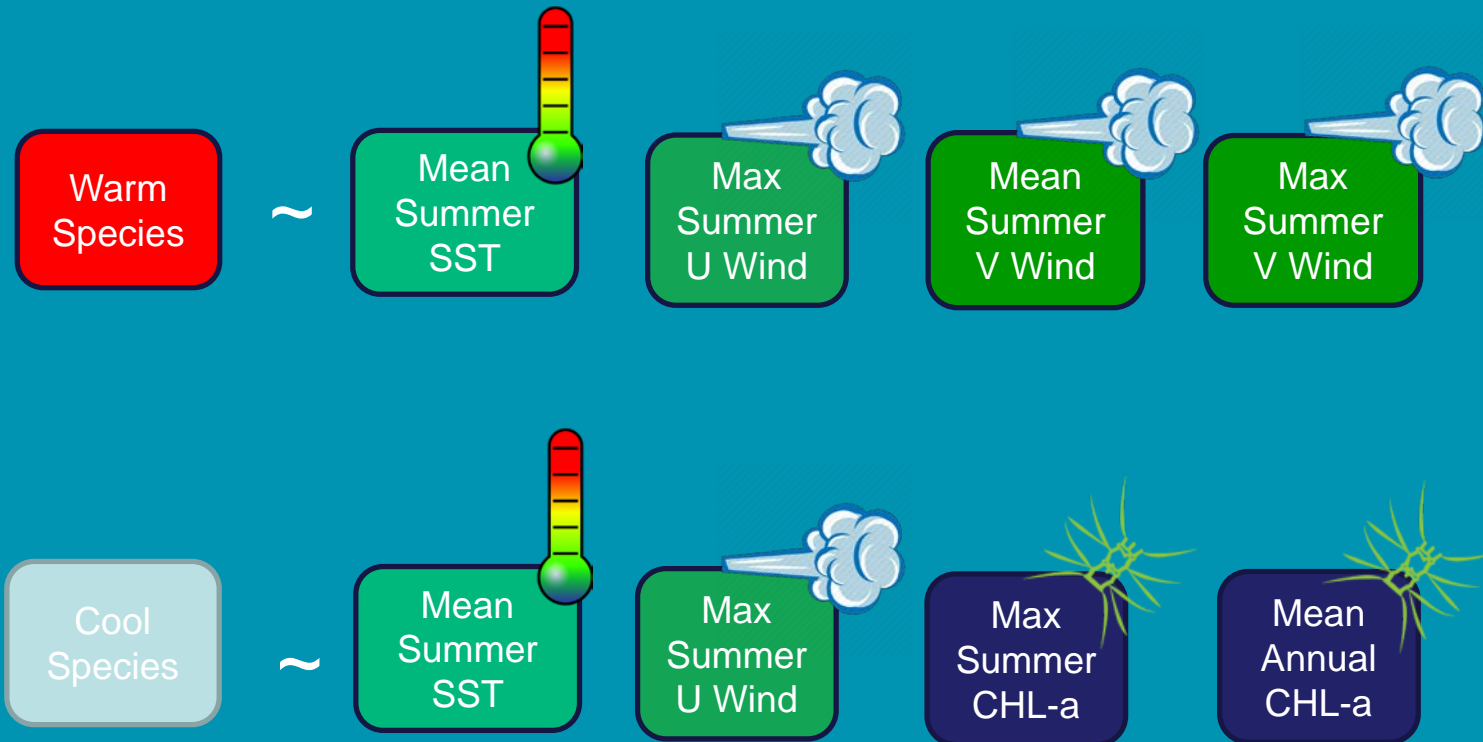


# Identifying Multiple Drivers





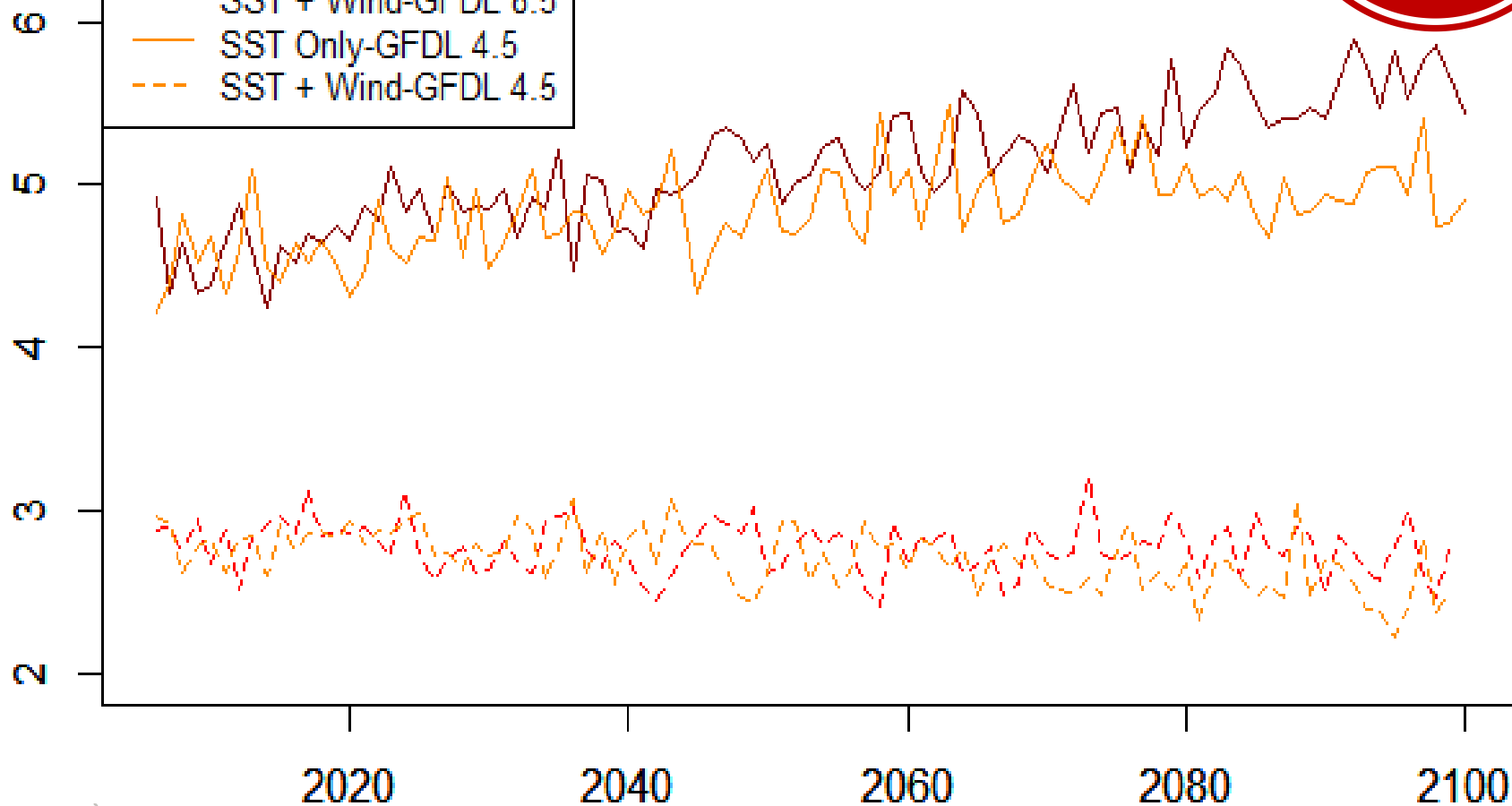
# Identifying Multiple Drivers



Warm  
Species  
Forecast

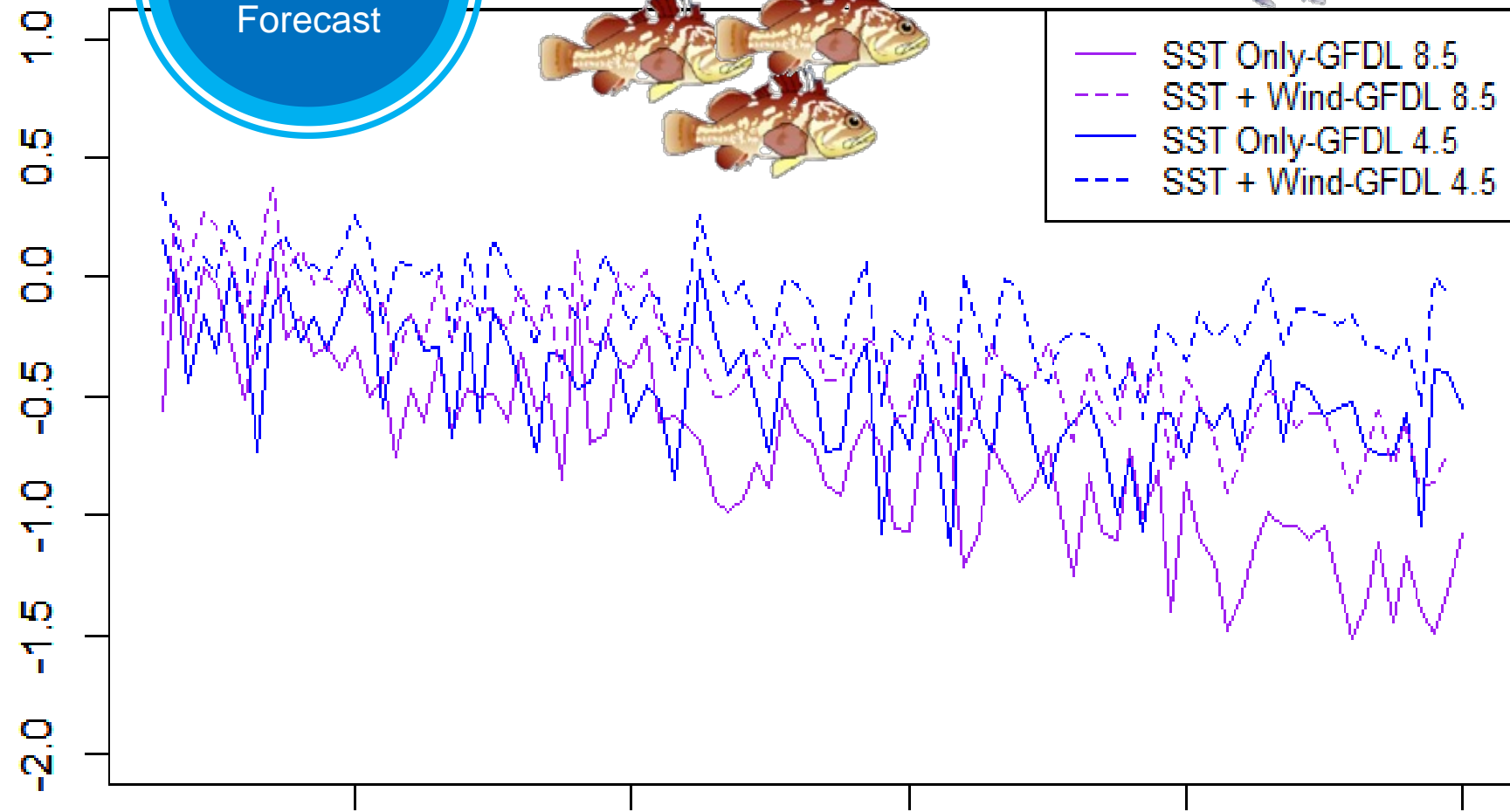
Summed Density

- SST Only-GFDL 8.5
- - - SST + Wind-GFDL 8.5
- SST Only-GFDL 4.5
- - - SST + Wind-GFDL 4.5



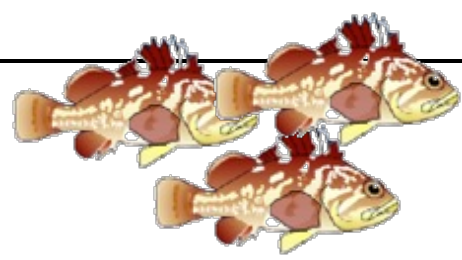
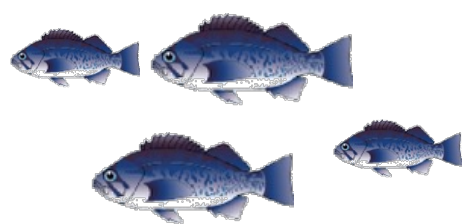
Cool  
Species  
Forecast

Summed Density



2020 2040 2060 2080 2100

Year



# Looking Forward

- Managers should consider synergistic and competing climate shifts
- Development of new metrics to track climate change should be a priority
- Comprehensive climate management should encourage multiple measures
  - Restoration
  - Fisheries
  - MPAs
  - Marine Spatial Planning





# Questions?

Thanks to: NOAA's IEA Program, NOAA's Office of National Marine Sanctuary, Lizzie Duncan, Lindsey Peavey, Kathy Broughton, Steve Gittings, Mitchell Tartt, CINMS' RAP, Chris Harvey, Jamel Samhour, Greg Williams

National Marine Sanctuaries  
National Oceanic and Atmospheric Administration



**Thank You!**