Toward dynamic harvest allocation rules for shifting species: a case study of three stocks in the Northeast US

Olaf Jensen
MAFMC-SSC

Center for Limnology
University of Wisconsin–Madison

Rod Fujita,
Environmental
Defense

Juliano Palacios-Abrantes,
U. of Wisconsin and UBC

Arielle Levine,
San Diego State U.

LENFEST
OCEAN
PROGRAM

Scott Crosson, NOAA

Chris Dumas, U. of North
Carolina - Wilmington

Katie Longo, Marine
Stewardship Council

FISH ARE MOVING ALL OVER THE WORLD

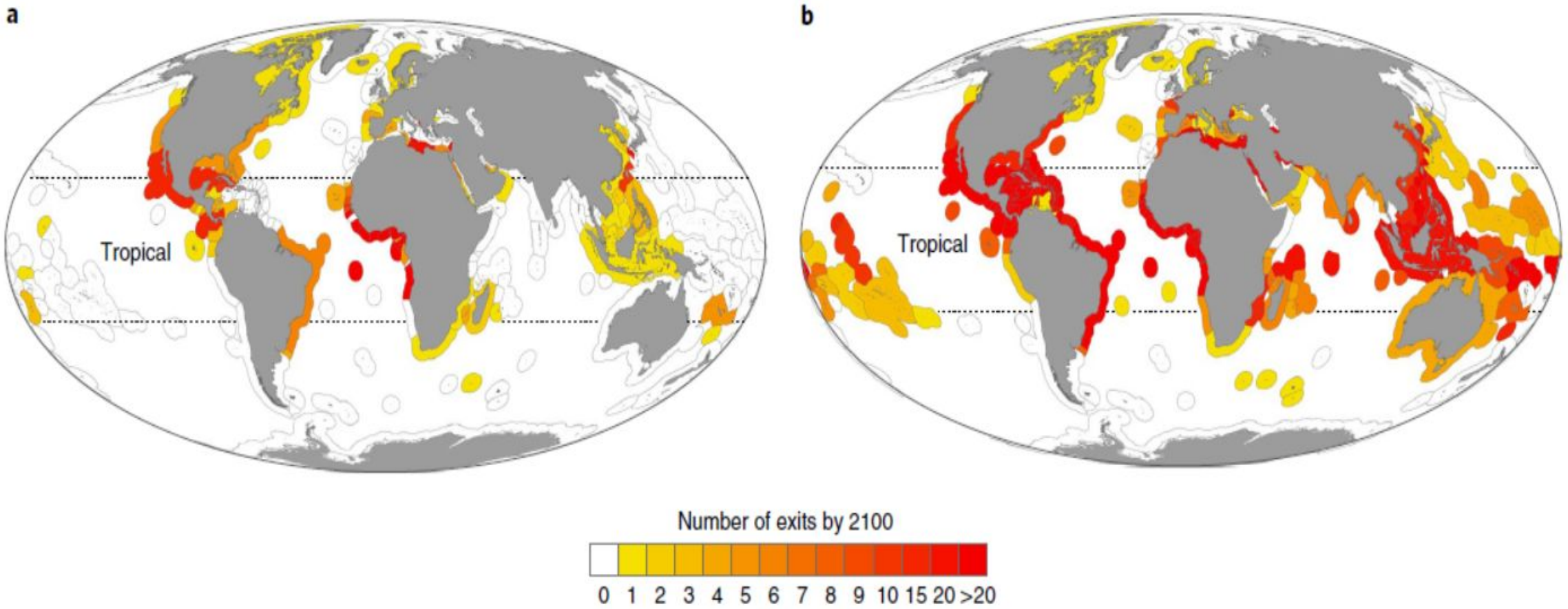
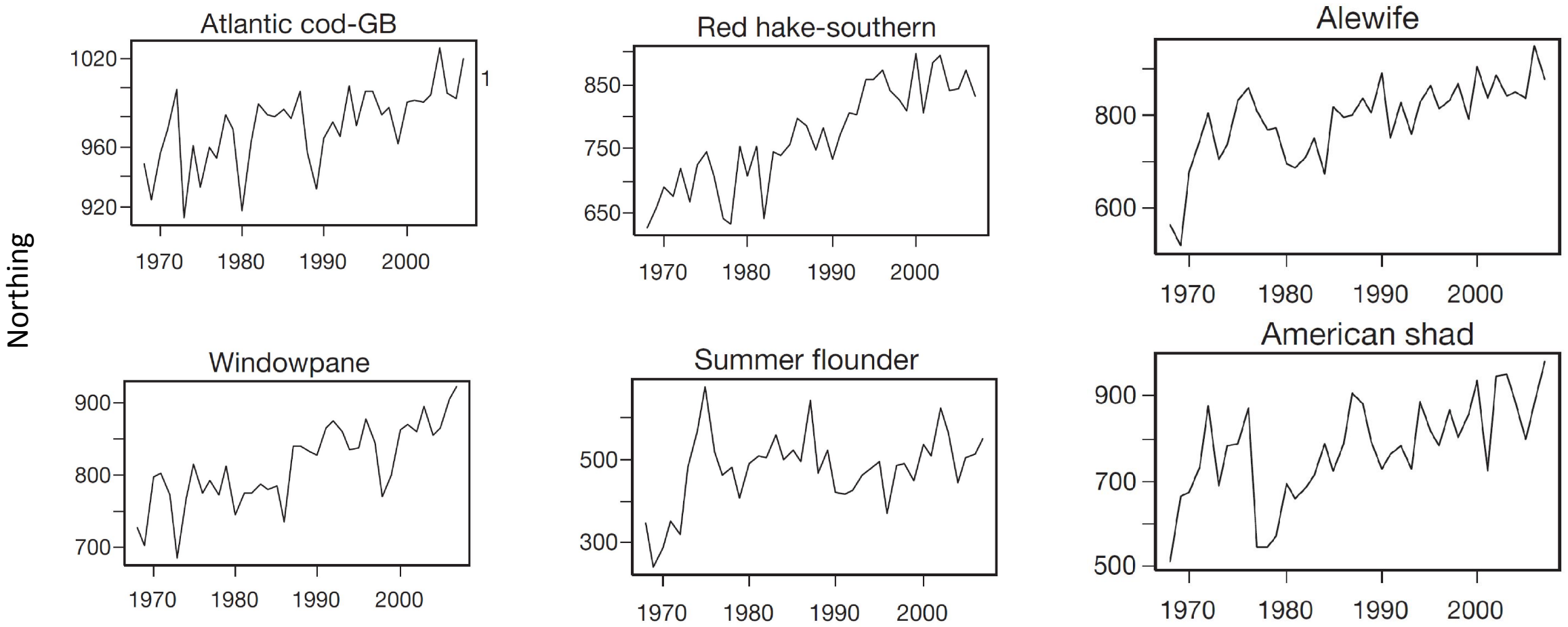


Fig. 1 | National loss of species. a,b, The number of species shifting out of each EEZ by 2100 under RCP 4.5 (**a**) and RCP 8.5 (**b**).

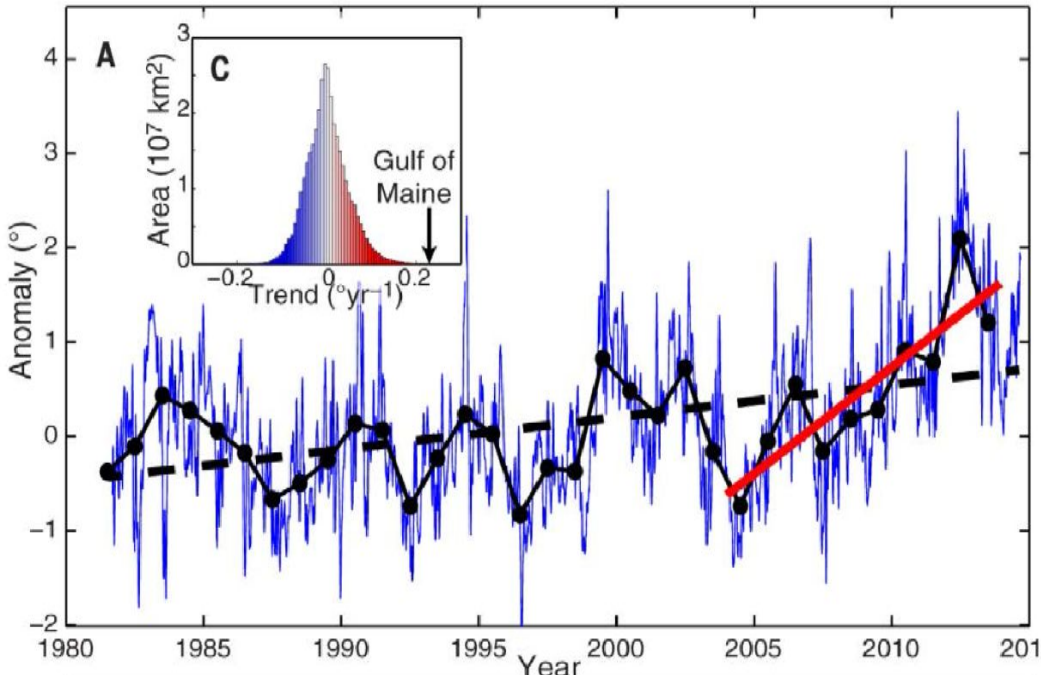
Oremus *et al.* 2020

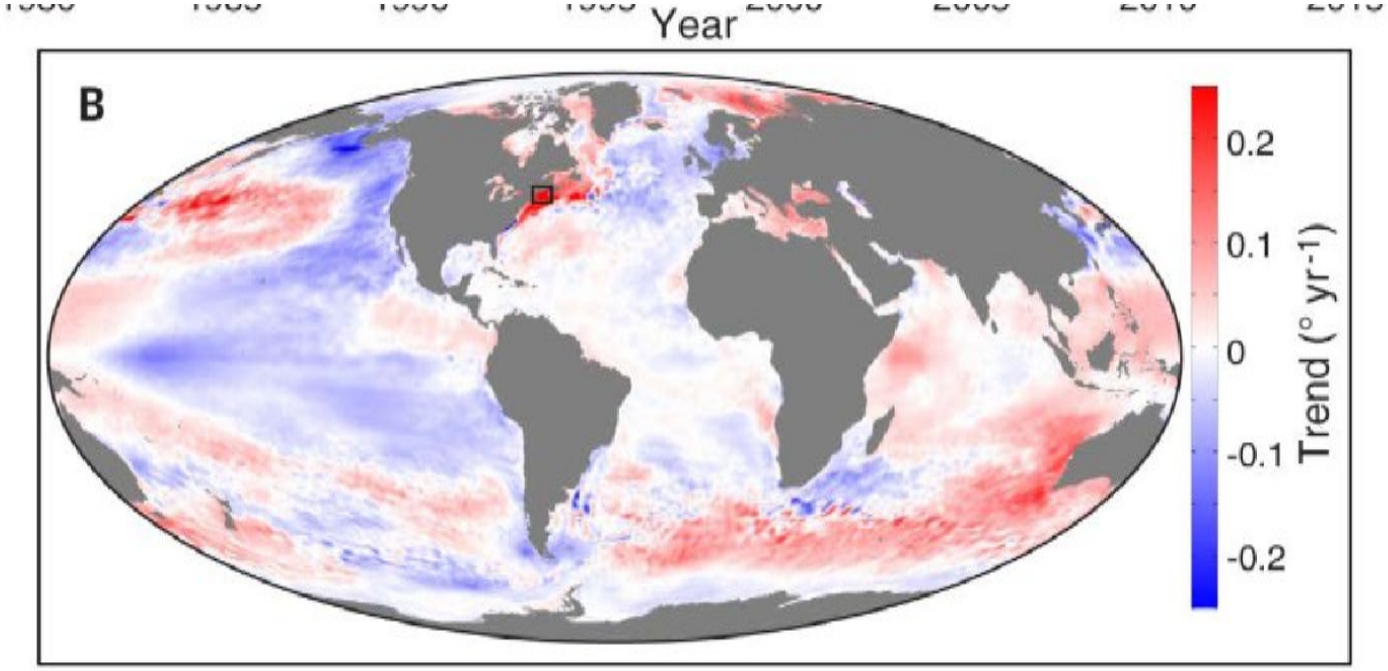
The US Northeast is no Execption



Nye et al. 2009

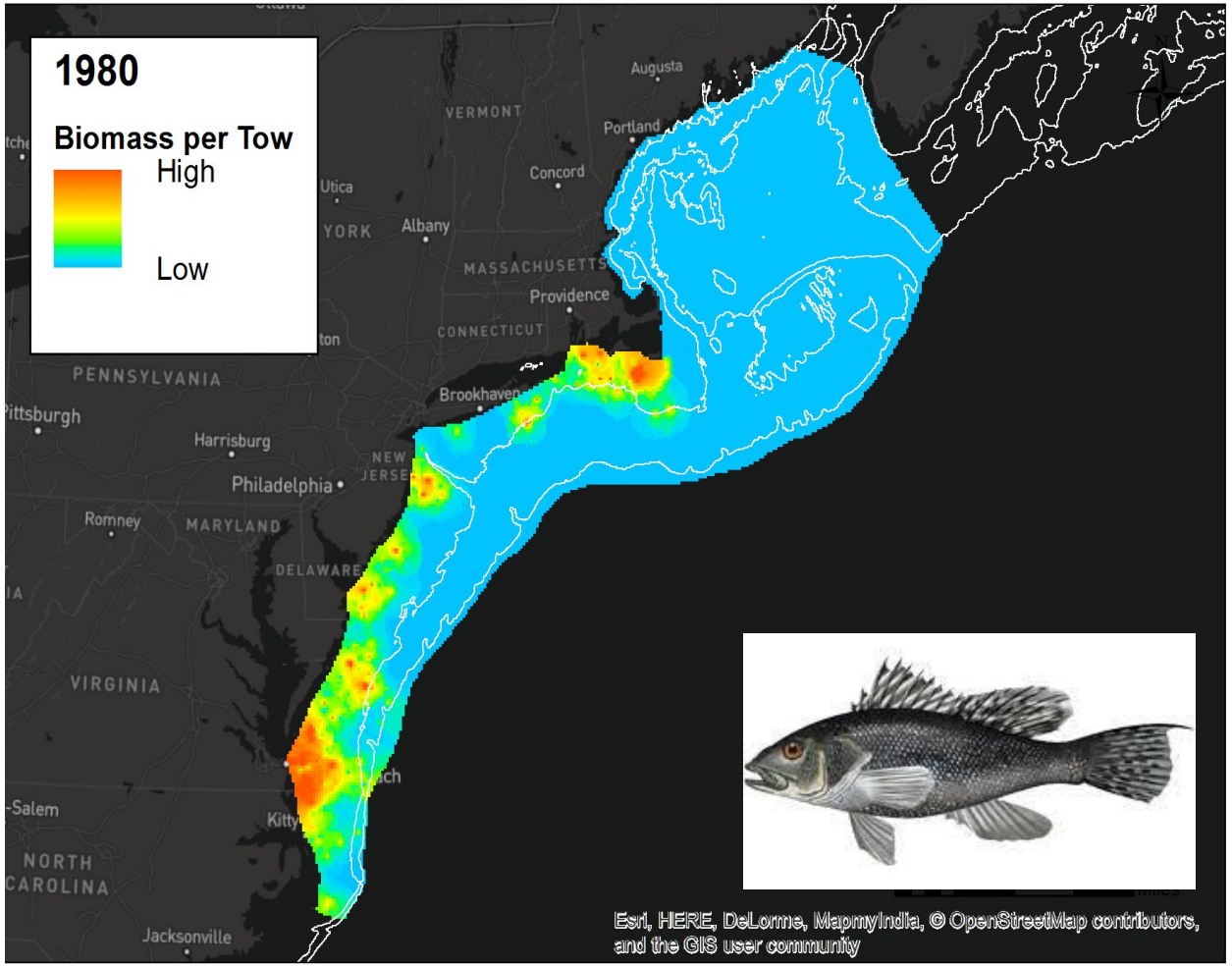
Extreme SST trends in NEUS





Pershing et al. 2015

STATE-LEVEL QUOTA ALLOCATIONS ARE CURRENTLY BASED ON HISTORIC CATCH



State	Percentage of Commercial Quota
Maine	0.4
New Hampshire	0.4
Massachusetts	15.6
Rhode Island	13.2
Connecticut	3.7
New York	8.6
New Jersey	20.1
Delaware	4.1
Maryland	8.9
Virginia	16.1
North Carolina	8.9

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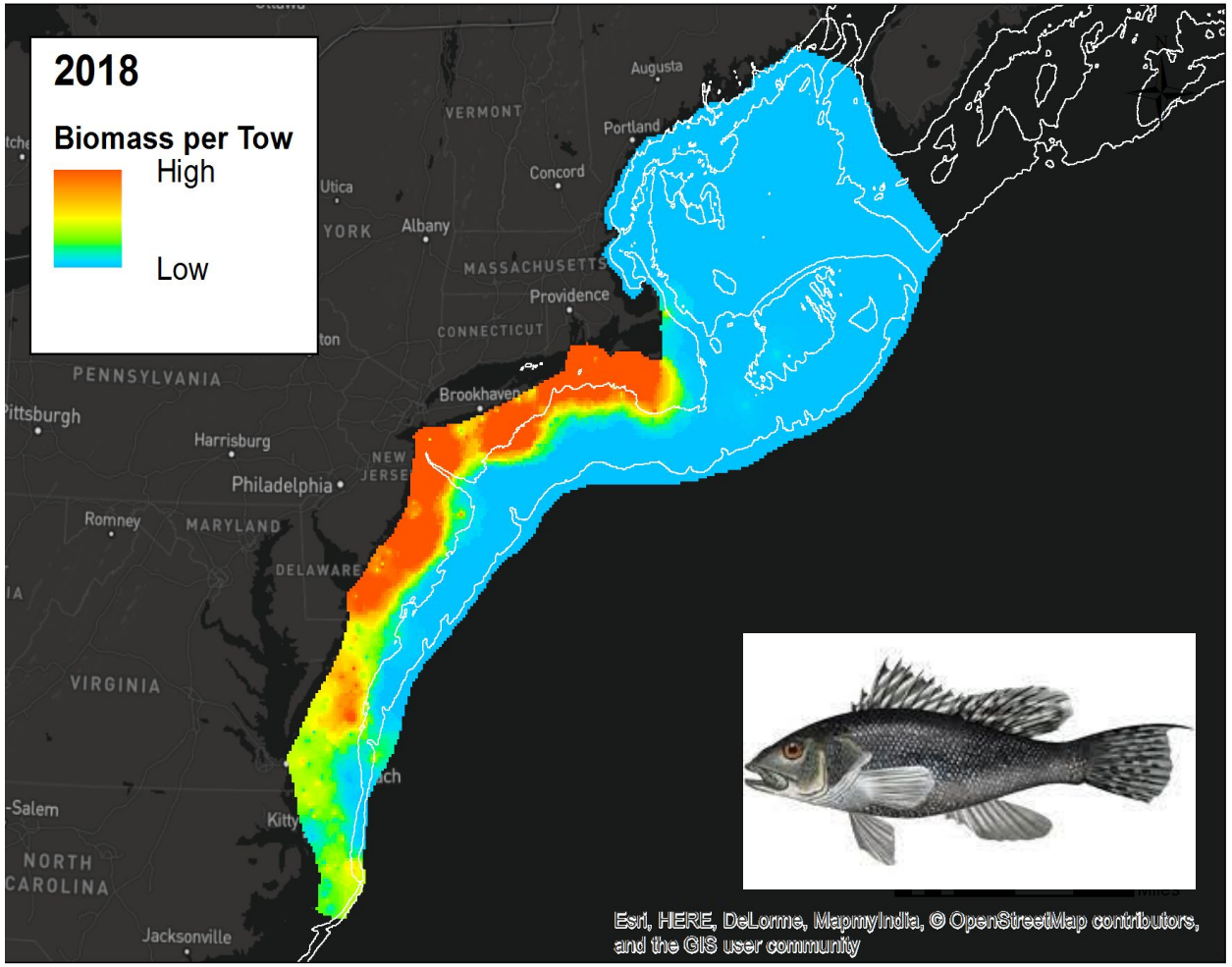

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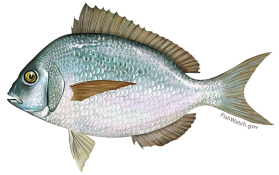
STATE-LEVEL TAC ALLOCATIONS ARE CURRENTLY BASED ON HISTORIC CATCH

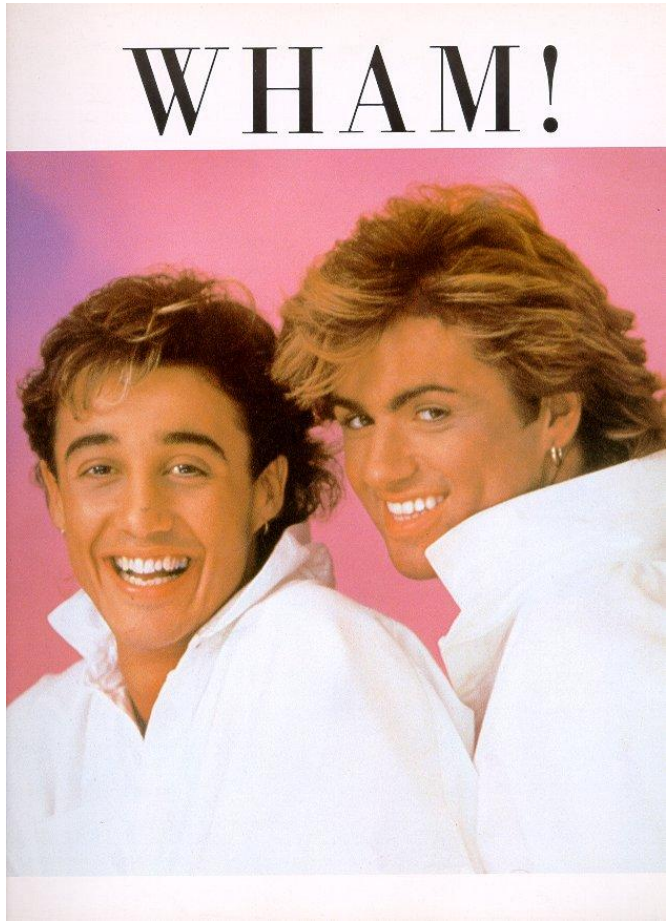
Reference Period

- 1980 – 2001 Black Sea Bass



- 1988 – 1992 Scup

- 1980 – 1986 Summer Flounder



Problem: states that have quota don’t have fish; states with fish don’t have quota

- Fishermen in northern states with insufficient quota:
  - lower daily trip limits, unplanned commercial closures
- Fishermen in southern states with quota:
  - travel to find the fish – economically inefficient, high GHG footprint

Solution: Dynamic (or adaptive) harvest allocation

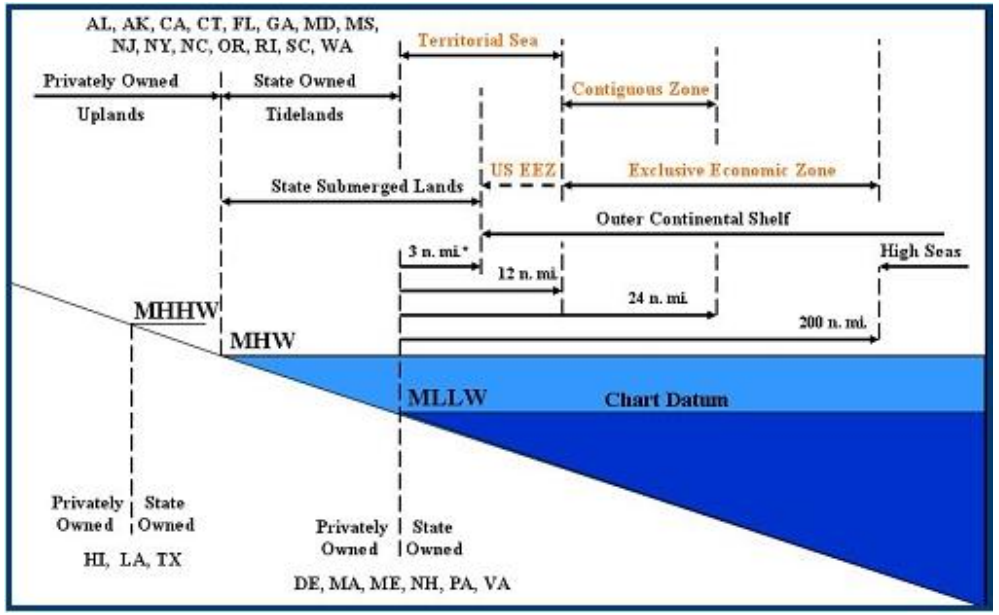
- As stocks shift, change the allocation of quota to reflect their distribution
- Pre-negotiated rule for changing quota allocation – analogous to HCR

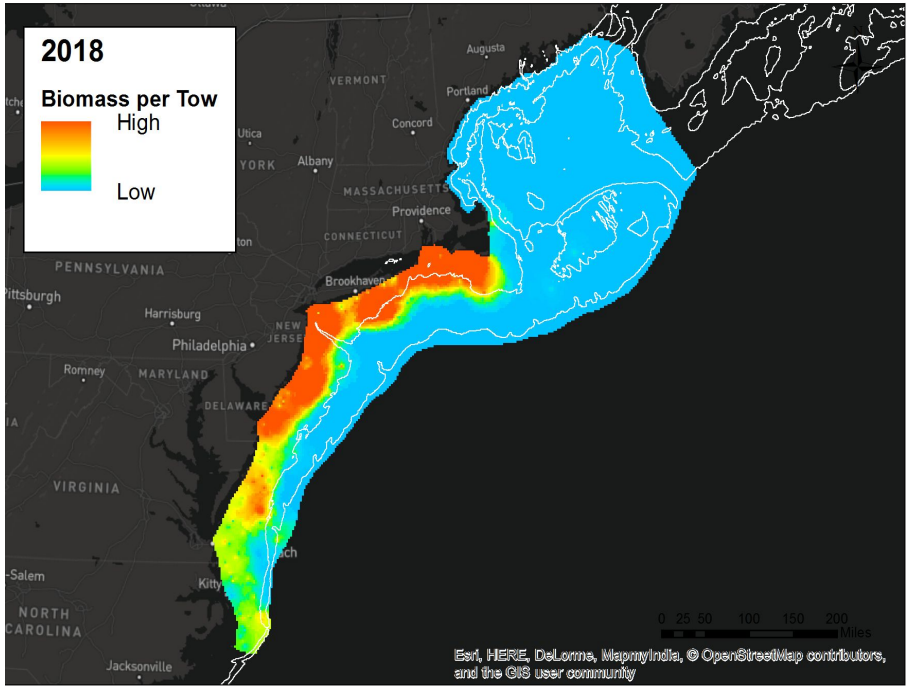
Challenges

- Hesitance to adopt new, untested rule with big but unknown consequences
- Range shifts are not monotonic and are not well predicted in advance
- Balancing multiple competing objectives: quota stability, responsiveness to range shifts, economic efficiency, multiple concepts of “fairness”
- How do you define the stock distribution with respect to individual states?

Defining the stock distribution with respect to individual states

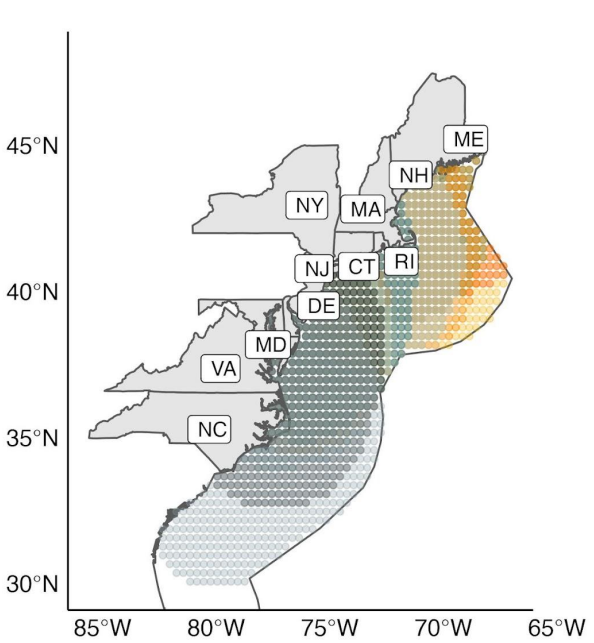
- To which states do you attribute fish in federal waters?
- What data do you use to define fish distributions?

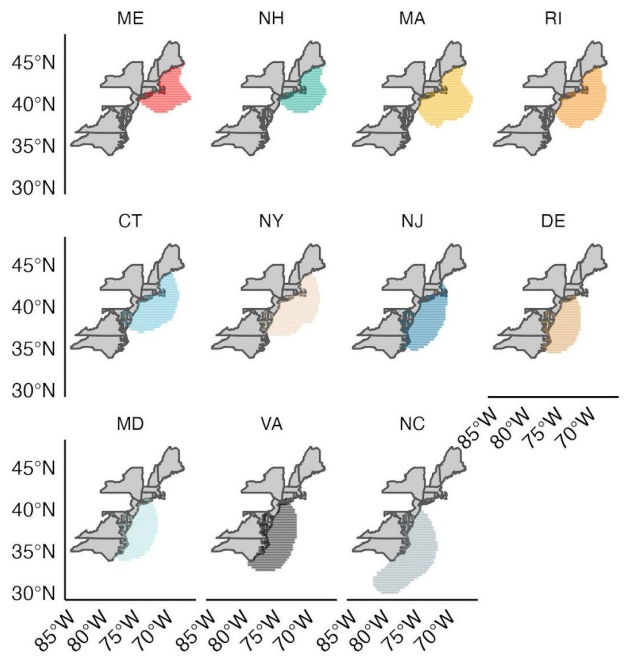




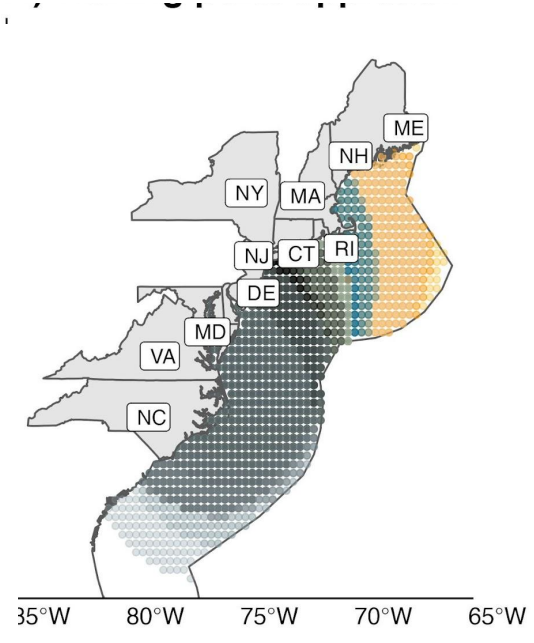
Defining state footprints within the US EEZ

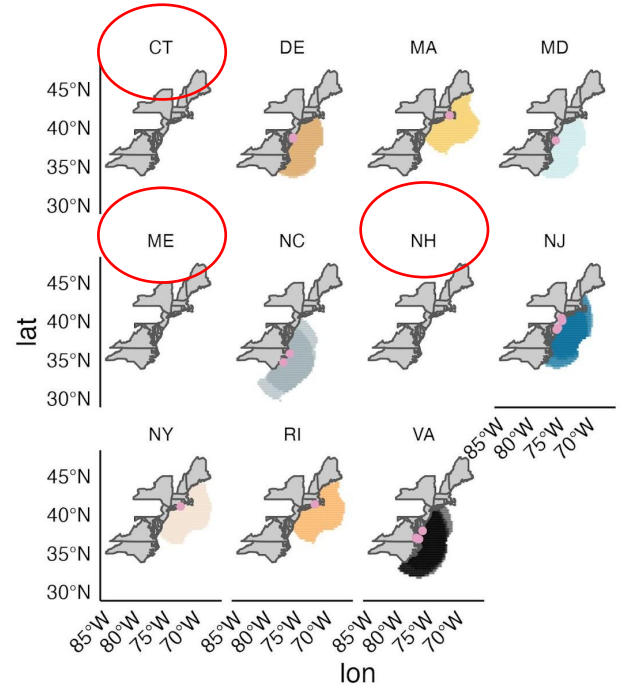
- Expand State Polygons



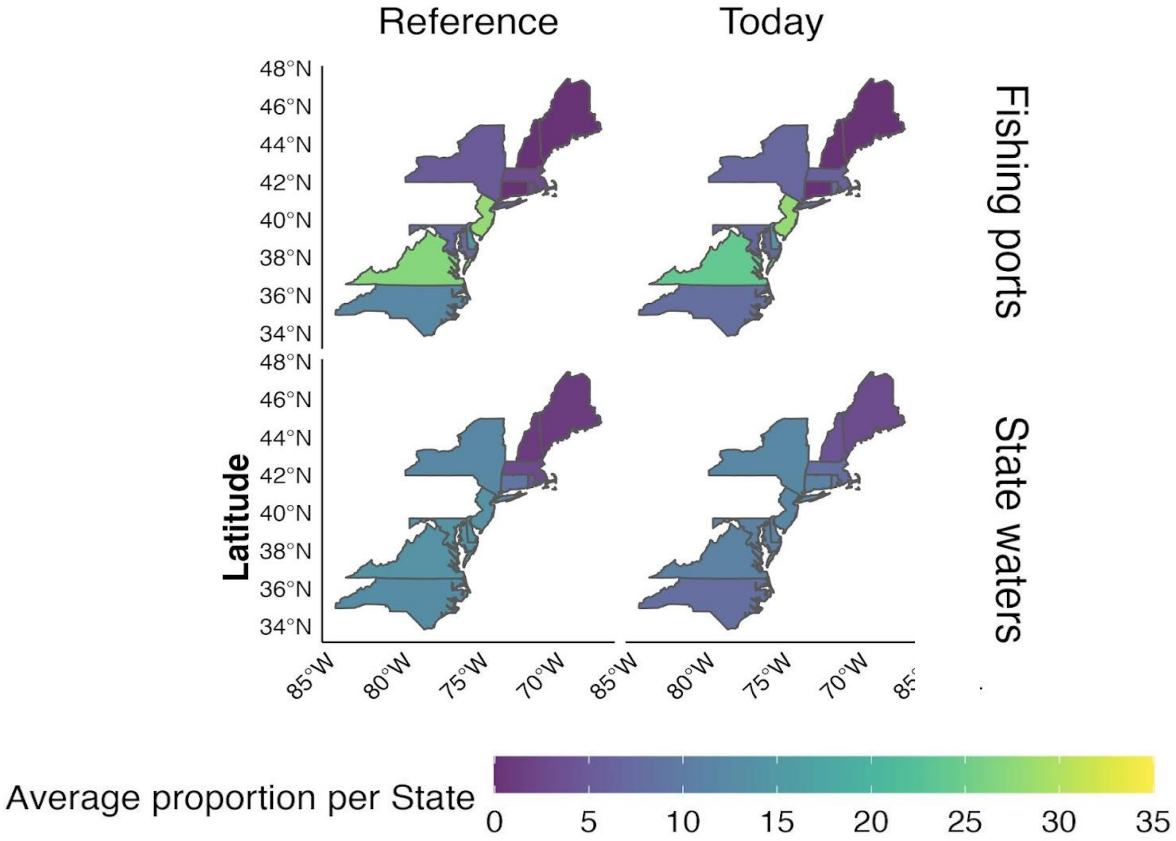


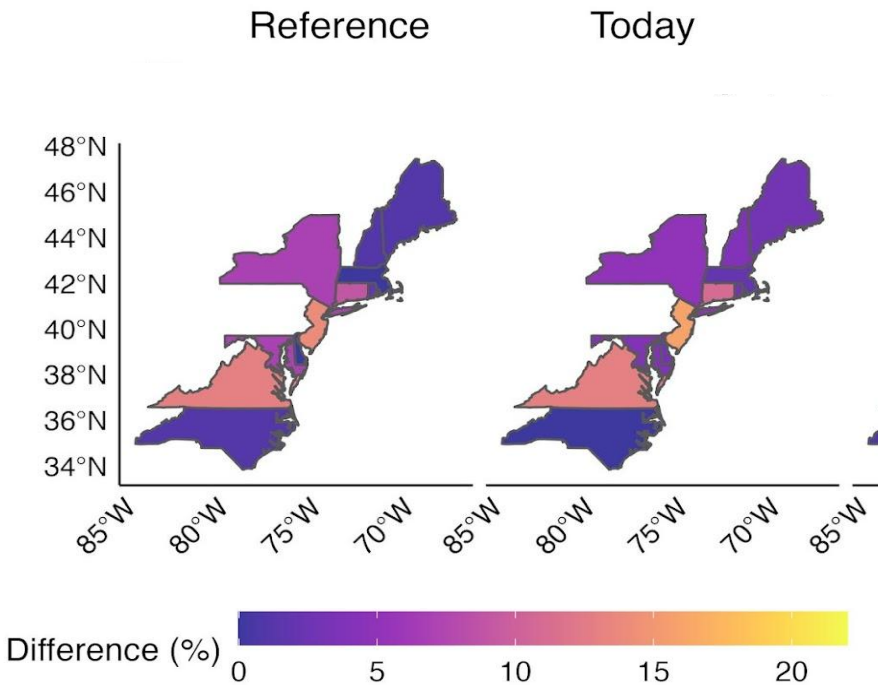
- Buffer Primary Fishing Ports



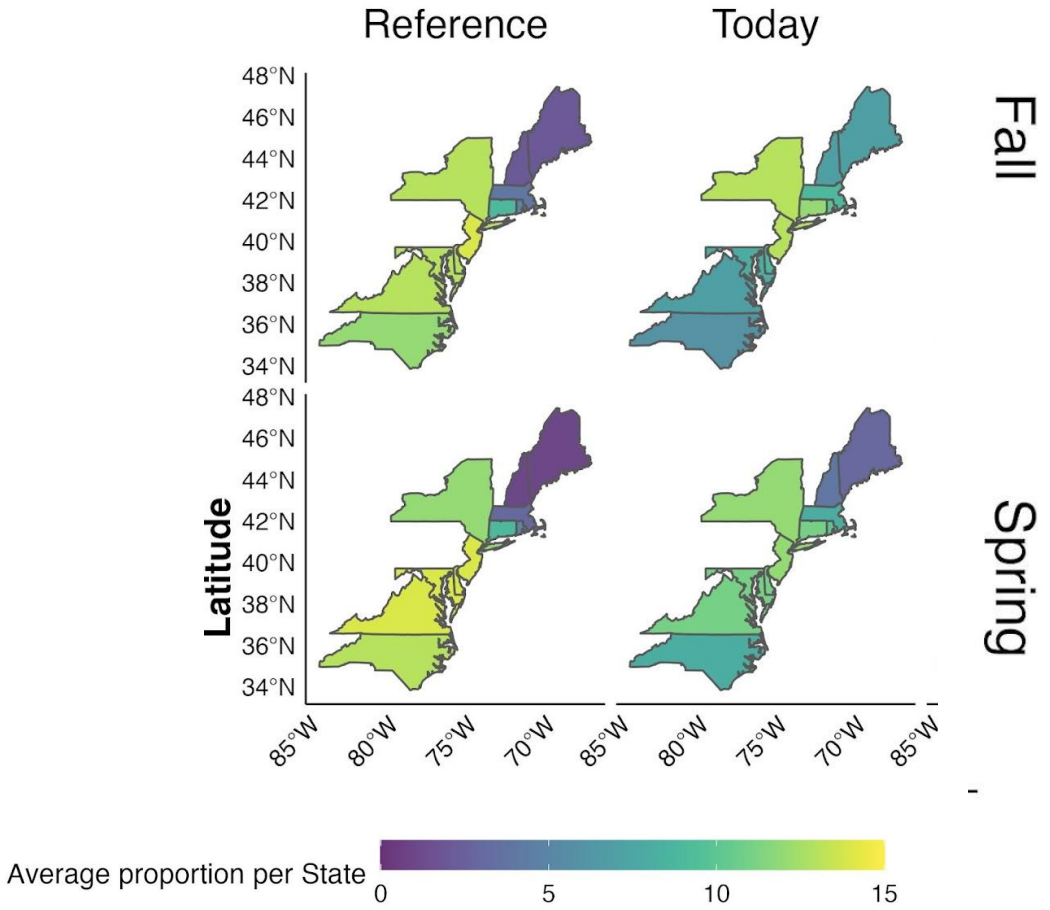


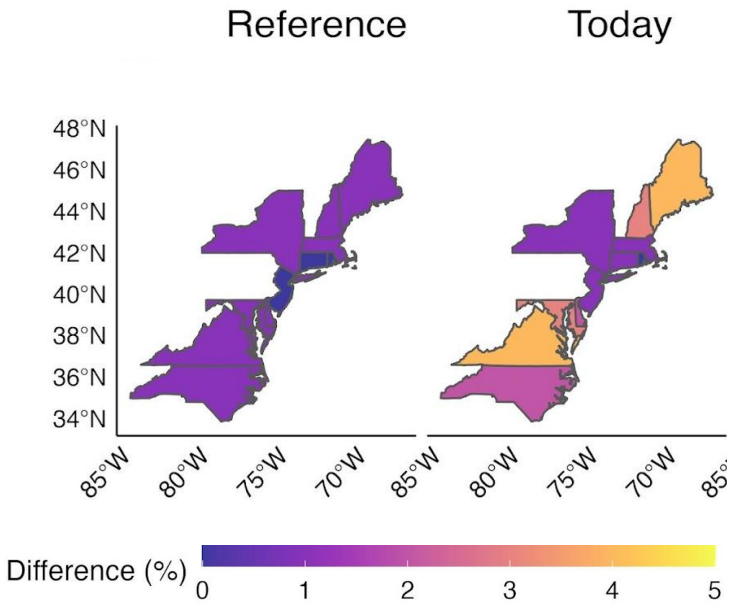
State footprint method matters





Survey season matters, but less so





Palacios-Abrantes *et al., In review*

Clear winners and losers between different approaches

Evaluating Historical Performance of Alternative Dynamic Allocation Rules

Example Dynamic Allocation Rules:

- Historical Baseline -- 100% historical landings / 0% based on biomass dist.
- Dynamic Reallocation (DARA) -- 0% historical landings / 100% based on biomass dist.
- Intermediate (Fifty-Fifty) --50% historical landings / 50% based on biomass dist.
- Gradual Shift (Phase In) -- 100% historical in year 1, 100% biomass dist. in final year
- Static Trigger -- 100% historical to catch trigger, 100% biomass shift beyond
- Maximize Economic Value

Economic Behavior and Impacts

Fleets:

"Follow 2019 fleets across time for each allocation scenario"
Comm Otter Trawl Vessel trips to fed waters, 2019 fleet, by port
Recr private/charter/headboat trips to fed waters, 2019 baseline trips, by state

Trip Behavior:

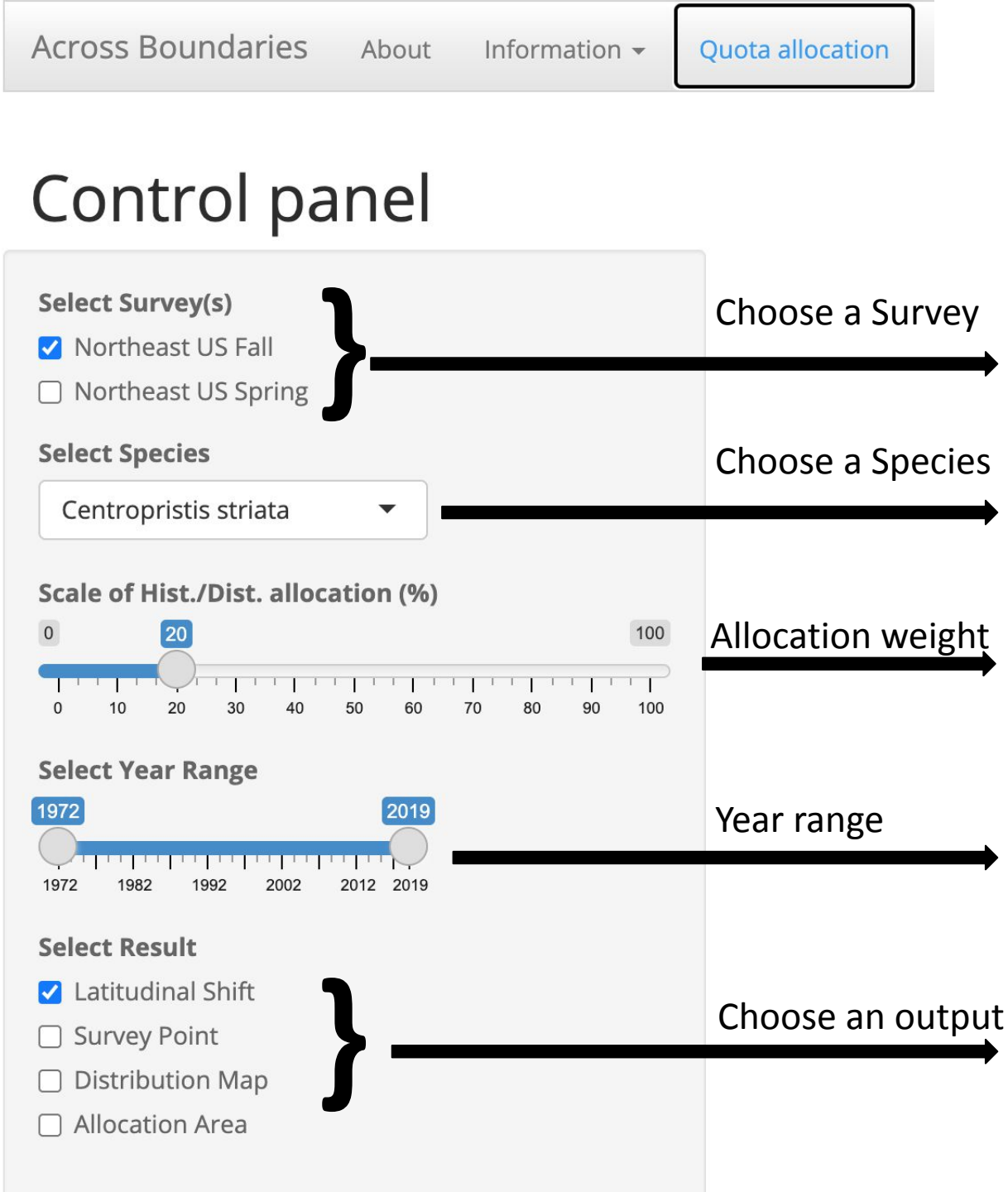
Fishing site choice by day = f(relative fish abundance, site distance, fuel price)
Comm: vessel-level choice. Recr: estimate # trips by state to each site.

Alternative Allocation Rules:

Constrain catch in different ways: by fleet, by state, by year, by site

Results:

Landings and Discards by fleet, state, site
Comm Ex-Vessel Revenues, Trip Distances, Econ Impacts
Recr CPUE, # Trips, Trip Distances, Econ Impacts



Outputs

- Biological / Fishery
  - Stock distribution
  - State-level distribution proportions

Coming Soon!

- Economic outputs
  - Fishing revenue
  - Employment

https://jepa.shinyapps.io/allocation_tool/

Across Boundaries | About | Information | Quota allocation

Control panel

Select Survey(s)

- [x] Northeast US Fall
- [ ] Northeast US Spring

Northeast US Fall

Select Species

Centropristis striata

Black Sea Bass

Scale of Hist./Dist. allocation (%)

0 20 100

0 10 20 30 40 50 60 70 80 90 100

NA

Select Year Range

1972 2019

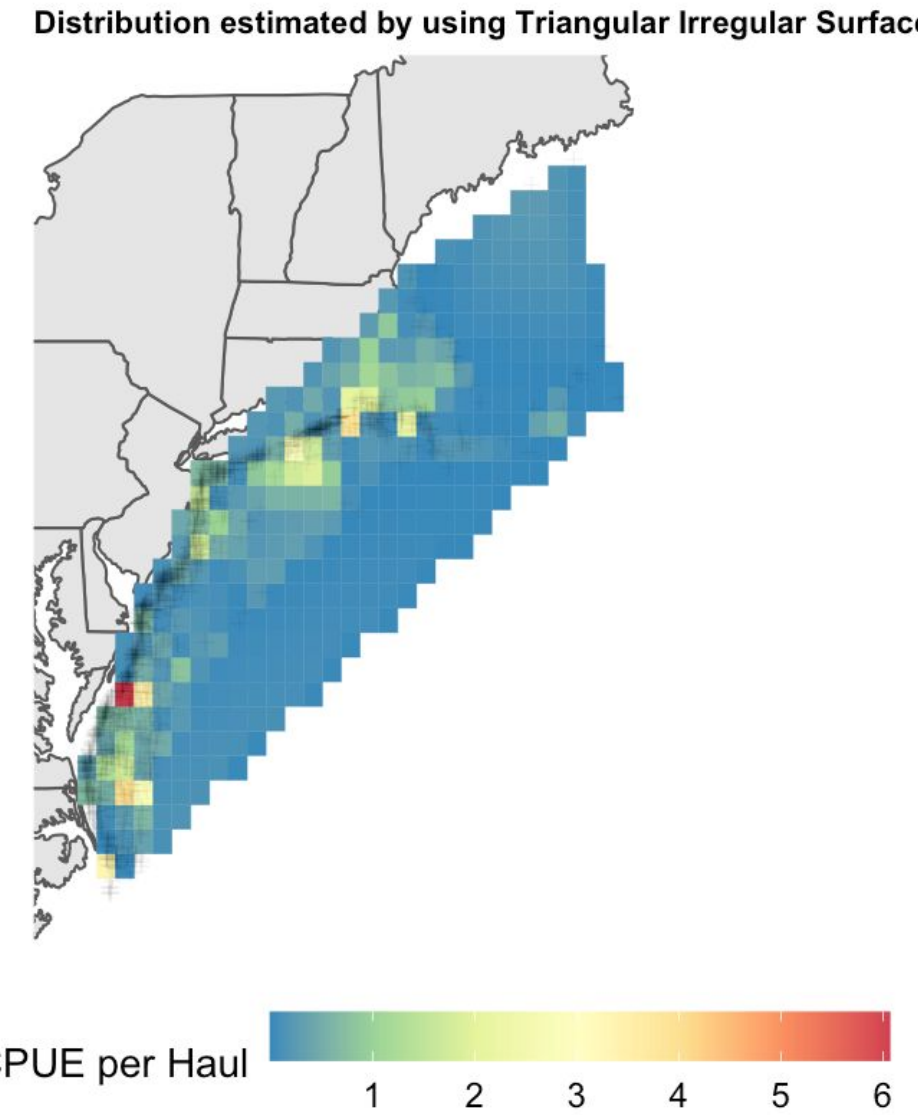
1972 1982 1992 2002 2012 2019

1972 to 2019

Select Result

- [ ] Latitudinal Shift
- [ ] Survey Point
- [x] Distribution Map
- [ ] Allocation Area

Distribution map



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HOTSPOT ANALYSIS

Finding locations/stocks with similar characteristics:

I. Conflicts due to shifting stocks

II. Could use dynamic allocation rules

III. Opportunity for policy change

IV. Data available

Conclusions

- The method of defining state footprints is more influential than the choice of seasonal survey
- The biggest difference between approaches comes from states without a port with landings > threshold
- Winners and losers regardless of the methods
- No scientific basis for preferring one method or survey season over another
- Caveat: the assumption that the ACL has the same impact on population dynamics regardless of where it’s taken is likely wrong

Thank you!

Julia Beaty and Brandon Muffley (MAFMC)
Toni Kerns (ASMFC)
Jason McNamee (RI DEM)

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