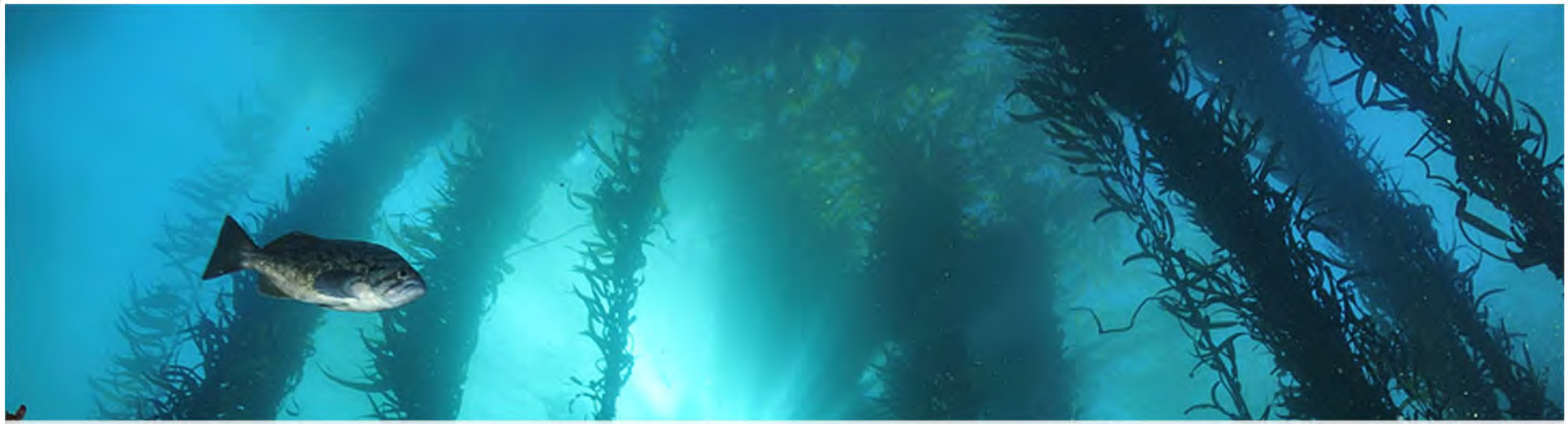


Using imperfect ecosystem knowledge to inform management

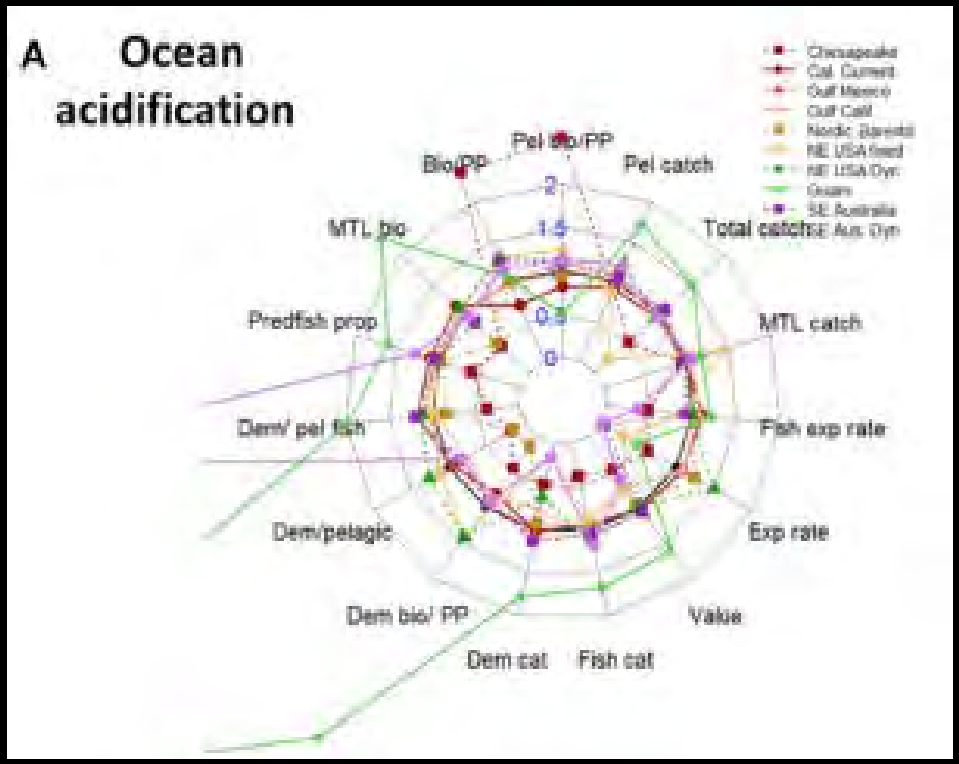
Sarah Cooley

2018 ECCWO Symposium, June 5, 2018

- What can ecosystem models tell us?
- What are they less able to tell us?
- What policy questions remain?
- How can we put knowledge to work now?
- Where can model improvements be made?

What can ecosystem models tell us?

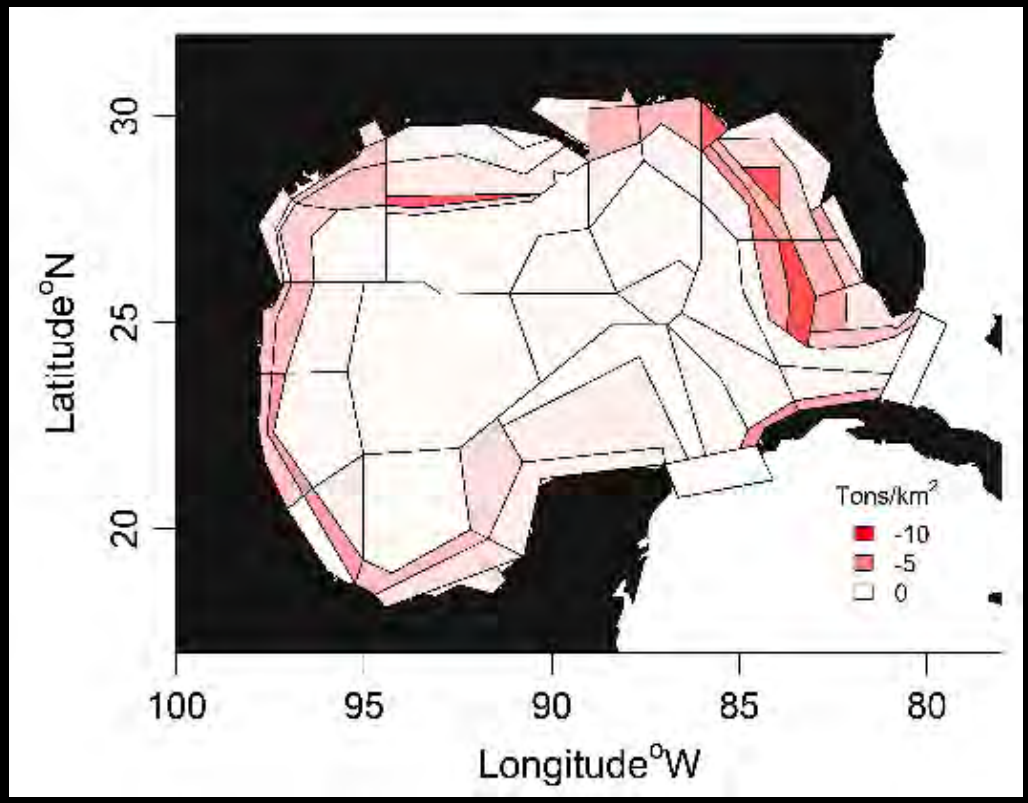
- Progressive change
- Sudden change
- BGC, physical controls
- Pollutant movement
- Identity/function



Olsen et al. 2018 Frontiers

What can ecosystem models tell us?

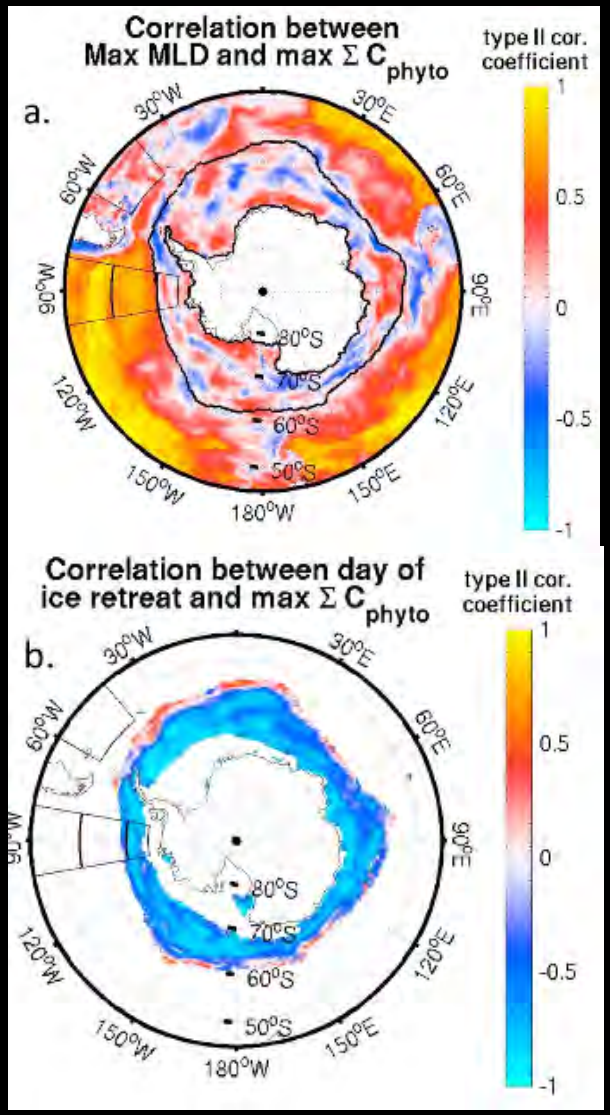
- Progressive change
- Sudden change
- BGC, physical controls
- Pollutant movement
- Identity/function



Ainsworth et al. 2018 PLOS One

What can ecosystem models tell us?

- Progressive change
- Sudden change
- BGC, physical controls
- Pollutant movement
- Identity/function

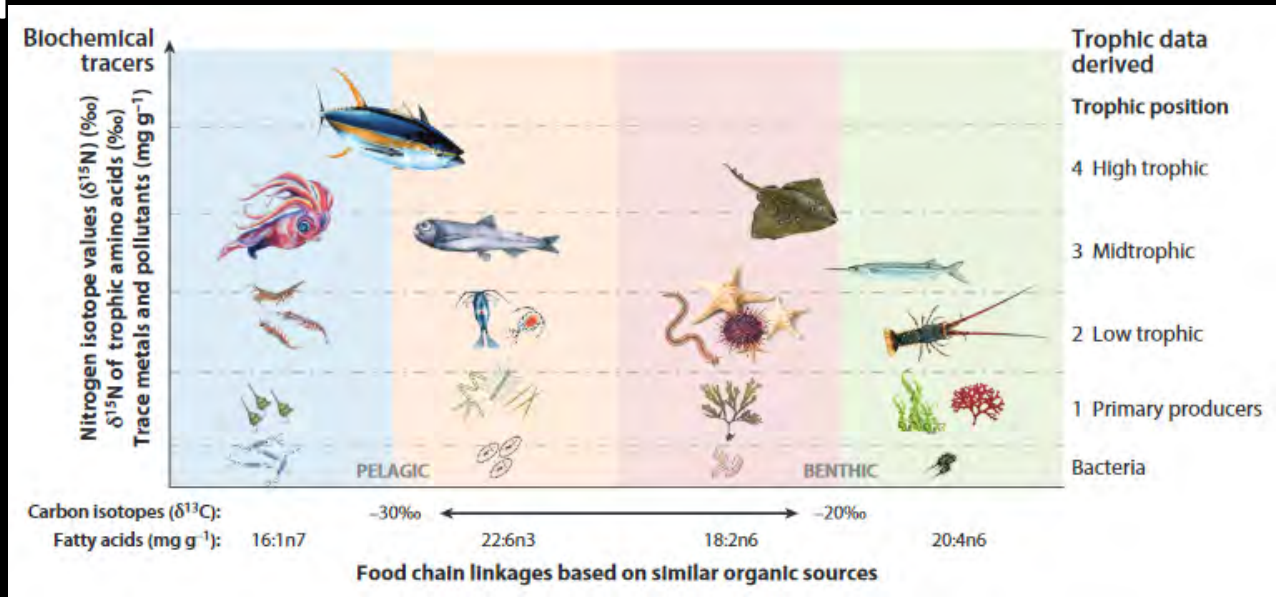


Rohr et al. 2017 GBC

What can ecosystem models tell us?

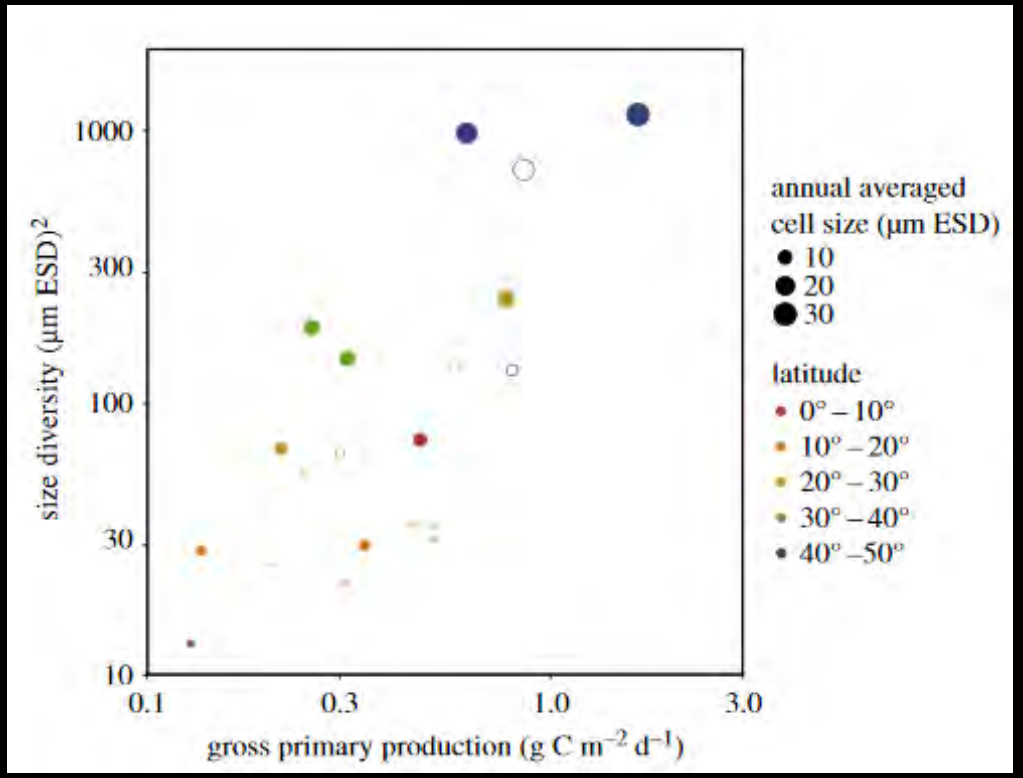
- Progressive change
- Sudden change
- BGC, physical controls
- Pollutant movement
- Identity/function

Pethybridge et al. 2018 Ann Rev.



What can ecosystem models tell us?

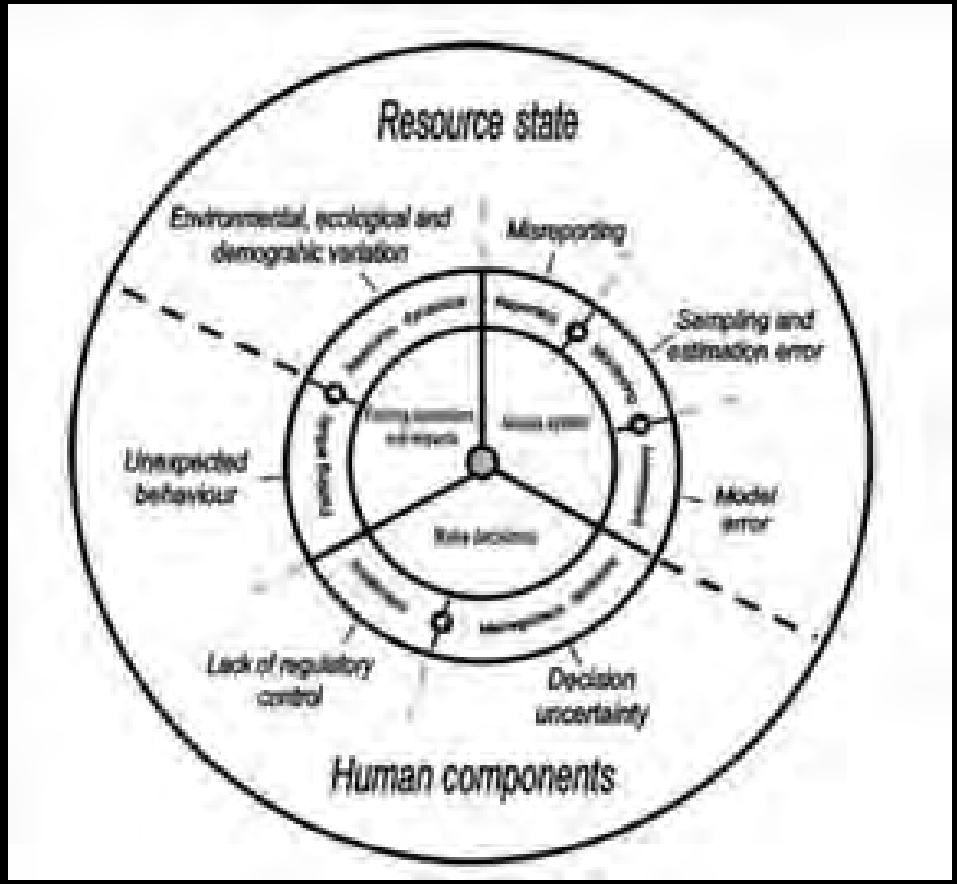
- Progressive change
- Sudden change
- BGC, physical controls
- Pollutant movement
- Identity/function



Acevedo-Trejos et al. 2018 Proc R Soc B

Things that ecosystem models are (currently) less capable of determining

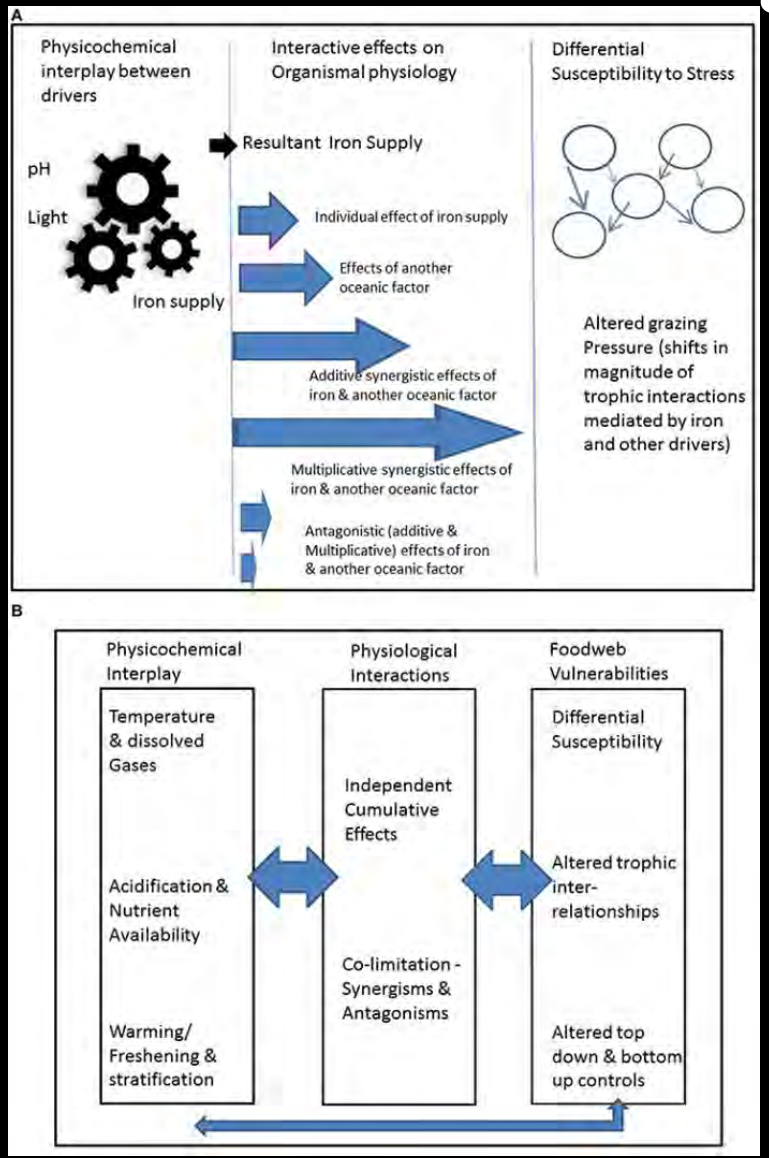
- Human decisions
- Synergies
- Tipping points
- Uncertainty estimates
- Behavior switching



Fulton et al. 2010 Fish & Fisheries

Things that ecosystem models are (currently) less capable of determining

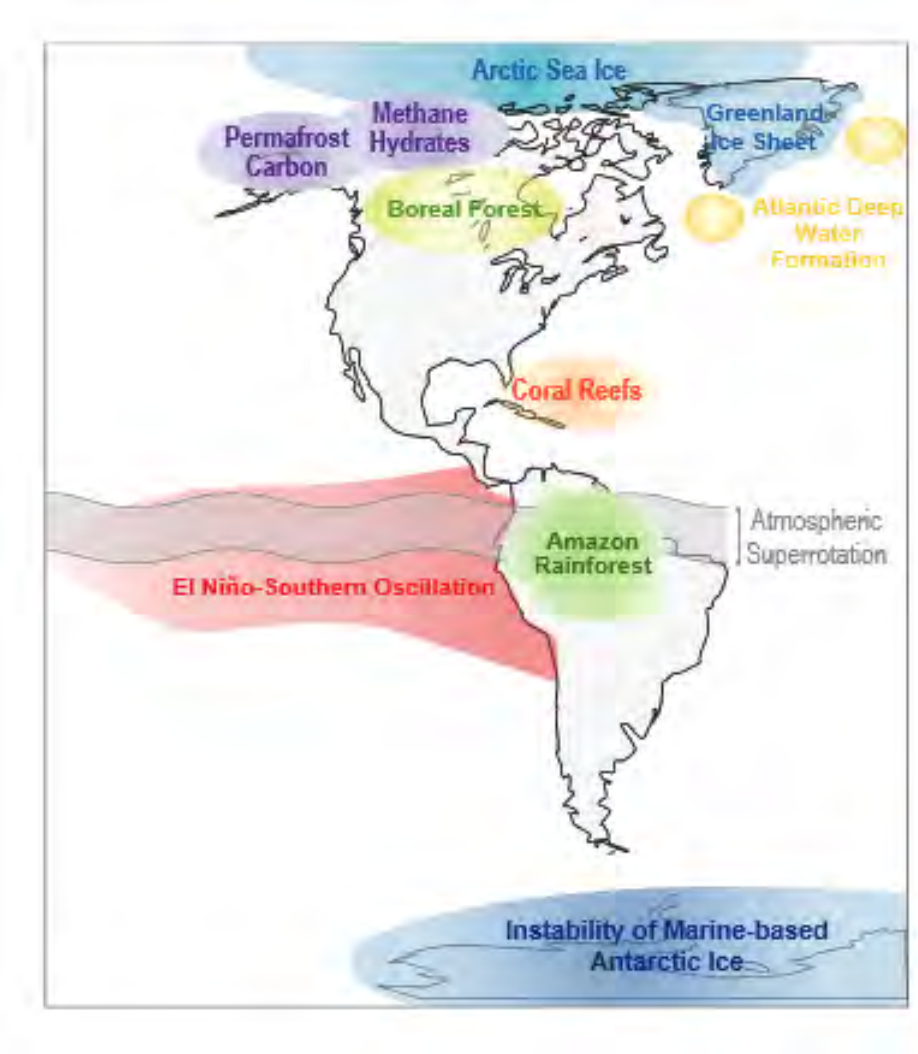
- Human decisions
- Synergies
- Tipping points
- Uncertainty estimates
- Behavior switching



Boyd & Brown, 2015 Frontiers

Things that ecosystem models are (currently) less capable of determining

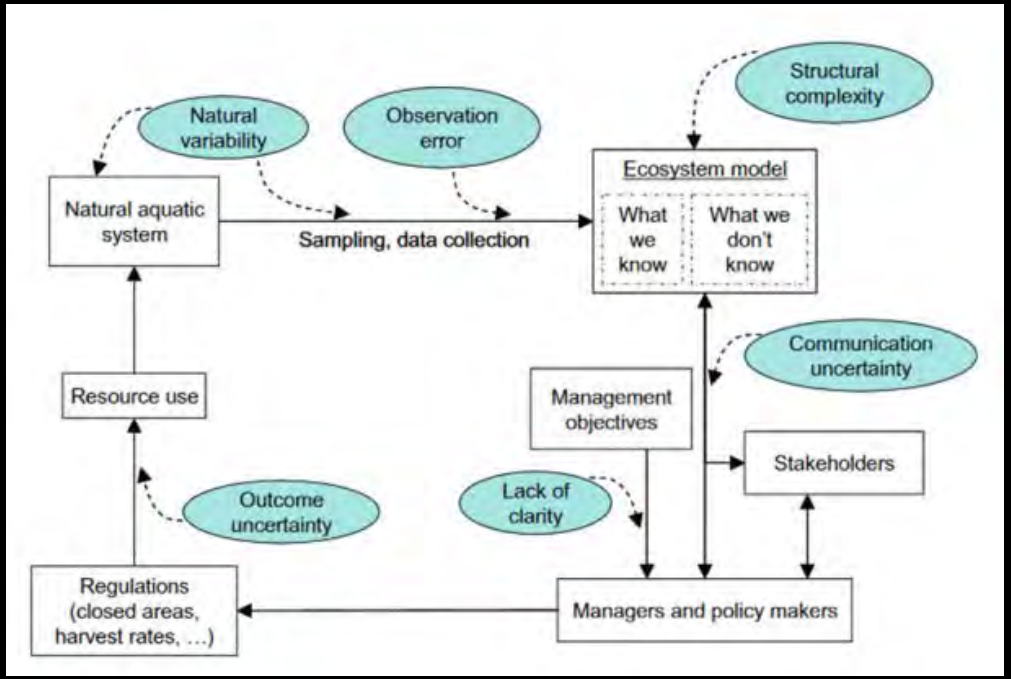
- Human decisions
- Synergies
- Tipping points
- Uncertainty estimates
- Behavior switching



Adapted from Lenton et al. 2008 PNAS

Things that ecosystem models are (currently) less capable of determining

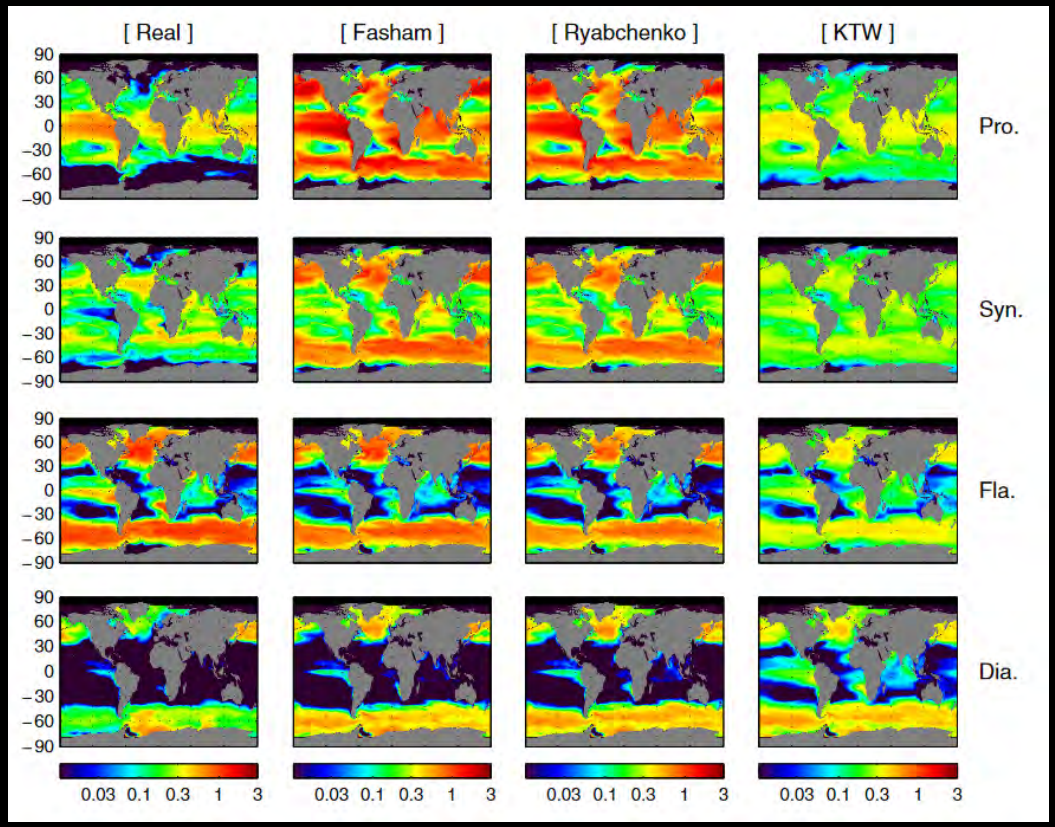
- Human decisions
- Synergies
- Tipping points
- Uncertainty estimates
- Behavior switching



Link et al. 2012 PIO

Things that ecosystem models are (currently) less capable of determining

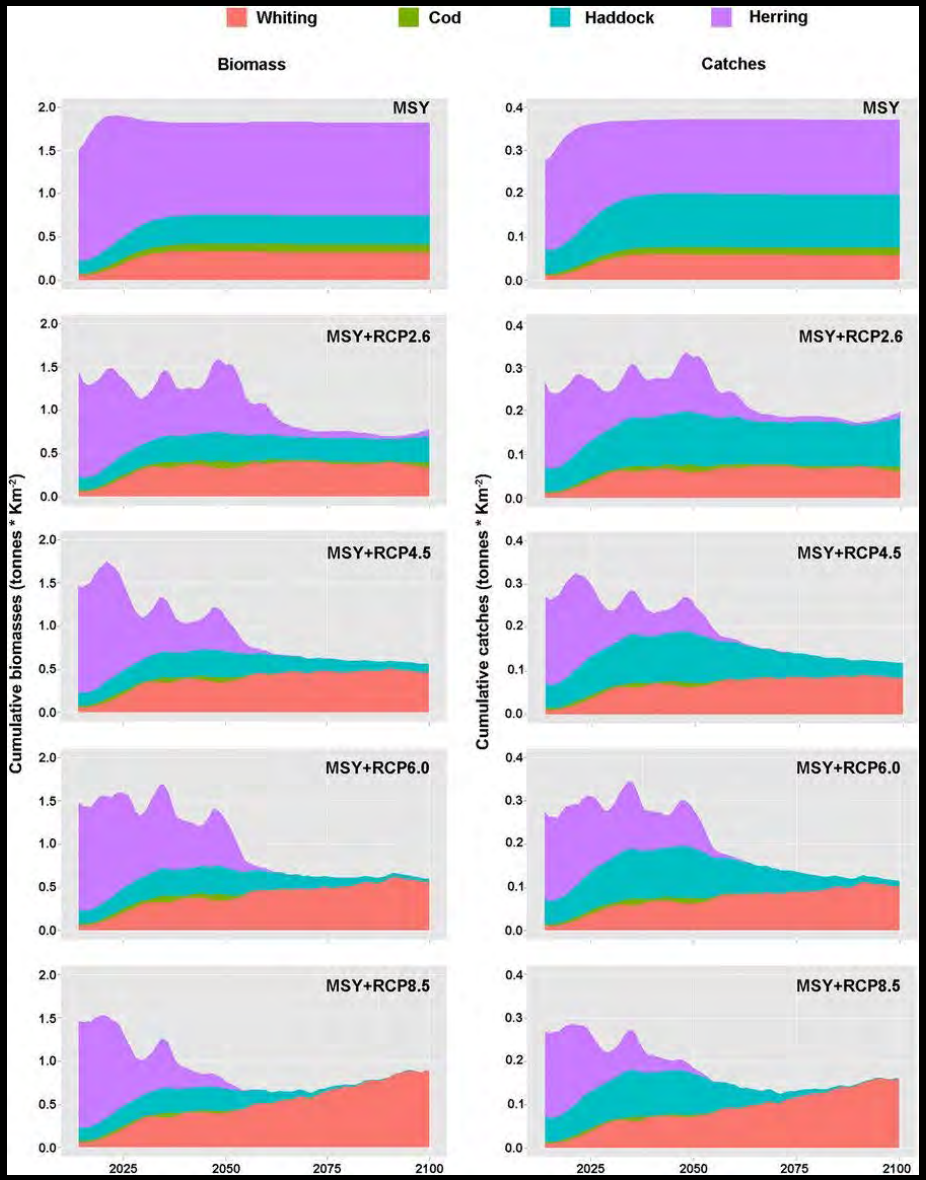
- Human decisions
- Synergies
- Tipping points
- Uncertainty estimates
- Behavior switching



Vallina et al. 2014 PIO

Policy questions remain

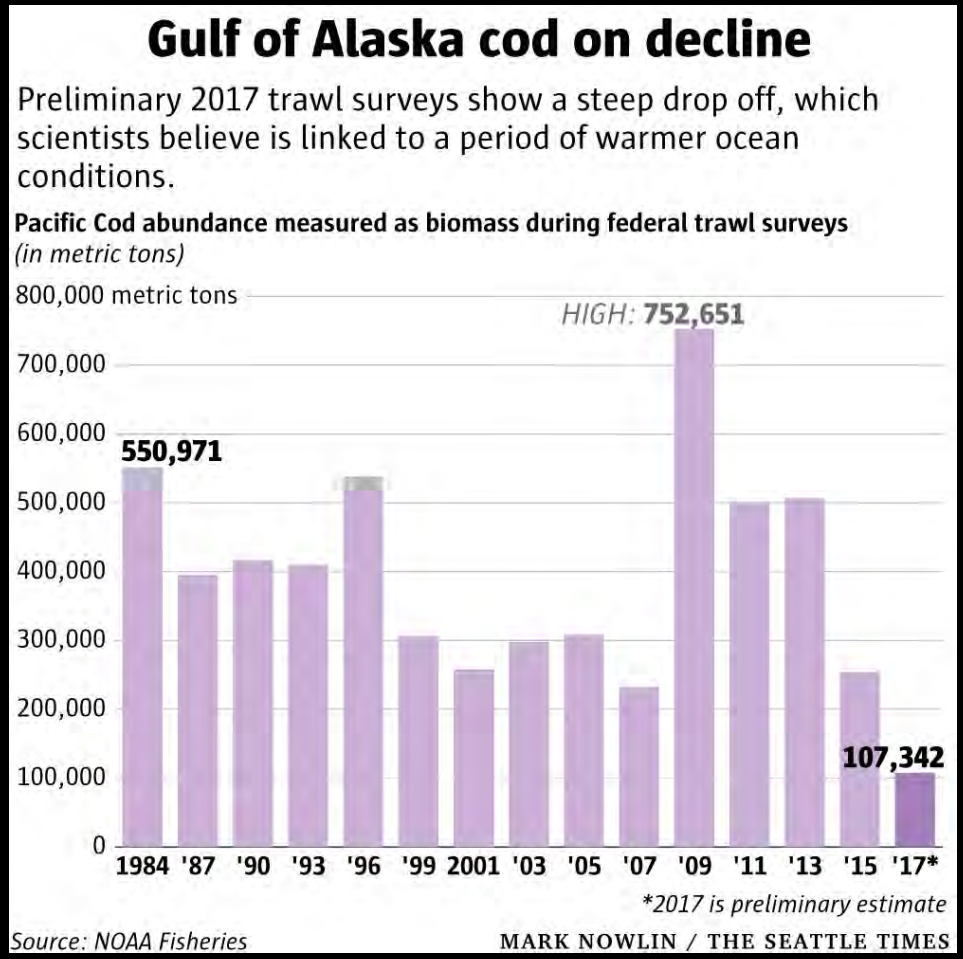
- Catch levels under growing environmental change & variability
- Placement of closed areas
- Water quality
- Risk & cost of (in)action
- Options to preserve ecological function



Serpetti et al. 2017 NCC

Policy questions remain

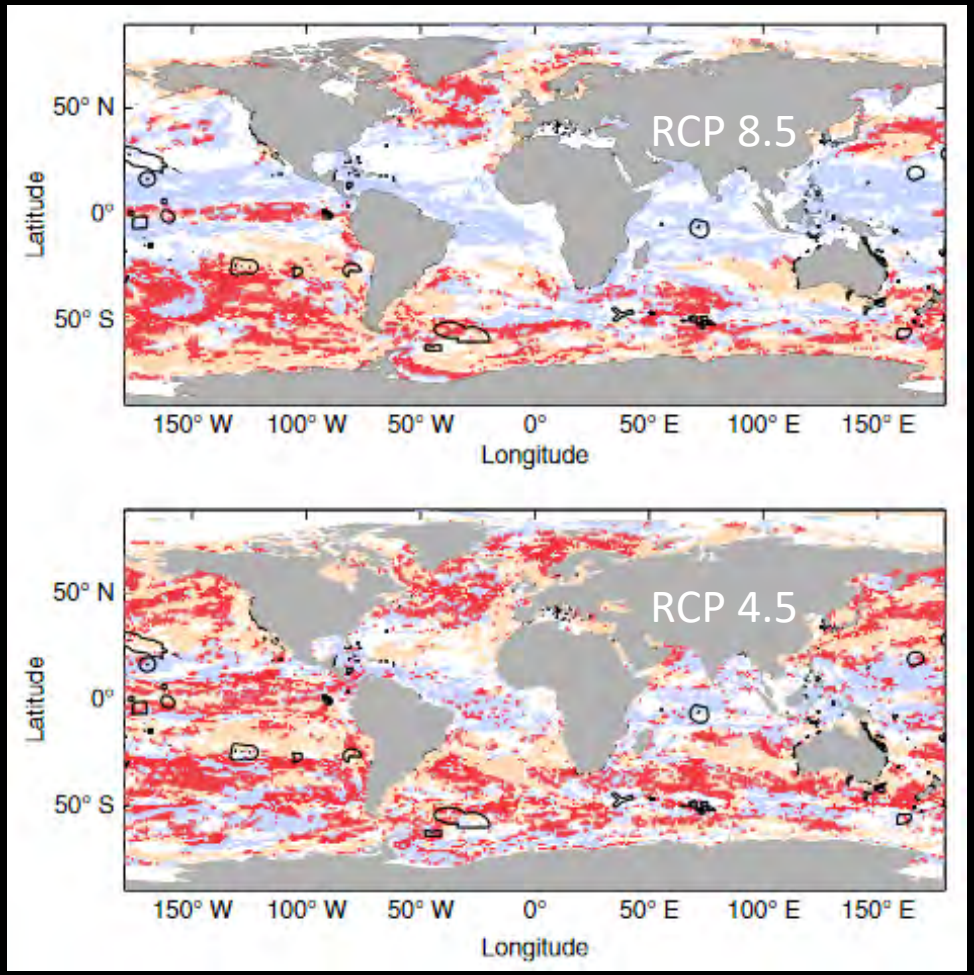
- Catch levels under growing environmental change & variability
- Placement of closed areas
- Water quality
- Risk & cost of (in)action
- Options to preserve ecological function



Seattle Times, Nov. 4, 2017

Policy questions remain

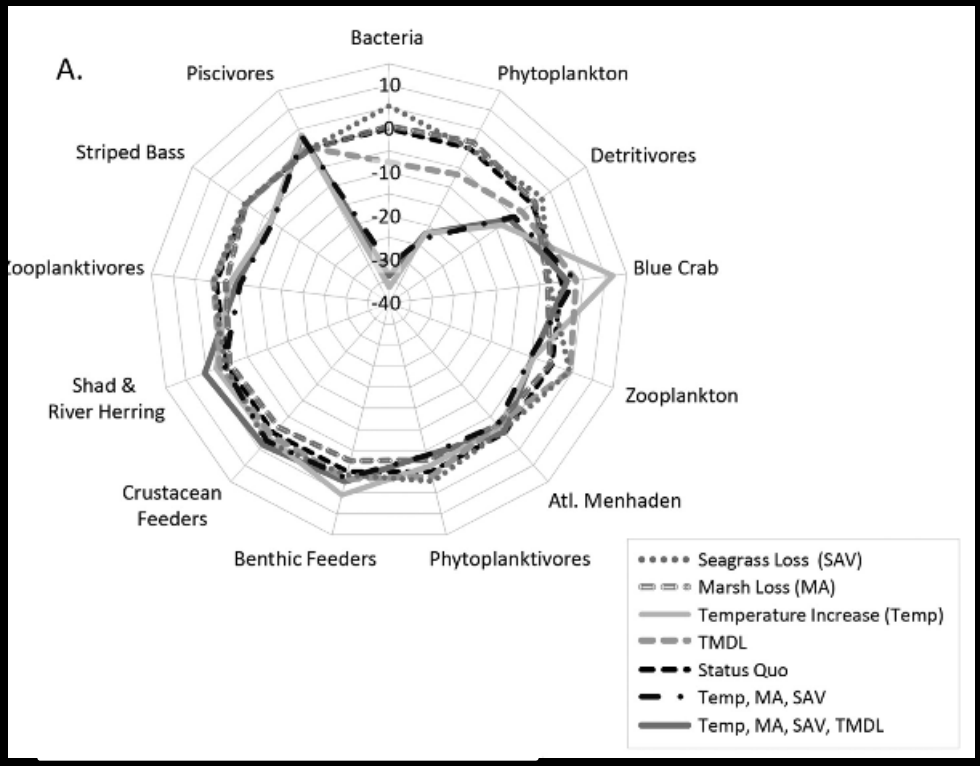
- Catch levels under growing environmental change & variability
- Placement of closed areas
- Water quality
- Risk & cost of (in)action
- Options to preserve ecological function



Bruno et al. 2018 NCC

Policy questions remain

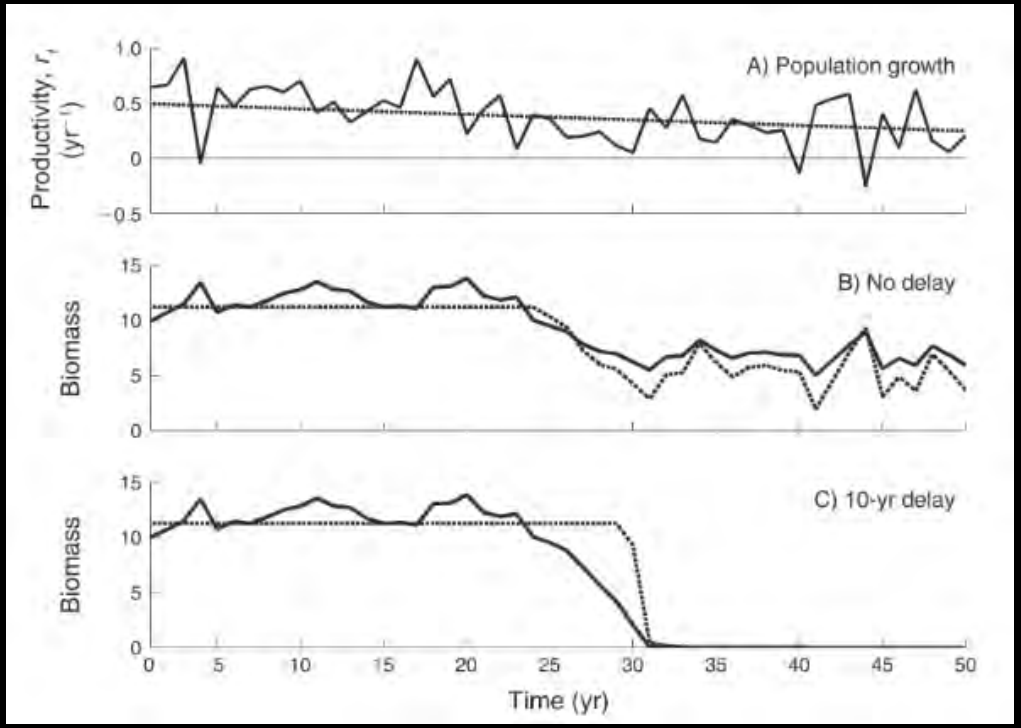
- Catch levels under growing environmental change & variability
- Placement of closed areas
- Water quality
- Risk & cost of (in)action
- Options to preserve ecological function



Ihde & Townsend, 2017 Ecol Model.

Policy questions remain

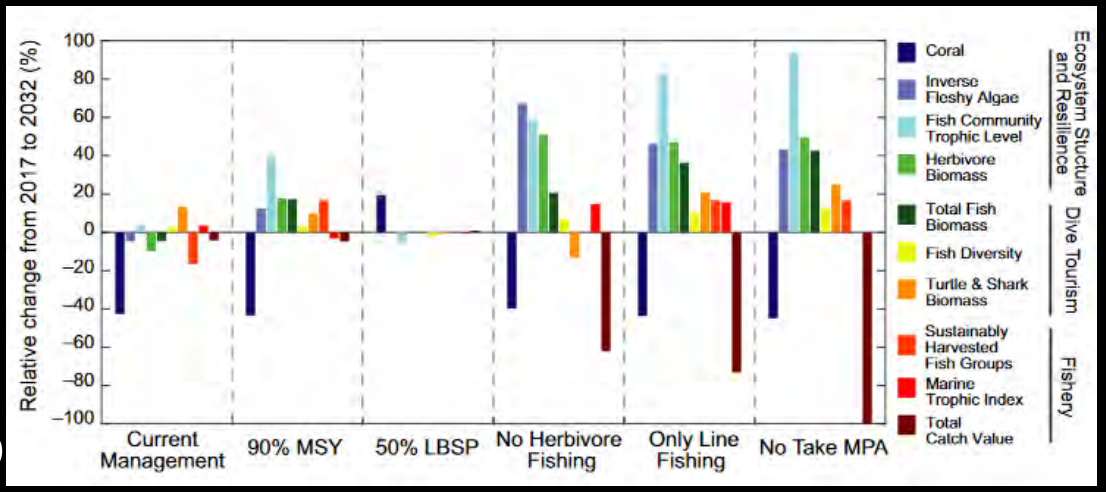
- Catch levels under growing environmental change & variability
- Placement of closed areas
- Water quality
- Risk & cost of (in)action
- Options to preserve ecological function



Brown et al. 2012, Ecol Appl

Policy questions remain

- Catch levels under growing environmental change & variability
- Placement of closed areas
- Water quality
- Risk & cost of (in)actio
- Options to preserve ecological function



Weijerman et al. 2017 J. Appl. Ecol

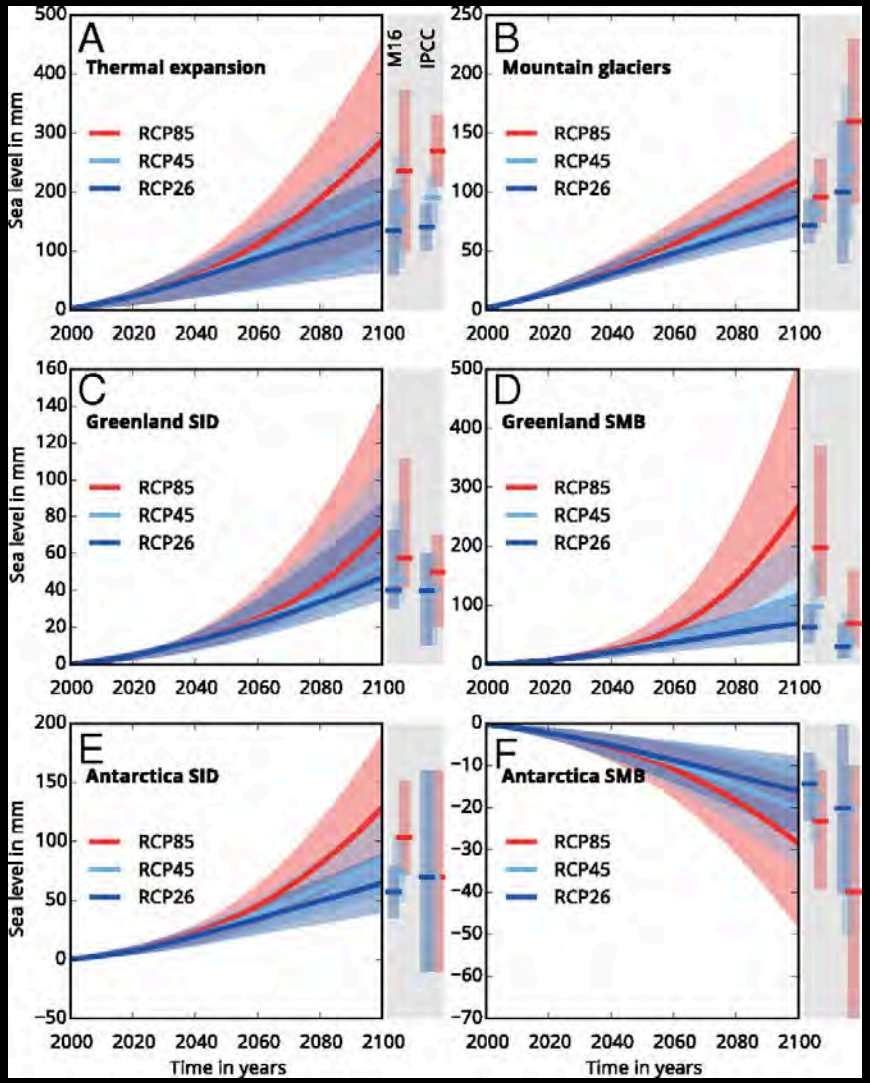
Put knowledge to work now

1. Strategic use of models

2. Process is critical

Strategic use of models

- Undesirable futures
- Scenario analysis
- Landscape of outcomes



Mengel et al. 2018 PNAS

Strategic use of models

- Undesirable futures
- Scenario analysis
- Landscape of outcomes

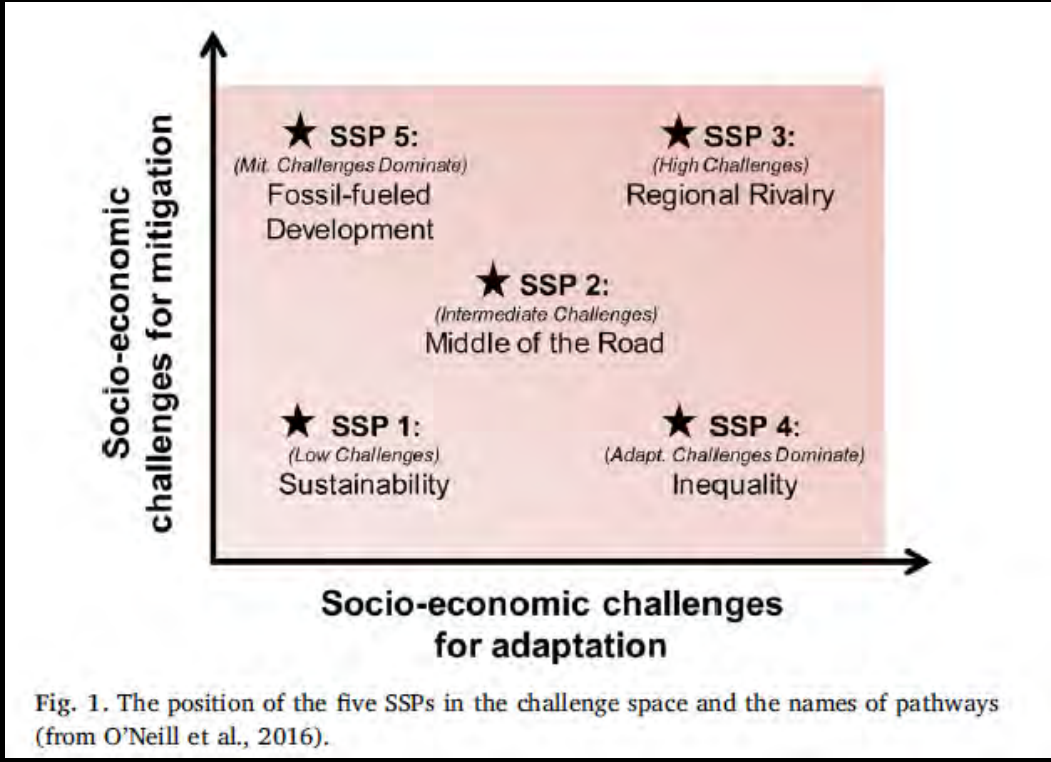
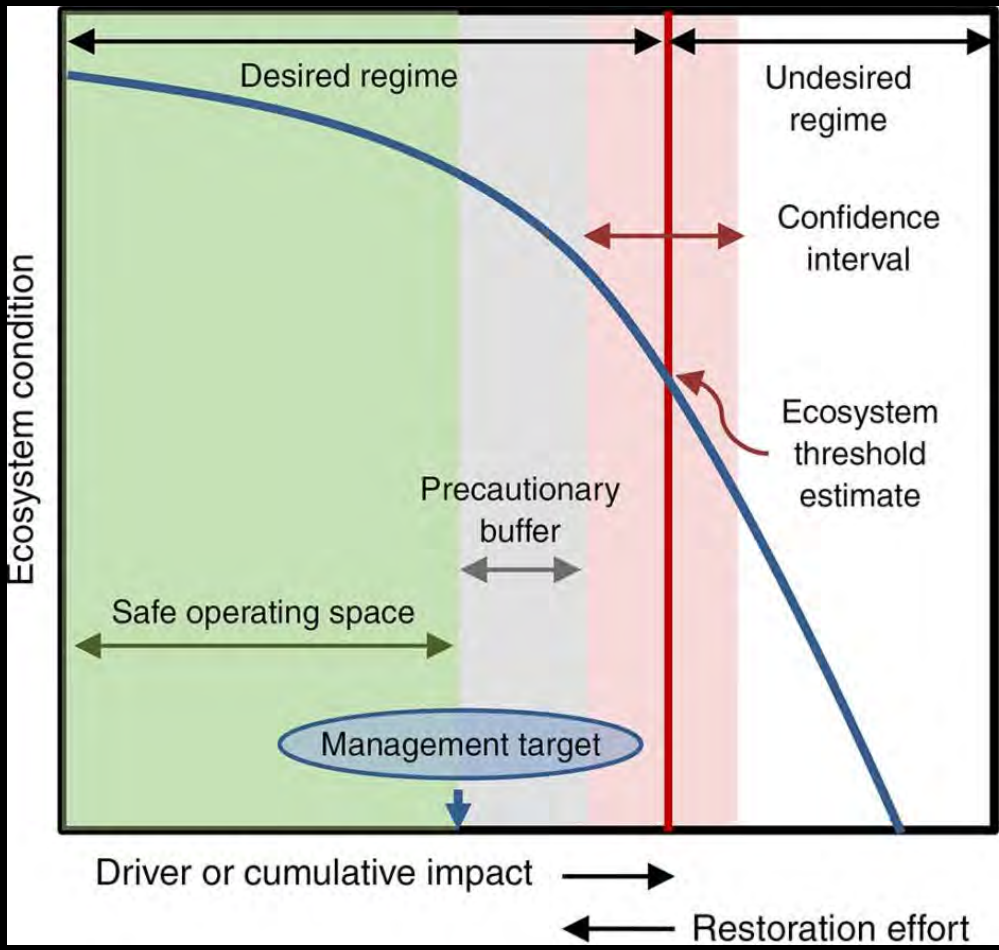


Fig. 1. The position of the five SSPs in the challenge space and the names of pathways (from O'Neill et al., 2016).

Maury et al. 2017, GEC

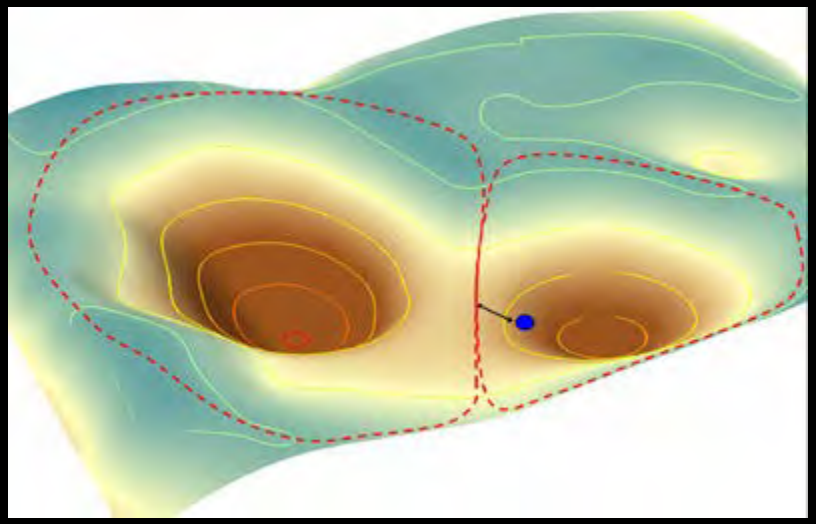
Strategic use of models

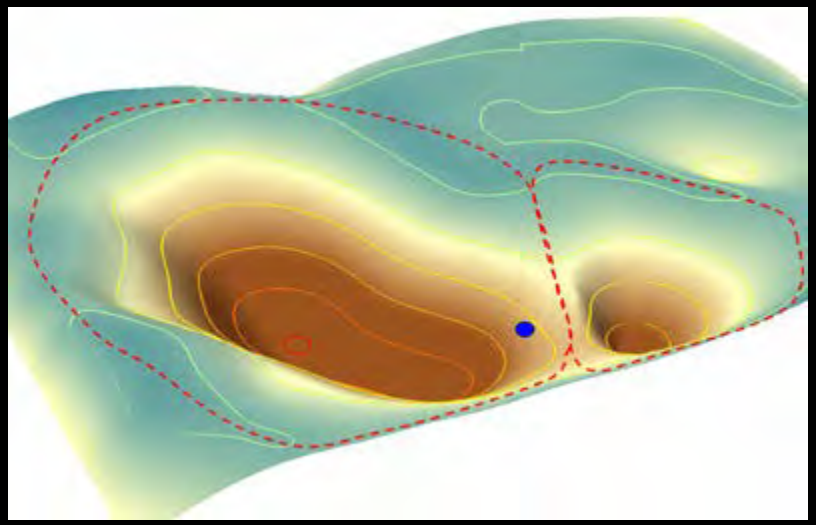
- Undesirable futures
- Scenario analysis
- Landscape of outcomes



Strategic use of models

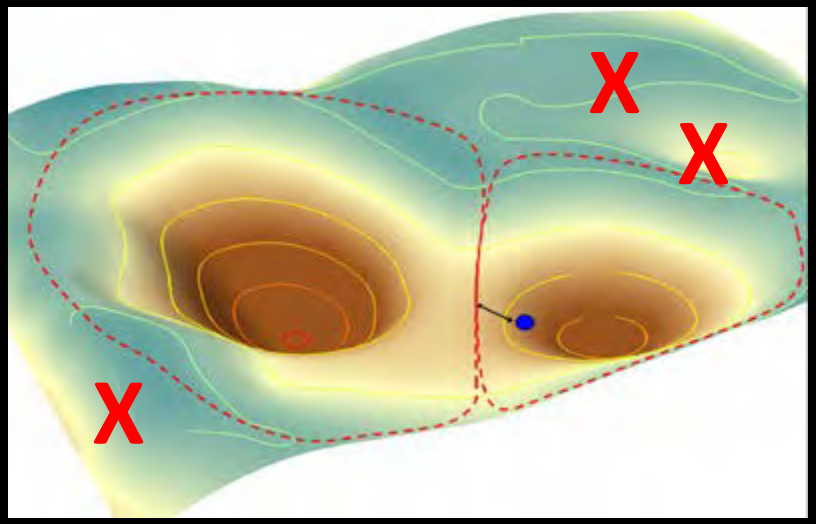
- Undesirable futures
- Scenario analysis
- Landscape of outcomes

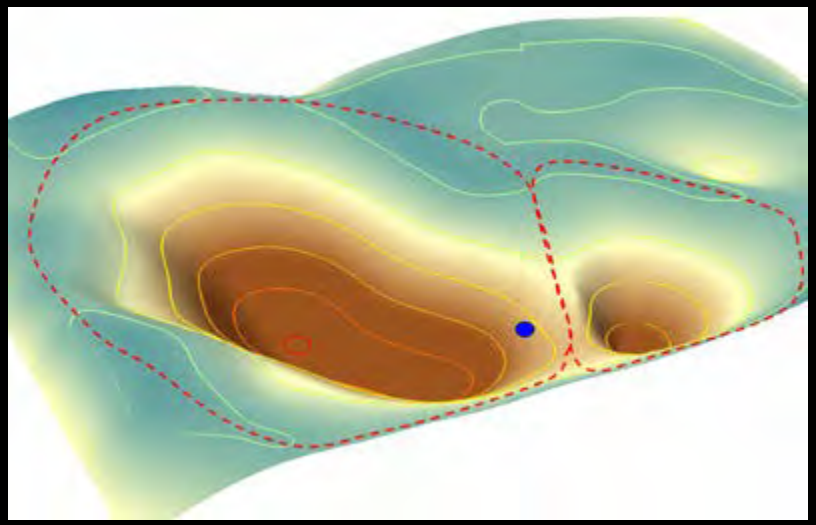




Strategic use of models

- Undesirable futures
- Scenario analysis
- Landscape of outcomes

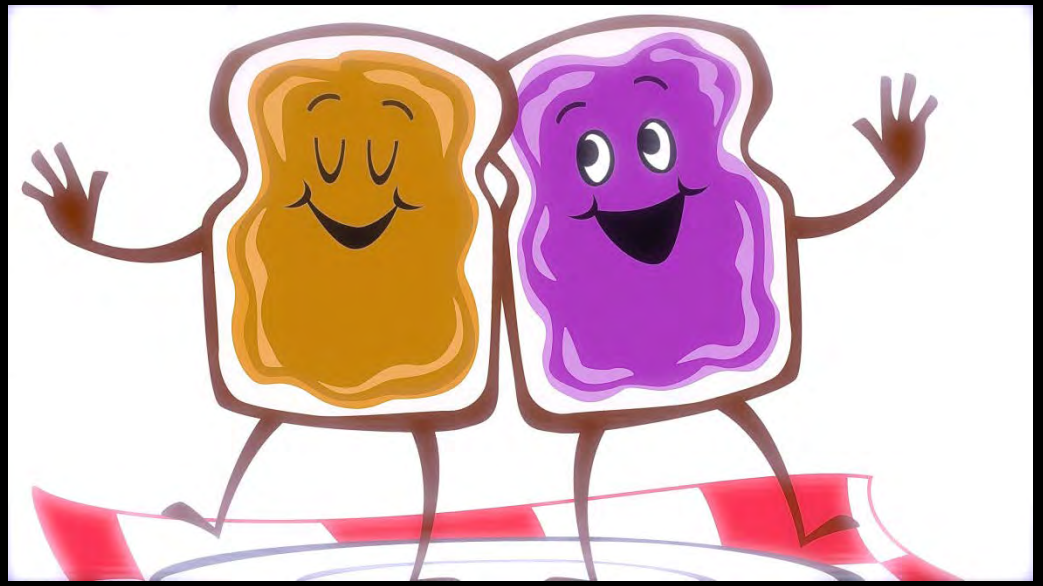




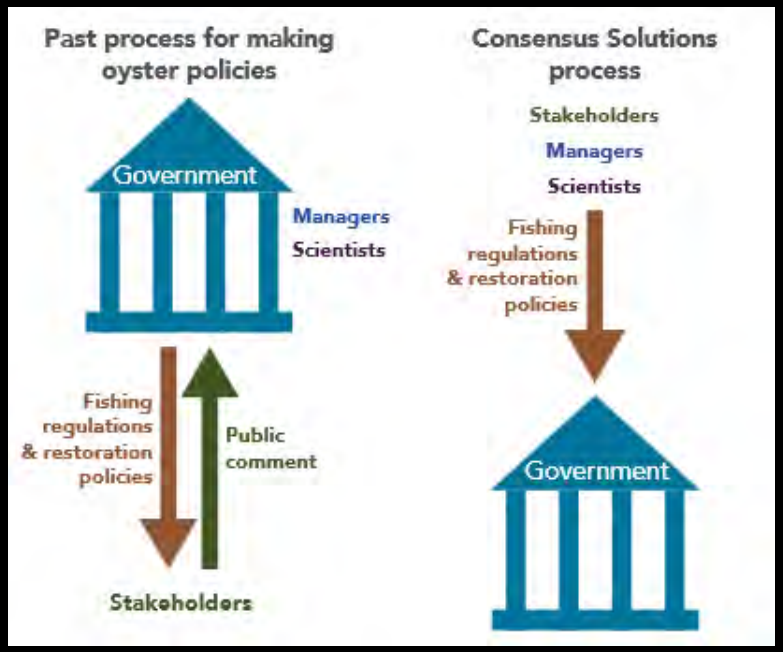
Process is critical

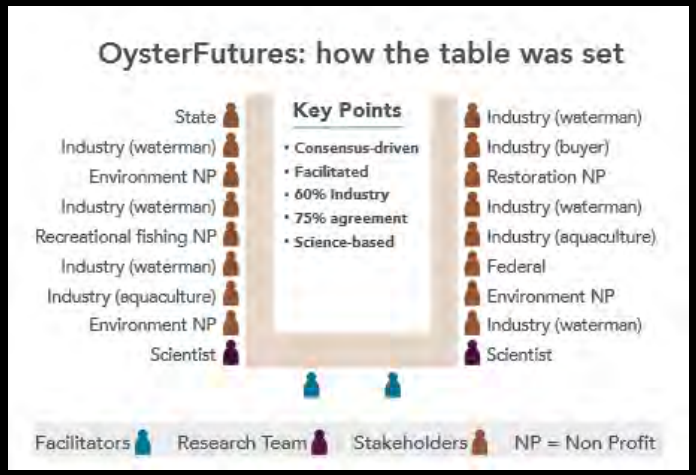
- Models
  + Inclusive process
  solid policy progress

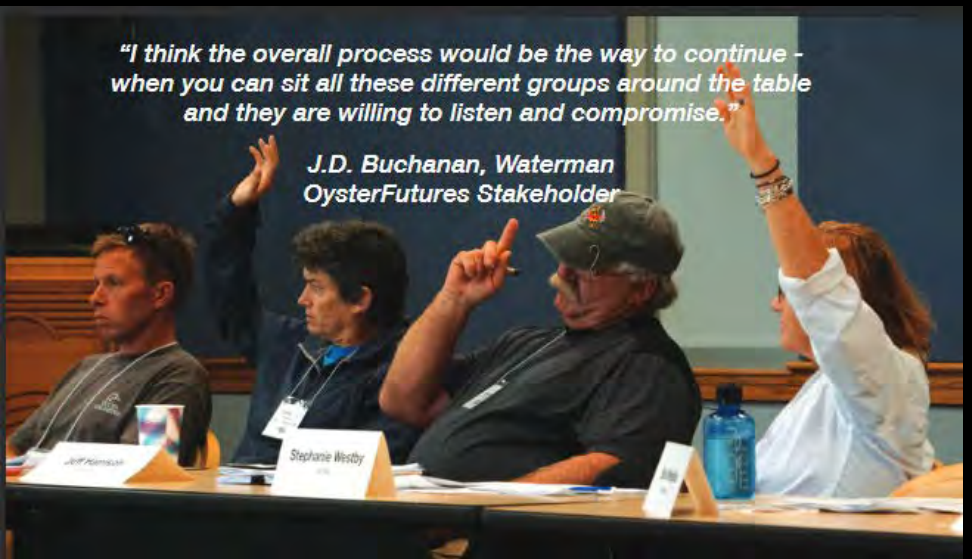
- Multiple rounds

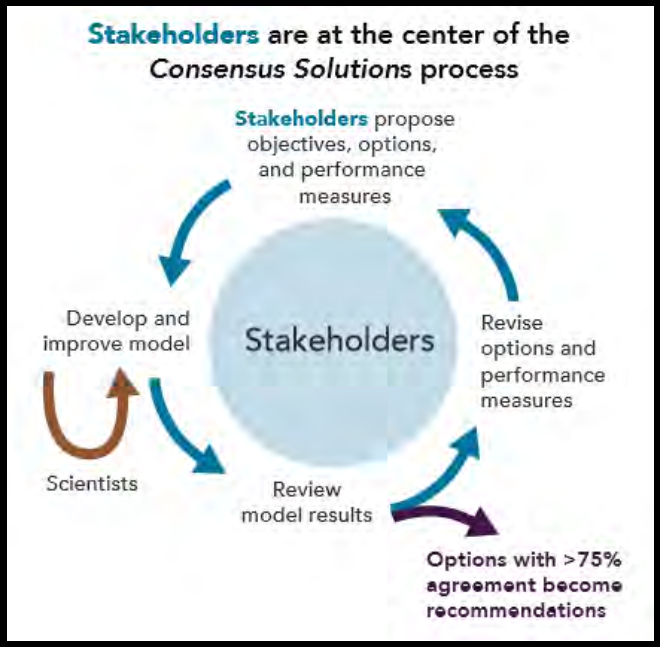


Oyster Futures





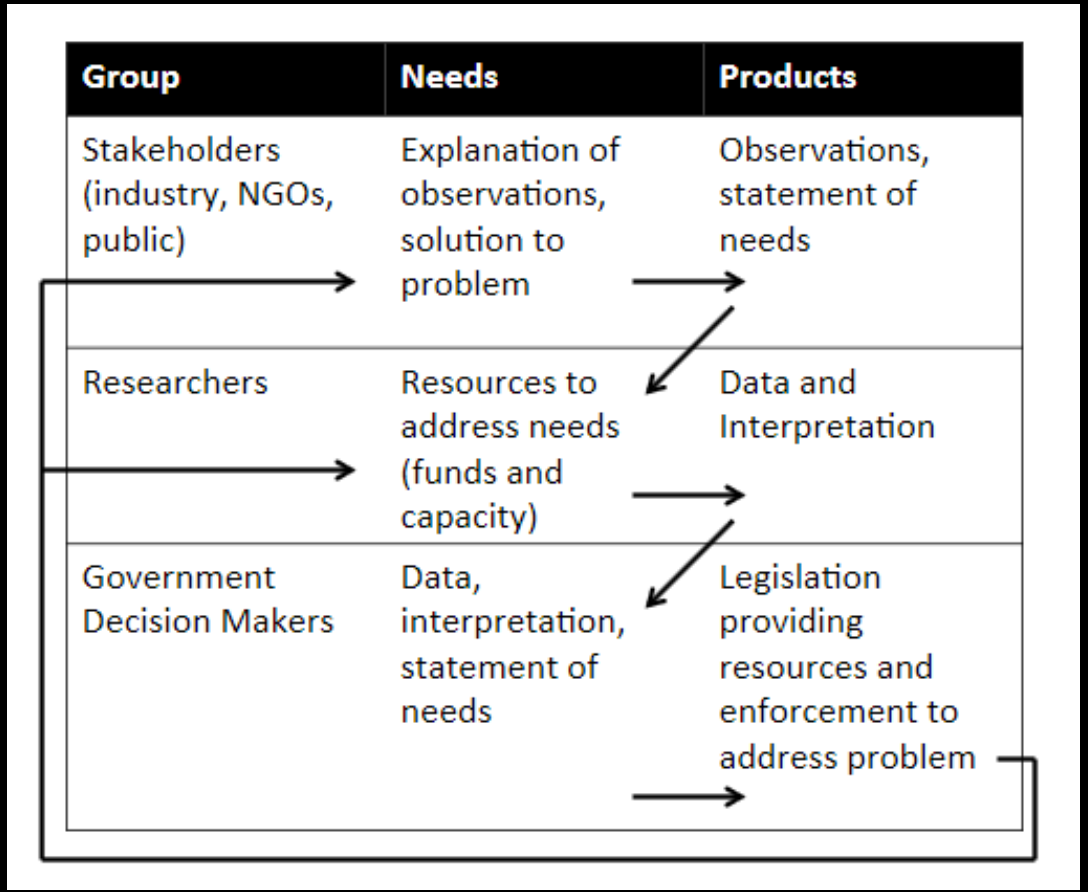




https://oysterfutures.wordpress.com/about-oysterfutures/

Process is critical

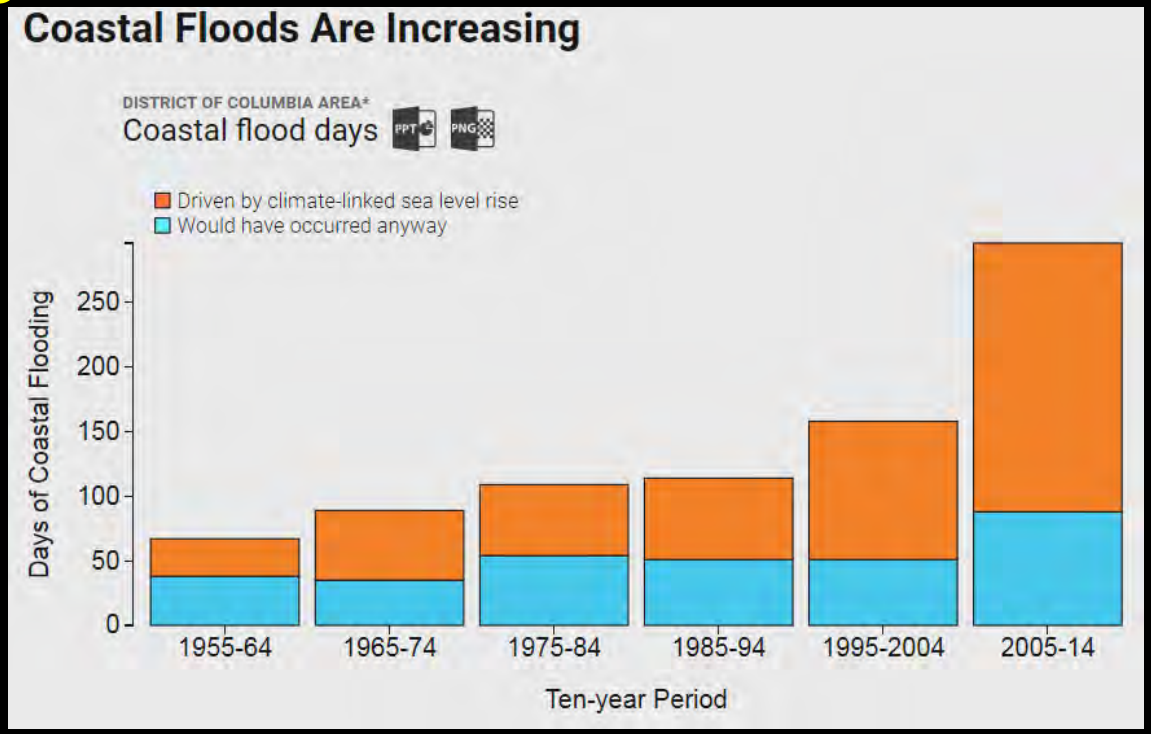
- Models
  + Inclusive process
  solid policy progress
- Multiple rounds



Cooley et al., 2015, Oceanography

Improvements can be made

- Probabilistic framing
- New techniques
- End-to-end views
- Sustained use of products



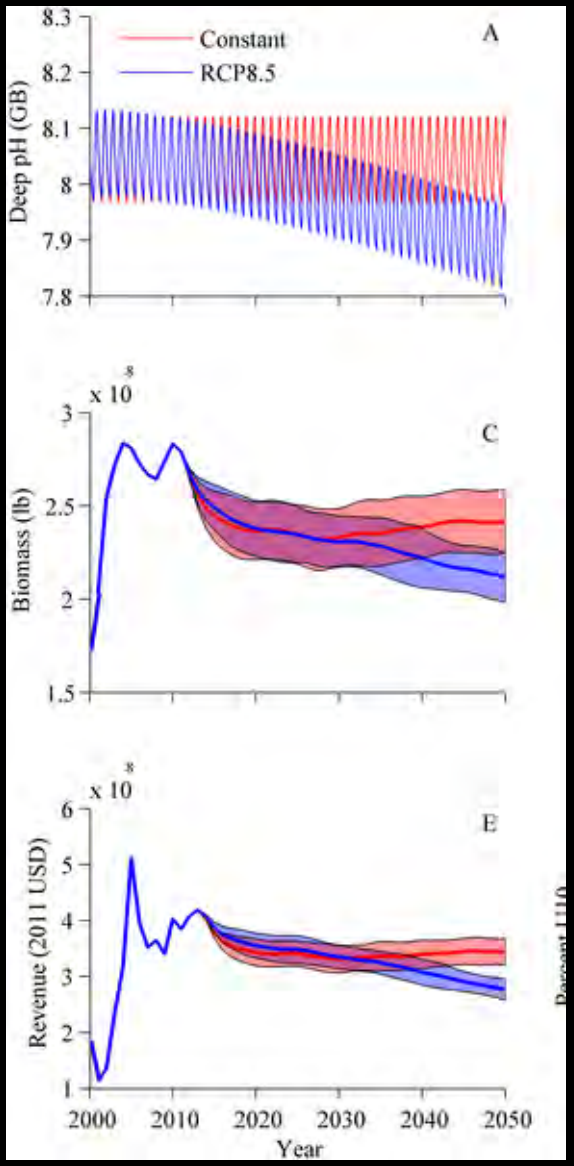
https://riskfinder.climatecentral.org/state/district-of-columbia.us

Improvements can be made

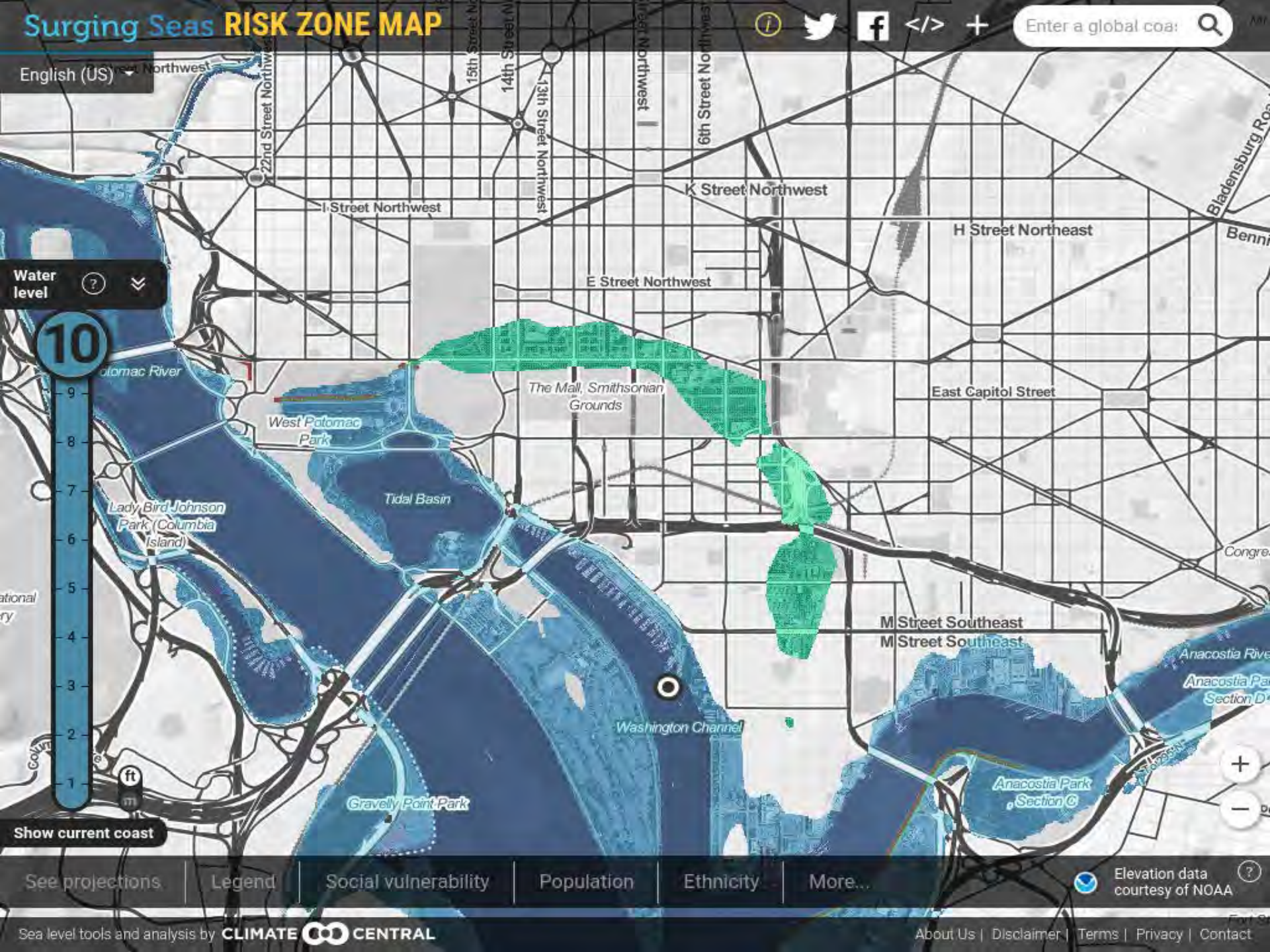
- Probabilistic framing
- New techniques
  - Bayesian
  - Monte Carlo
  - Network
  - Data assimilation/ big data mining
  - Risk/tradeoff analyses
- End-to-end views
- Sustained use of products

Improvements can be made

- Probabilistic framing
- New techniques
- End-to-end views
- Sustained use of products

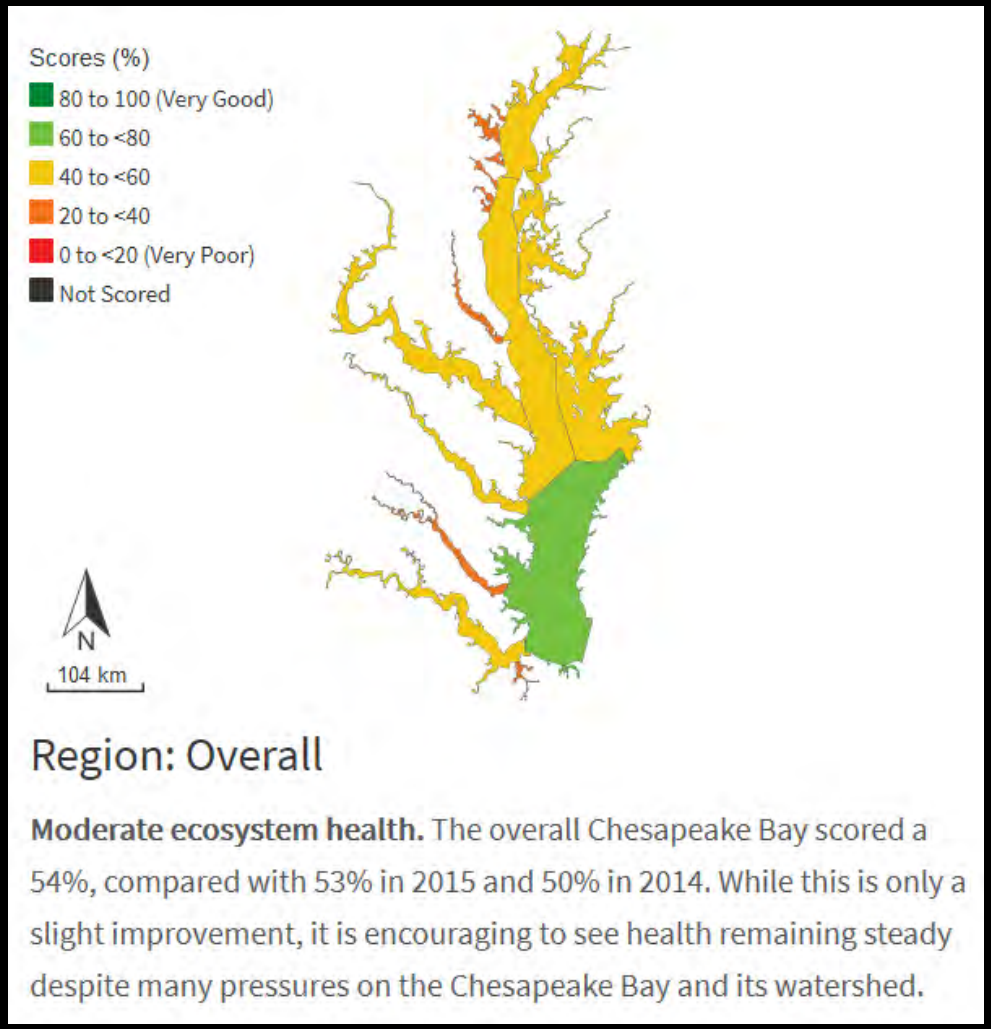


Cooley et al. 2015 PLOS


Surging Seas RISK ZONE MAP
English (US)
Enter a global coas
22nd Street Northwest
15th Street Northwest
14th Street Northwest
13th Street Northwest
6th Street Northwest
I Street Northwest
K Street Northwest
H Street Northeast
Bladensburg Road
E Street Northwest
Water level
10
9
8
7
6
5
4
3
2
1
ft
Show current coast
The Mall, Smithsonian Grounds
East Capitol Street
West Potomac Park
Tidal Basin
Lady Bird Johnson Park (Columbia Island)
M Street Southeast
Anacostia River
Washington Channel
Anacostia Park Section C
Gravelly Point Park
See projections
Legend
Social vulnerability
Population
Ethnicity
More...
Elevation data courtesy of NOAA
Sea level tools and analysis by CLIMATE CENTRAL
About Us | Disclaimer | Terms | Privacy | Contact

Improvements can be made

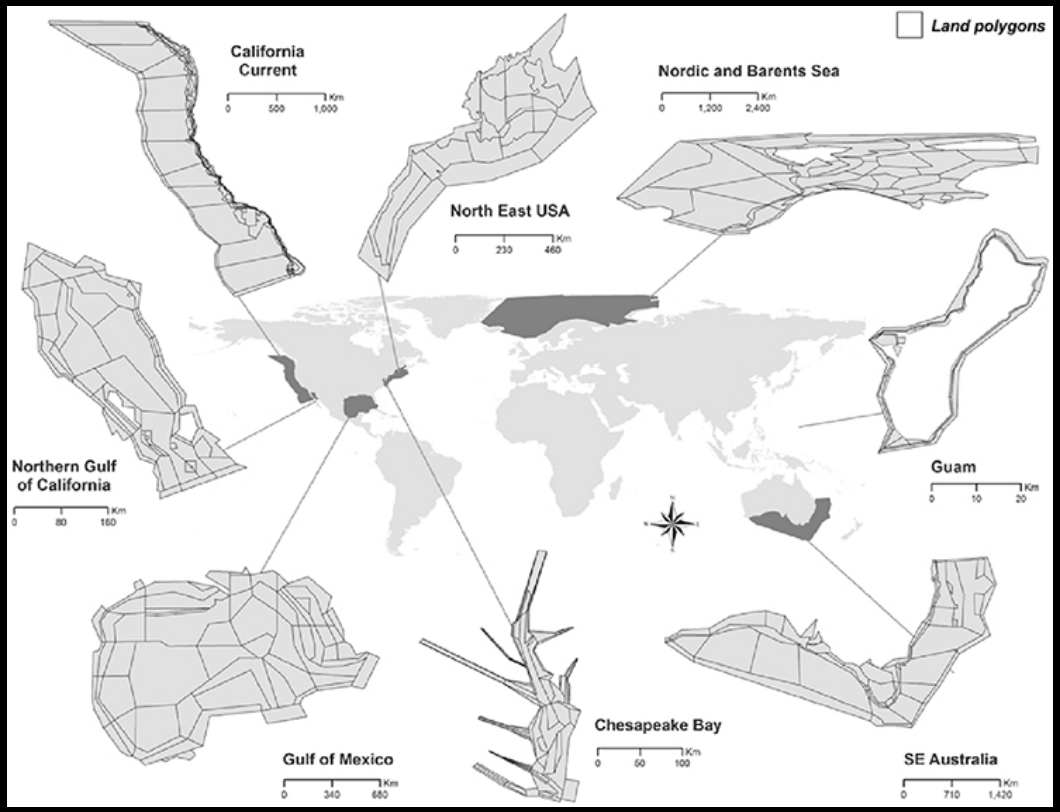
- Probabilistic framing
- New techniques
- End-to-end views
- Sustained use of products



Ecoreportcard.org; UMCES

Improvements can be made

- Probabilistic framing
- New techniques
- End-to-end views
- Sustained use of products



Olsen et al. 2018 Frontiers

But process continues to be important

- Inclusive deliberation and goal setting
  - What management futures exist?
  - What are our community/resource-wide priorities?
  - What outcomes can we live with?
- Co-management successes in small scale fisheries

Hoped-for outcomes from joint approach

- By narrowing in on outcomes, ID parts of the science -> policy cycle that need attention.
  - Prioritize which science uncertainties should be addressed to inform policy
- By approaching policy work collaboratively, get more realistic policy that has buy-in from all groups

Thank you!

- Get in touch:
  - scooley@oceanconservancy.org
  - Twitter: @co2ley