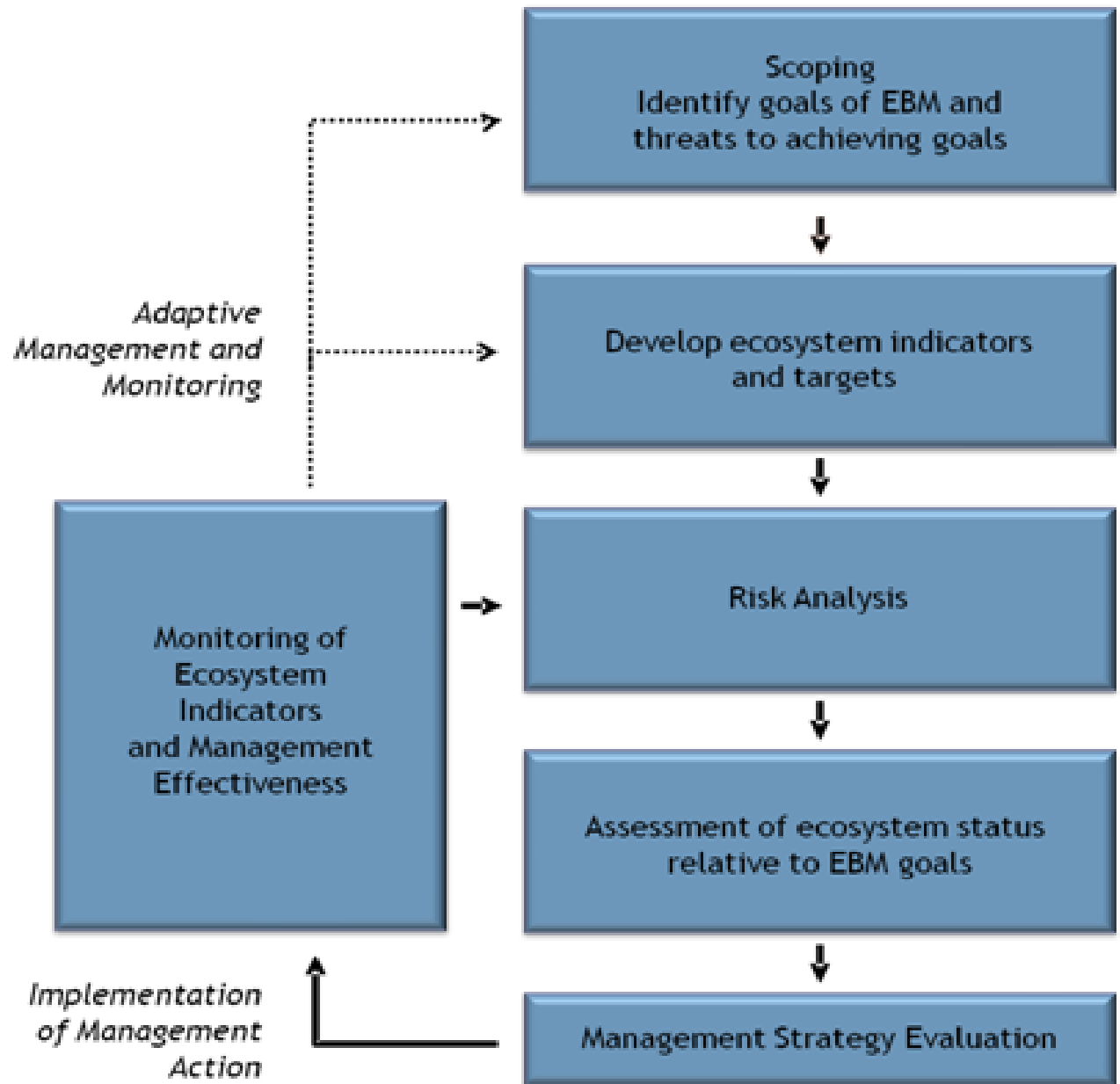


Integrated Ecosystem Assessments for NW Atlantic Ecosystems

How might conceptual models help
address interactions?

Integrated Ecosystem Assessment is a *Process*



California Current Example

INTEGRATED SOCIO-ECOLOGICAL SYSTEM OF THE CALIFORNIA CURRENT

FOCAL ECOSYSTEM COMPONENTS

Ecological Integrity

Diversity, Seabirds, Marine mammals, Salmon, Forage species, Groundfish, Species interactions



Human Wellbeing

Conditions, Connections, Capabilities (e.g., safety, community, livelihood)



MEDIATING COMPONENTS

Habitat

Marine, Estuarine, Freshwater



Human Activities

(e.g., fishing, farming, mining, recreation, research, education, activism, restoration, management)



Local Social Systems

(e.g., laws, policies, economies, institutions, social networks, hierarchies, cultural values, built environment)

DRIVERS AND PRESSURES

Climate & Ocean Drivers

(e.g., climate, ocean upwelling)



Social Drivers

(e.g., population growth and settlement patterns, national and global economic and political systems, historical legacies, dominant cultural values, and class systems)

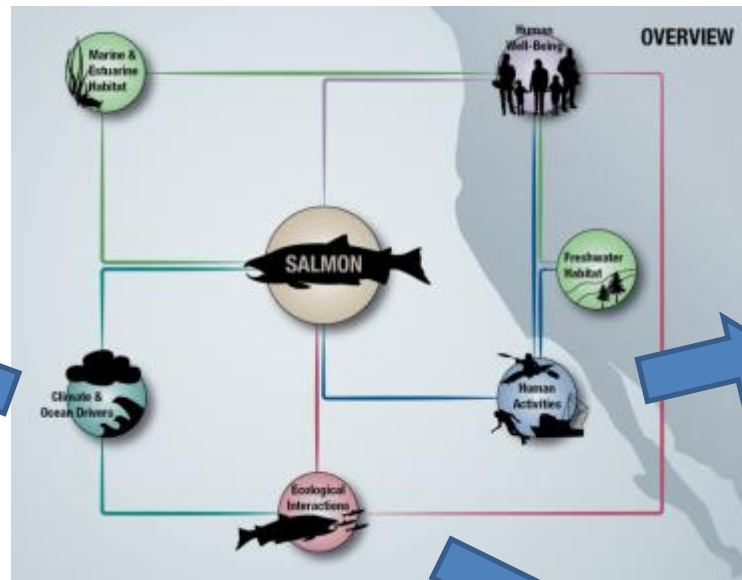
Overview and detailed models

“Overview” model outlines links between species and key ecosystem drivers, components, and goals

Environmental Drivers



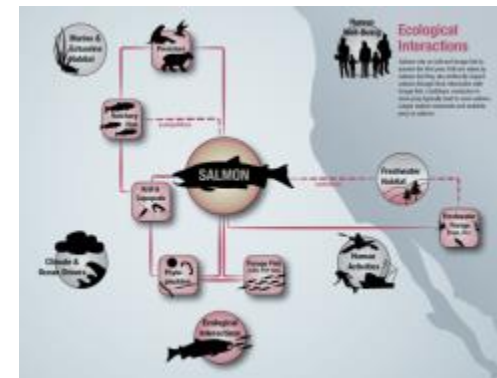
Next-tier models
flesh out key details



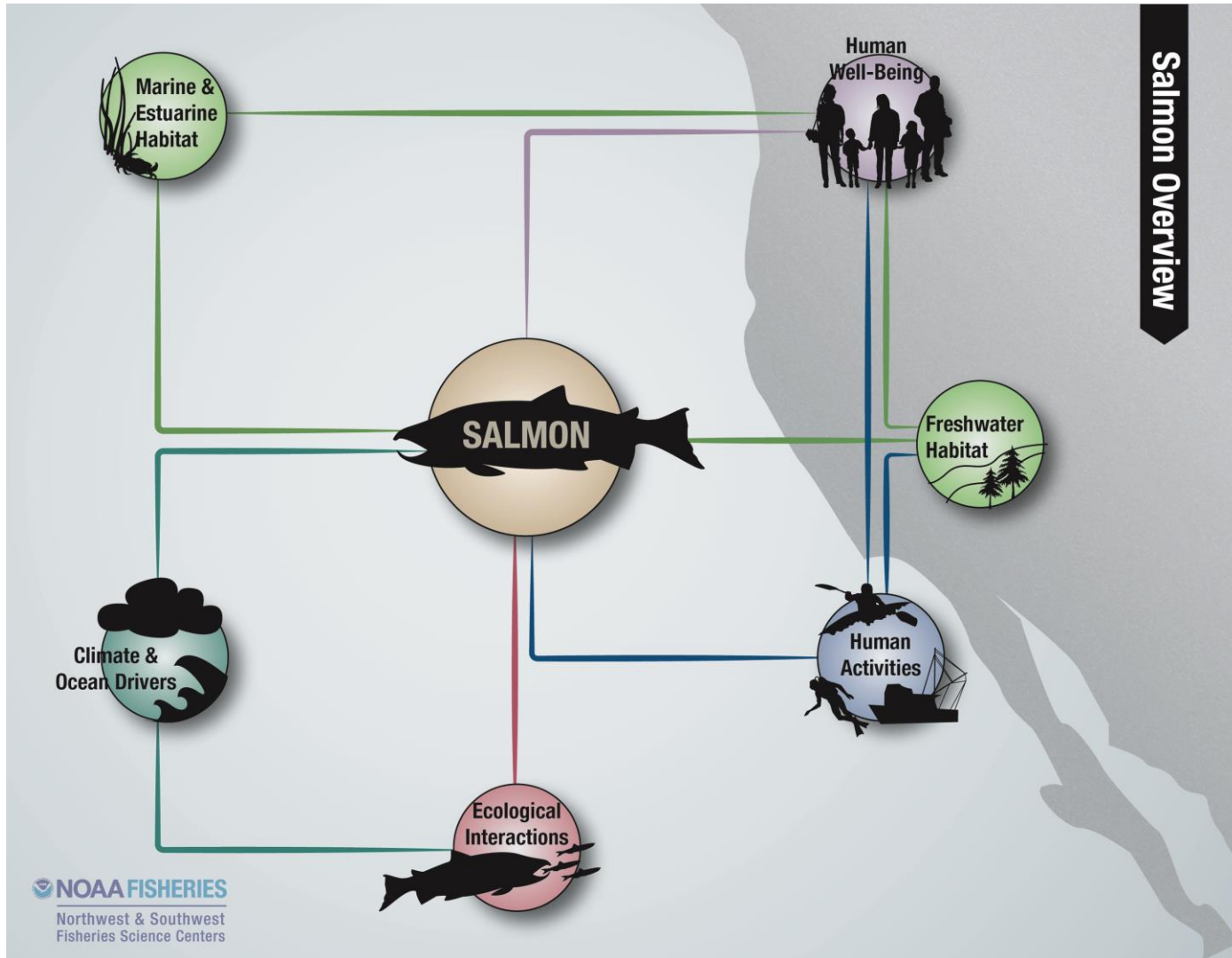
Human Activities



Ecological Interactions

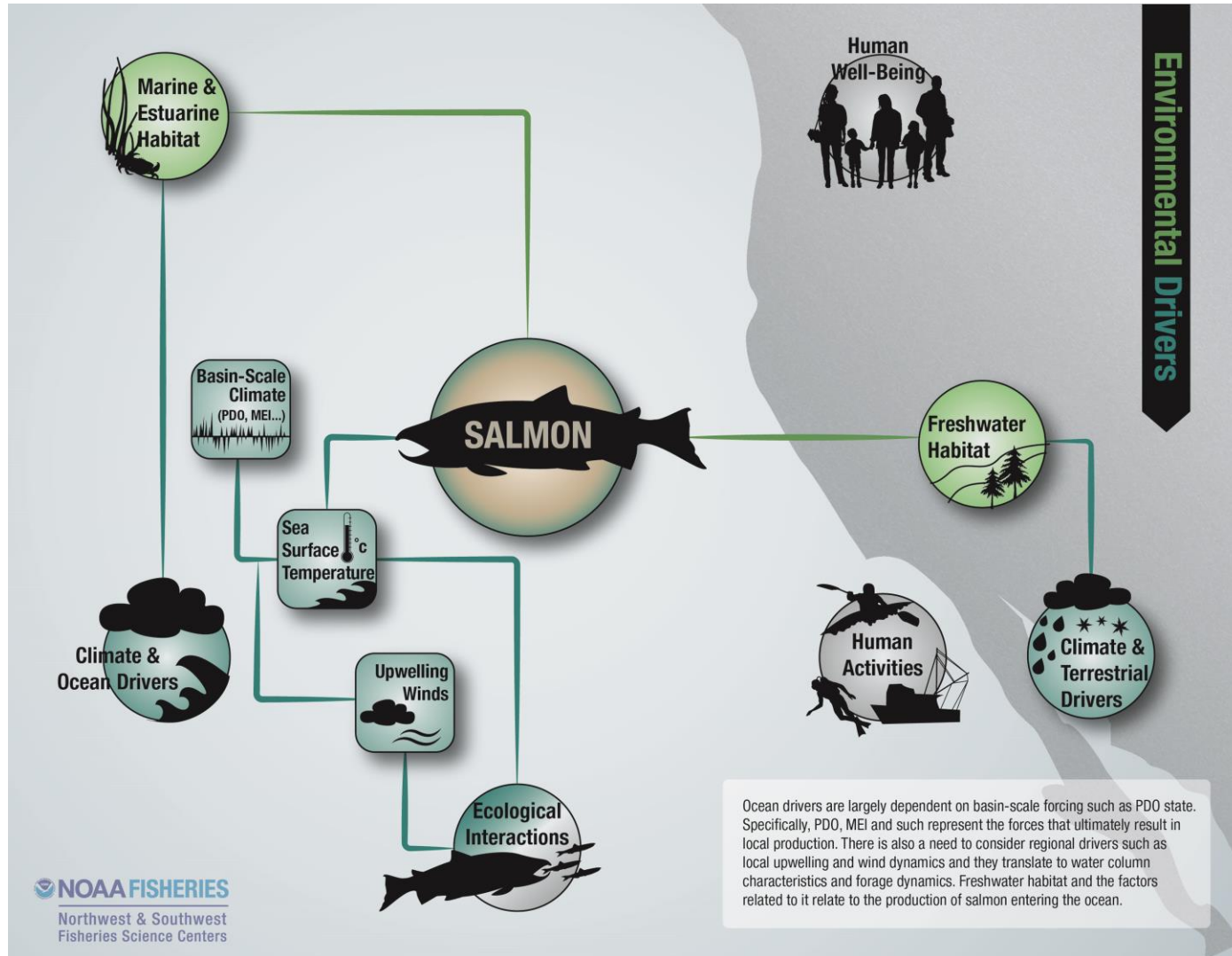


Conceptual model Example: Salmon Overview



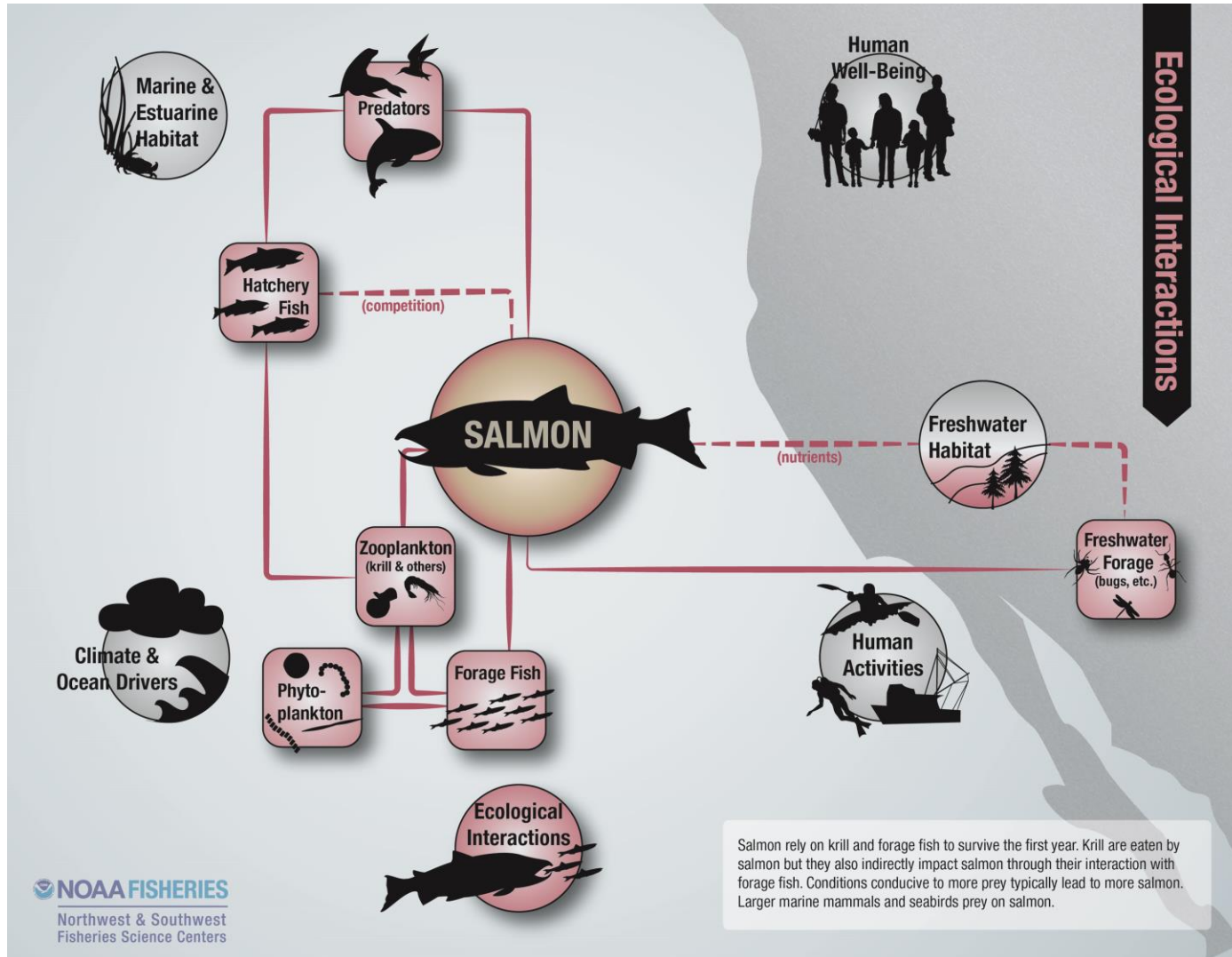
Conceptual model Example

Salmon and Environmental Drivers

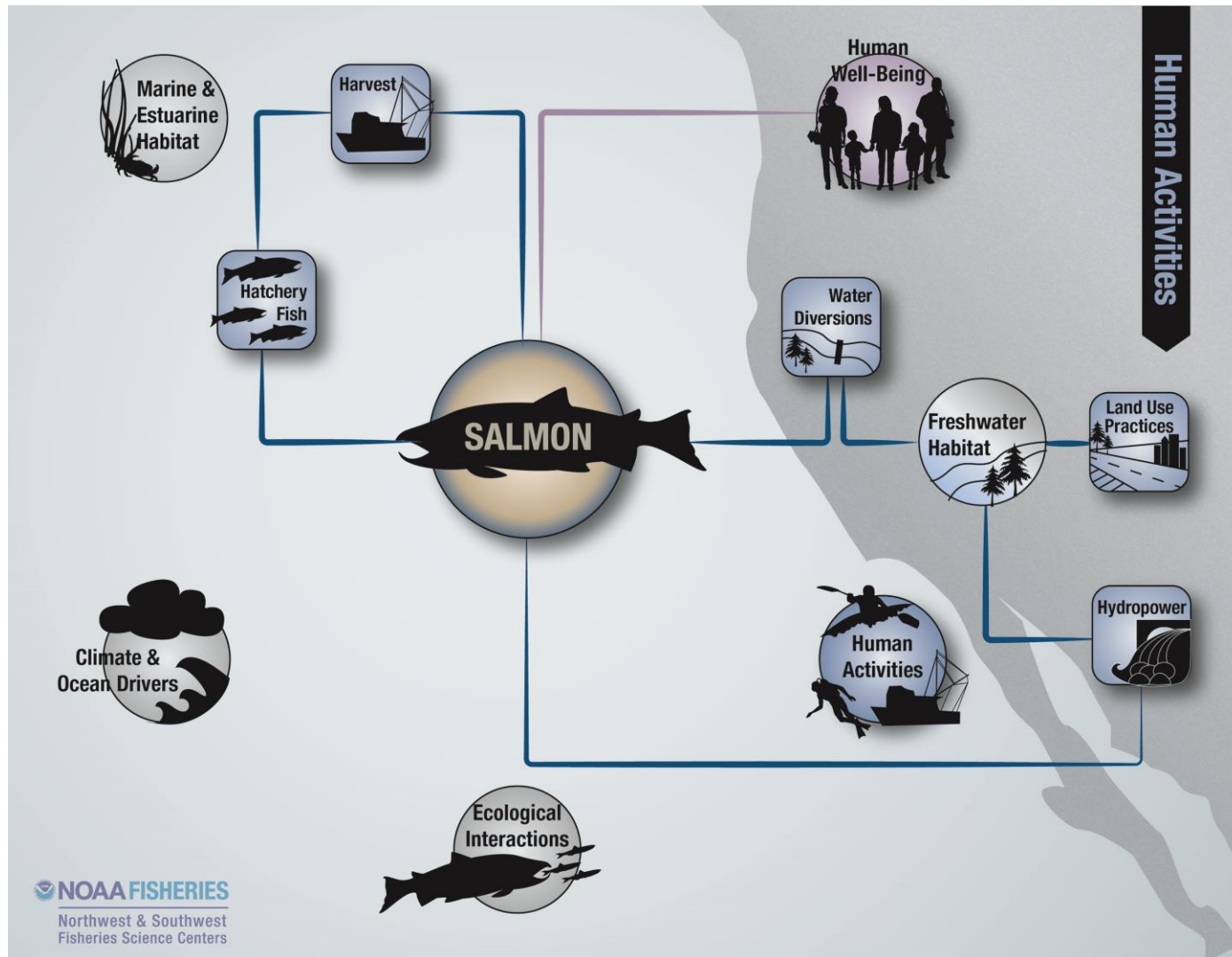


Conceptual model Example

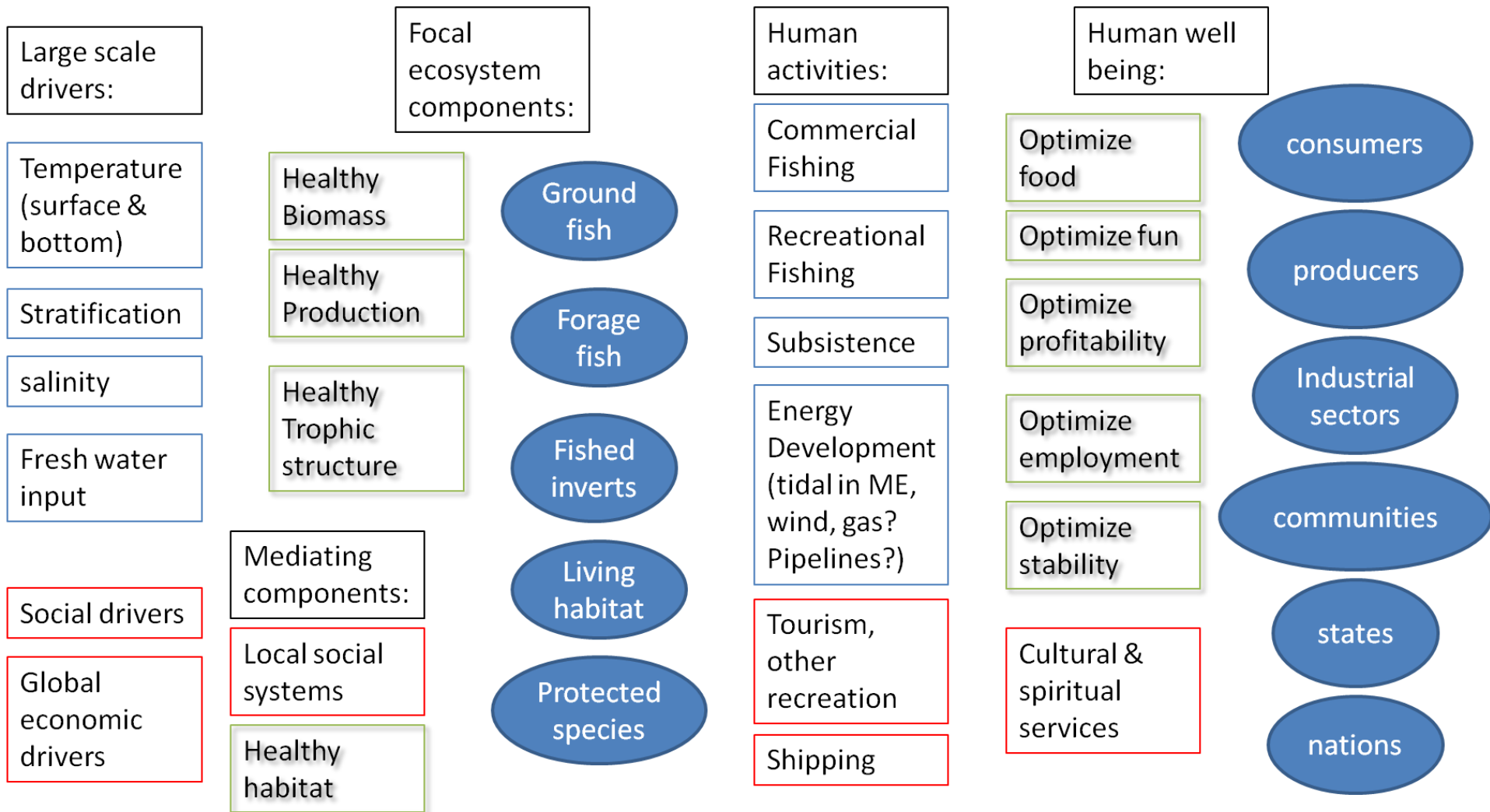
Salmon and Ecological Interactions



Conceptual model Example Salmon and Human Activities



First draft IEA Conceptual Model: Georges Bank Gulf of Maine



KEY

Category

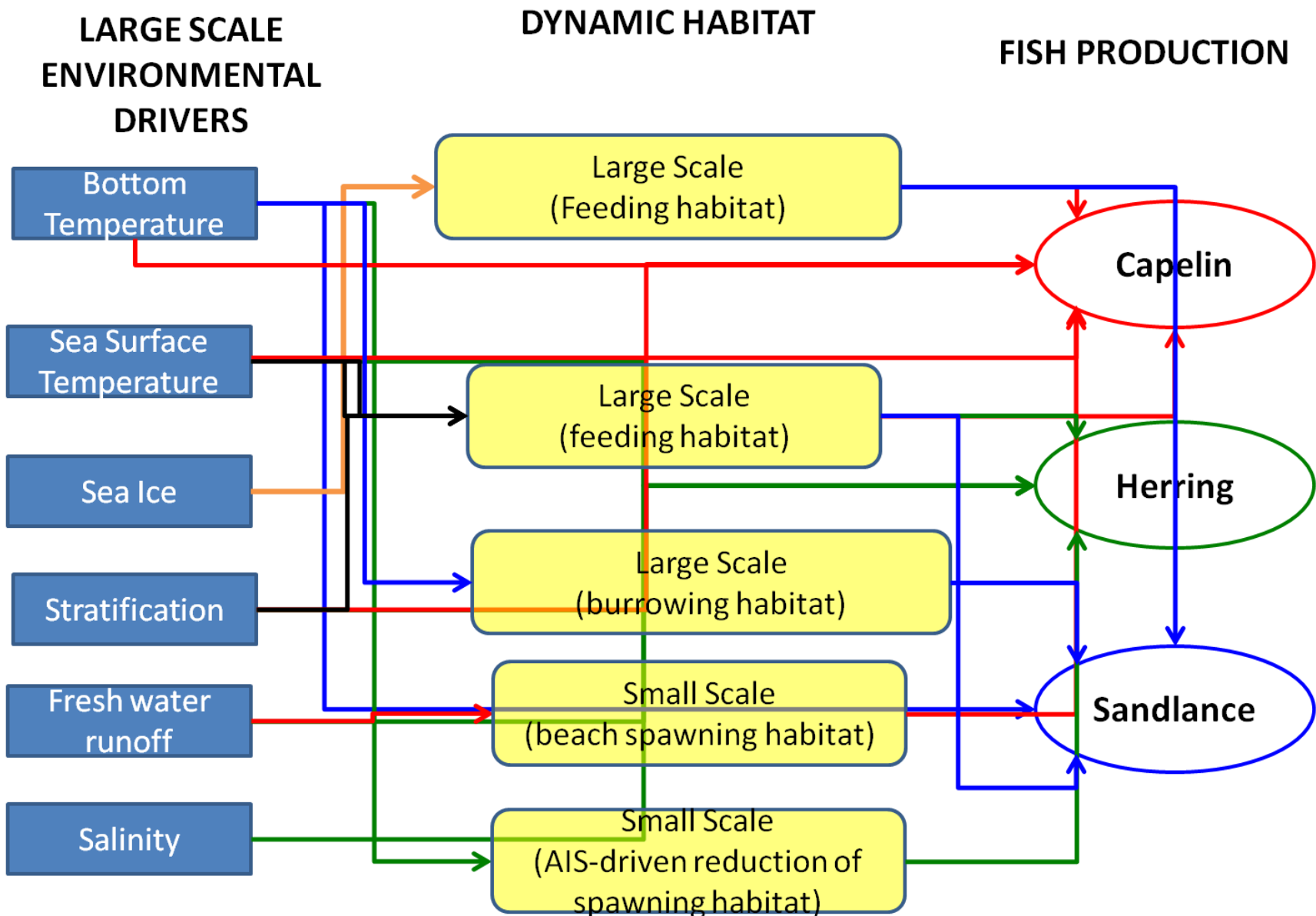
Driver or Human activity (2014)

Objective within category (pre 2015)

Driver, Activity or Benefit not considered yet

Focal component

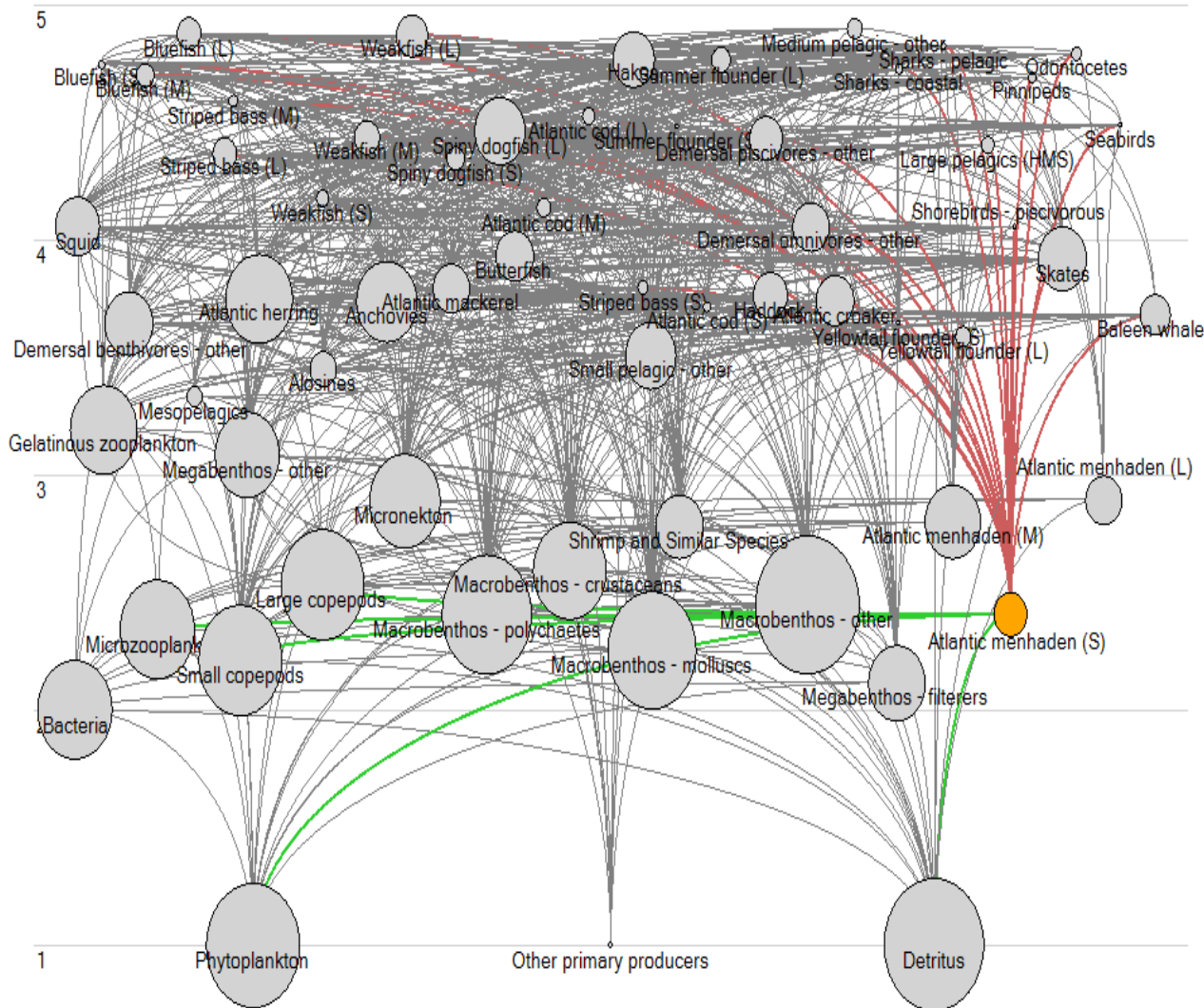
First draft Conceptual model linking large scale drivers to ecosystem component: forage fish



Chesapeake Bay example

Tradeoffs!

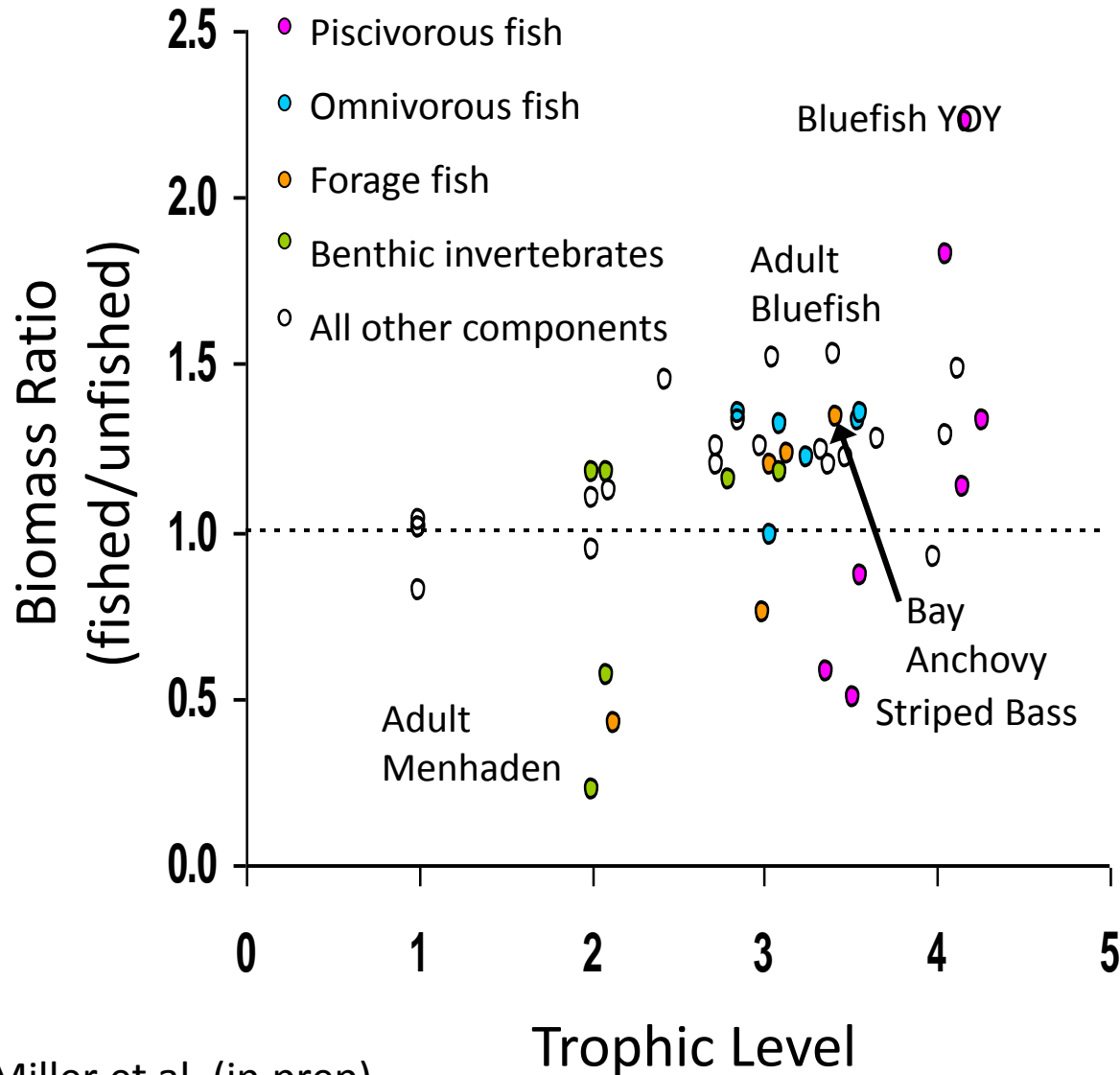
Ecosystem-based approaches



- Ecosystem-based approaches include mortality as an explicit, dynamic feature of the ecosystem
- Recognize dependencies among species.
- Focus on trade-offs among objectives

Ecosystem model of the Northwest Atlantic Coastal Shelf Ecosystem – Buchheister and Miller (in prep)

Tradeoffs in Chesapeake Bay – fishing menhaden at MSY



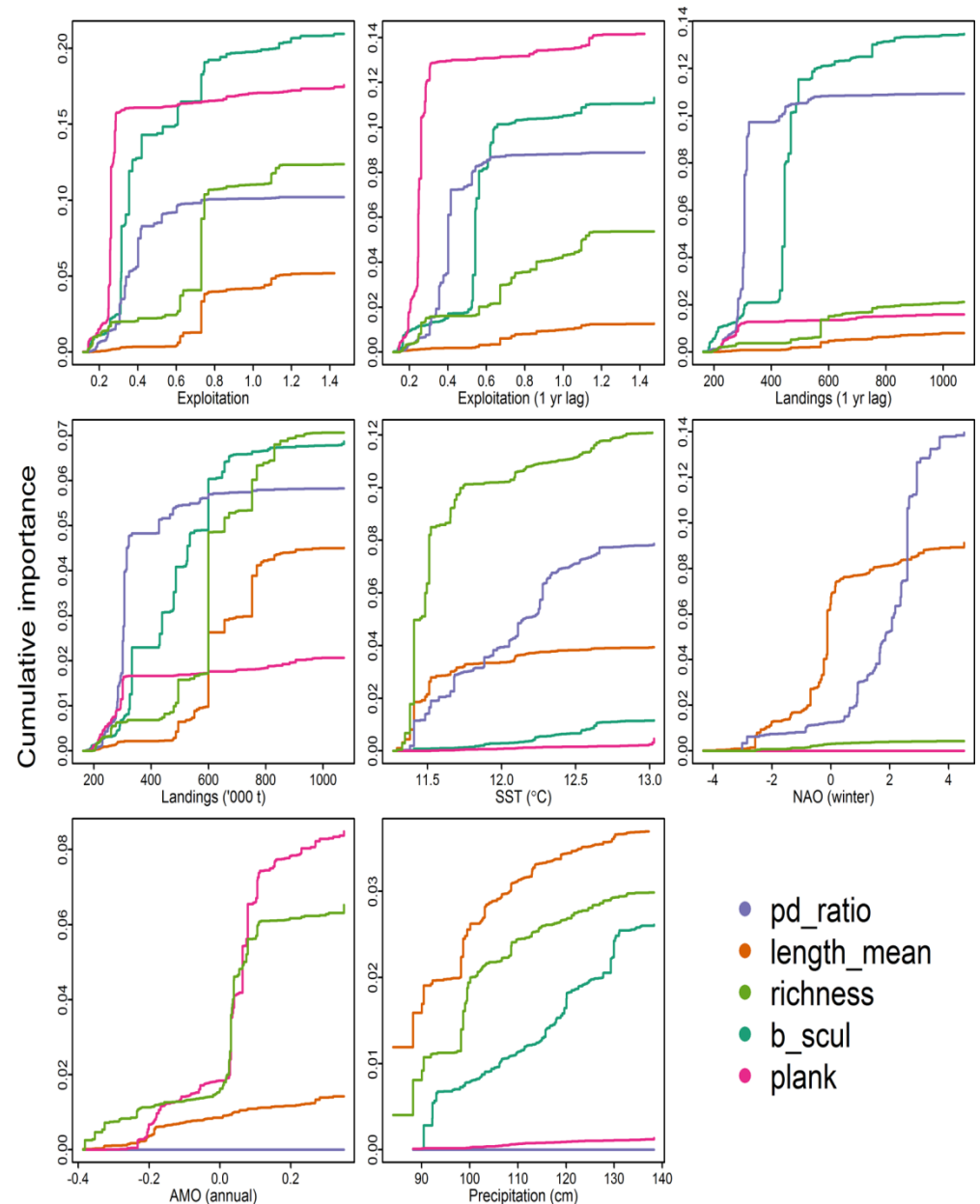
- Natural ecosystems are not Lake Wobegon,
 - There are winners and losers, (but winners and losers can be difficult to predict)
 - Limits to production
- Species are affected whether fished, managed or not

Ecosystem level Management Strategy Evaluation

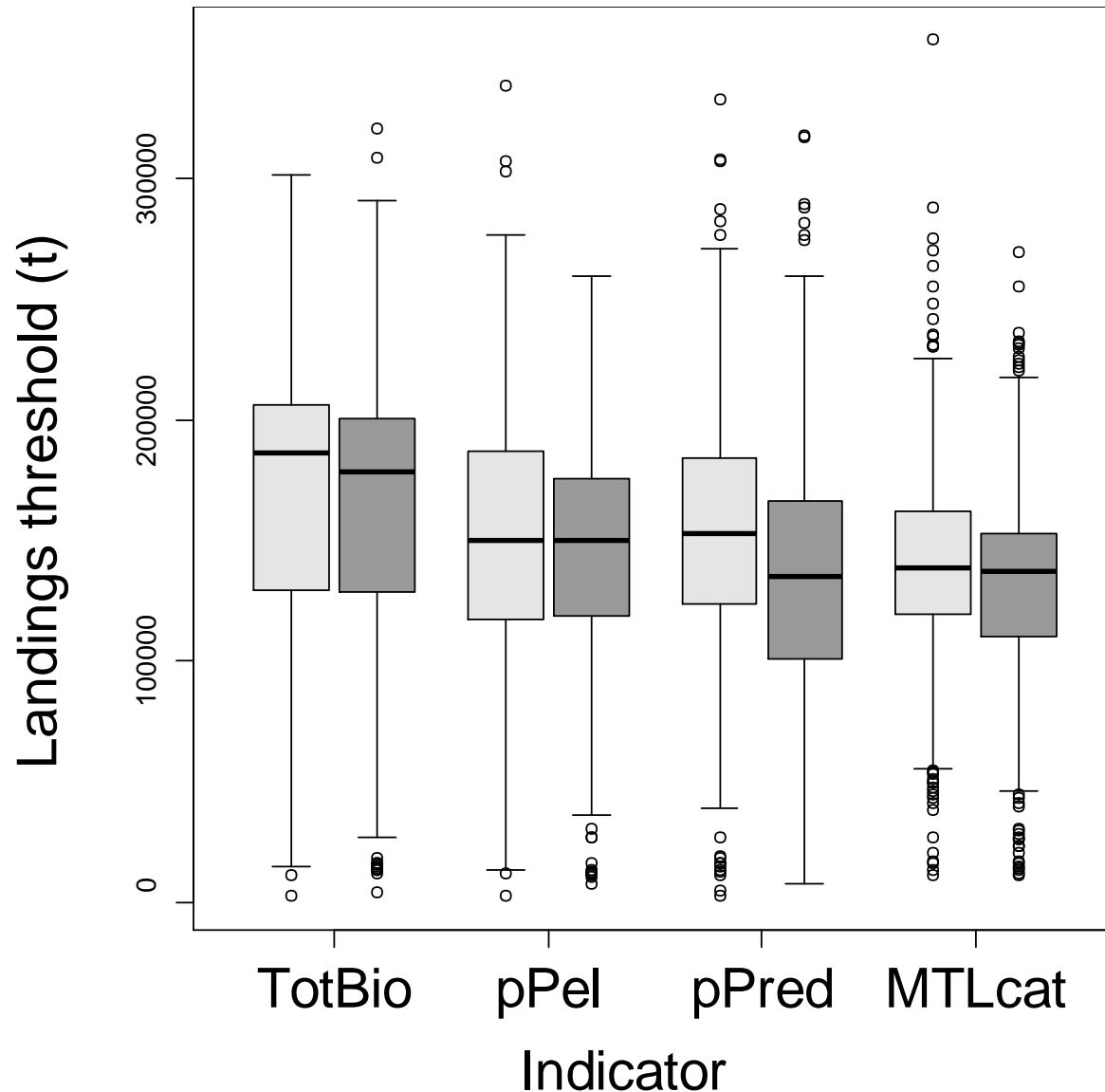
Identifying thresholds and tradeoffs
on the Northeast US shelf

Full system responses to climate and fishing

- Energy flow indicators most sensitive to fishing
- Diversity most sensitive to SST and precipitation
- Potential ecosystem level thresholds related to climate and fishing

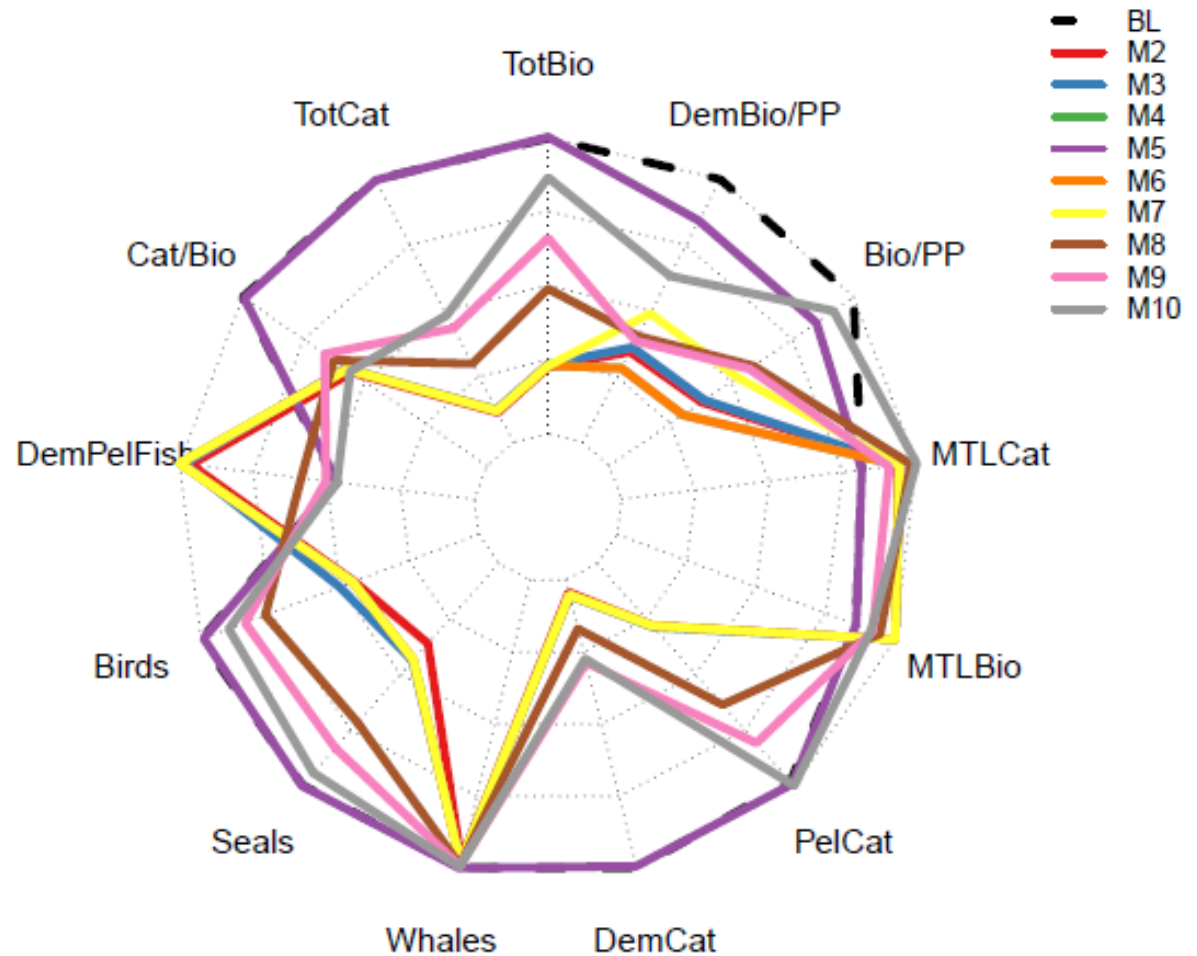
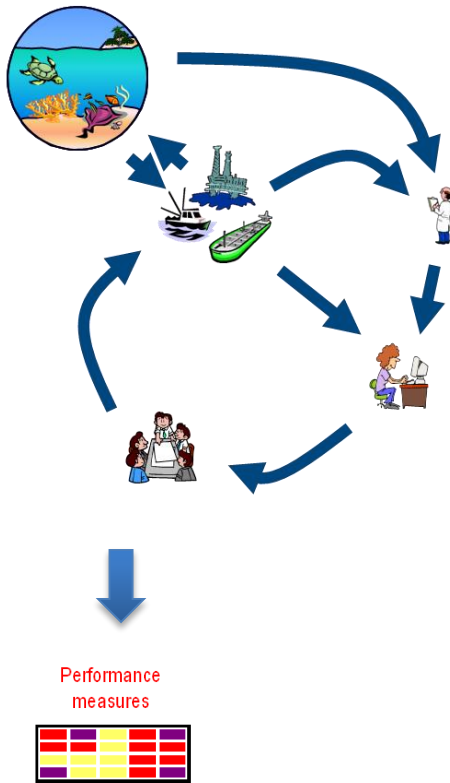


Sensitivity of thresholds to climate impact



- Reduction in groundfish growth rate.
- Thresholds of response to fishing can be dependent on other system drivers.

Full system climate impacts MSE

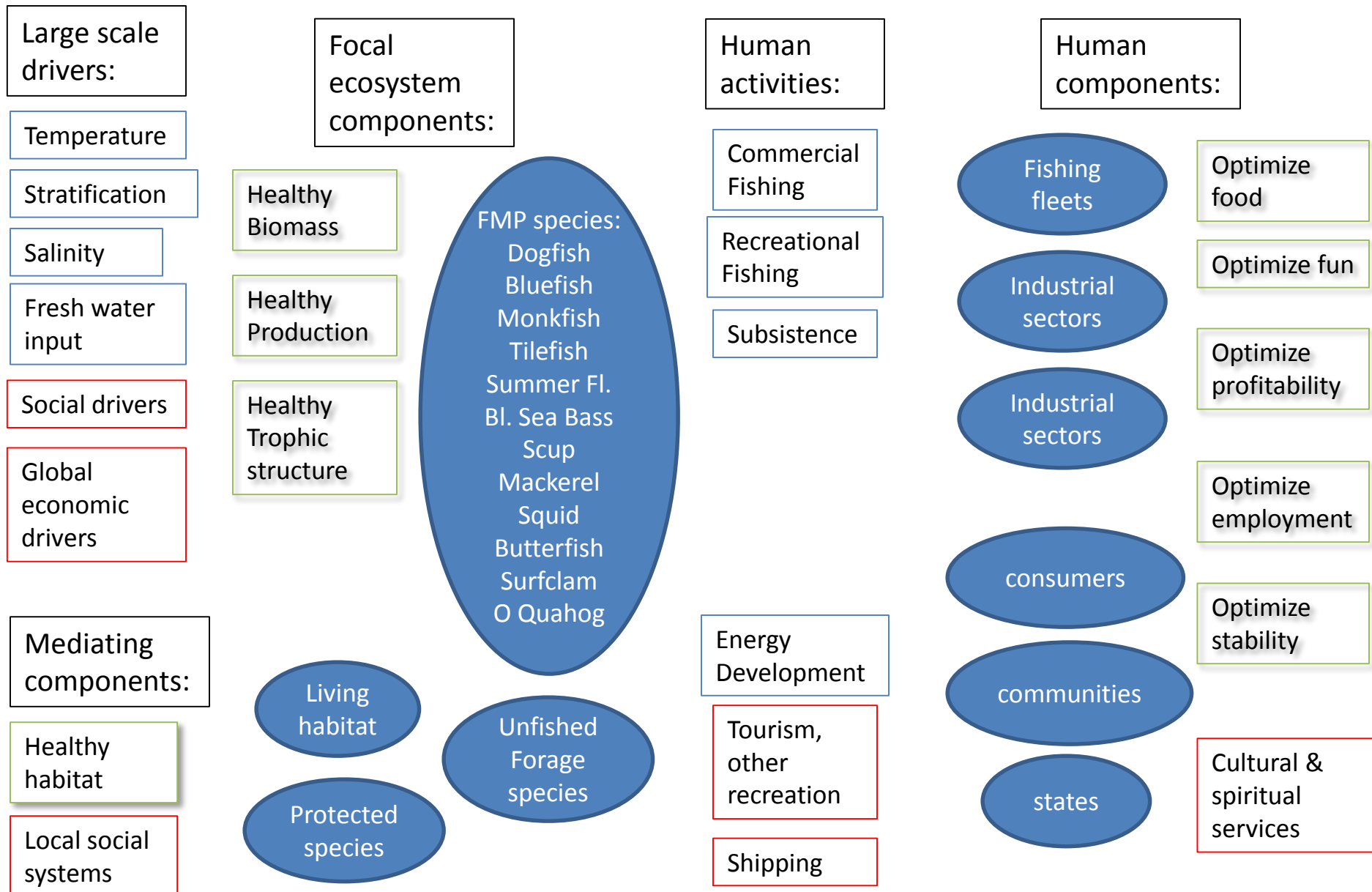


Fay, G., J.S. Link, and J.A. Hare. In Review. Assessing the effects of ocean acidification in the Northeast US using an end-to-end marine ecosystem model. Marine Ecology Progress Series.

What aspects are most important to MAFMC?

Start with a conceptual model?

Conceptual model: MAFMC species and fleet interactions

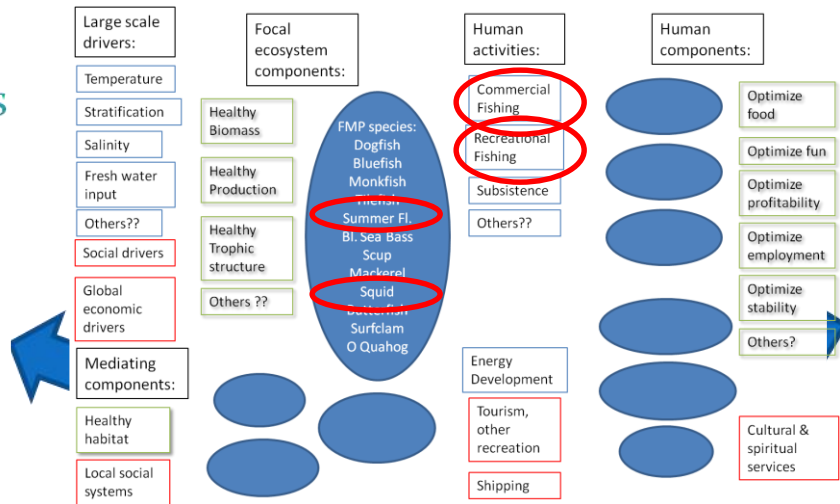
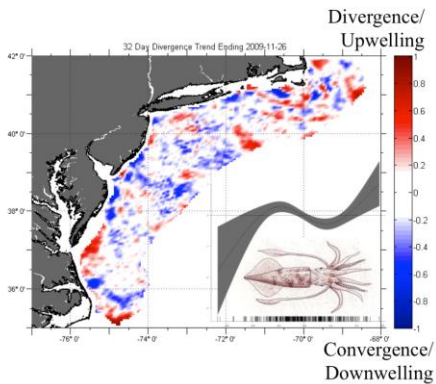


Mid Atlantic—connecting key interactions for management

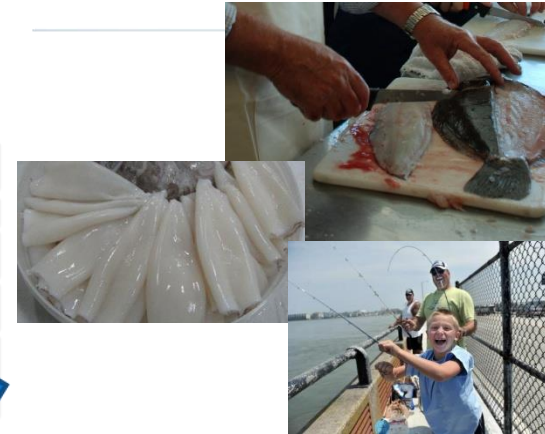
Next-tier models
flesh out key details



Environmental Drivers

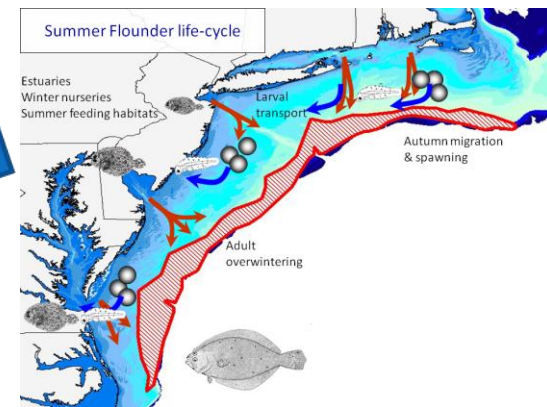


Human Activities



Ecological Interactions

“Overview” model outlines links between species and key ecosystem drivers, components, and goals



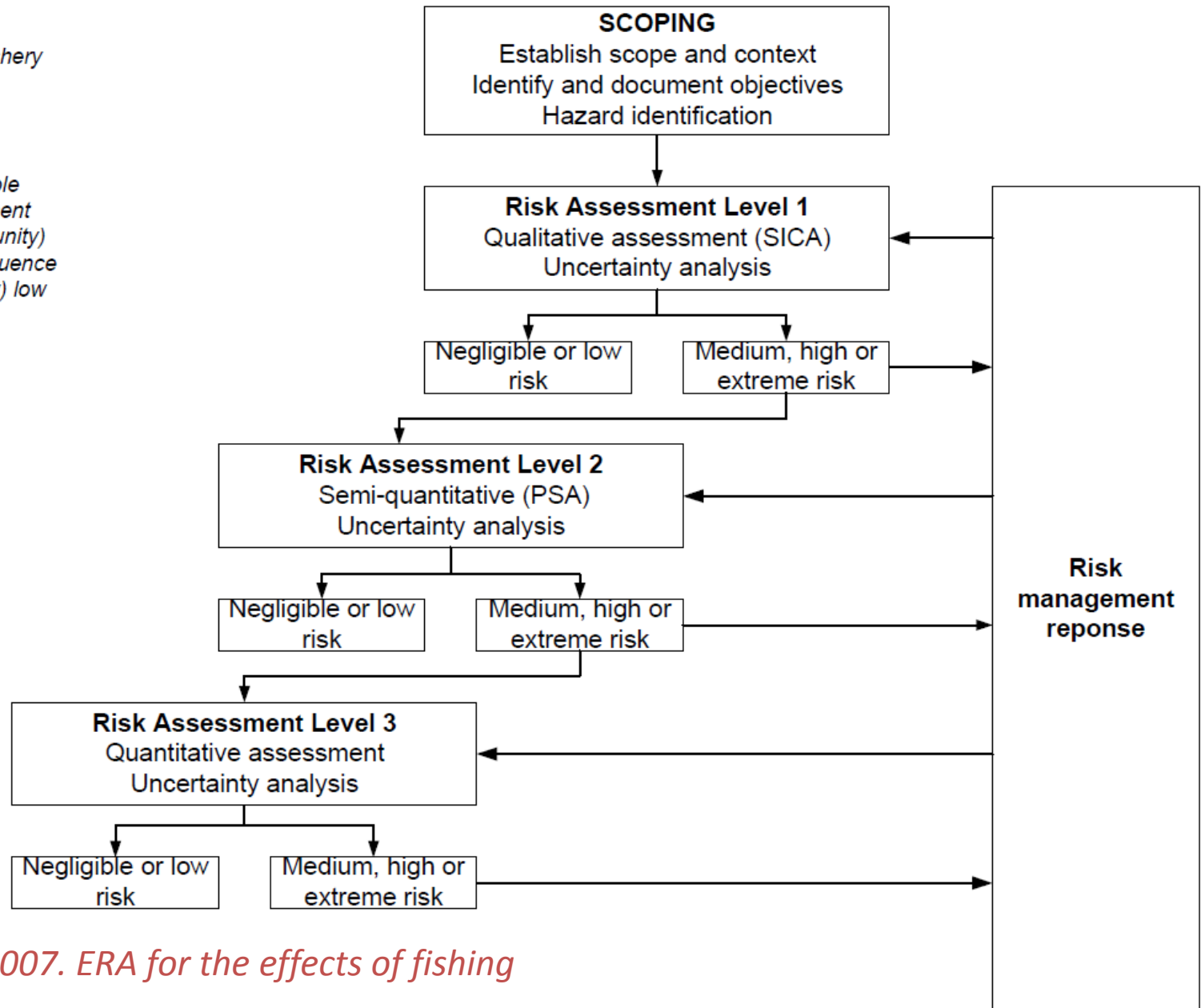
Australian Ecological Risk Assessment (ERA)

Analysis: Fishery/subfishery

*Analysis: most vulnerable element in each component (species, habitat, community)
Screen out: low consequence activities and (potentially) low risk components*

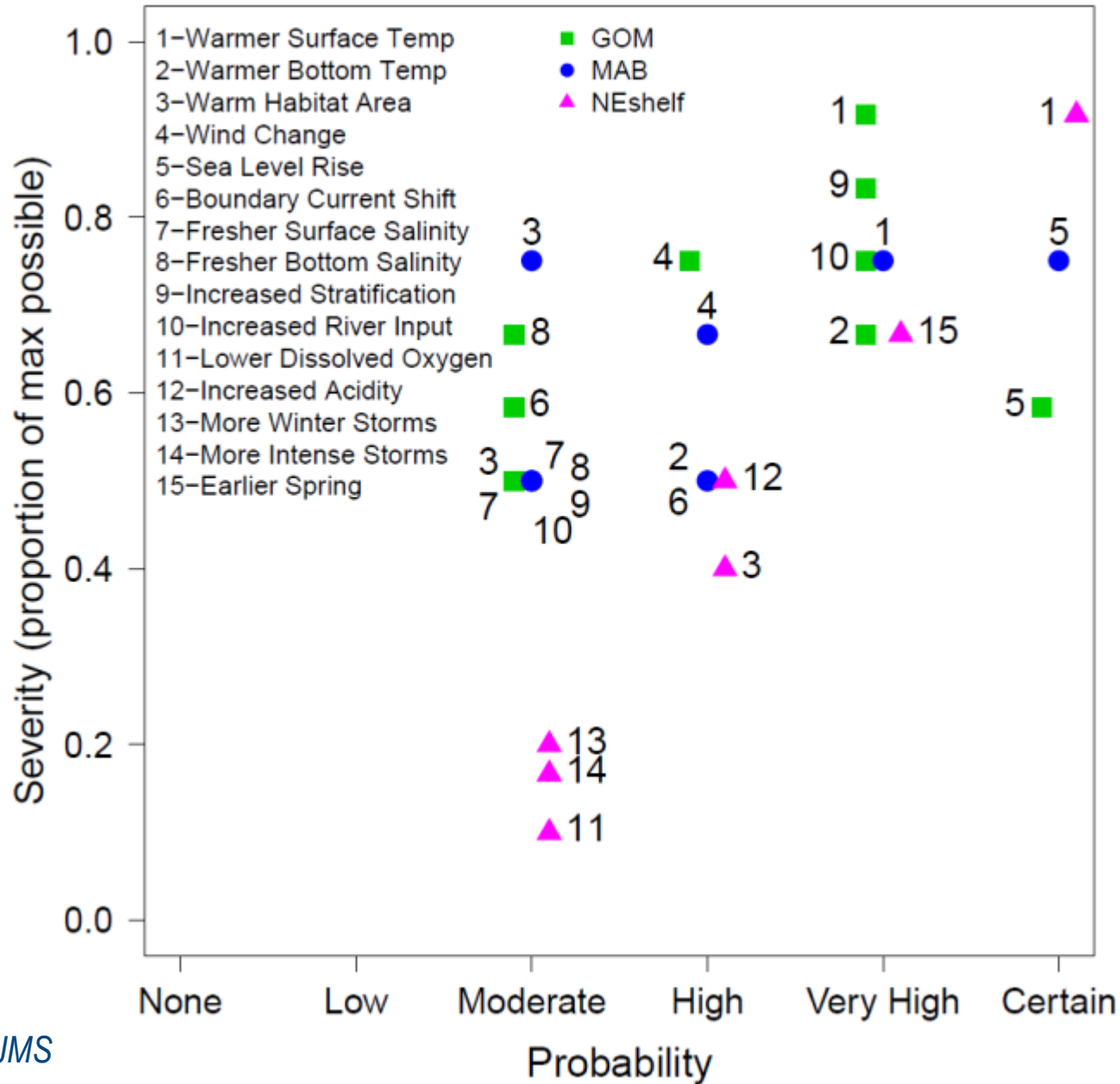
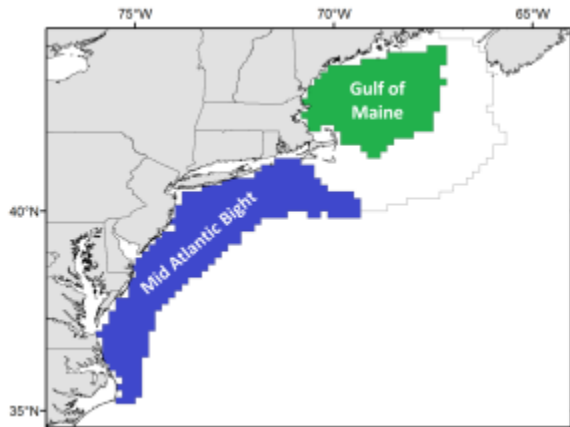
*Analysis: full set of elements for each component
Screen out: low risk elements*

Analysis: selected elements (species, habitat, community); spatial and temporal dynamics



Hobday et al. 2007. ERA for the effects of fishing

Climate risks vary at the regional scale



Gaichas, Link, and Hare 2014 ICES JMS

Conceptual model: What does the MAFMC want in here?

