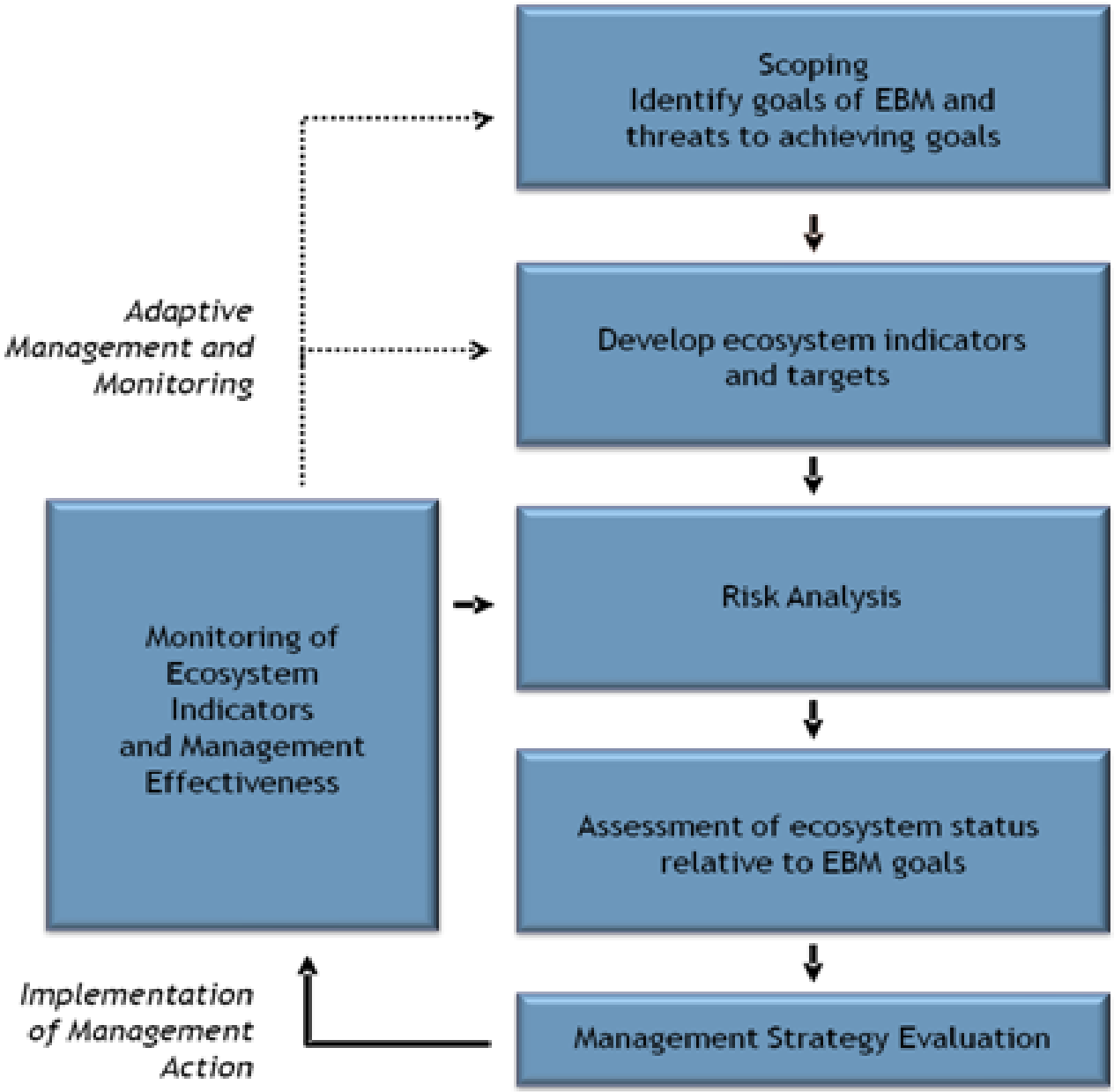
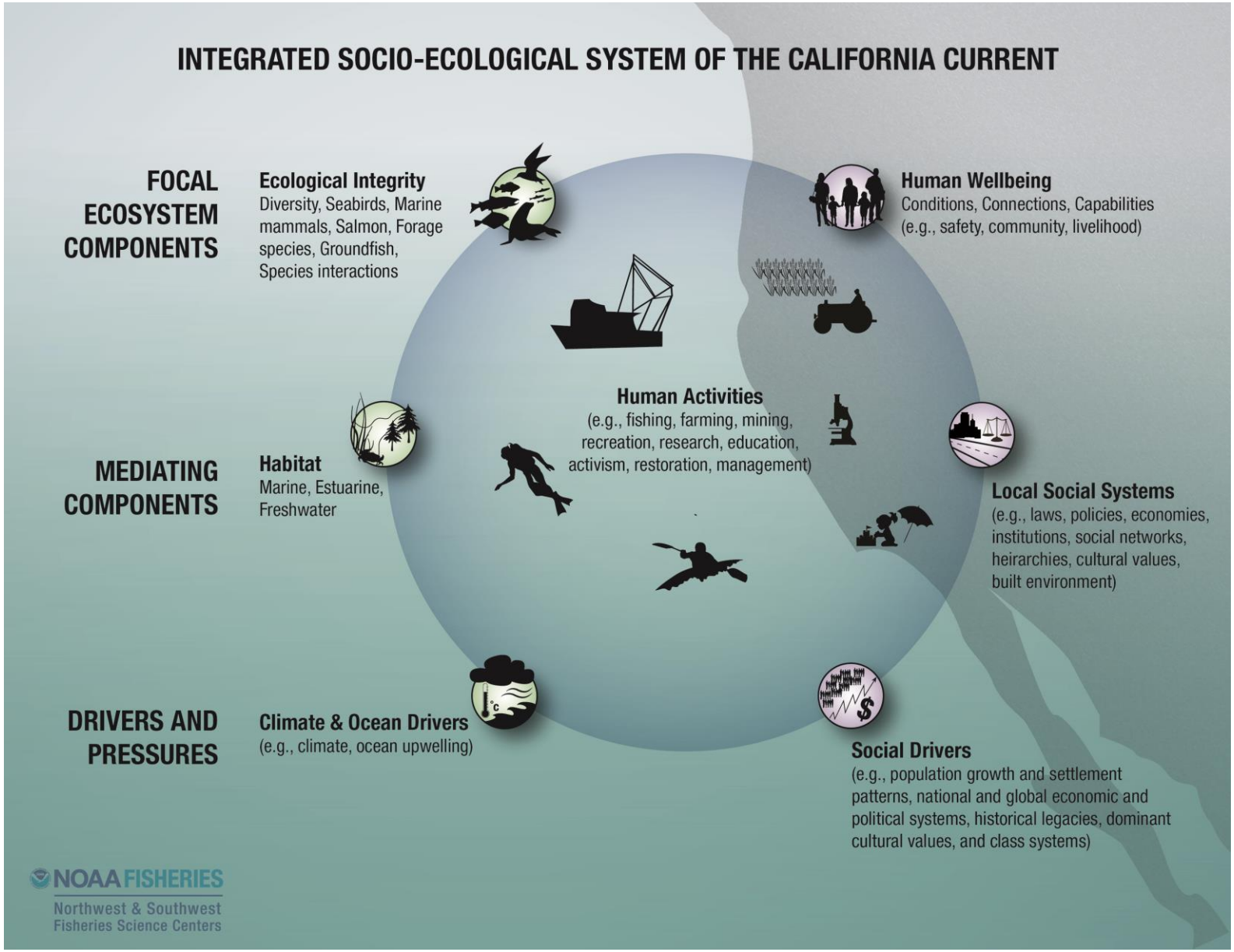
Integrated Ecosystem Assessments for NW Atlantic Ecosystems

How might conceptual models help address interactions?

Integrated Ecosystem Assessment is a *Process*



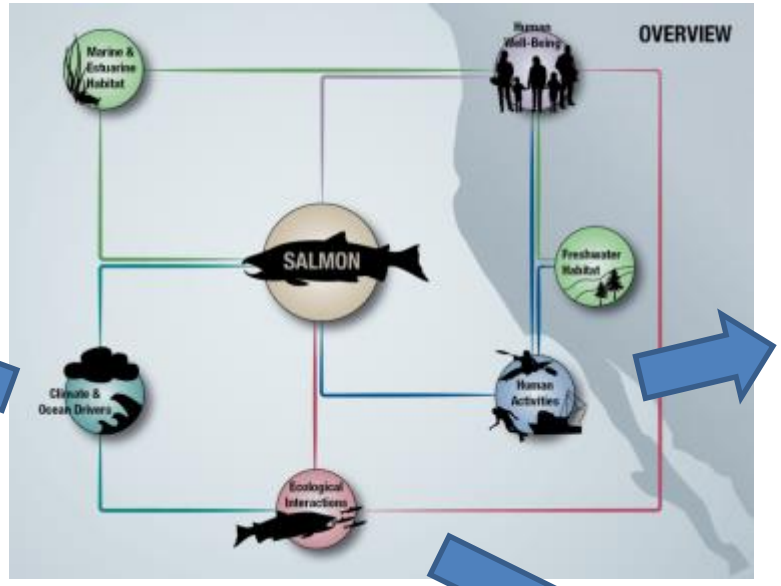
California Current Example



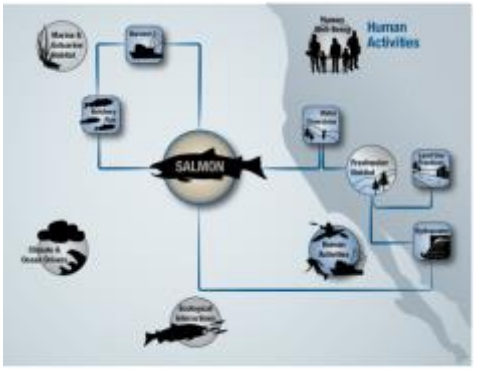
Overview and detailed models

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

Environmental Drivers

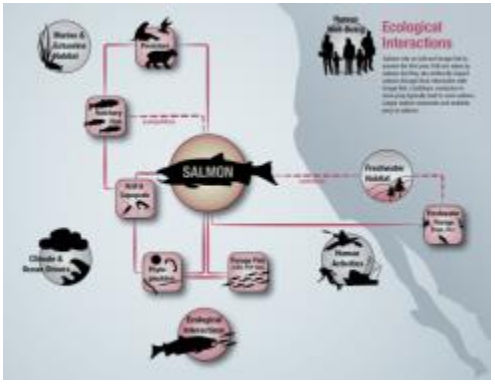


Human Activities

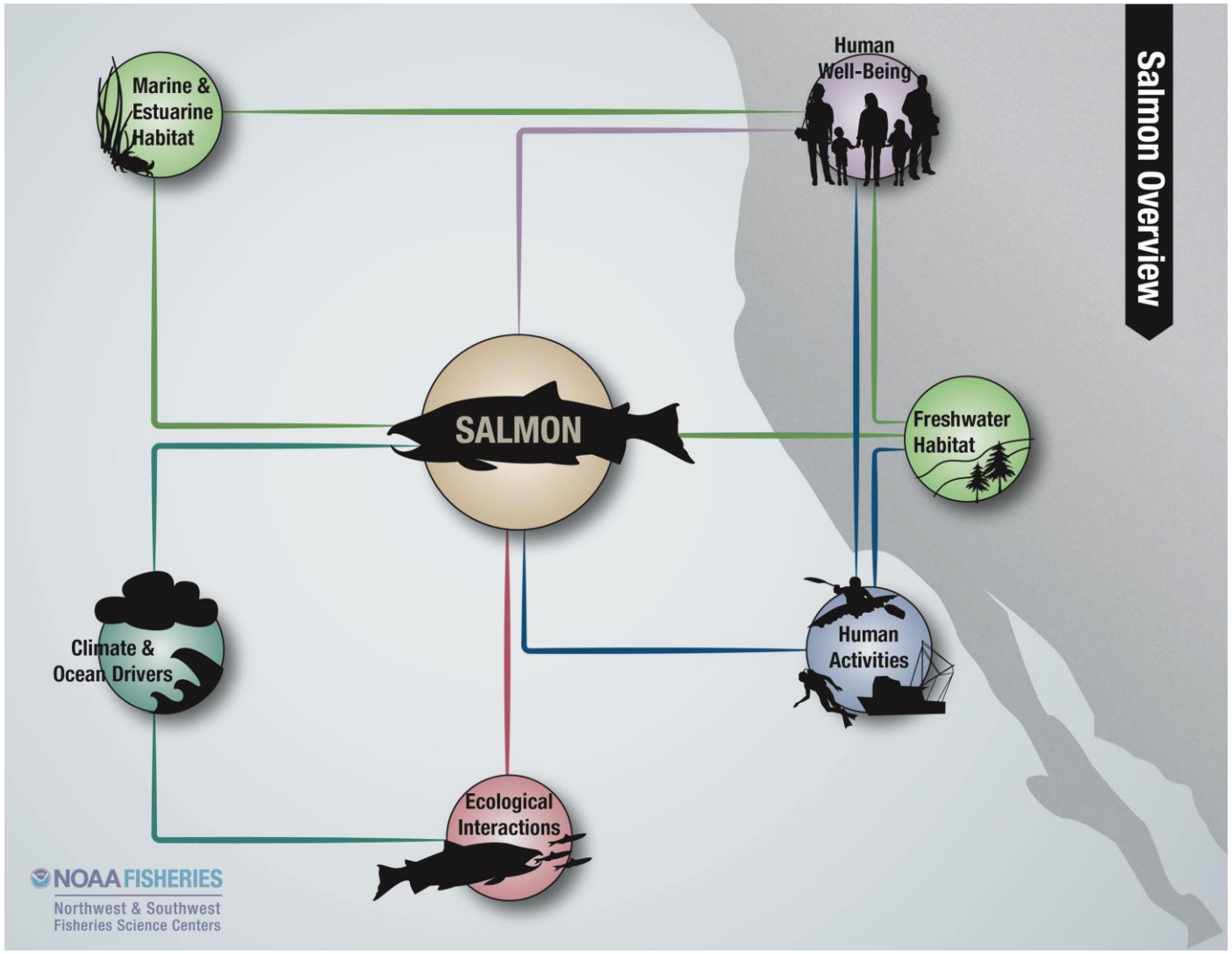


Next-tier models flesh out key details

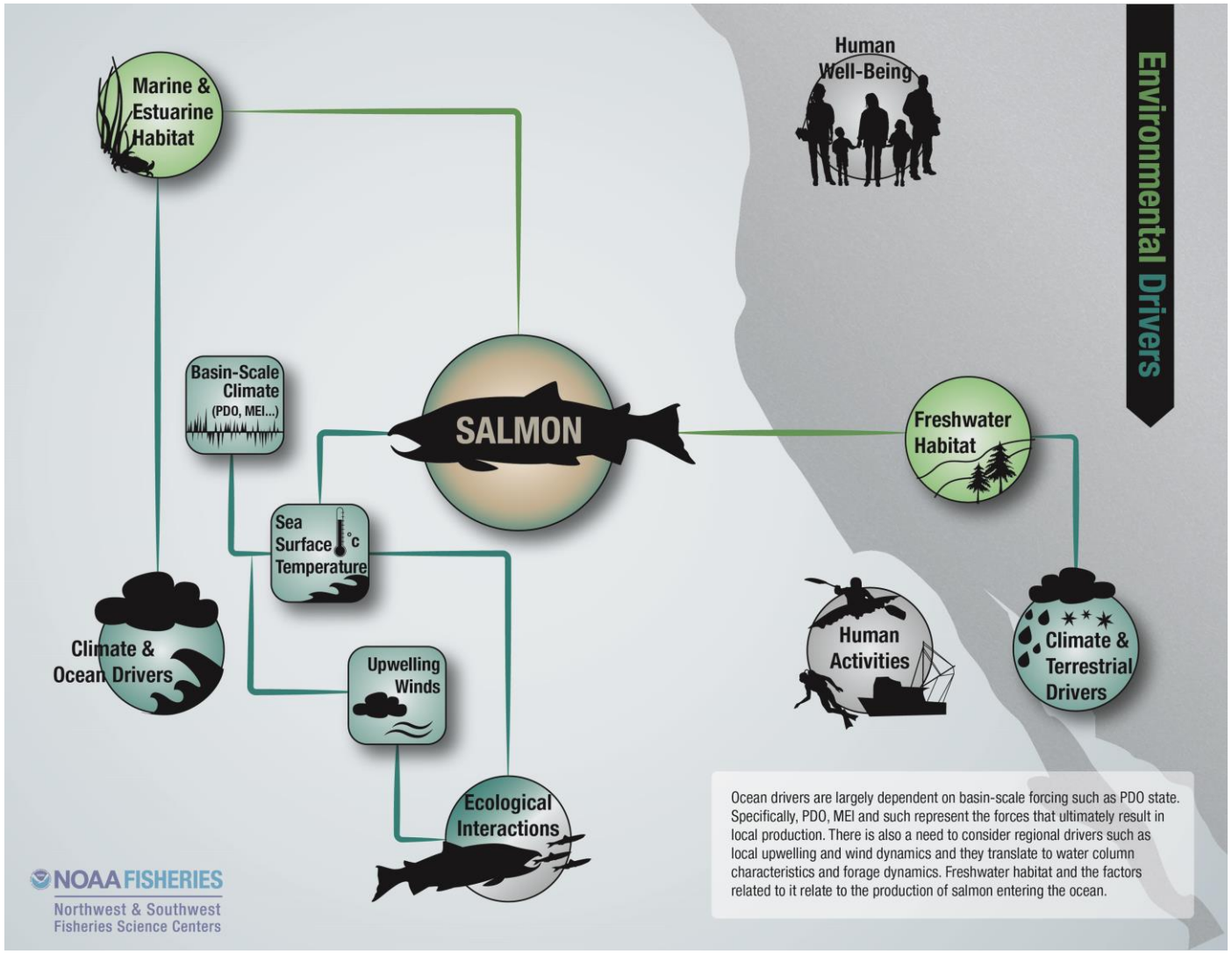
Ecological Interactions



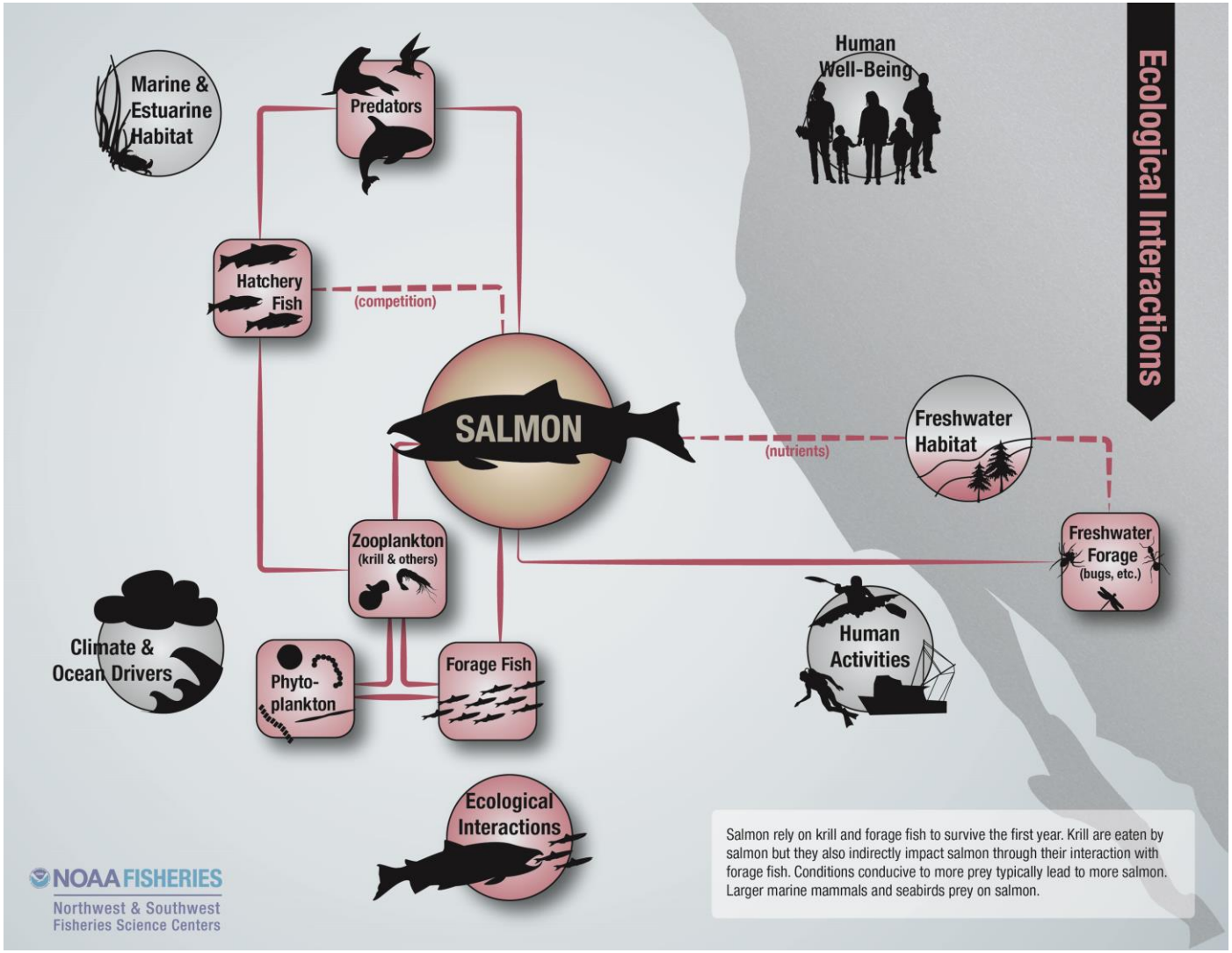
Conceptual model Example: Salmon Overview



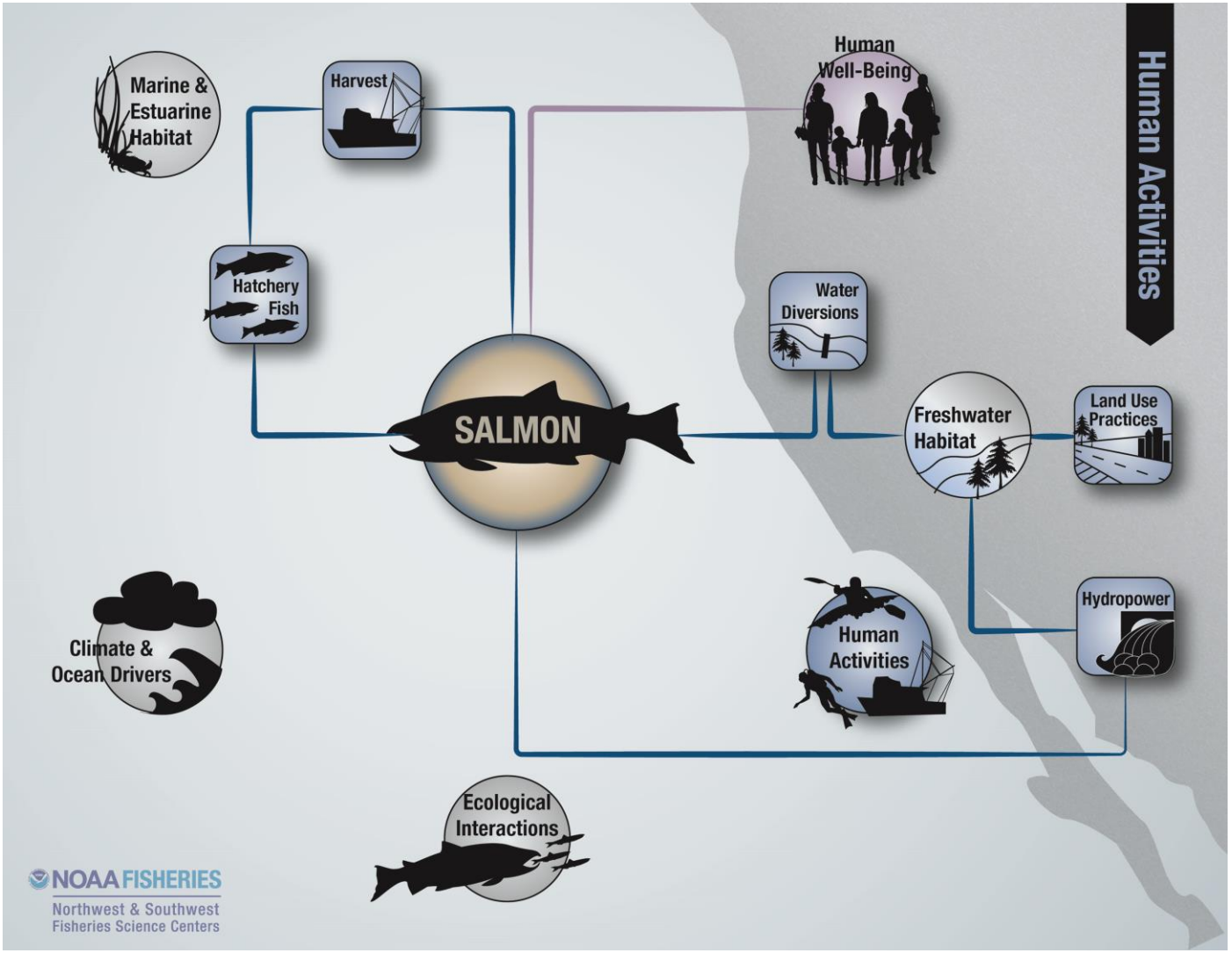
Conceptual model Example
Salmon and Environmental Drivers



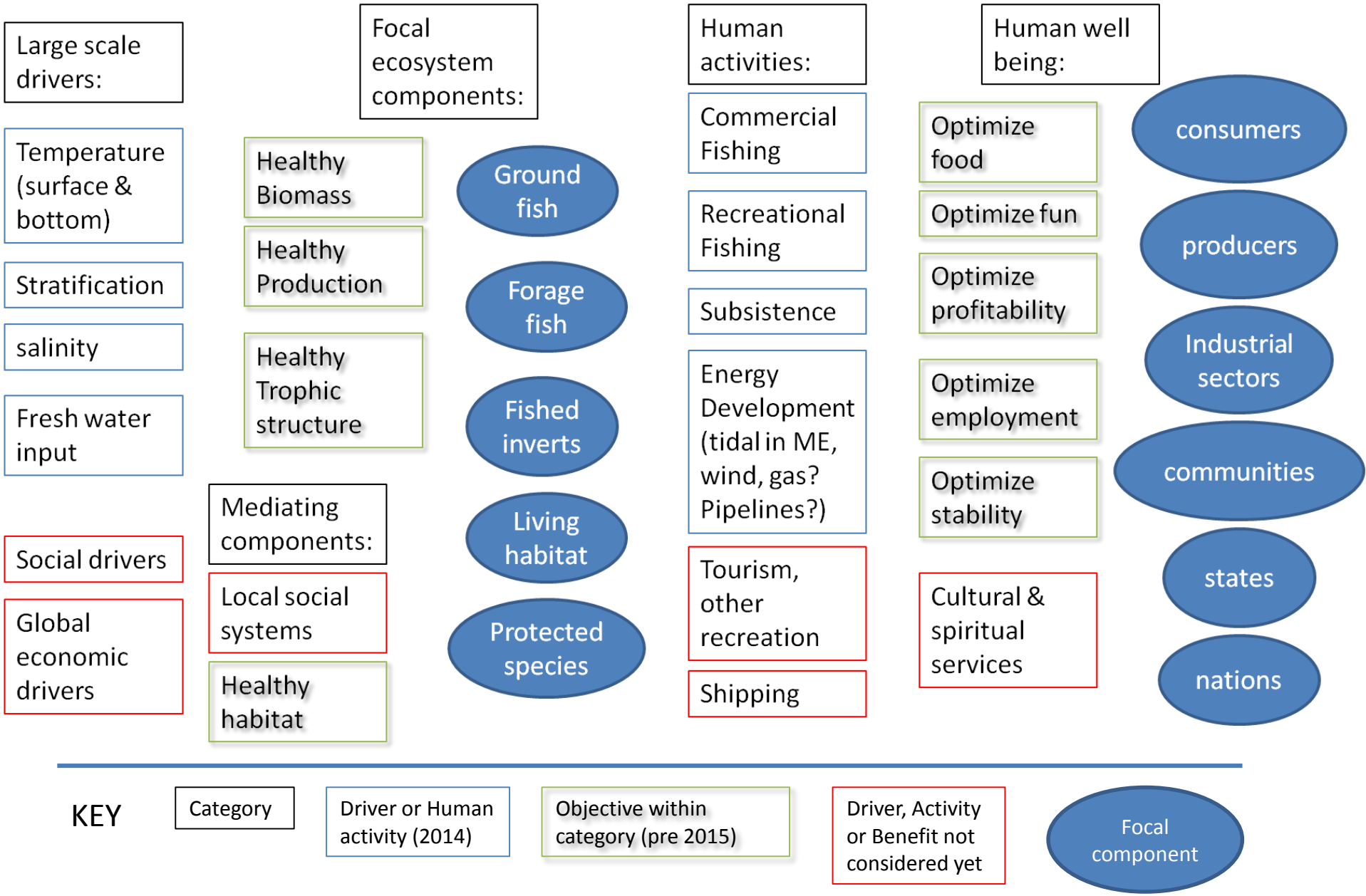
Conceptual model Example
Salmon and Ecological Interactions



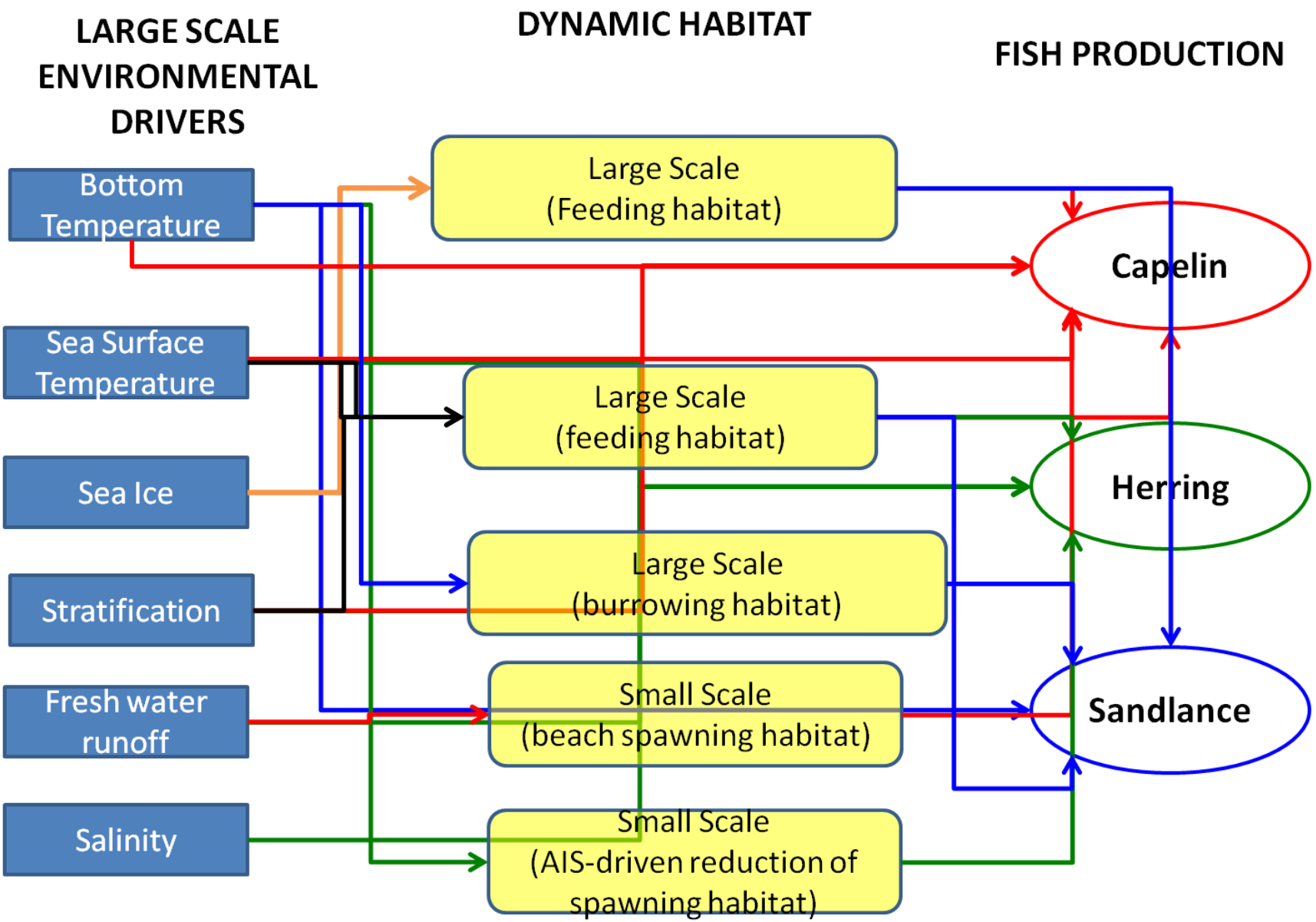
Conceptual model Example
Salmon and Human Activities



First draft IEA Conceptual Model: Georges Bank Gulf of Maine



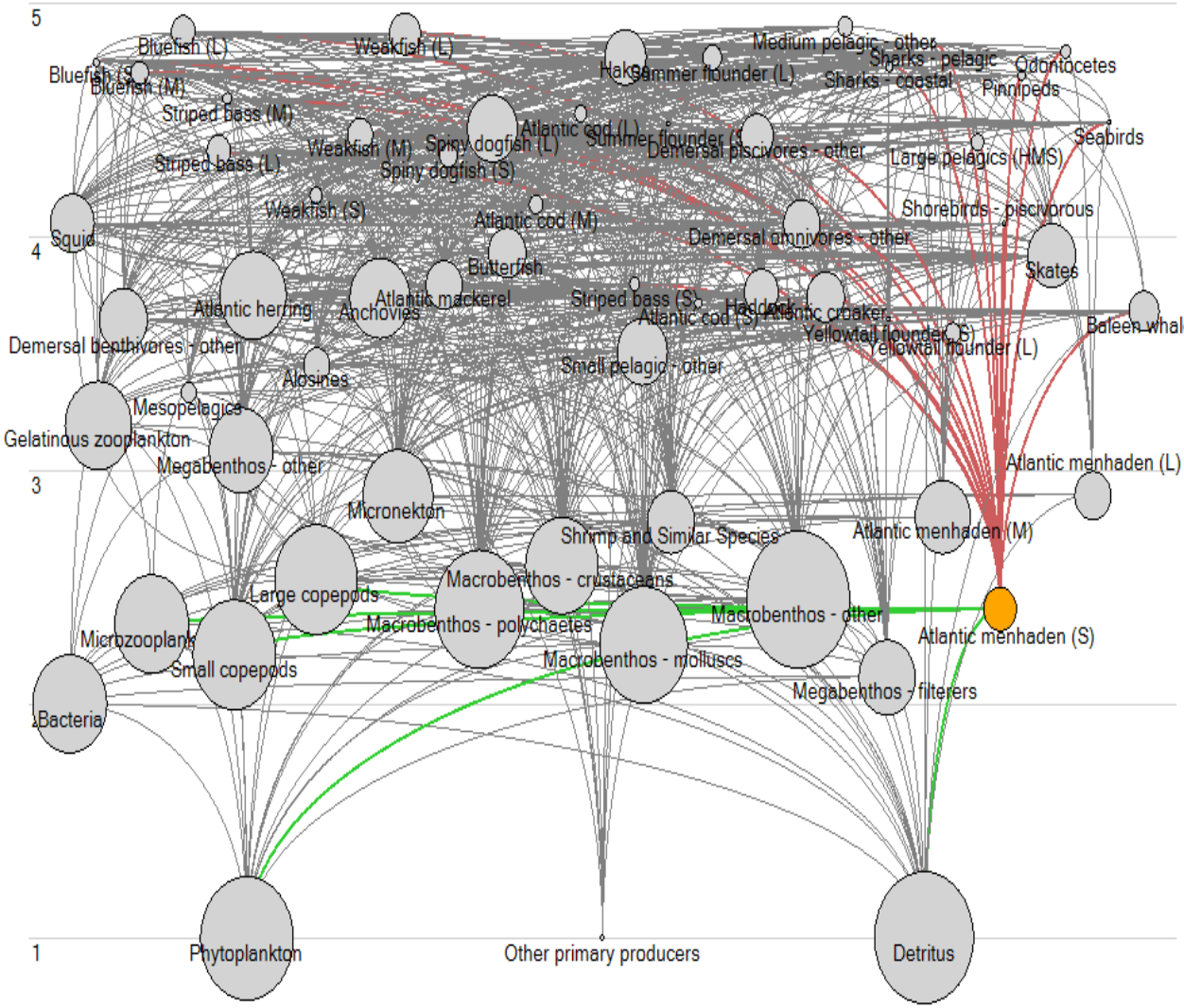
First draft Conceptual model linking large scale drivers to ecosystem component: forage fish



Chesapeake Bay example

Tradeoffs!

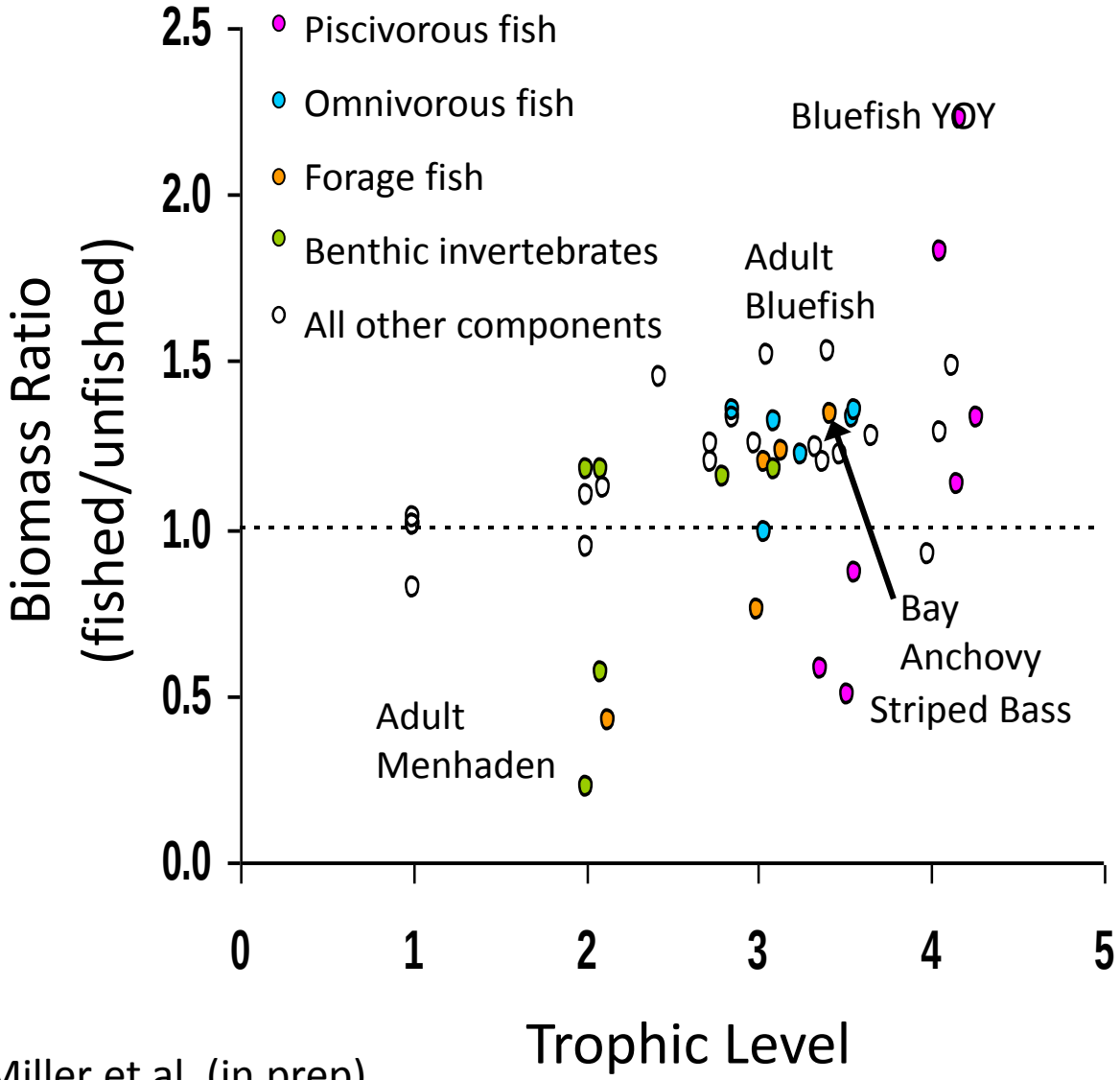
Ecosystem-based approaches



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

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

Tradeoffs in Chesapeake Bay – fishing menhaden at MSY



Miller et al. (in prep)

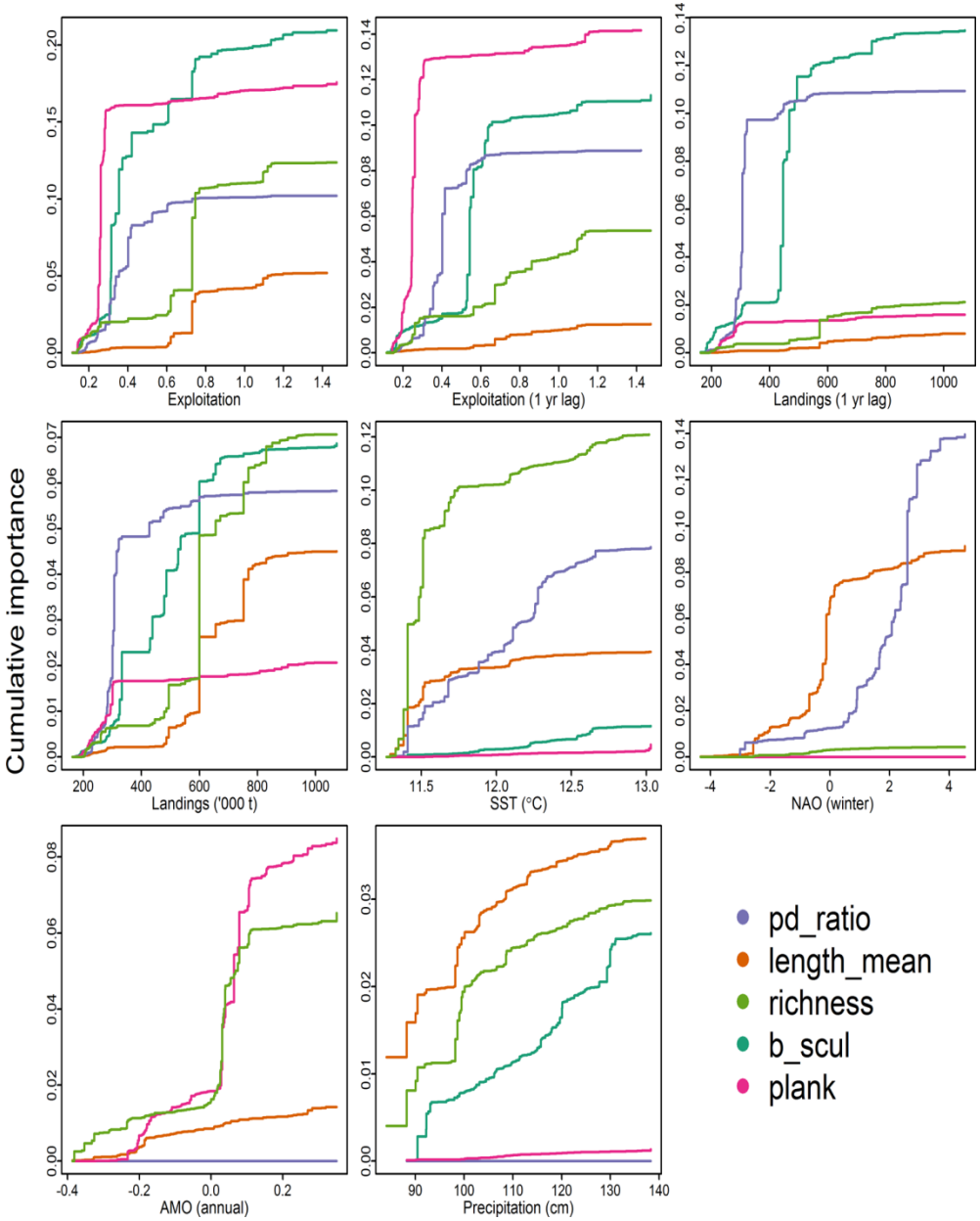
- Natural ecosystems are not Lake Wobegon,
  - There are winners and losers, (but winners and losers can be difficult to predict)
  - Limits to production
- Species are affected whether fished, managed or not

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



PLOS ONE

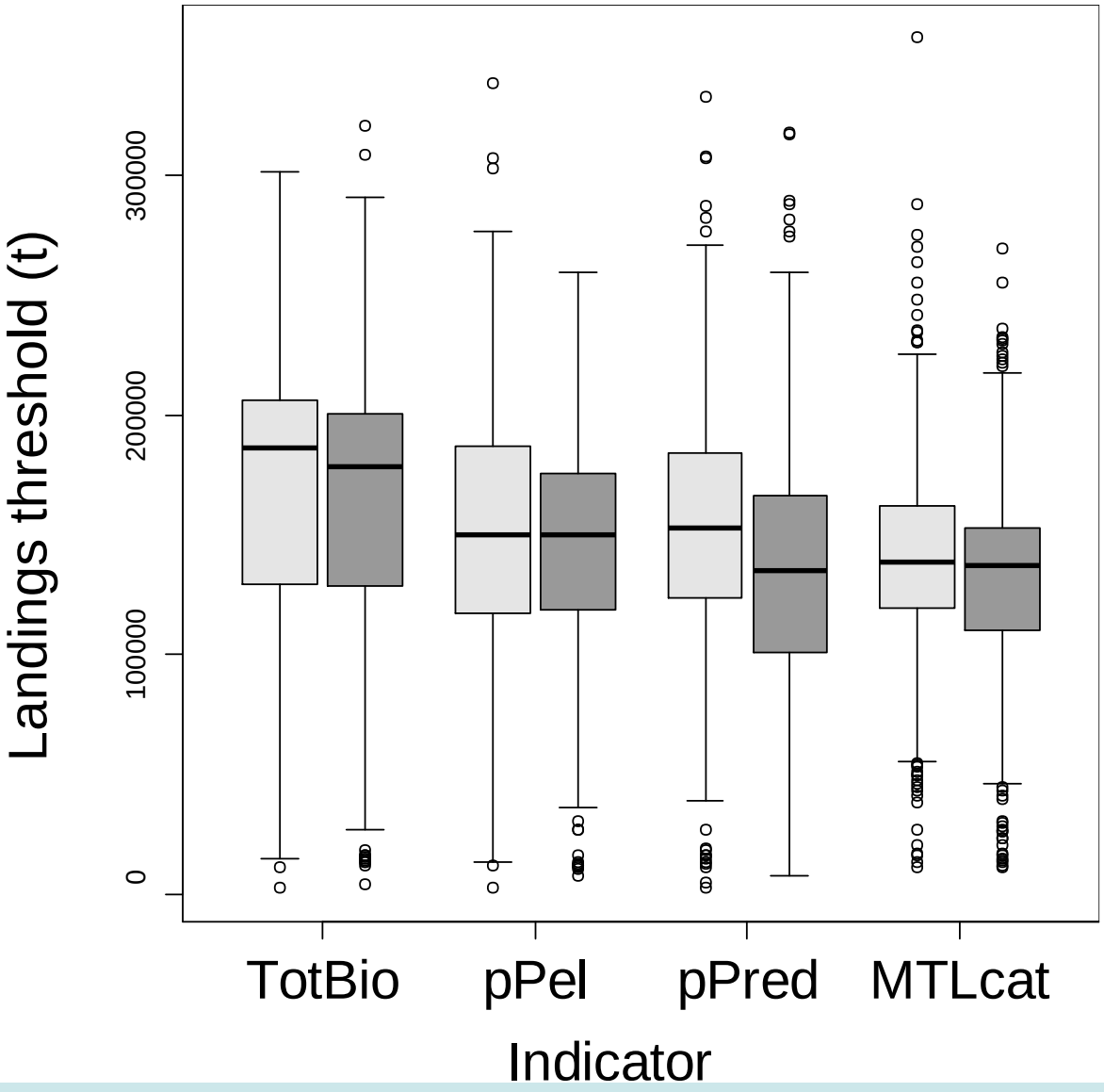
RESEARCH ARTICLE

Quantifying Patterns of Change in Marine Ecosystem Response to Multiple Pressures

Scott I. Large[1¤a]*, Gavin Fay[1¤b], Kevin D. Friedland[2], Jason S. Link[1]

PLOS ONE | DOI:10.1371/journal.pone.0119922 March 17, 2015

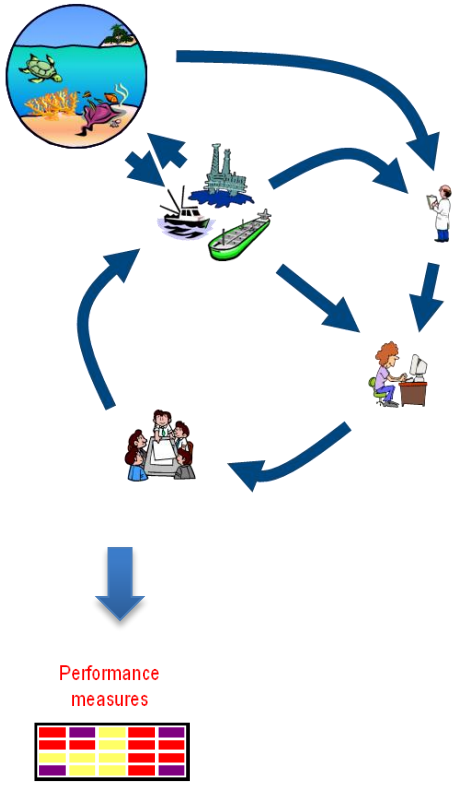
Sensitivity of thresholds to climate impact

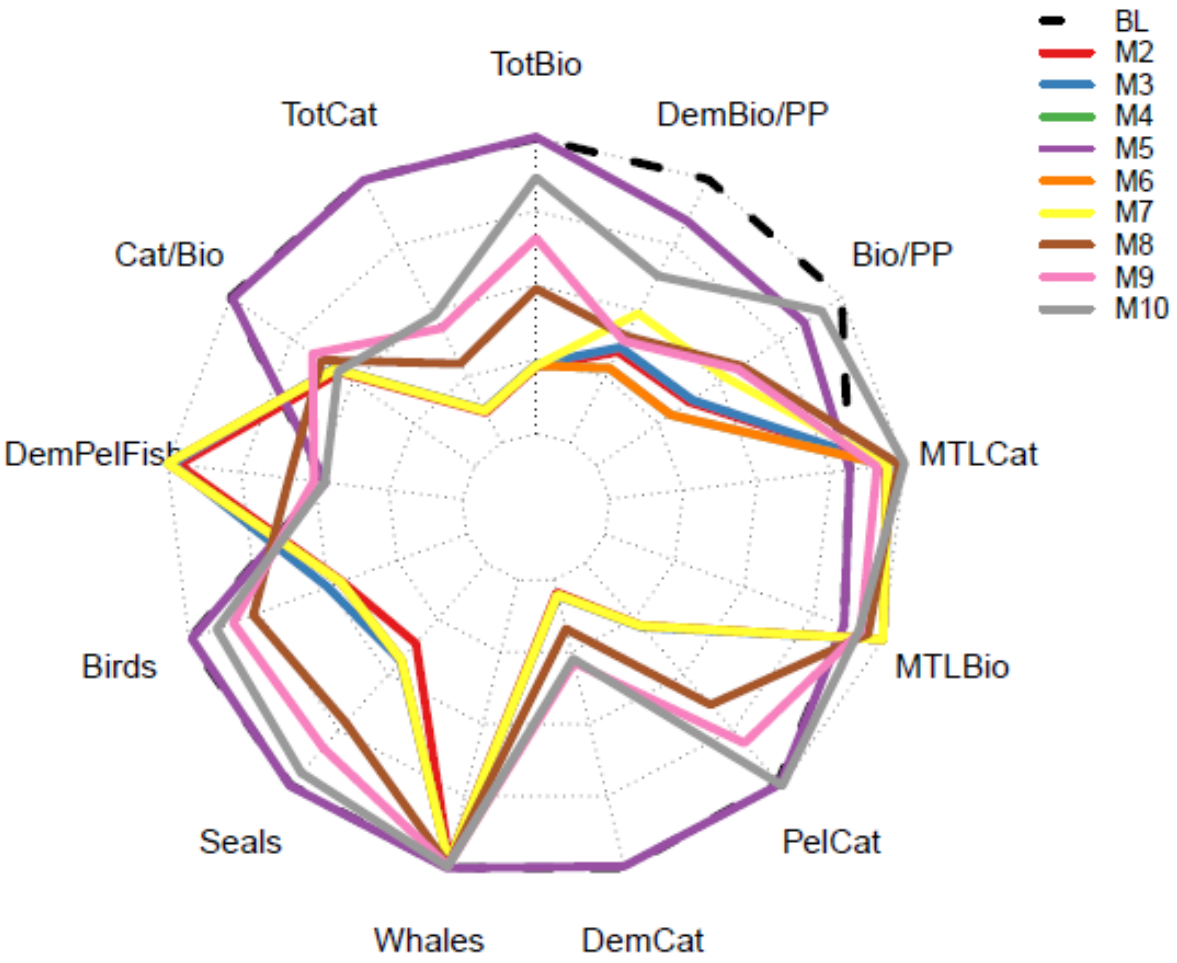


- Reduction in groundfish growth rate.
- Thresholds of response to fishing can be dependent on other system drivers.

Slide courtesy Gavin Fay

Full system climate impacts MSE



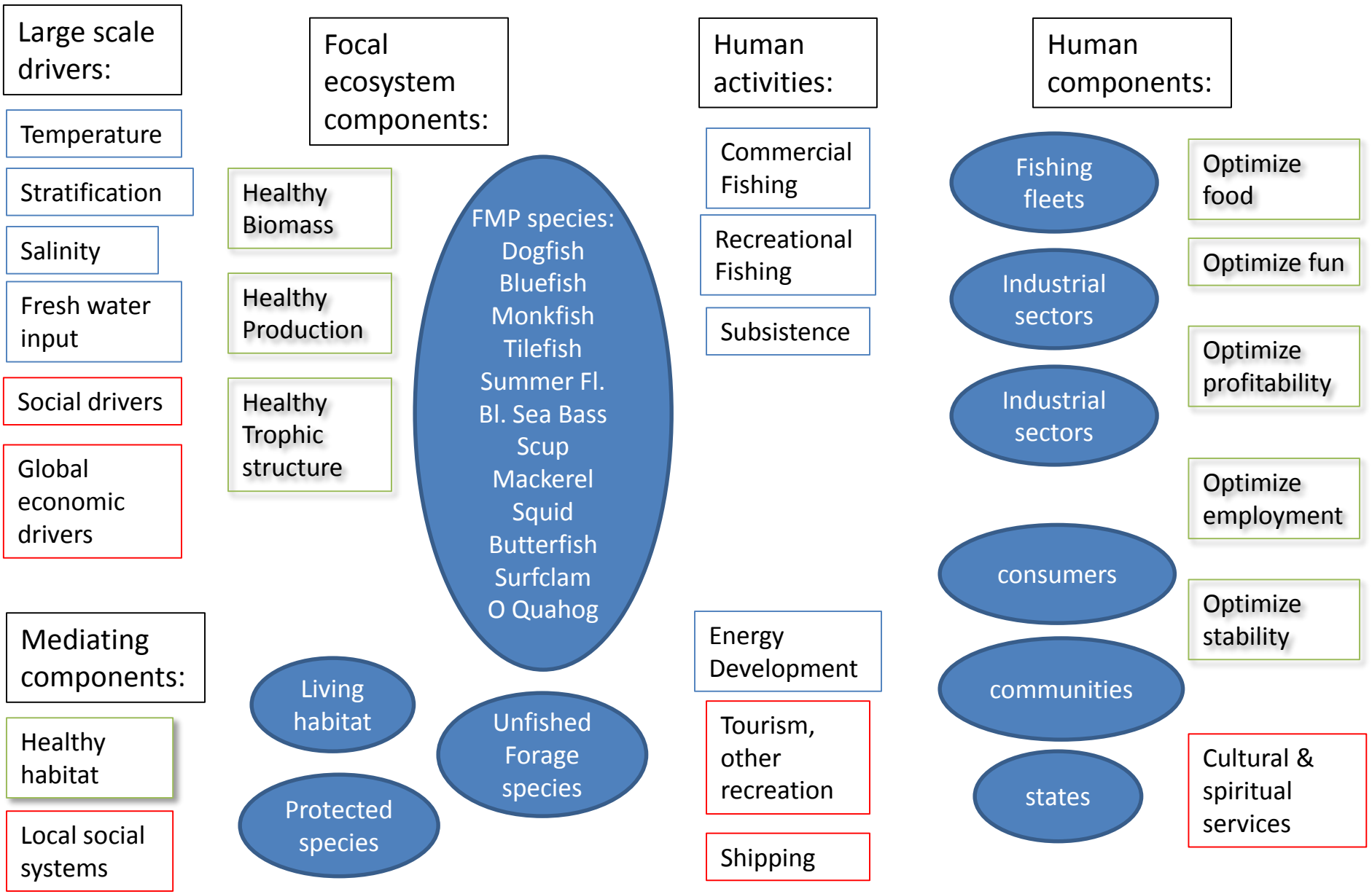


Fay, G., J.S. Link, and J.A. Hare. In Review. Assessing the effects of ocean acidification in the Northeast US using an end-to-end marine ecosystem model. Marine Ecology Progress Series.

What aspects are most important to MAFMC?

Start with a conceptual model?

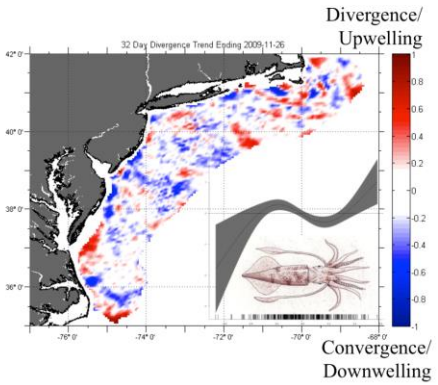
Conceptual model: MAFMC species and fleet interactions

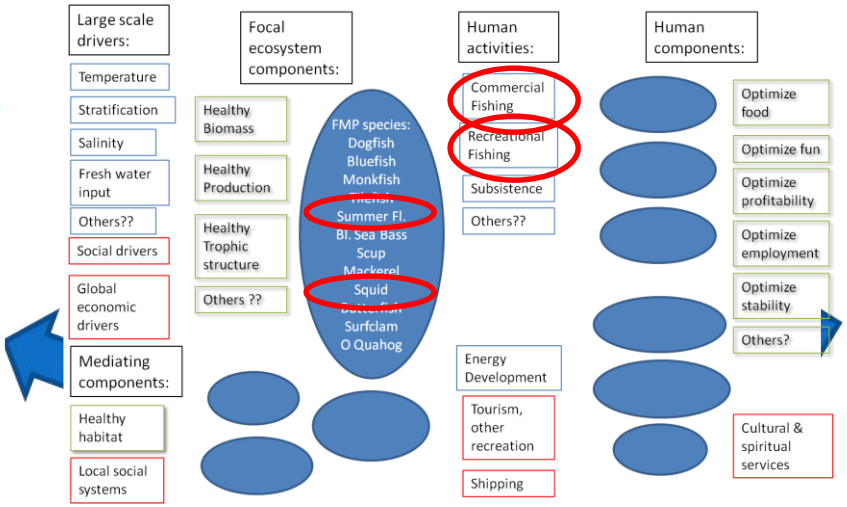


Mid Atlantic—connecting key interactions for management

Next-tier models
flesh out key details

Environmental Drivers





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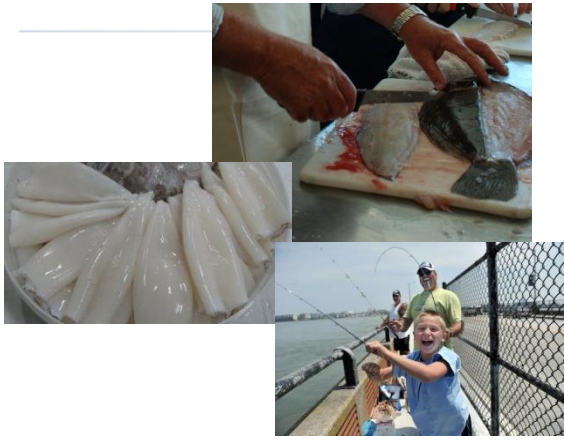

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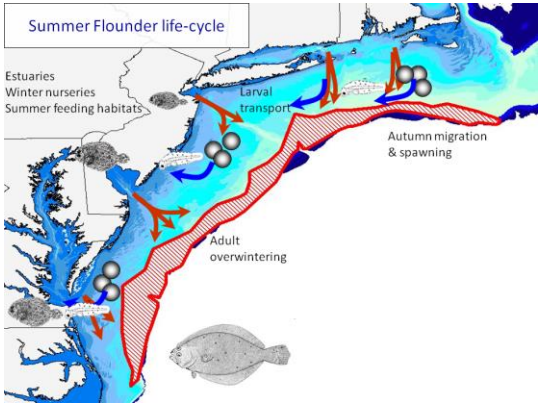
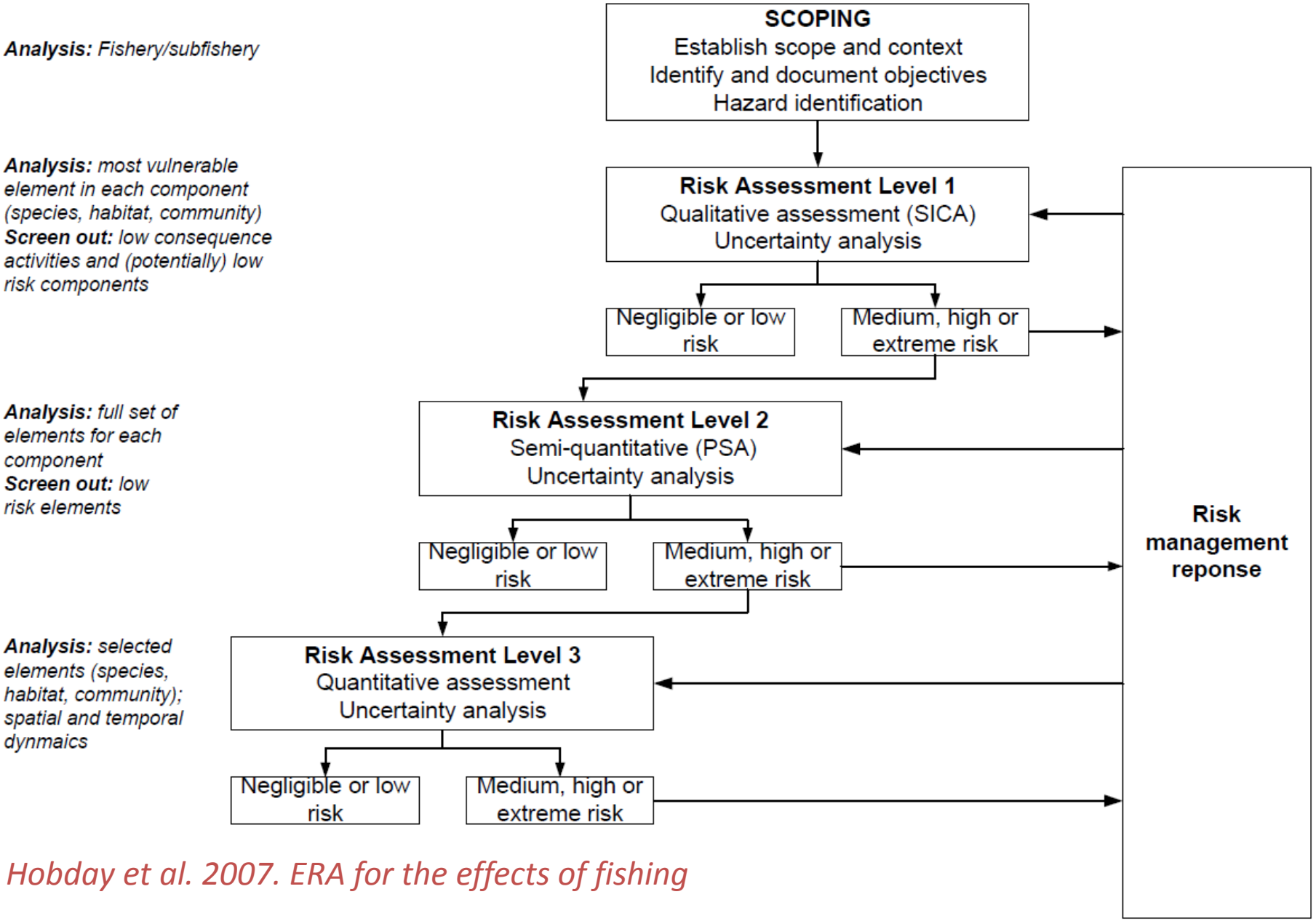
Ecological Interactions

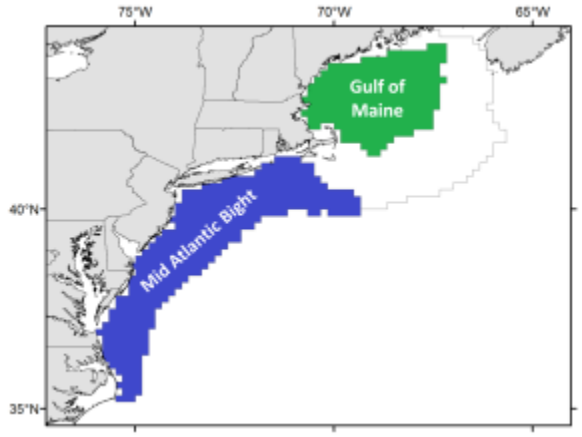


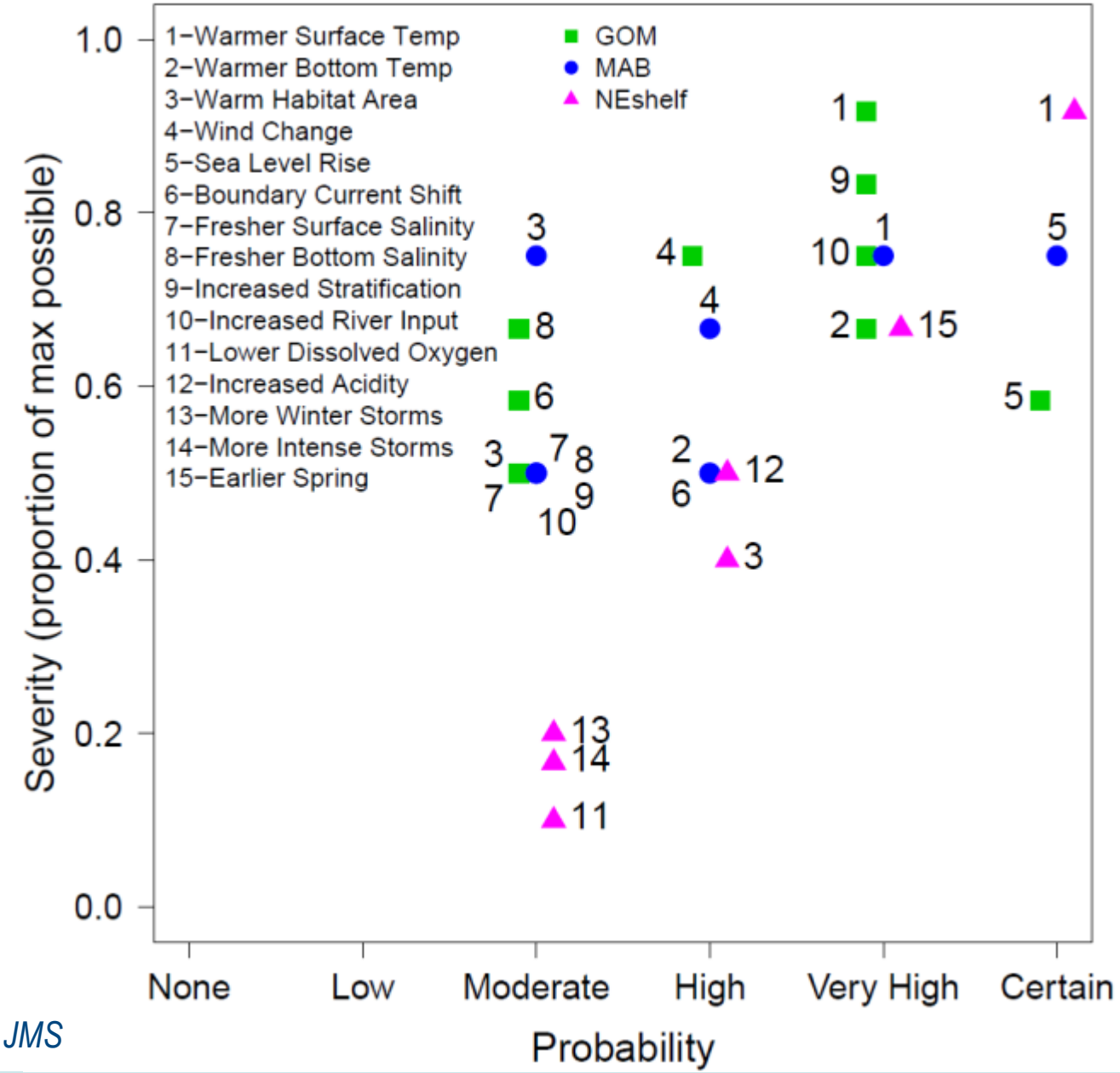
Australian Ecological Risk Assessment (ERA)



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?