Ecosystem modeling for habitat management

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NOAA/NMFS/Habitat Conservation - Chesapeake Bay Office

EFH Summit
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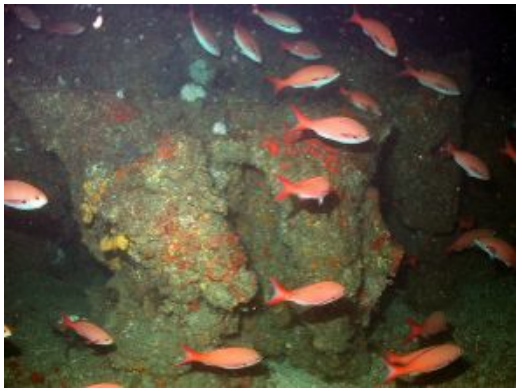
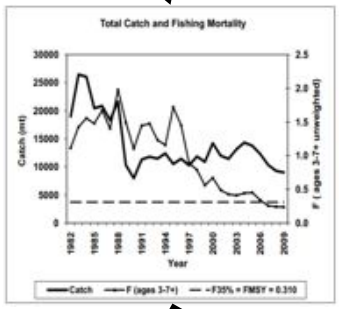
Habitats and Fish Stocks

…are inextricably linked.



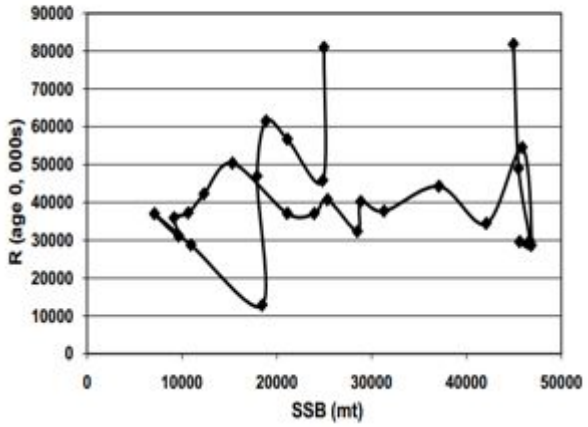
But habitat science/management
and science/management
often are not.

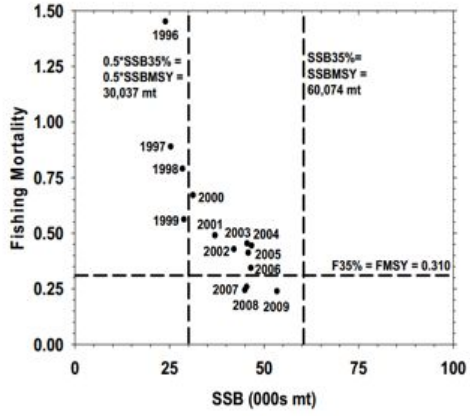
Z = F + M



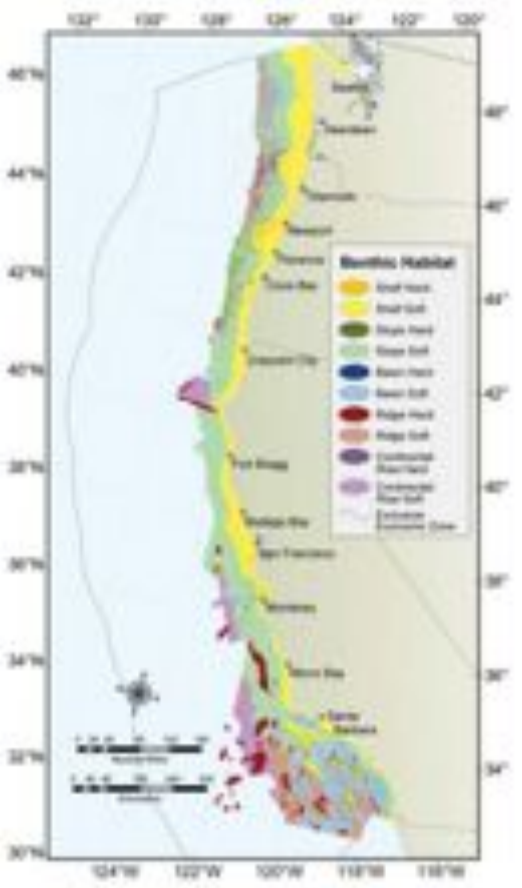
M=0.2

Summer flounder S-R Data
for 1983-2009 Year Classes



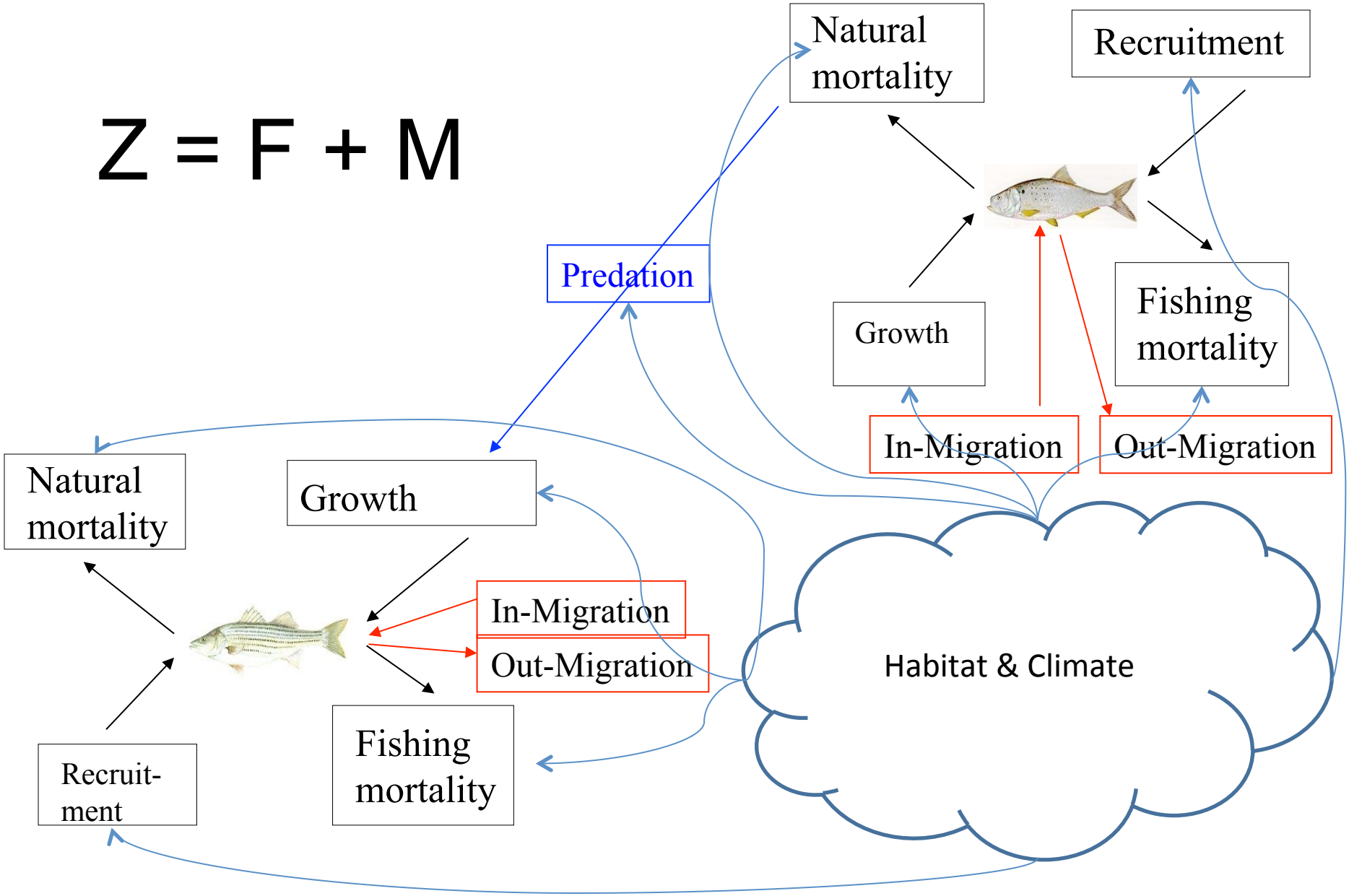


Habitat includes the physical, chemical, biological, and geological components of both benthic and pelagic realms.



Processes which control fish population levels

$$Z = F + M$$



Bridging the Gap

- Fisheries science/management can inform habitat science/management, and vice versa.

- Doing so requires
  - making habitat science/management more quantitative and scaleable
  - making fisheries science/management more spatial and integrative
  - Ecosystem Modeling

Levels of Model Use to Inform LMR Management

Tactical

- Fish Stock Assessments
  - Harvest Policy: strategy for %take
  - Status: Overfishing? Overfished?
  - Forecast: What catch would implement the policy
  - Account for scientific uncertaintySpecific Impacts on Non-Target Species, Habitat
- BINDING ON REGULATORY PROCESS
- Time-scale: 1-5 years

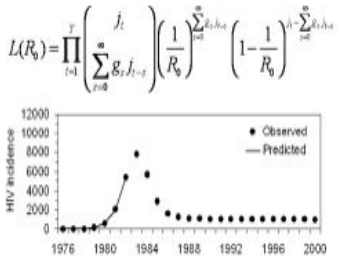
Heuristic

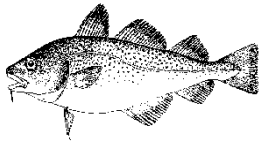
- Understanding Ecosystem Functioning
- Relative Importance of Different Processes
- Advancing Scientific Theory

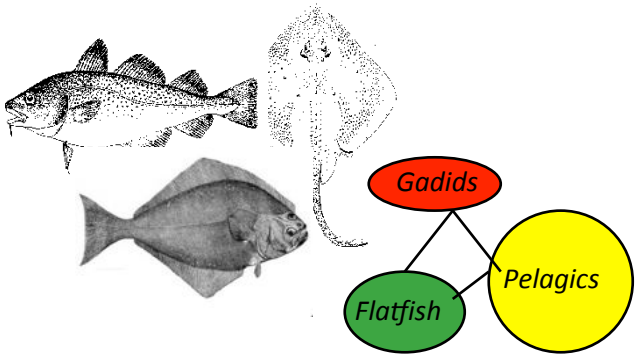
Strategic

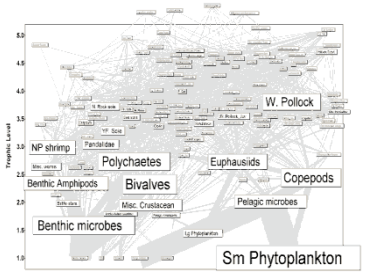
- Assessing Tradeoffs
- System Level Emergent Properties & RPs
- Evaluating Alternate Stable States
- Cumulative Impacts on Non-Target Species, Habitat
- General "What If" Scenarios and Gaming, Long Term Trends
- Time-scale: Decades

Spectrum of Modeling For LMR Management Process





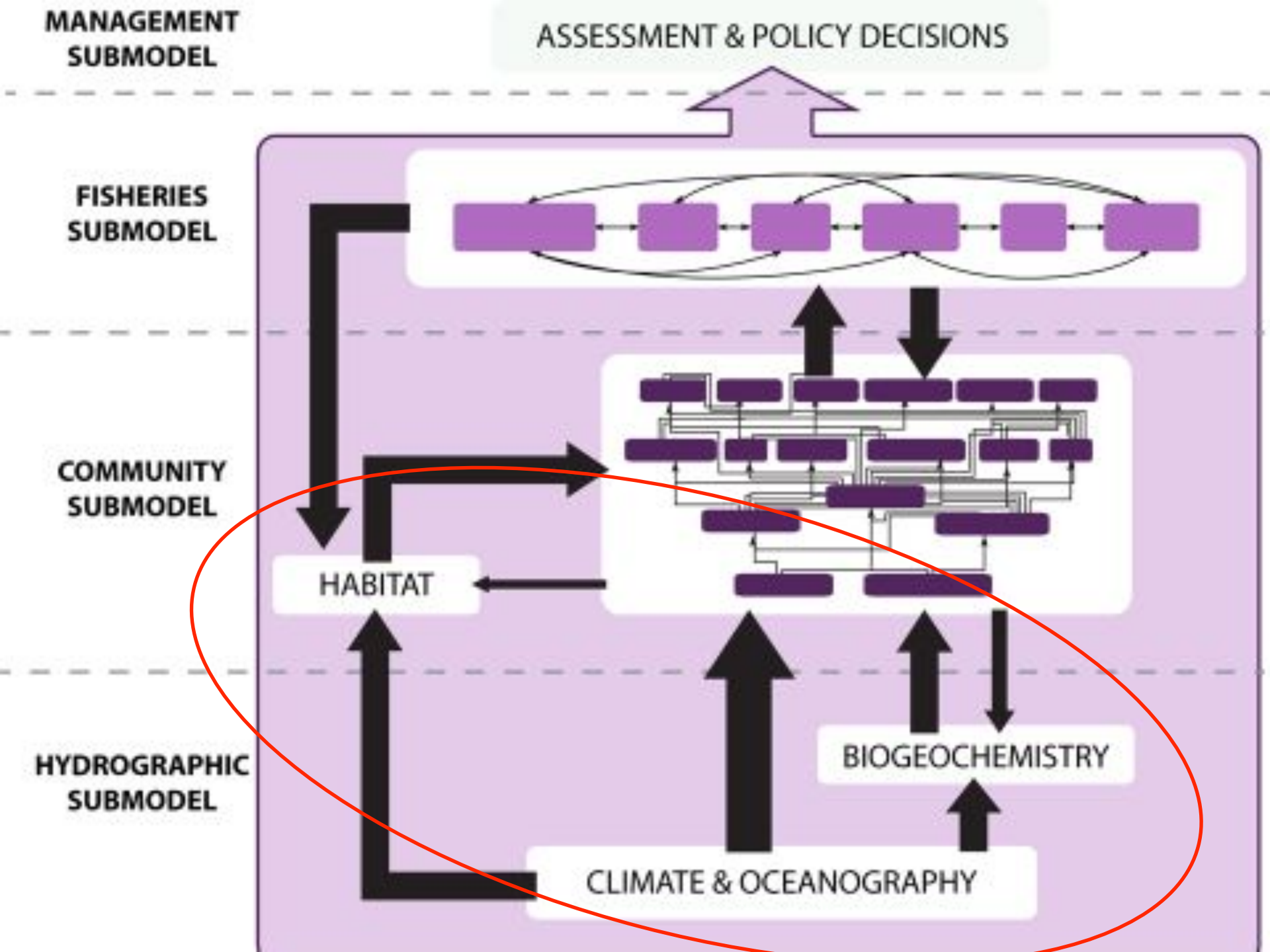




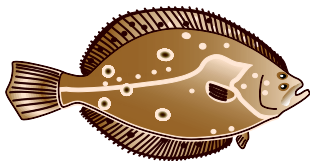
Data-limited Calculations | Biomass dynamics models | Age/Size Structured Models | Age/size Models w/ external factors | Multi-species Models | Biophysical Models | Aggregate Biomass Models | Food Web Models | Biogeo-chemical Models | Full System Models

Stock Assessment/Single Species Models

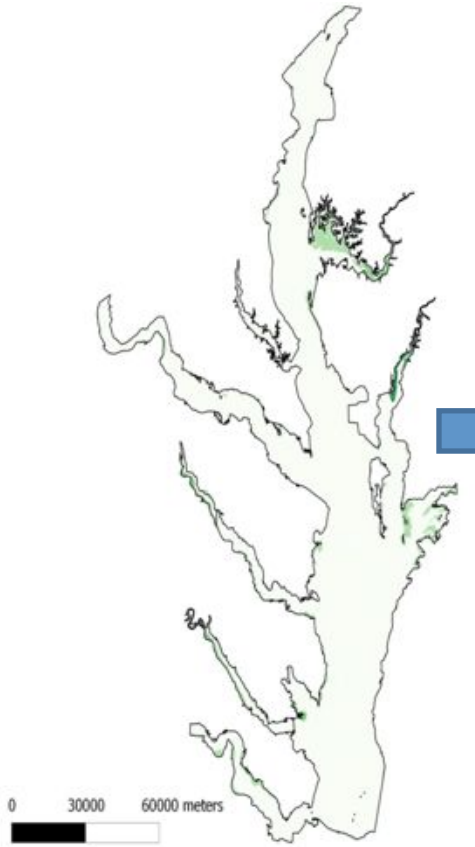
Ecosystem Assessment/Multi-species model


MANAGEMENT SUBMODEL
ASSESSMENT & POLICY DECISIONS
FISHERIES SUBMODEL
COMMUNITY SUBMODEL
HABITAT
HYDROGRAPHIC SUBMODEL
BIOGEOCHEMISTRY
CLIMATE & OCEANOGRAPHY

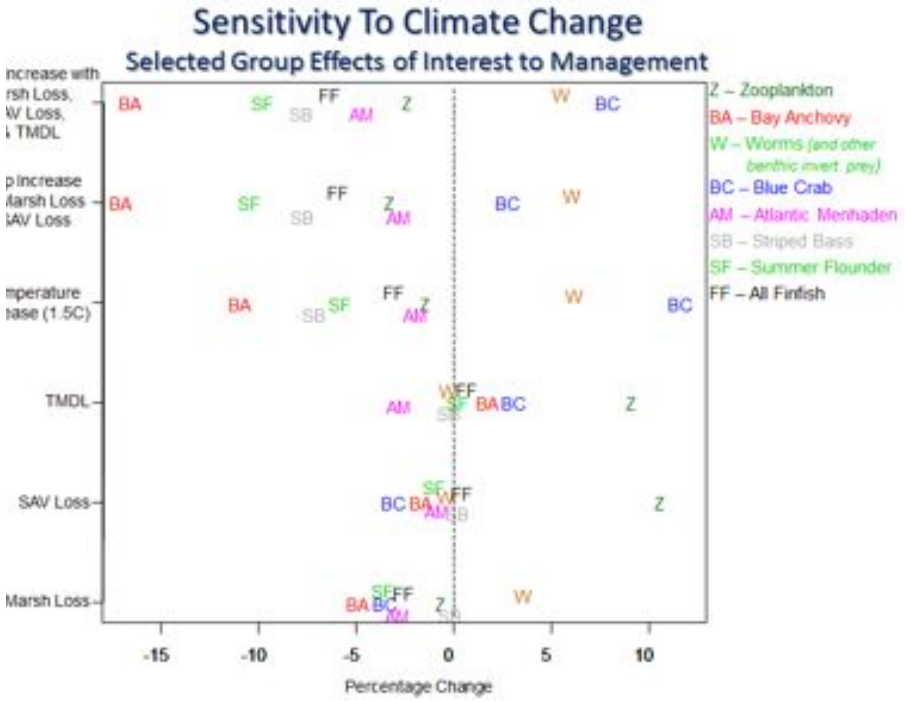
Chesapeake Marsh – Summer Flounder



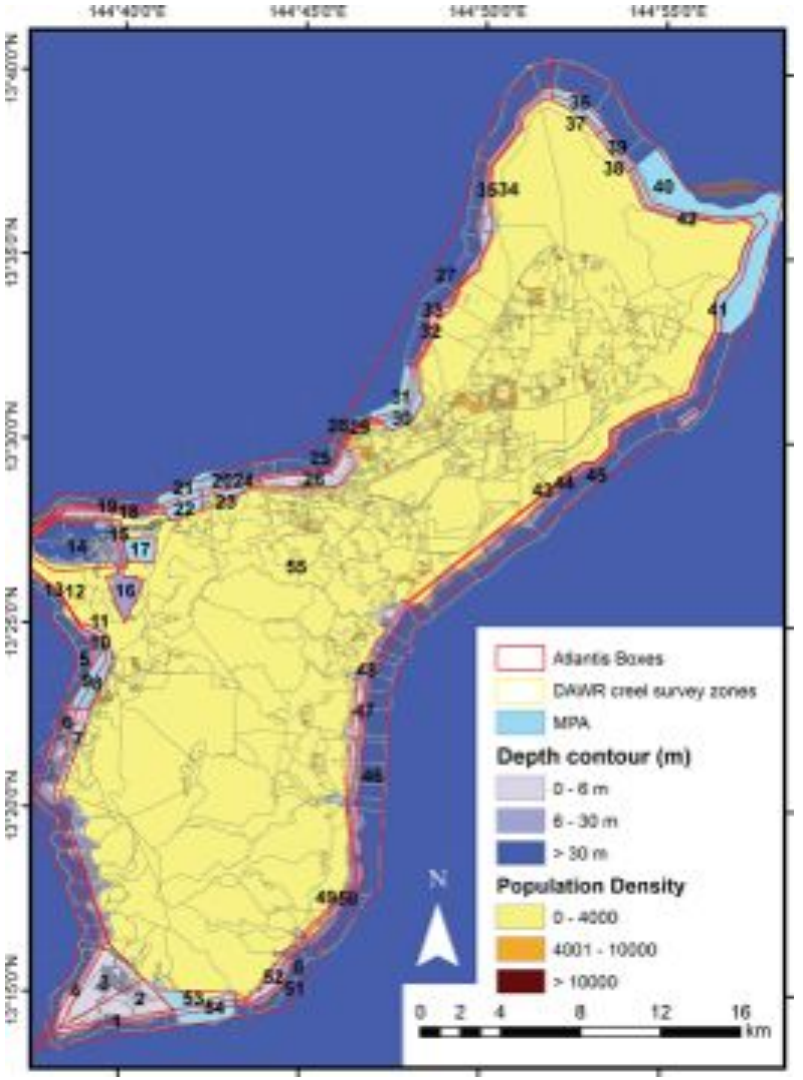
Chesapeake Marsh



Chesapeake Atlantis Model



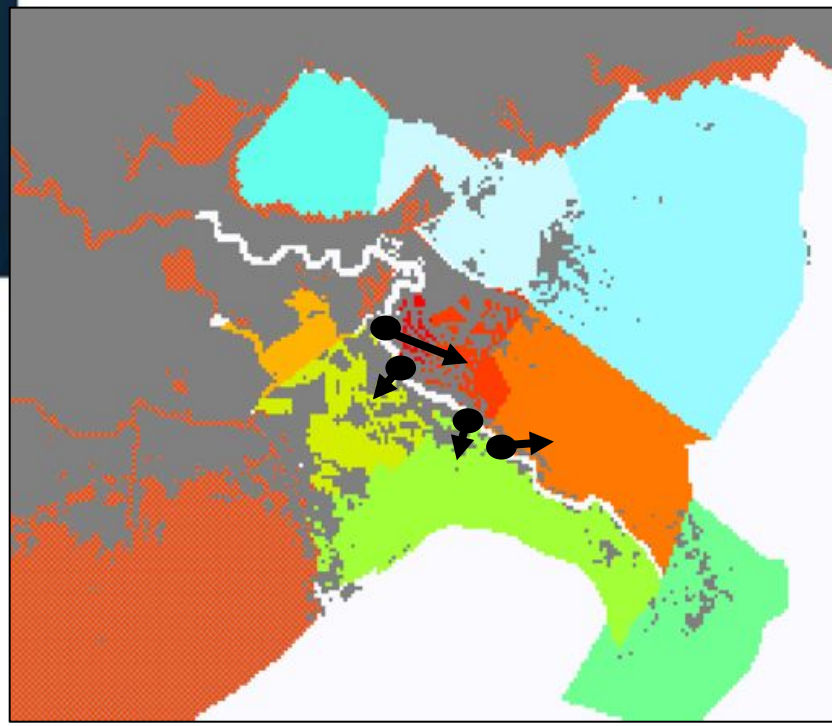
Guam Atlantis Ecosystem Model



Coastal Louisiana Restoration – Multiple Ecosystem Models

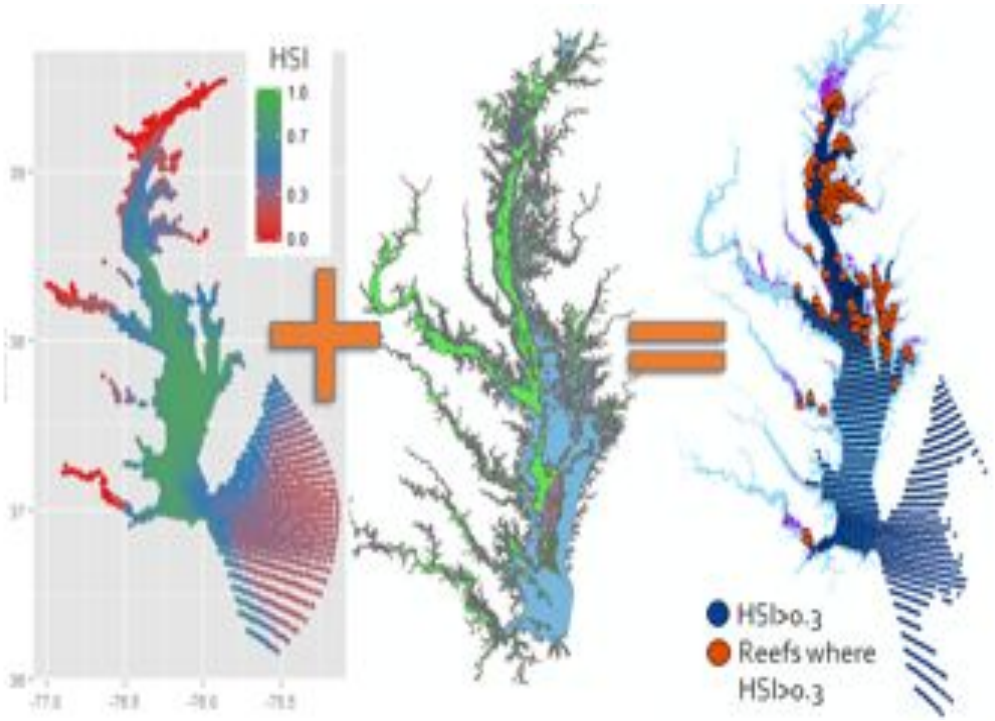
Complex Aquatic System Model (CASM)

Ecopath with Ecosim (EwE)/Ecospace



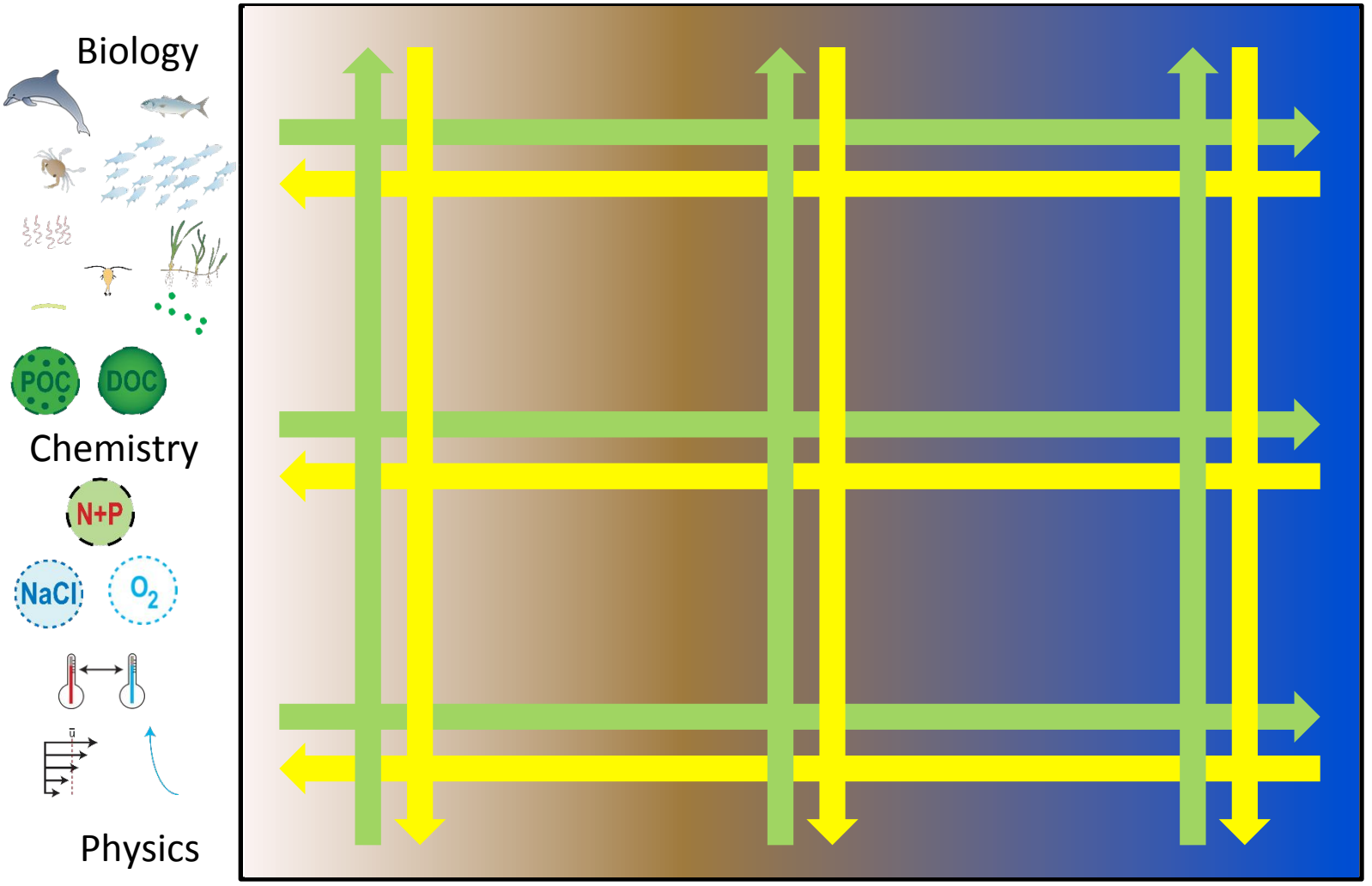
EXTRA SLIDES

Oyster Reef Ecosystem Services – black sea bass



Laura Almodovar, University of Maryland – Easter Shore

NART: River-to-marine integrated ecosystem modeling



Icons from: Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/)

In conclusion…

The law locks up the man or woman
Who steals the goose from off the common
But leaves the greater villain loose
Who steals the common from off the goose.

- Old English Rhyme