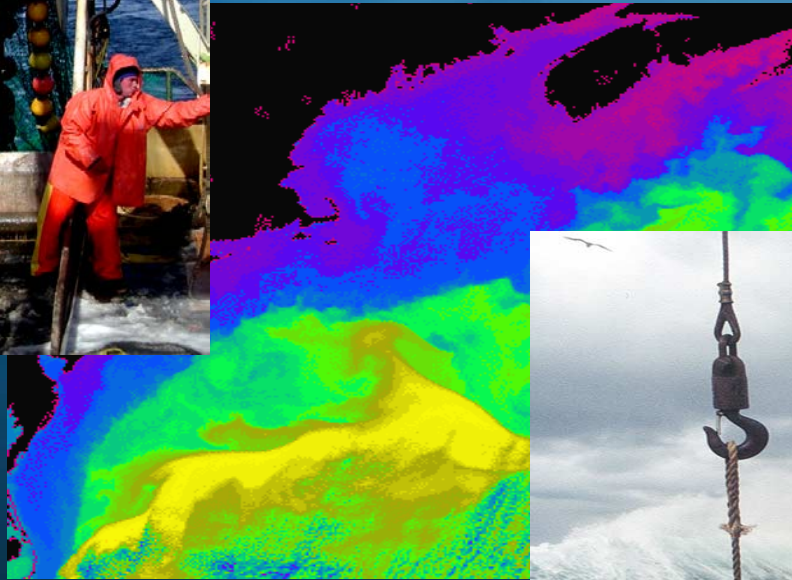


Making Ecosystem-Based Fishery Management Operational



NEFMC EBFM Plan Development Team

There Truly is Nothing New Under the Sun (Ancient Proverb)

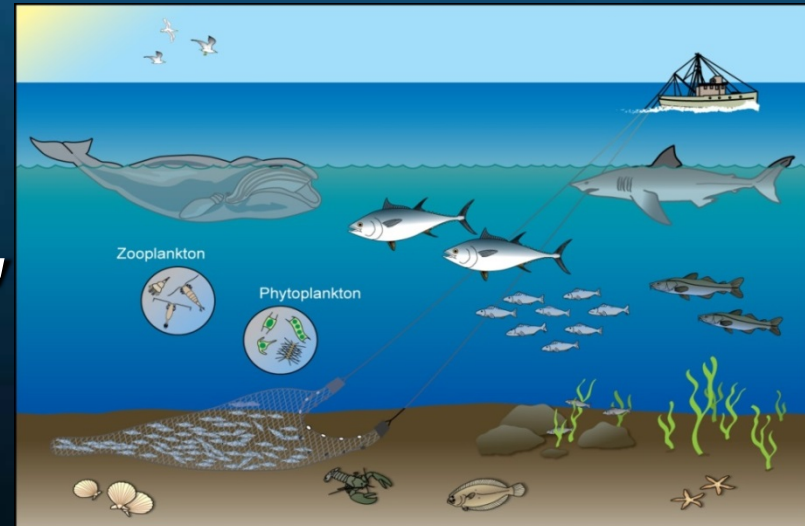
To avoid the deficiencies of a single-species approach, management might address itself to the productivity and harvest potential of an entire ecosystem, since the ecosystem in the long run has greater stability than any of its components.

... individual species, groups of species, or particular fisheries (defined by area or gear) would be regulated to control the relative balance of the species mix”

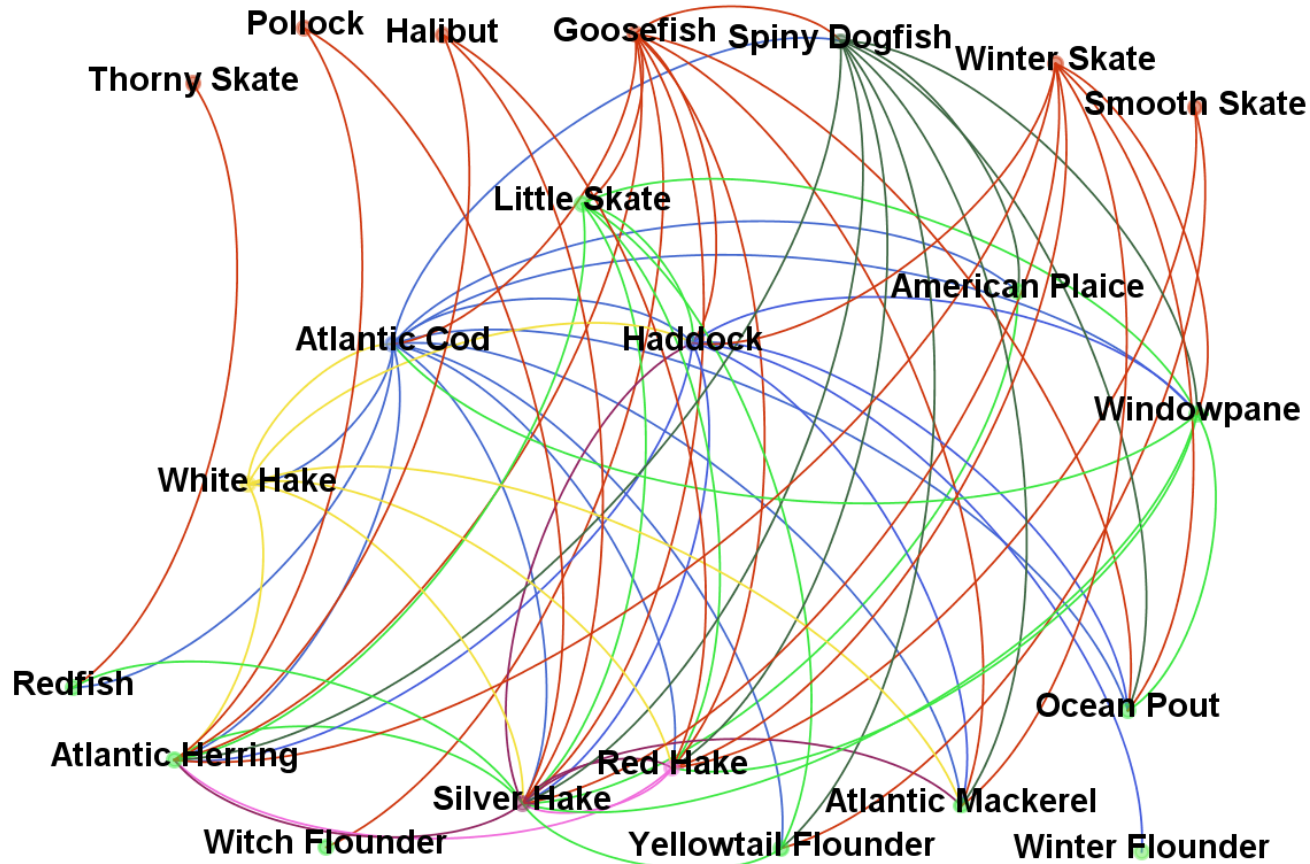
Northeast Fishery Management Task Force (1980)

Ecosystem-Based Management Requires a Multidisciplinary Approach:

“U.S. ocean and coastal resources should be managed to reflect the *relationships* among all ecosystem components, including *human* and nonhuman species and the *environments* in which they live. Applying this principle will require defining relevant *geographic management areas* based on ecosystem, rather than political, boundaries (USCOP 2004)”

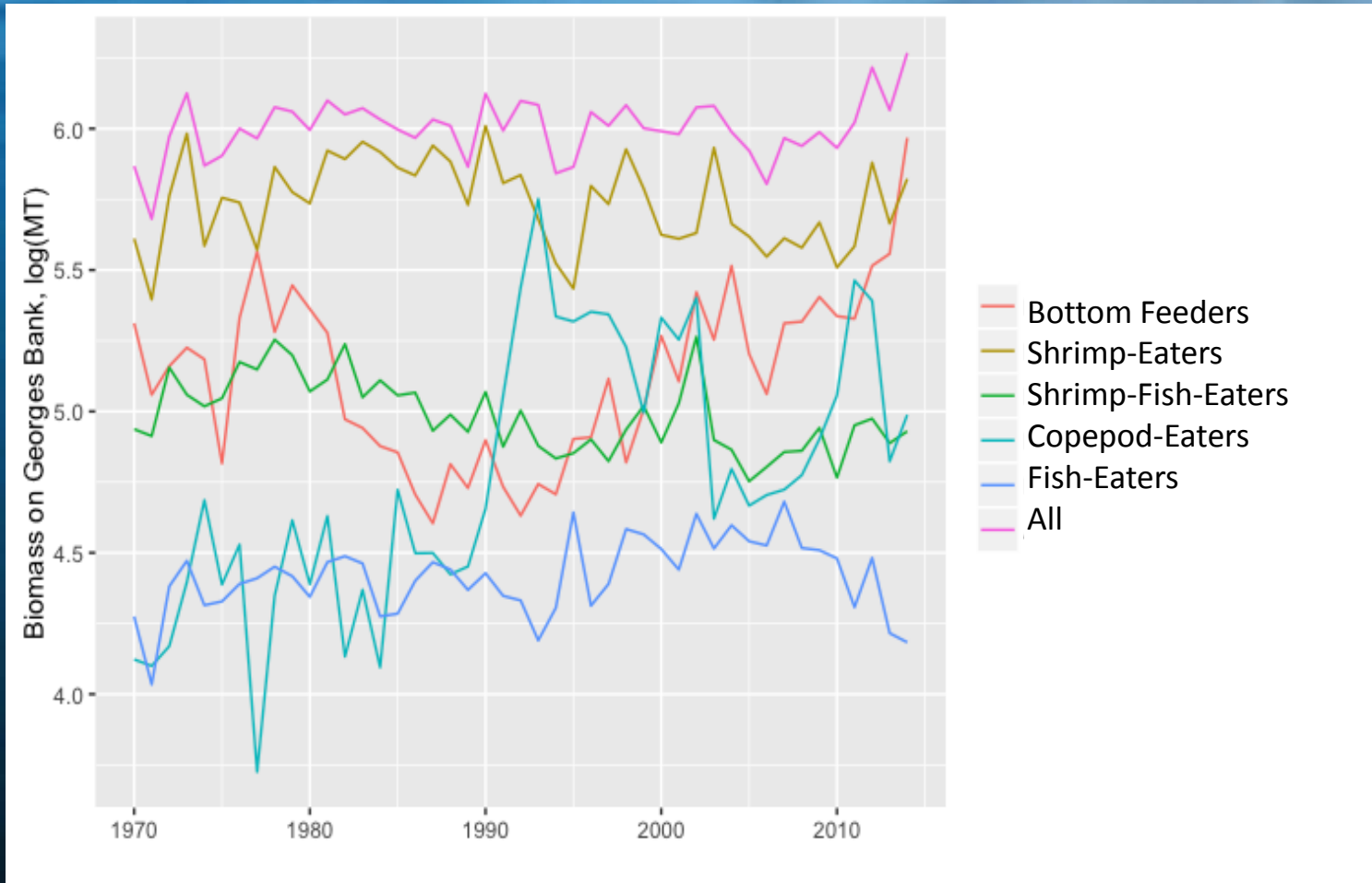


The Challenge:



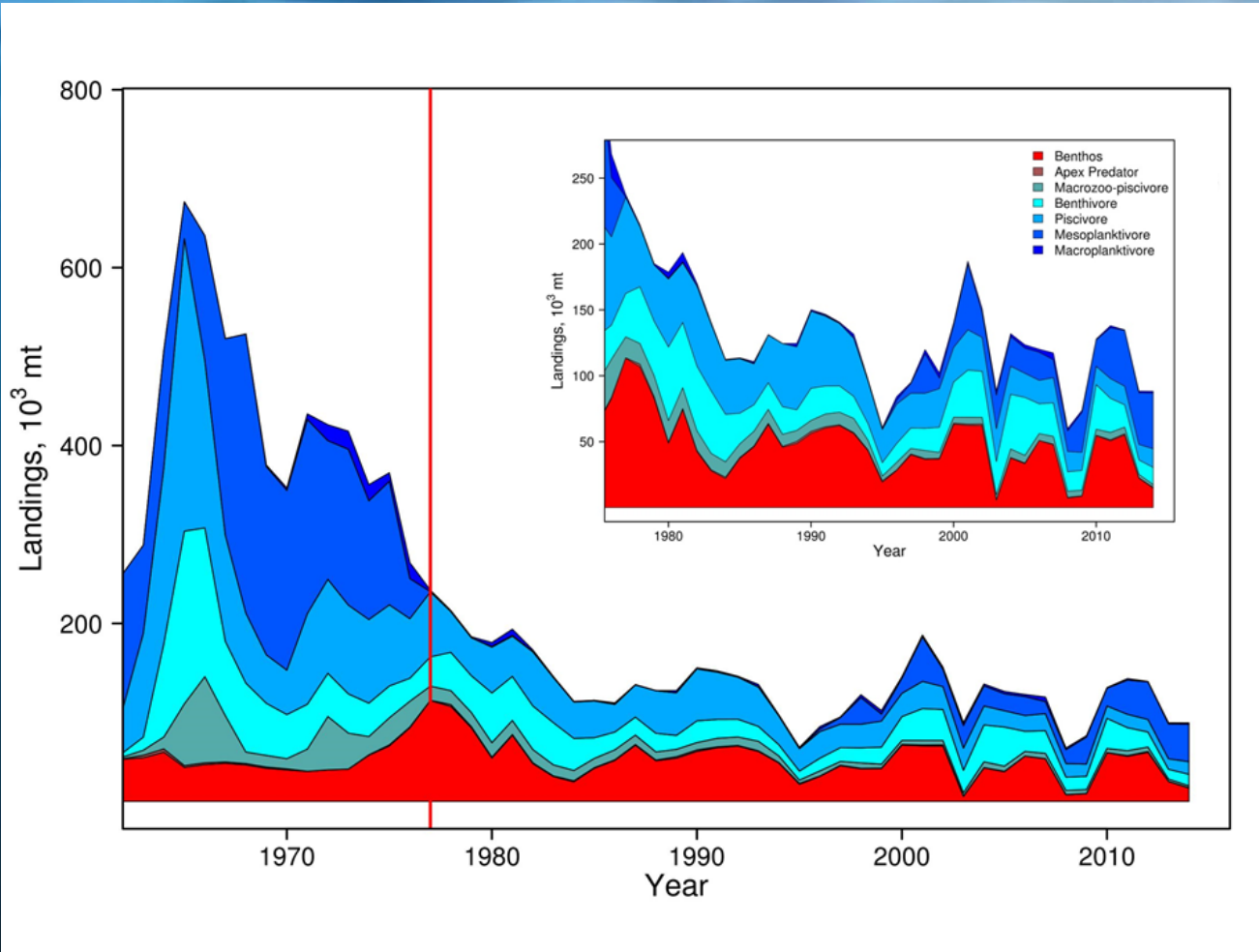
A Deeply Interconnected System

A Pathway Toward Simplification?



The Whole is More Stable than its Parts

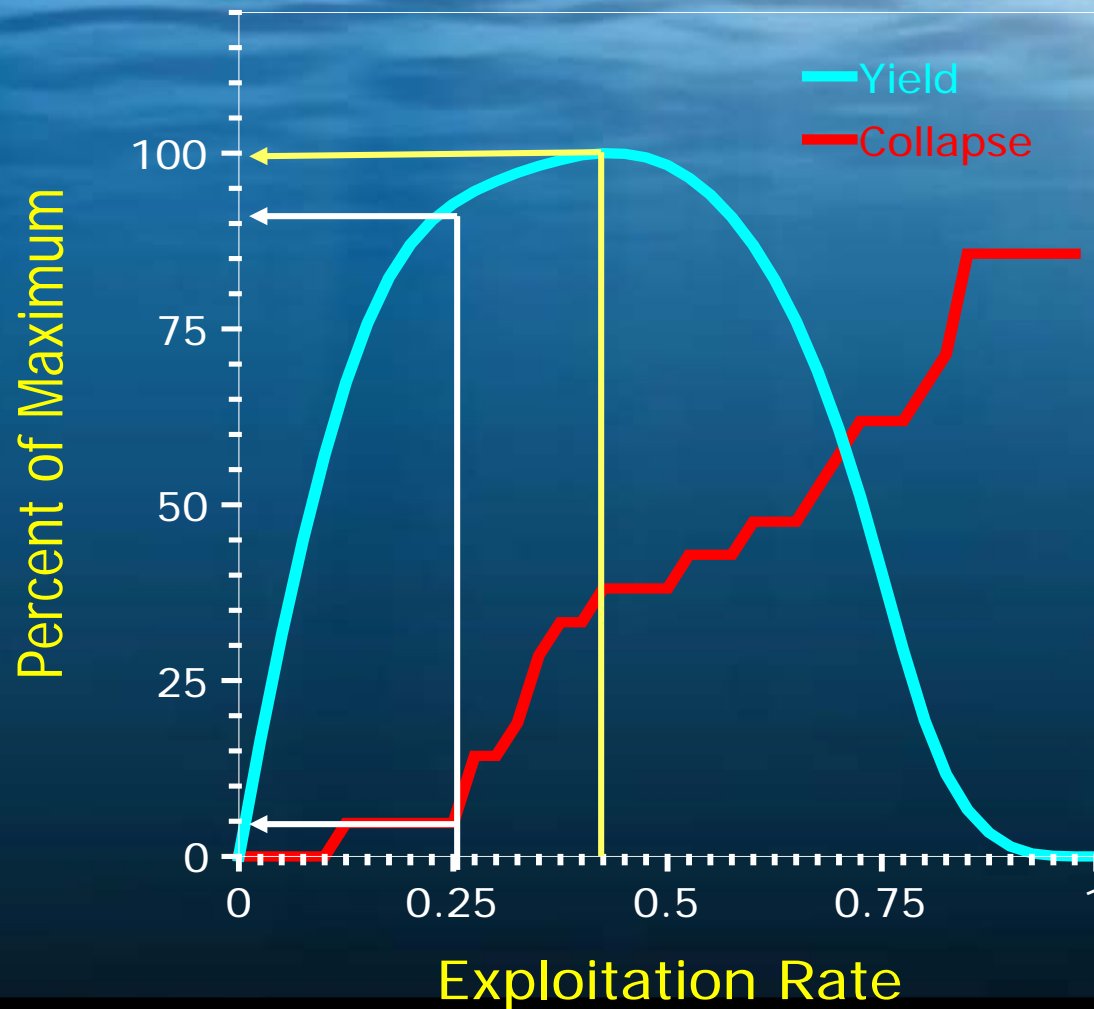
A History of Massive Intervention



The Pathway: Building on Existing Structures

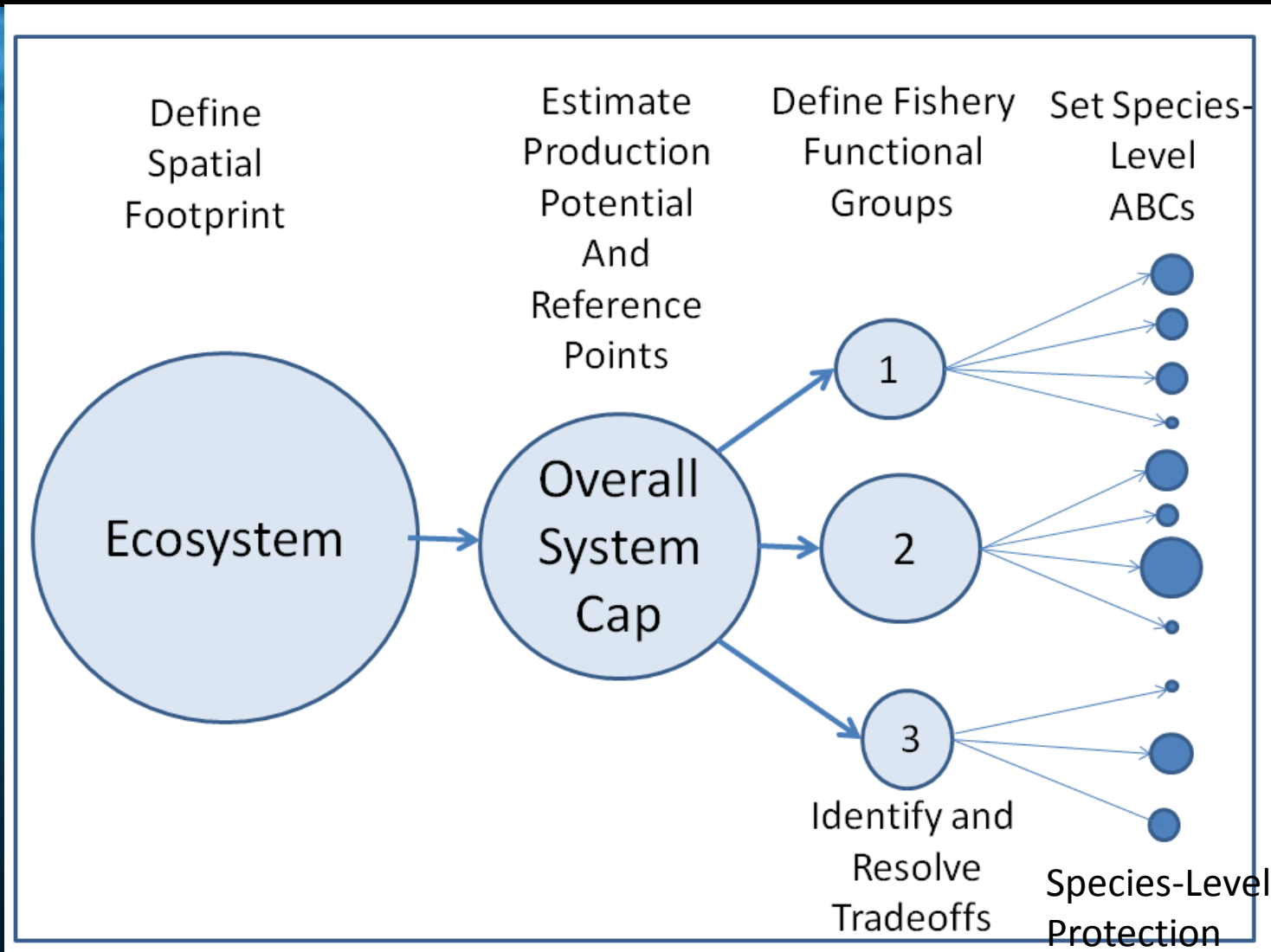


Tradeoffs Between Yield and System Resilience: Seeking Win-Win Solutions



Multispecies Fishery Model for Georges Bank
Worm et al. (2009). *Science* 325:578-585

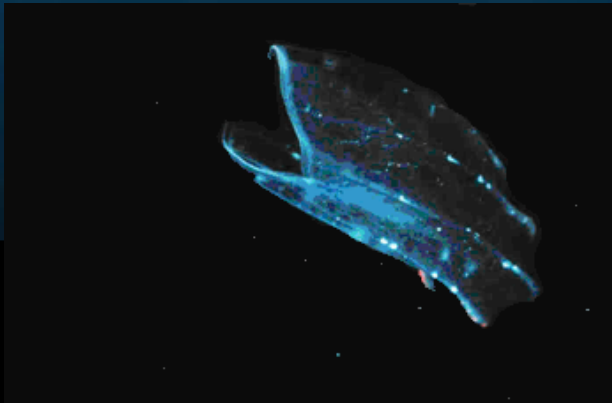
An Hierarchical Approach to Setting Catch Limits



NEMFC EBFM PDT Modeling and Analysis: Core Elements

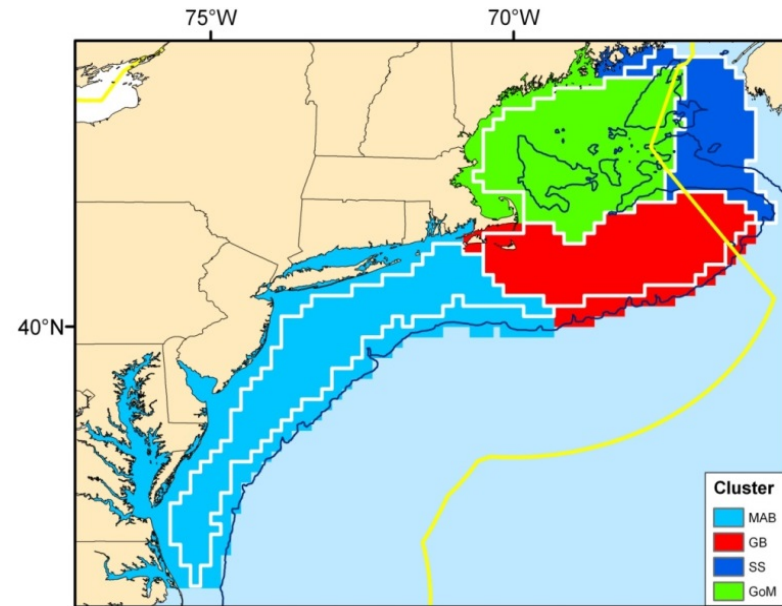
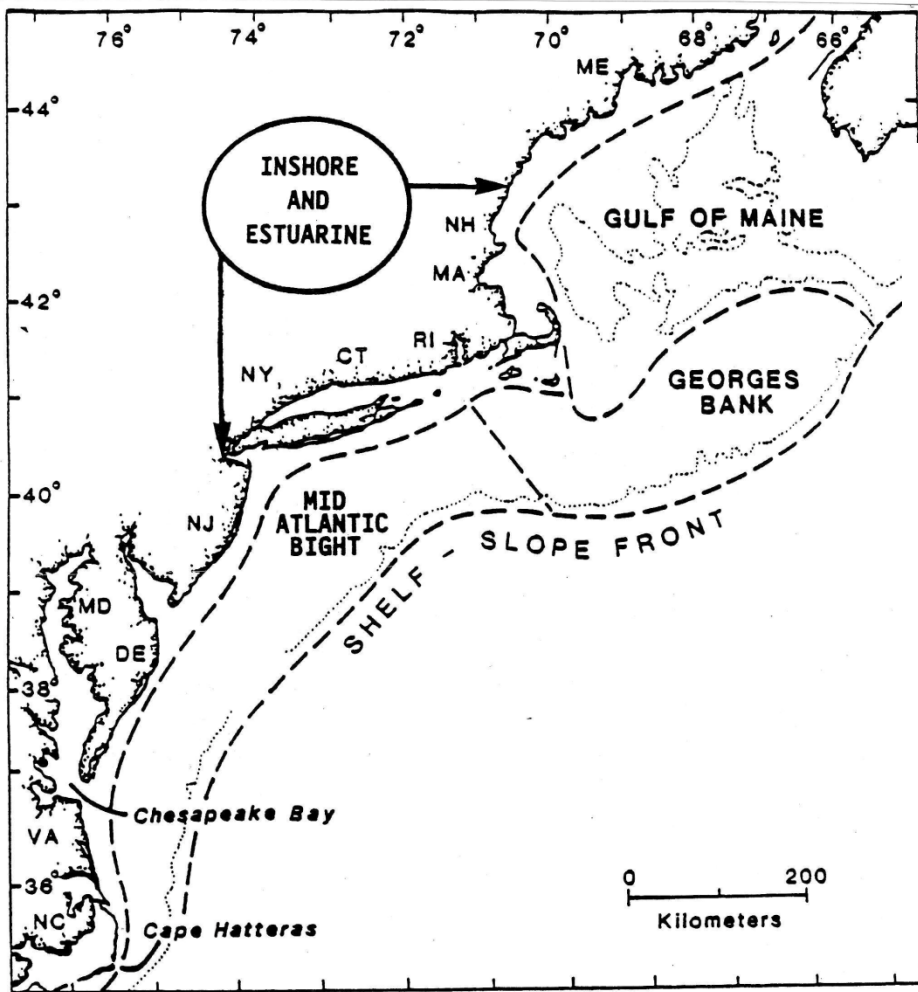
- Define Ecological Production Units
- Integrated Analysis of Climate, Physics, Ecology, Human Use, Social & Economic Considerations
- Management Strategy Evaluation
- Multi-model inference to Address Model Uncertainty
- Management Procedures for Tactical Management Advice

Fishery Functional Group:

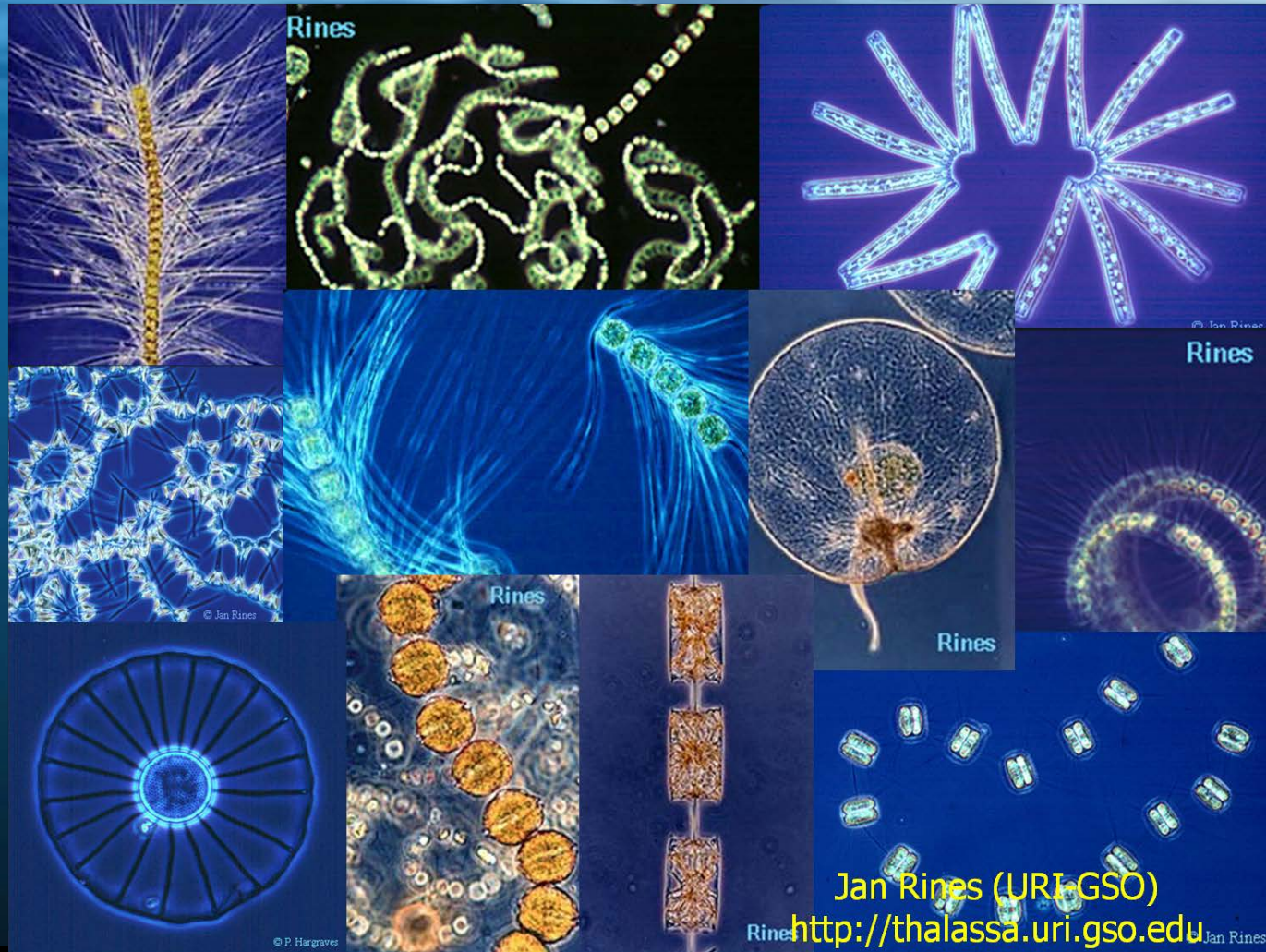


A group of species that are typically caught together in a particular type of gear and feed on similar food items

Defining Ecological Production Units



Phytoplankton Production Sets the Stage for Fishery Production



Ecosystem Data: NEFSC Ecosystem Observing Program Elements

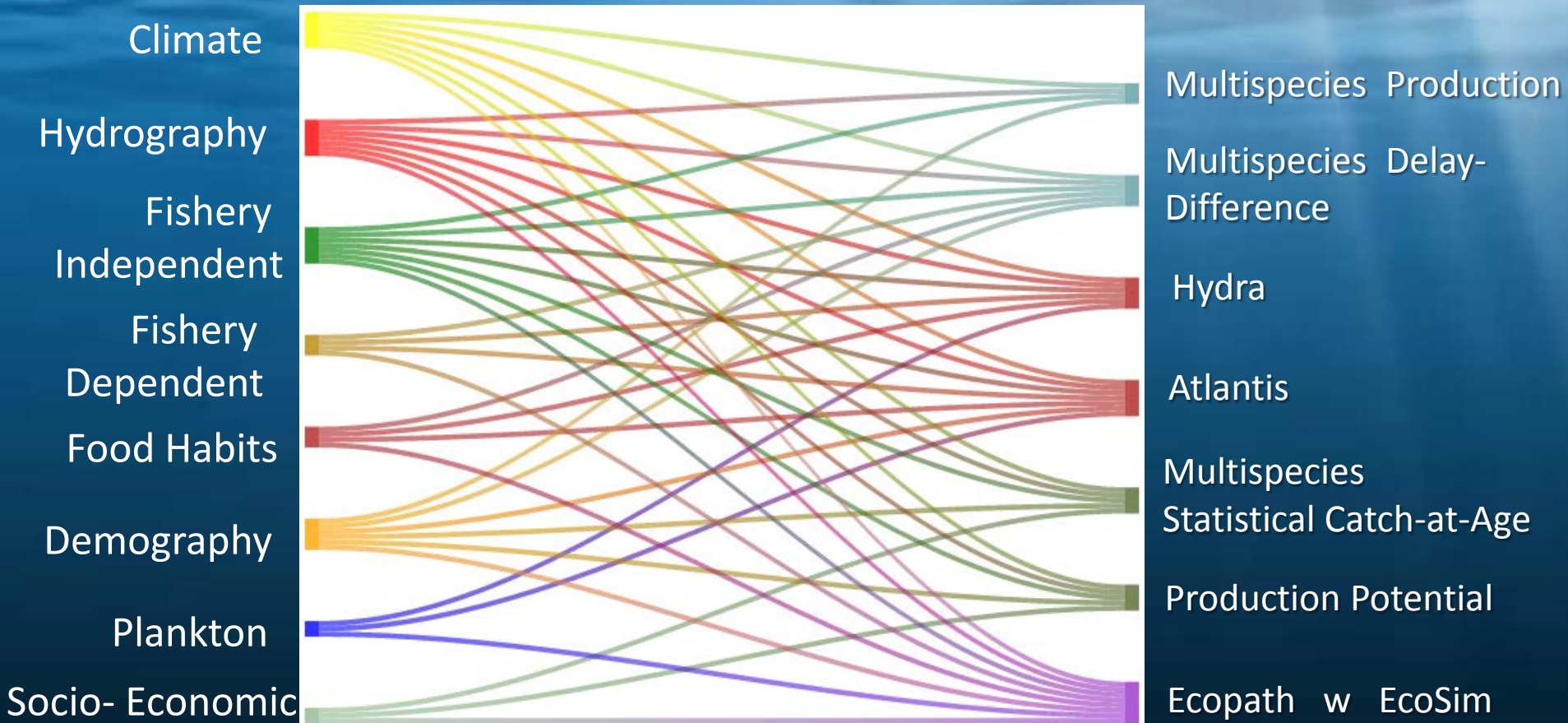


- Satellites
- Oceanographic Buoys
- Standardized Surveys
 - Trawl & Acoustics
 - Plankton
 - Shellfish Dredges
 - Longlines
 - Air Craft
- Observer Program
- Cooperative Industry Research
- Fishery Reporting System
- Fishermen Interviews

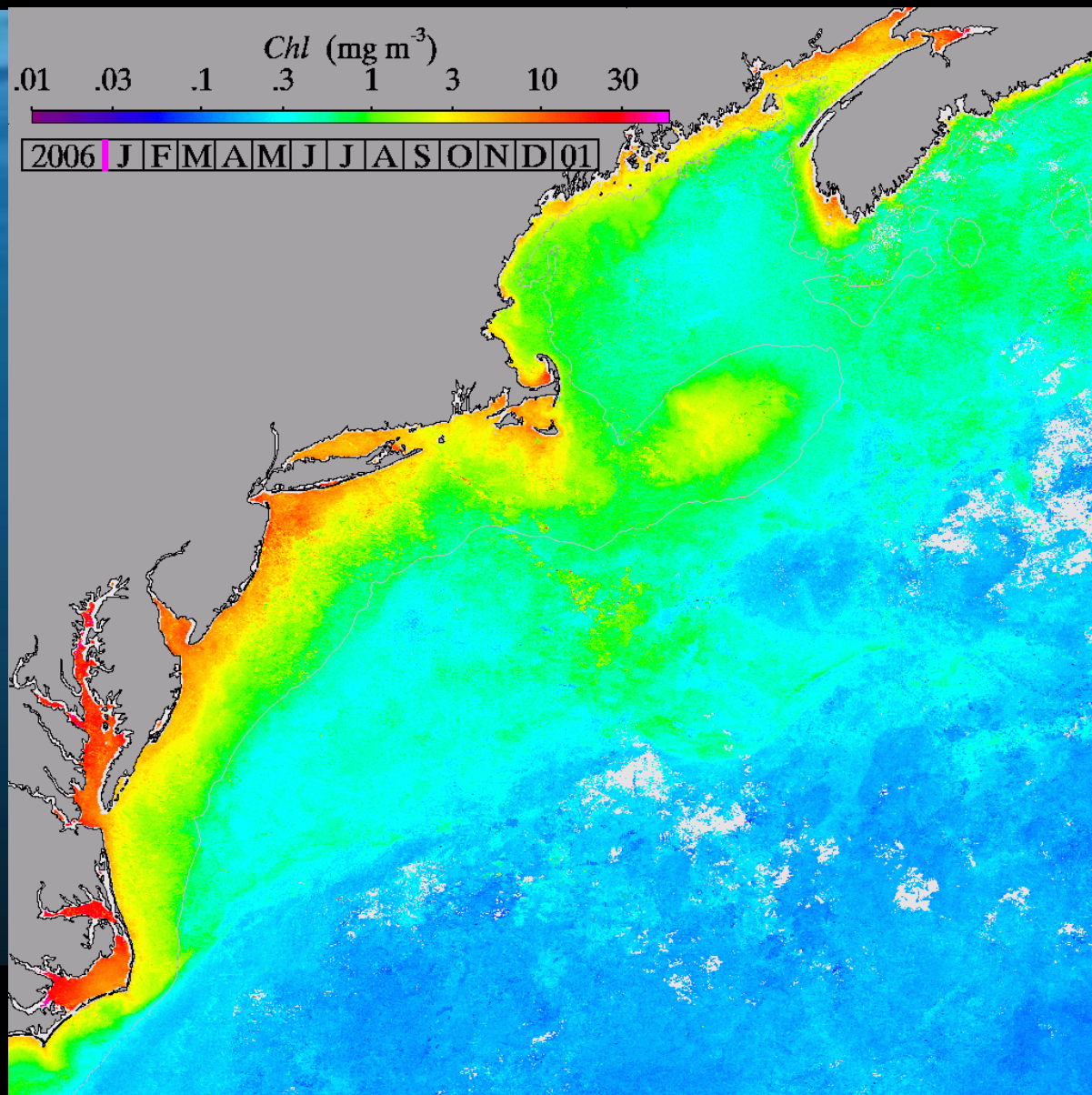
Ecosystem Modeling and Analysis: Synthesis and Integration

DATA

MODELS

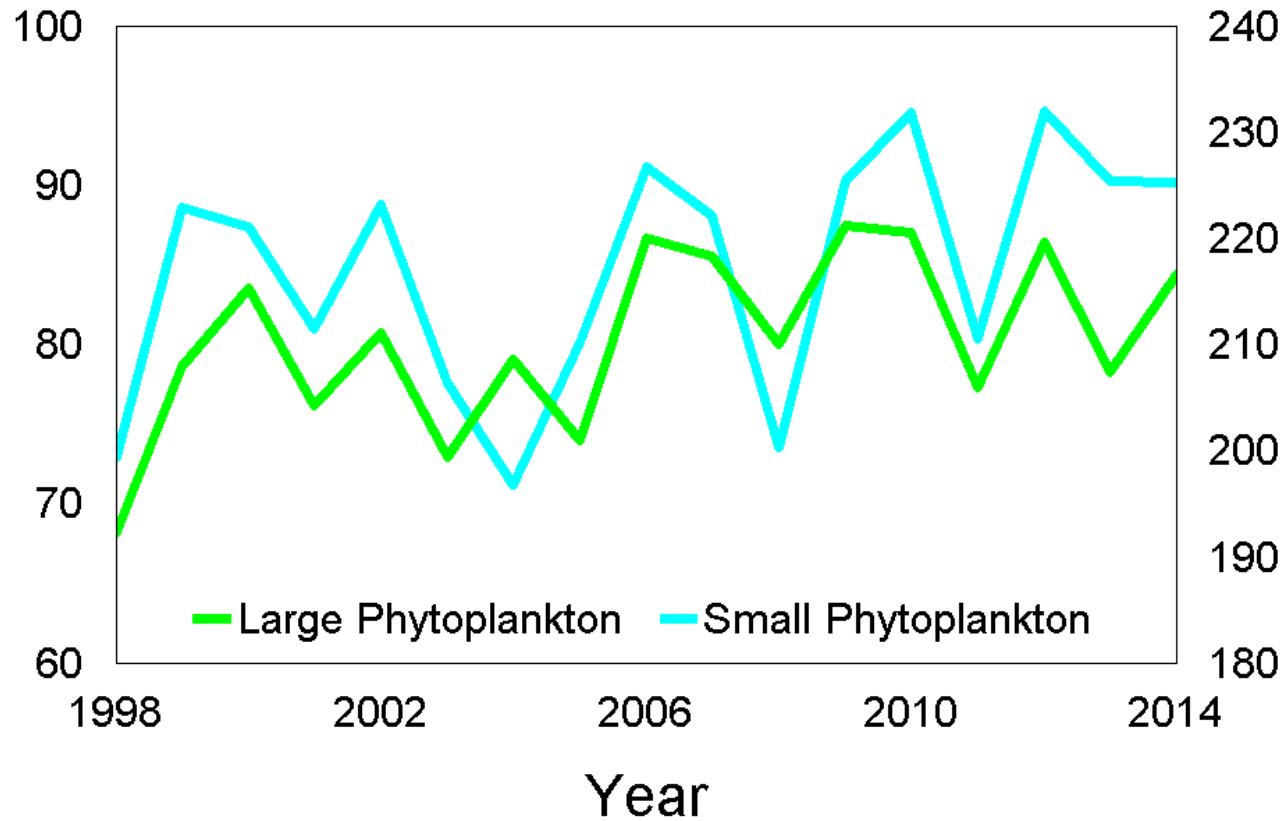


Annual Chlorophyll Cycle



Trends in Large and Small Phytoplankton Production

Large Phytoplankton Production



Small Phytoplankton Production

Example Management Strategy Evaluation Setup

Council Decision Support:

- **Tradeoffs** between objectives
- Potential management strategy **performance** considering
 - key interactions
 - risks
 - uncertainties

Council/stakeholder process
Specifies MSE objectives,
Performance measures,
Range of strategies

Scientists
develop tools

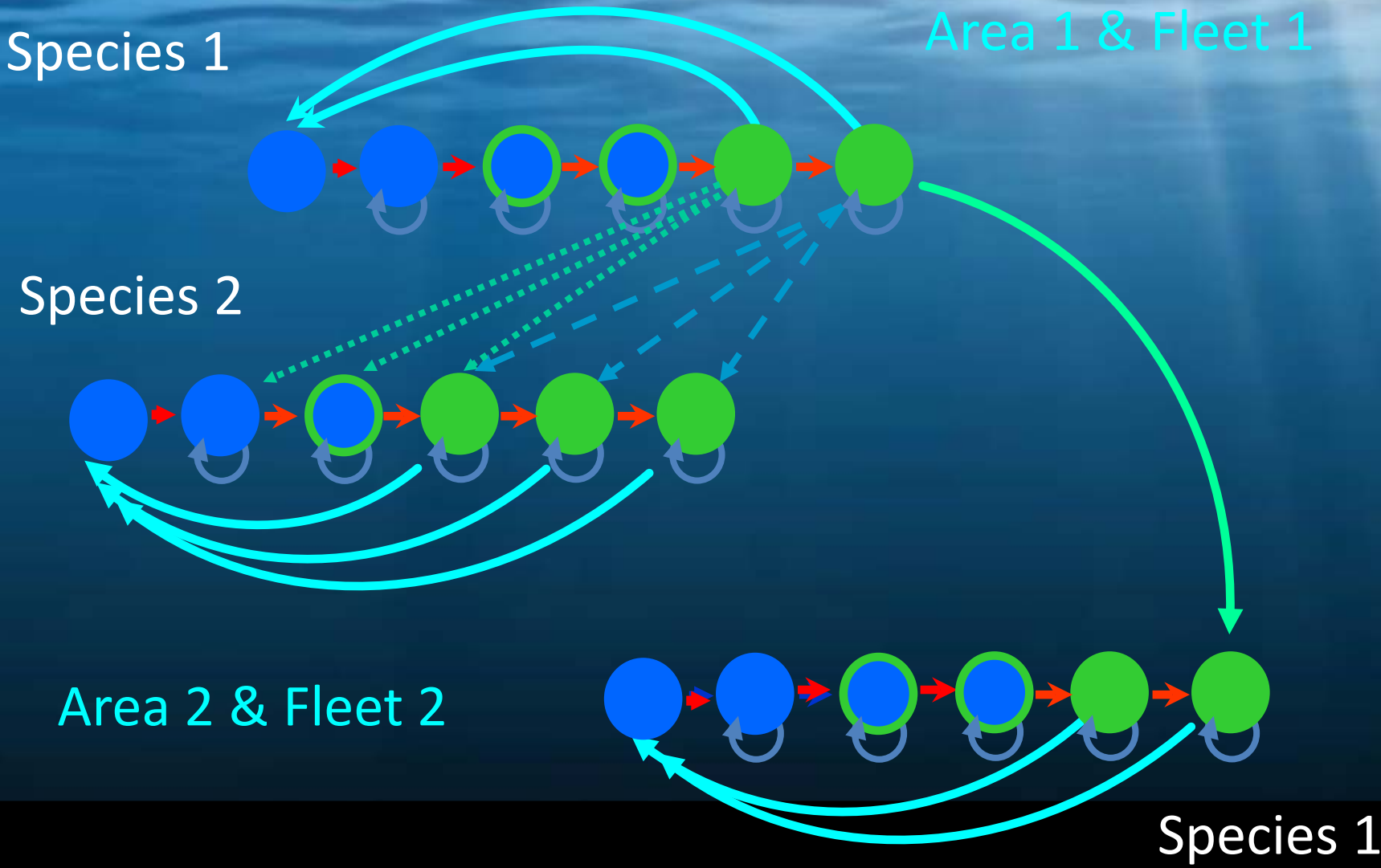


Performance
measures

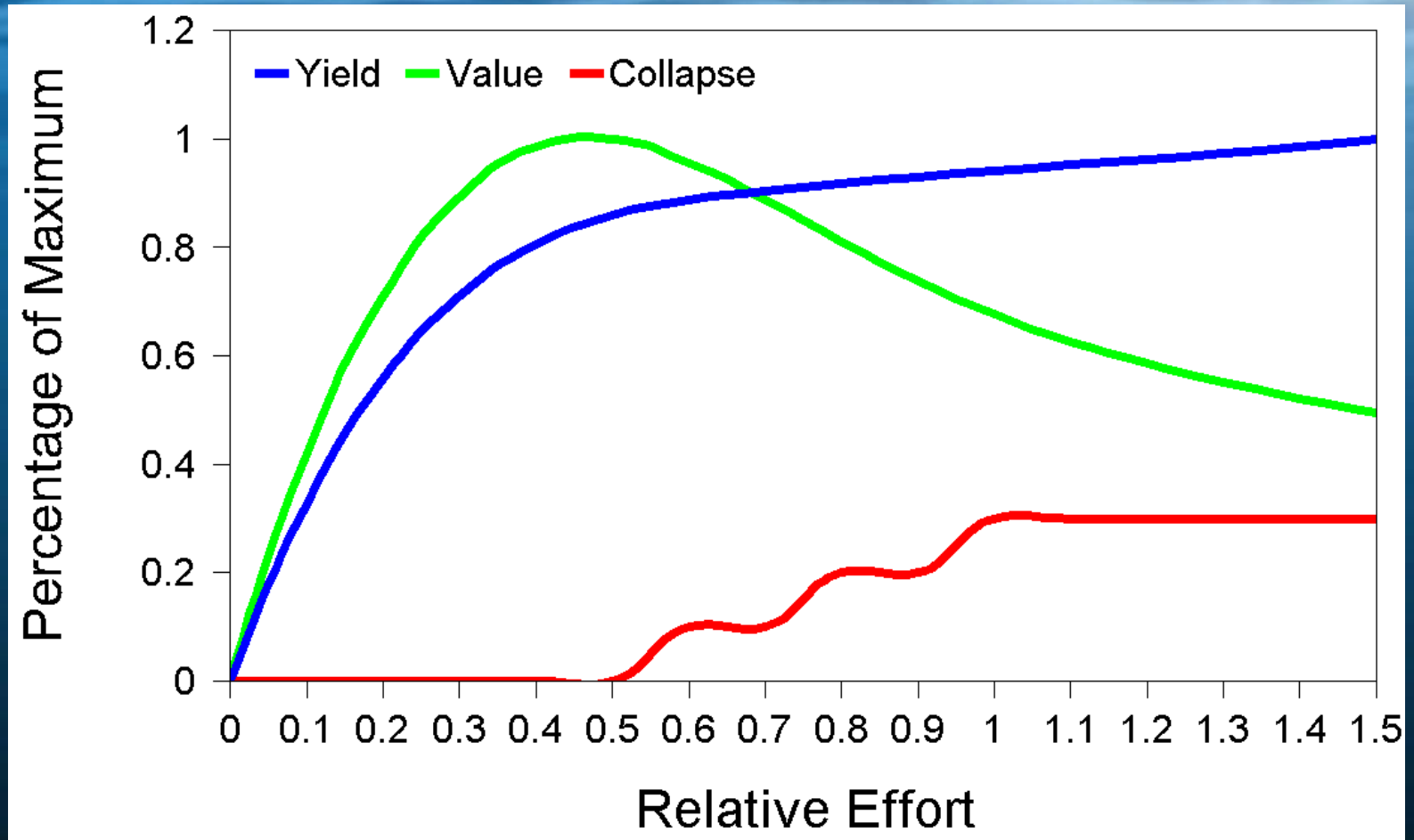


Courtesy Beth Fulton
Sarah Gaichas

Hydra: A Size-Structured Multi-fleet Simulation Model



Functional Groups Total



Bottom-Feeding Functional Group

