NEW ENGLAND FISHERY MANAGEMENT COUNCIL

Towards ecosystem-based management

How to operationalize a Fishery Ecosystem Plan…

Mar 28, 2005
Newport, RI - Ecosystems Ctte

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Presentation Overview

- **Fundamental concepts**
- **Theoretical framework**
- **The structure of an FEP**
- **A way forward**

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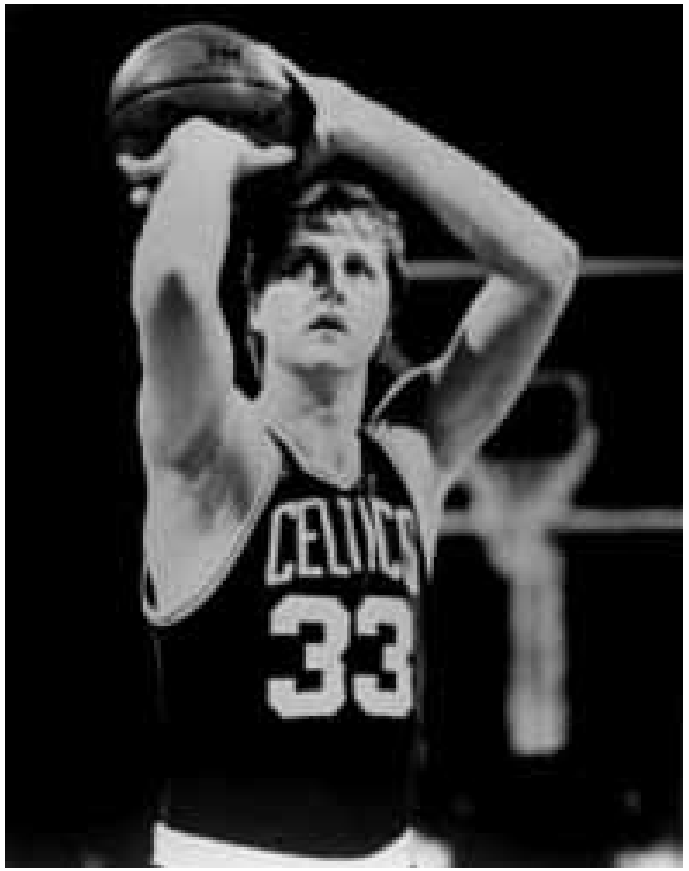
Ecosystem Approaches

The Fundamentals



Fundamental concepts

Principles of EAM

- Objectives are a matter of societal choice
- Management should be decentralized to lowest possible level –*subsidiarity*–
- Consider effects on adjacent ecosystems
- Need to manage in an economic context, focusing on:
  - Reducing market distortions that adversely affect ecosystem structure, function and biodiversity
  - Align incentives to promote conservation and sustainable use
  - Internalize costs and benefits within a given ecosystem

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Principles of EAM (con't)

Fundamental concepts

- Maintaining ecosystem services (structure and function) should be a primary objective
- Focus on appropriate spatial and temporal scales
- Set long-term objectives for management
- Recognize that change is inevitable (the steady-state myth)
- Consider all forms of relevant information, including indigenous and local knowledge
- Seek to involve all relevant sectors of society and scientific disciplines

International Union for the Conservation of Natural Resources, 2004

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More Principles of EAM

Fundamental concepts

- Long-term sustainability as a fundamental value
- Clear operational goals
- Sound ecological models and understanding
- Understanding complexity and interconnectedness
- Recognition of dynamic character of ecosystems
- Attention to context and scale
- Acknowledgment of humans as ecosystem components
- Commitment to adaptability and accountability

Ecological Society of America, 1995

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Theoretical Framework

How do you manage an ecosystem?

Theoretical framework

The basics

- Ecosystem approaches to management have two components
  1. Governance
  2. Science
- High degree of overlap
- MSE's

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Theoretical framework

Governance Issues

- Expand mandates to include:
  - Biodiversity
  - Ecosystem structure and function
  - Other objectives (?)
- Expand sphere of influence to include all uses of marine environment
- May need to remove focus on individual stock biomass
- Develop capacity for local governance

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Science Issues

Theoretical framework

- New, higher-level assessments incorporating
  - Trophic interactions
  - Multivariate analysis
- Increased emphasis on ecosystem component monitoring
- Establish links btwn carrying capacity, primary production and exploitable fishery stocks
- Development of MSE's

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Fishery Ecosystem Plans

Theoretical framework

FEP's = *strategic*

FMP's = *tactical*

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Theoretical framework

Place-based, stakeholder driven

- FEP's and FMP's are specific to local ecosystems
- Stakeholders central to:
  - Setting objectives
  - Chosing "tools"
  - Monitoring and assessment

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Theoretical framework

How does an FEP differ from current FMP?

- Regional governance structure
  - Objectives specific to each region
- Requires stakeholder involvement
- May use broader objectives
  - biodiversity, eco. structure/function
- Confronts tradeoffs head-on
  - Inter- and intra- fisheries

Theoretical framework

What are the benefits?

- Place-based emphasis
  - People closest to resource setting objectives
  - Encourages stewardship/participation
  - Different strokes for different folks
- Broader objectives will benefit all
  - Resource more stable
  - Able to accommodate stresses

Theoretical framework

What are the benefits?

- Reality check
  - Can't have all species at MSY simultaneously
  - Explicit recognition of carrying capacity
  - Potential ability to adjust "targets" with long-term trends in productivity
- Confronting tradeoffs
  - Integrating other marine uses into decision making
  - Explicit decisions relative to extraction of exploitable species (and mortality of non-exploitable ones)

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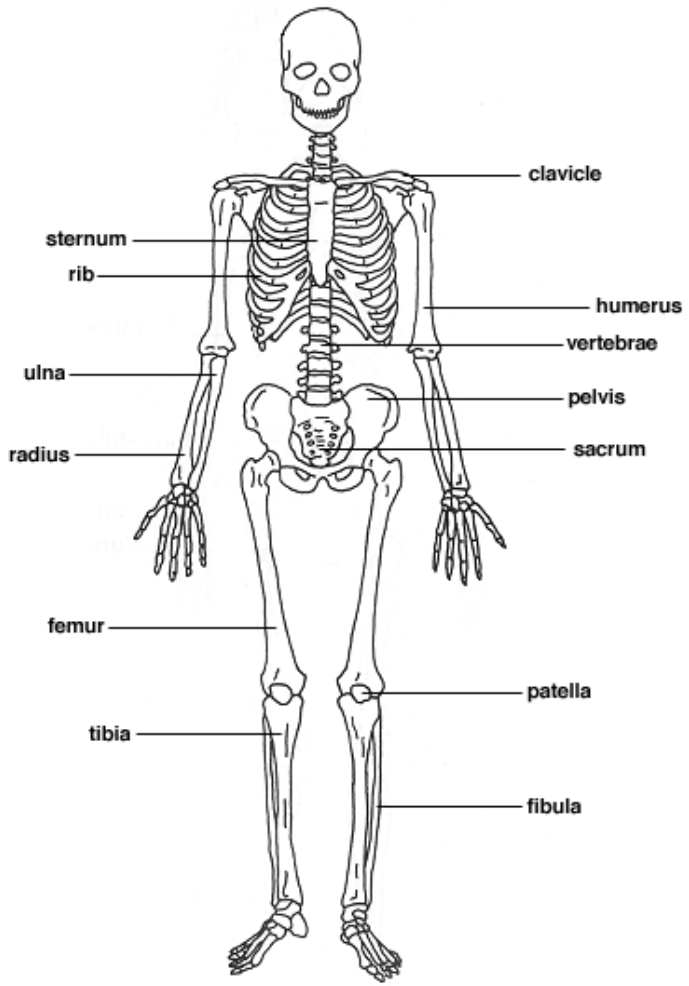
Implementation of a Fishery Ecosystem Plan

A bare-bones approach



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Eight steps to an FEP

Implementation

1. Determine the stakeholders
2. Define the spatial boundaries
3. Characterize the structure and function of the ecosystem, including ecological and monetary economies
4. Define long-term objectives
5. Define indicators of health/success
6. Determine robust, flexible paths for realizing objectives
7. Monitor and assess impacts of decisions relative to long-term objectives
8. Determine impacts of decisions on adjacent ecosystems

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Implementation: Step 1

Stakeholders

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Stakeholders

Implementation: Step 1

- Should incorporate all marine uses
  - Fisheries stakeholders relatively well established
- Iterative process
  - Education/information required prior to obtaining feedback
  - Active participation required

These are the folks setting the ground rules

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Stakeholders

Implementation: Step 1

Question:

How do we identify stakeholders?

- Who is captured by the Council mailing lists?
- Can we break these out by constituency?
- Who is missing?
  - Recreational?
  - Party/Charter?
  - Protected resources IP's?

Survey should help inform

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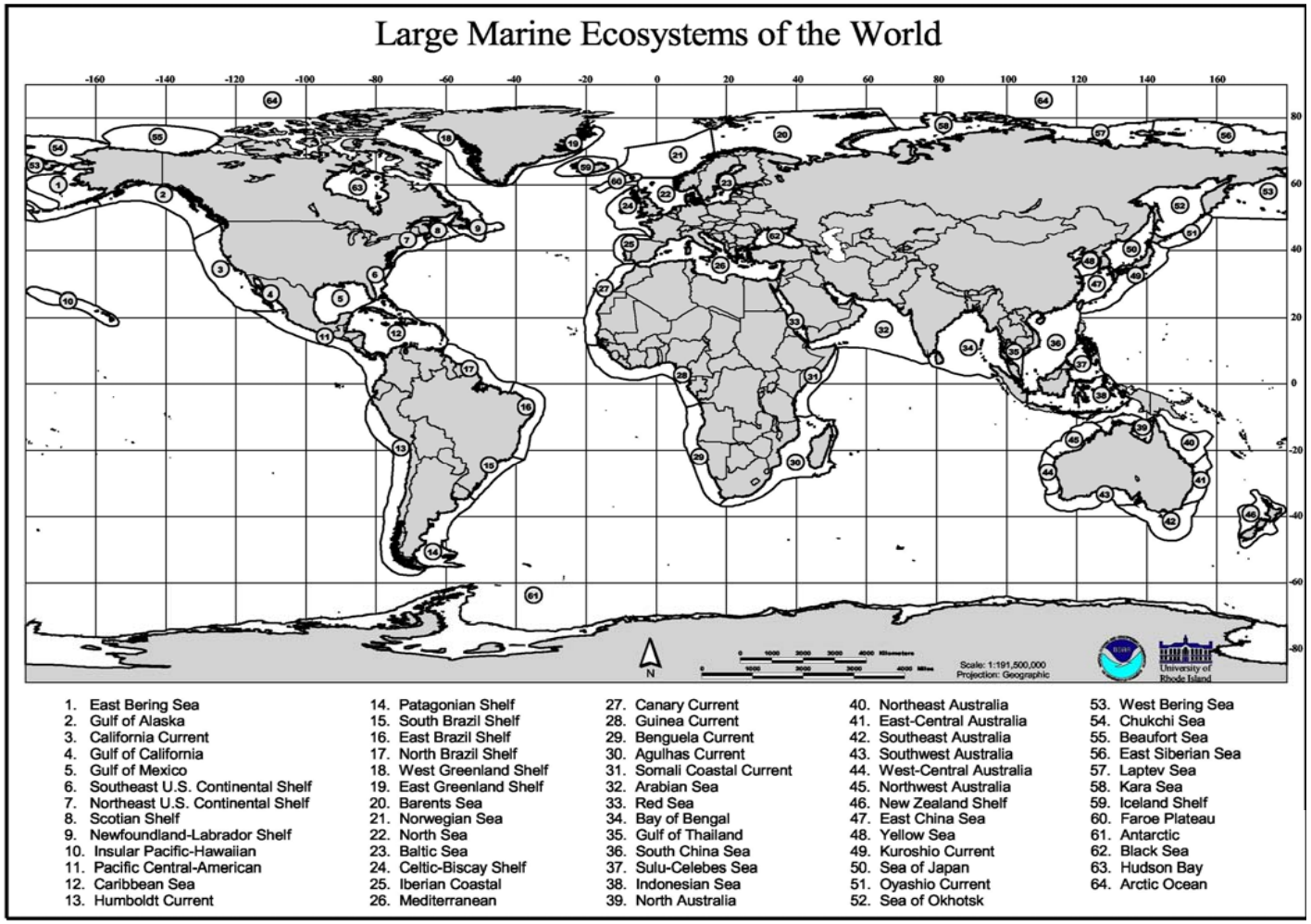
Implementation: Step 2

Spatial boundaries



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Spatial boundaries: US

Implementation: Step 2

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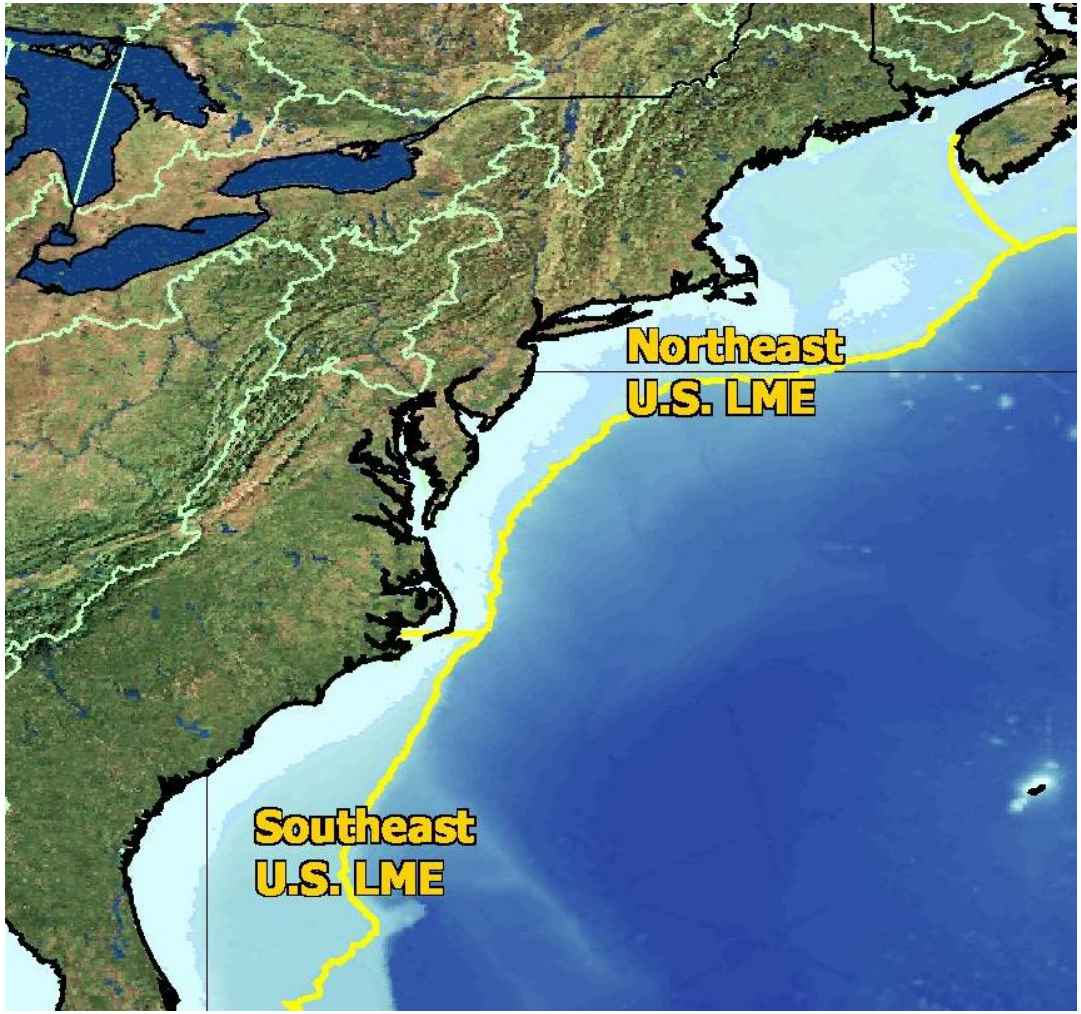
Spatial boundaries: Northeast

Implementation: Step 2



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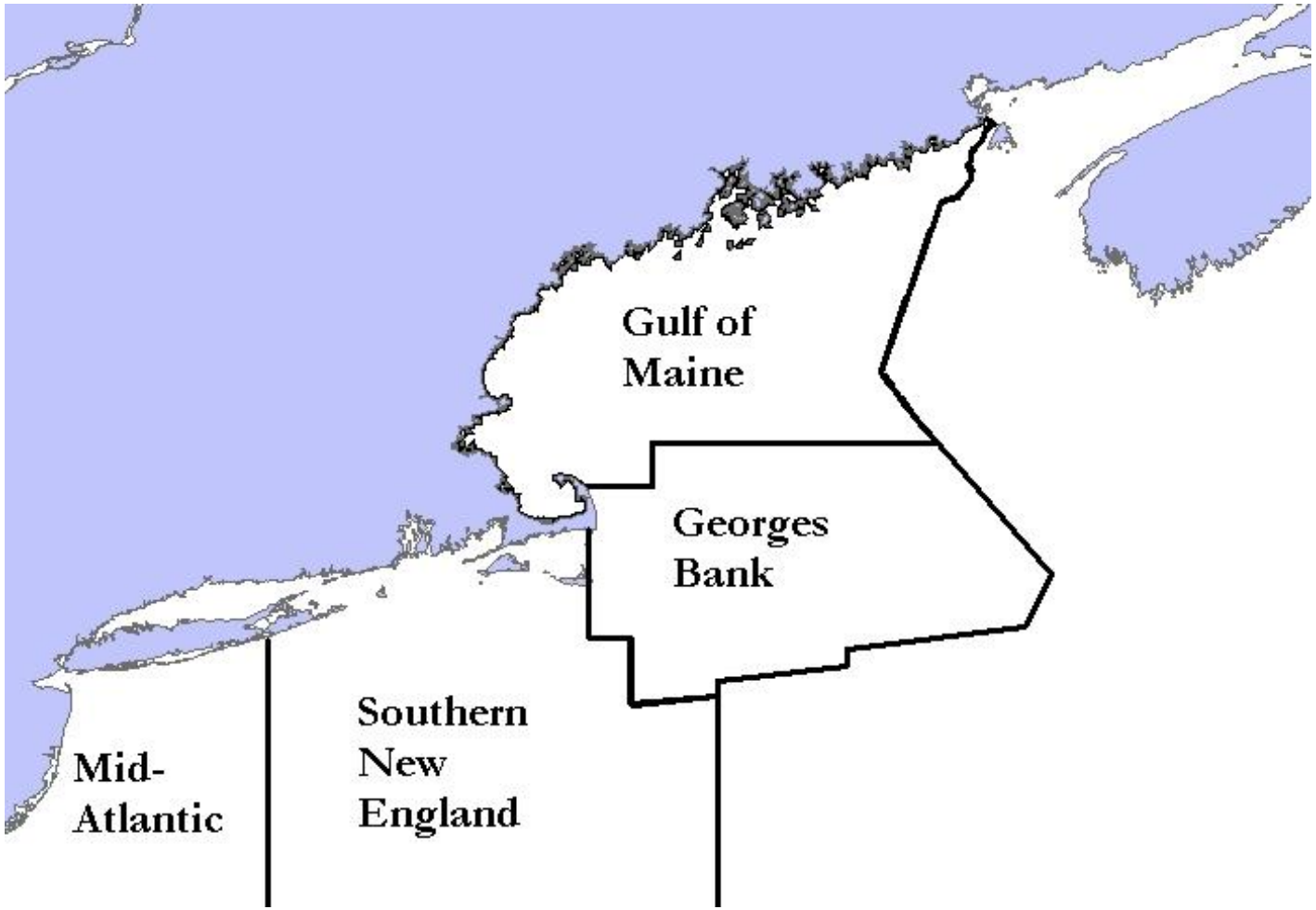
Spatial boundaries: local

Implementation: Step 2



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Spatial boundaries: local

Implementation: Step 2

- Defined by:
  - Ecological boundaries (GOM, GB, etc)
  - Political boundaries (Hague line, states, etc)
  - Management boundaries (reg. mesh areas, etc)
  - Management requirements (thou shalt manage as a unit throughout the range of a stock)
- Use:
  - For all fisheries?
  - Specific to each fishery?

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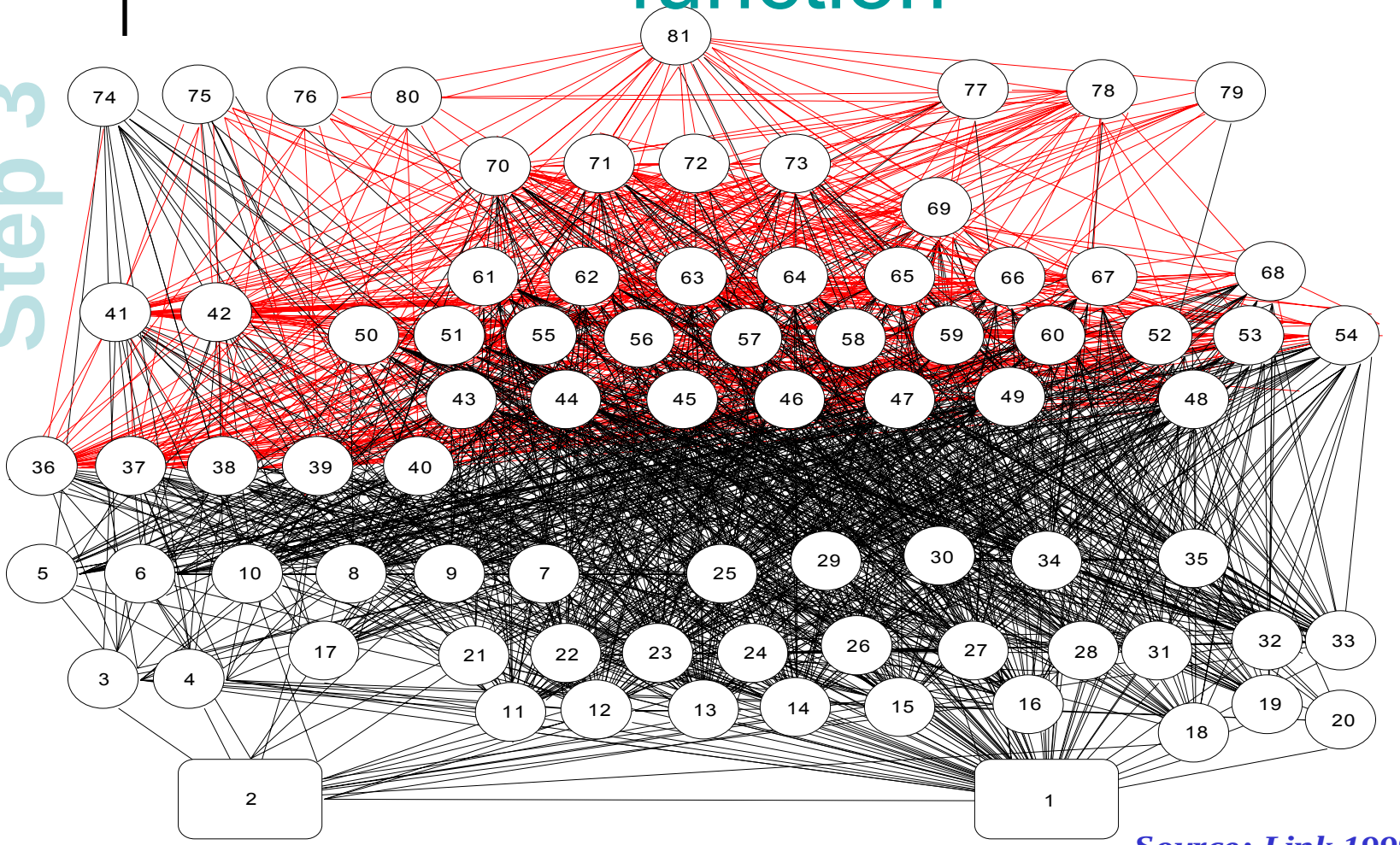
Ecosystem structure and function

Implementation: Step 3



Source: Link 1999

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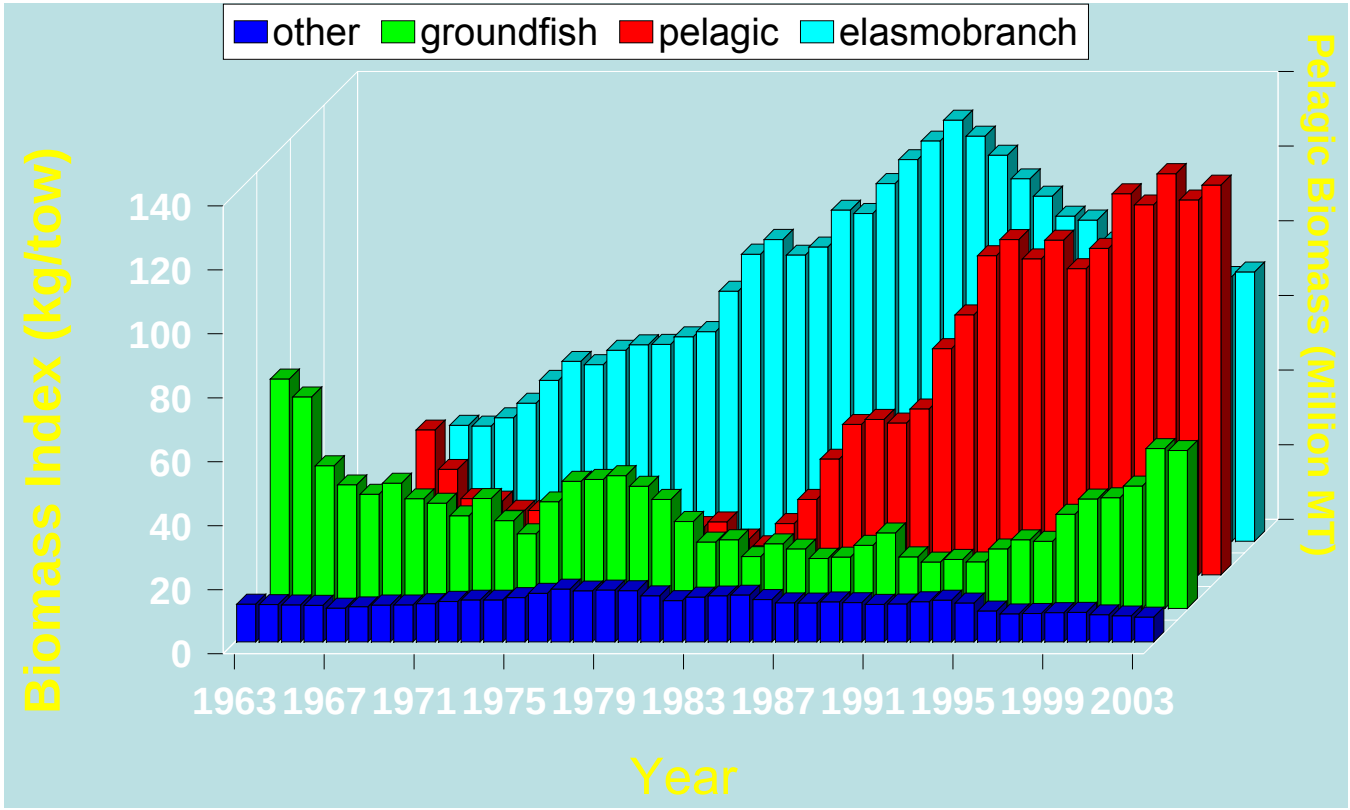
Ecosystem structure and function

Implementation: Step 3

Changes in community structure impact energy flows



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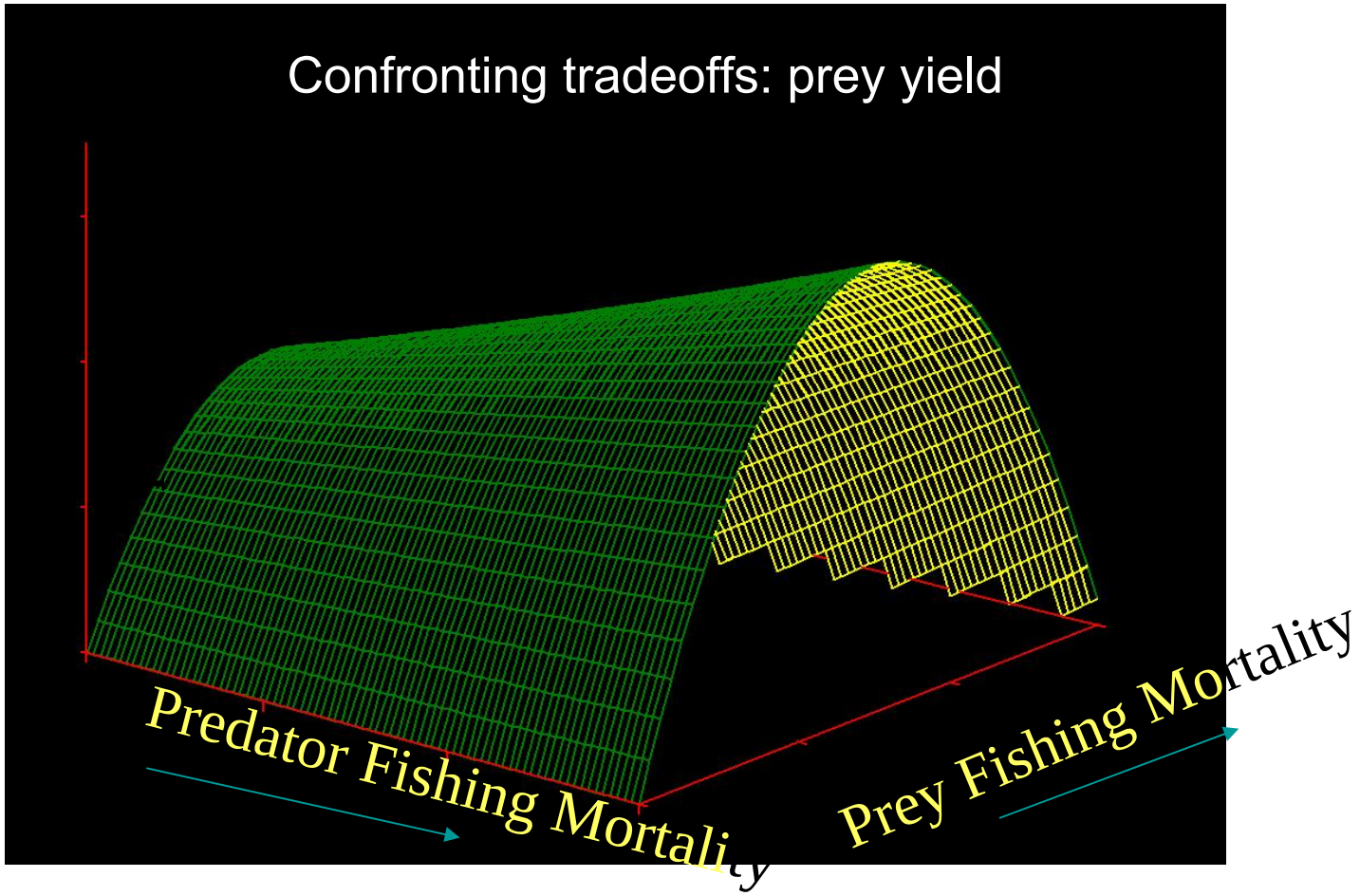
Ecosystem structure and function

Implementation: Step 3



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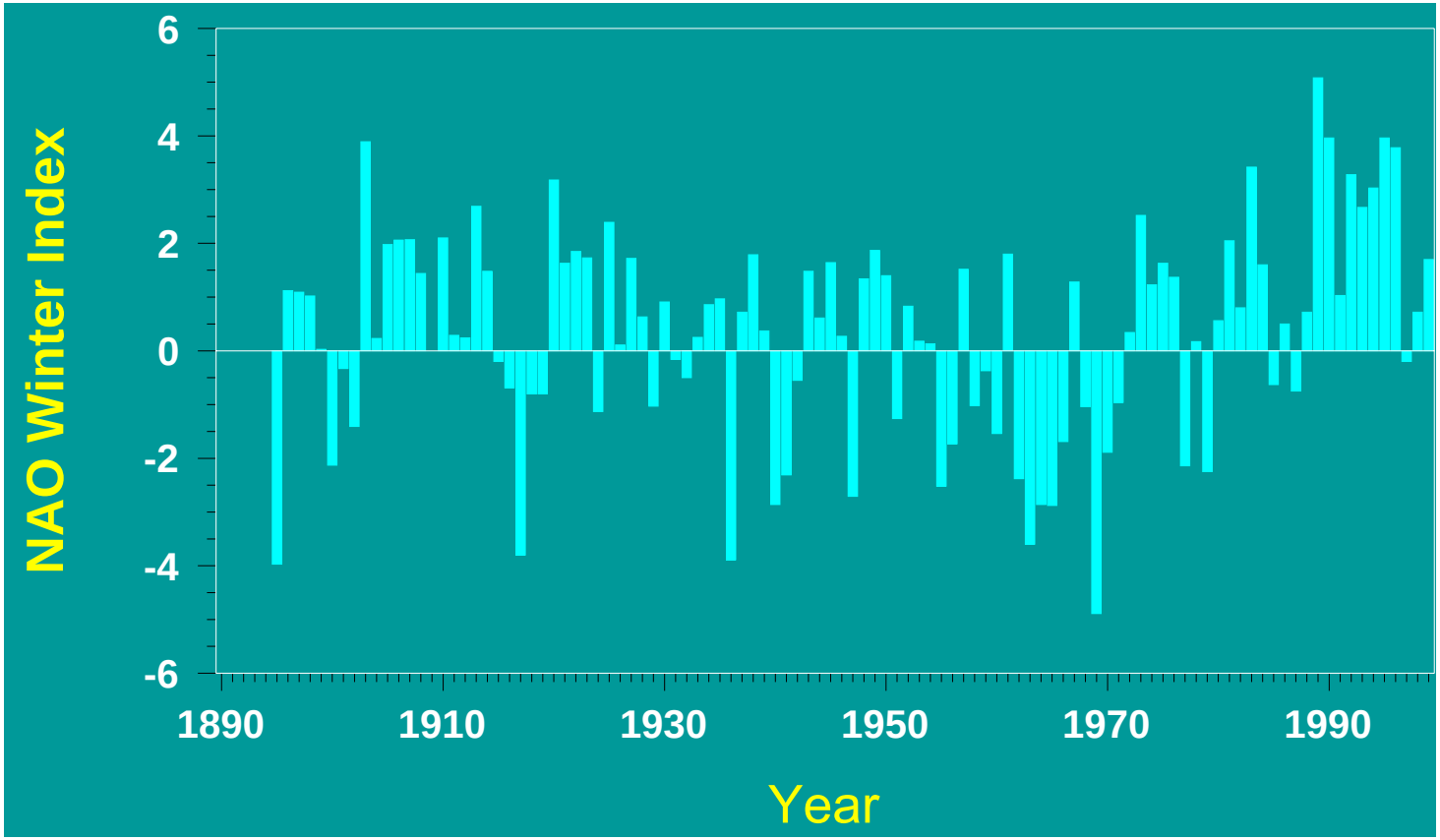
Ecosystem structure and function

Implementation: Step 3

Emphasis on low-frequency oscillations



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Ecosystem structure and function

Implementation: Step 3

- Trophic structure
- Carrying capacity
- Primary production
- Regime Shifts
- Causality of observed changes
- Relationship to external ecosystems and/or regulatory spheres

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Implementation: Step 4

Define objectives

Implementation: Step 4

Define objectives

National Conservation Objective	Fisheries	Oil & Gas	Transport	Military	Other Stakeholders (NGOs & Public)	Specific Ecosystem Components on ESS related to the Issues
Maintain communities	Modification of Bottom habitat	Effects on Benthic Biota		Impact of Explosives on Bottom Diversity	Protection of Fragile Benthic Communities I.e. Coral and in Gully	Diversity of the benthic community, the coral community and the high diversity benthic community in the Gully
Maintain species	Protection of Species at Risk, low productivity & narrow niche species	Drilling Waste and Noise (seismic & acoustic) Effects on marine mammals & sea turtles	Impact of Shipping Noise on Marine Mammals, Ship/w hale collisions, Introduction of Invasive Species through Ballast w ater	Impact of Noise on Marine life	Protection of Northern Bottlenose Whale & Leatherback Turtles & other Species at Risk	Overall Species Diversity & specifically the status of species designated Endangered or Threatened
Maintain populations	Maintenance of Population Richness w ithin Management units					Genetic Diversity of populations under Human Pressure
Maintain primary production		Impact of Produced Water Discharges on Primary Productivity	Impact of pollution on Primary Productivity			Productivity of Base of Food Chain
Maintain trophic structure	Harvesting of forage species				Harvesting of Krill	Productivity of Each Trophic Level (incl. Forage species) and Energy Transfer along Food Chain
Maintain mean generation times of populations	Fishing Mortality on directed & by-catch species	Drilling Waste and Noise (seismic & acoustic) Effects on fish larvae, fish and shellfish	Impact of oily discharges on Seabirds			Grow th & Recruitment Productivity of Individual Populations
Conserve ecosystem's physical features - critical bottomscape		Drilling muds disposal and contaminant degradation				Sediment Quality
Conserve ecosystem's physical features - w ater column properties	Fishing Noise Impacts on Ecosystem	Seismic Impacts on Ecosystem	Shipping Noise Impacts on Ecosystem	Military Noise Impacts on Ecosystem		Overall Sound Environment
Conserve ecosystem's chemical features - w ater quality	Ship-source Pollution	Produced Water Discharge, Contaminant Biodegradation & Biotransformation	Oil Pollution	Ship-Source Pollution		Overall Chemical Environment

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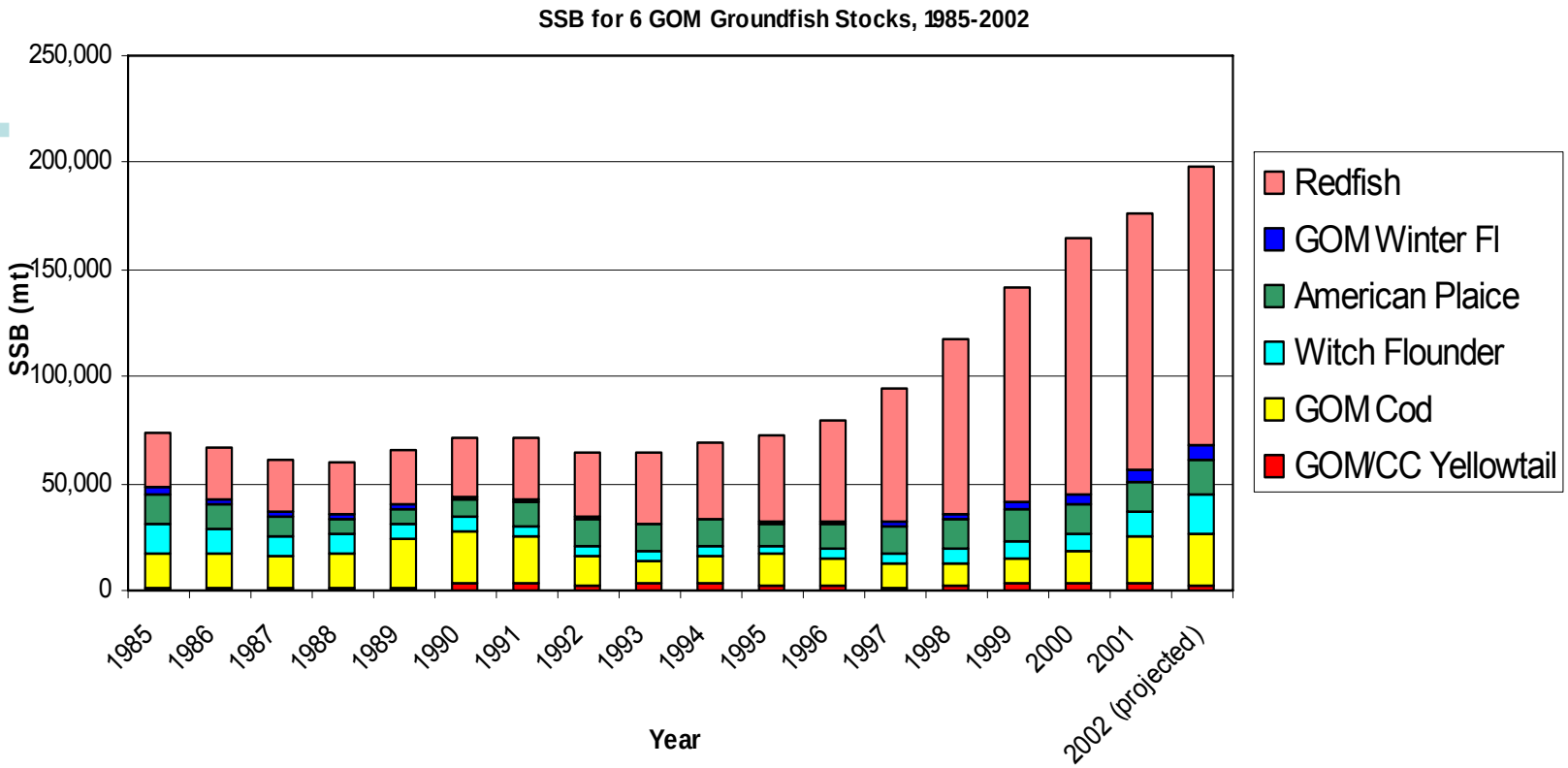
Define indicators

Implementation: Step 5



*2002 projections are from Groundfish PDT work for Amendment 13.

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Implementation: Step 5

Define indicators

- Index of biodiversity
  - Genetic (inter- and intra-species)
  - Taxonomic
- Other biological/ecological
  - Trophic and/or guild relationships
  - Age structure, weight-at-age, length-at-age, etc.
- Pollution levels/water quality indicators
- Profits (not revenues!)
- Low-frequency oscillations (temp, salinity)
- Indicators of primary production
- Community indicators? Others?

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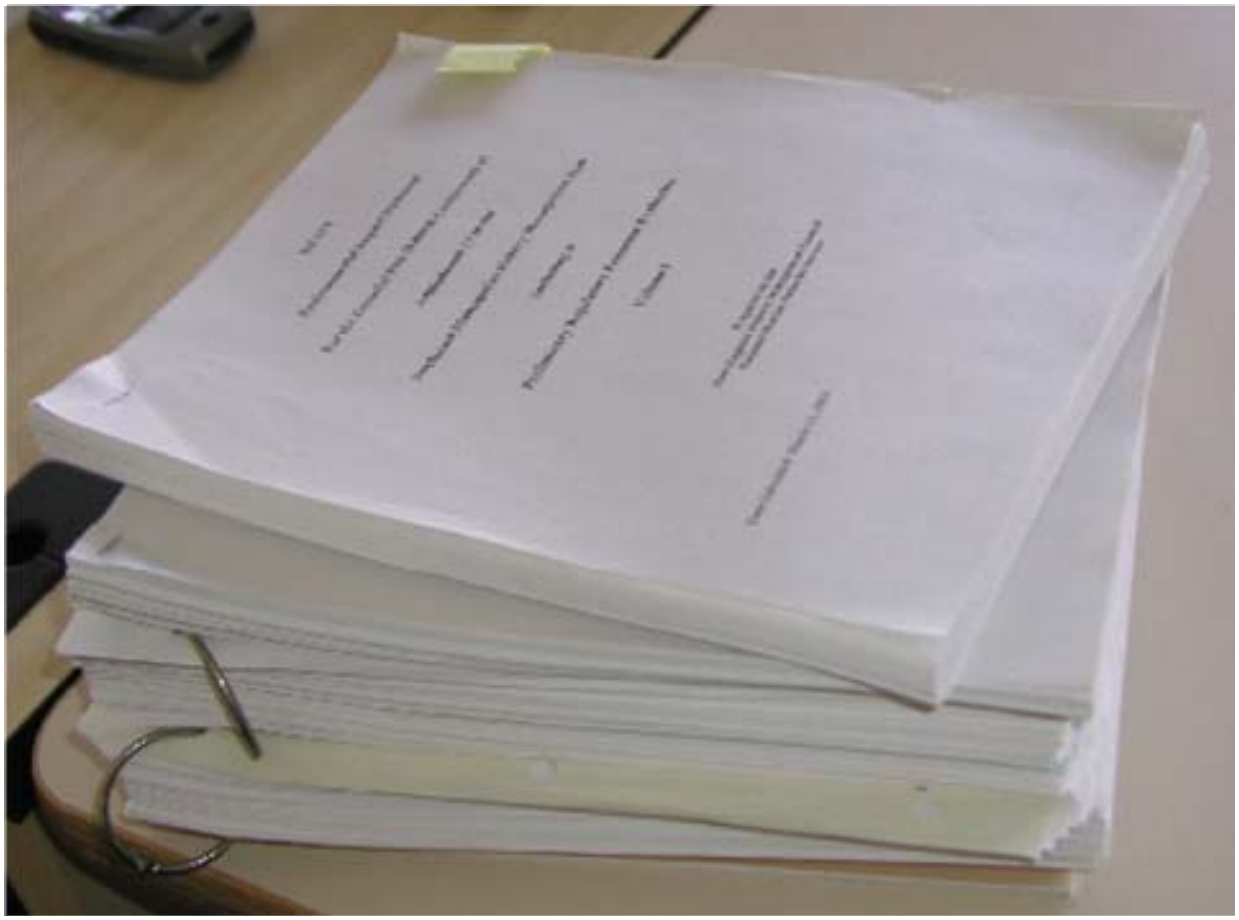
Implementation: Step 6

Robust, flexible methods



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Robust, flexible methods

Implementation: Step 6

- Match “tool” to objective
  - Permanent closed areas
  - Minimum fish/minimum mesh size
  - Rolling closures
- Encourage resource “ownership”
- EAM ≠ MPA!
- Beware the cookie-cutter

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Monitor and assess

Implementation: Step 7

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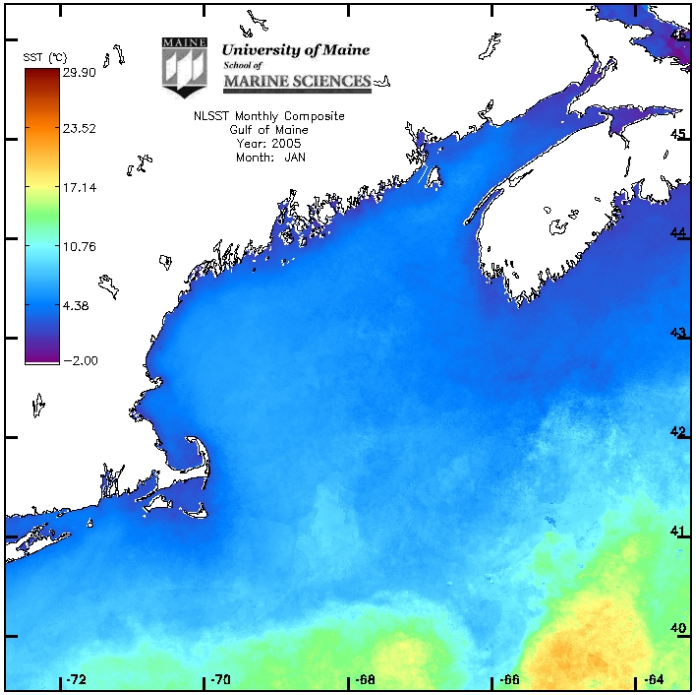
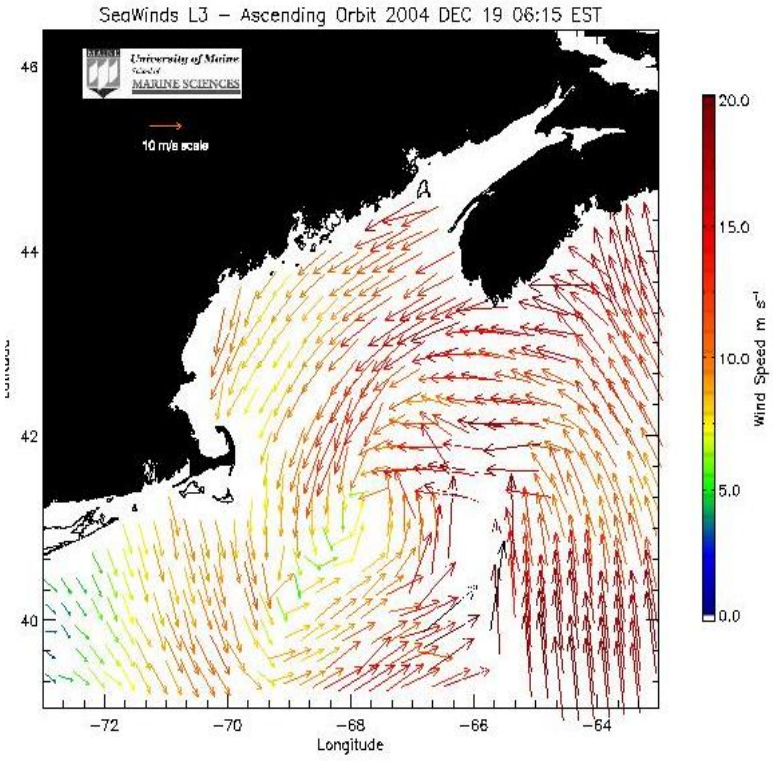
Implementation: Step 7





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Implementation: Step 7

Monitor and assess

- Traditional methods
  - Fishery dependent / fishery independent data
  - Cooperative
  - Oceanic monitoring (GoMOOS, etc)
- Non-traditional methods
  - New uses for existing data sources
  - Expanded monitoring requirements demanded by indicators

CUMULATIVE EFFECTS

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Implementation: Step 8

Determine impacts on adjacent ecosystems

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Implementation: Step 8

Determine impacts on adjacent ecosystems

- Impact “exports” / technical interaction
  - Transfer of fishing effort
  - Mortality of trans-boundary stocks
  - Cascading impacts to trophic structure
- Impact of non-fishing sector operations
- “Tools” mismatch

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Requirements: Gov't and Science

Implementation

FEP Step	Governance	Science
1. Determine the stakeholders	✓	
2. Define the spatial boundaries	✓	✓
3. Characterize the structure and function of the ecosystem		✓
4. Define long-term objectives	✓	
5. Define indicators of health/success	✓	✓
6. Determine robust, flexible paths for realizing objectives	✓	✓
7. Monitor and assess choices relative to long-term objectives	✓	✓
8. Determine impacts of decisions on adjacent ecosystems	✓	✓

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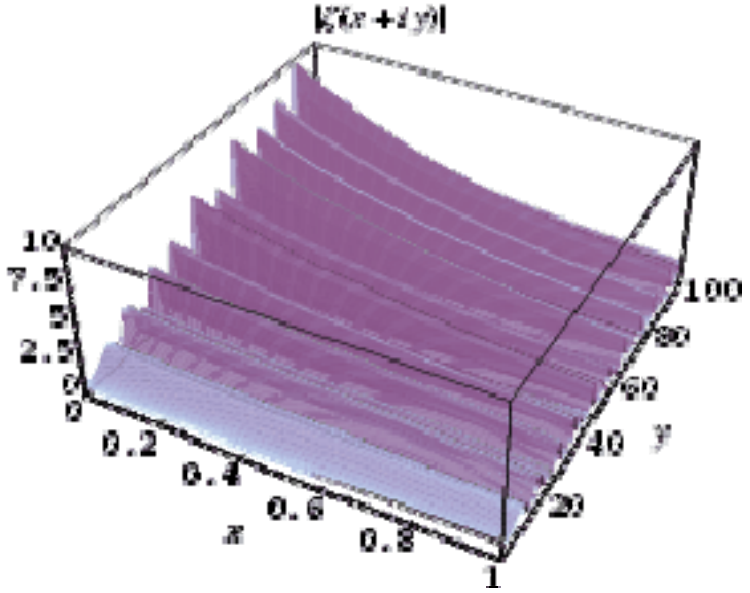
A way forward

Solving the greatest riddle in fisheries management



$$\zeta(x) \equiv \frac{1}{\Gamma(x)} \int_0^\infty \frac{u^{x-1}}{e^u - 1}\, du,$$

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A way forward

Proceed with reckless abandon

- Construction starts with:
  - Stakeholders
  - Boundaries
- Further steps (e.g. Step 3) already underway
- Expectation of action critical to involving stakeholders

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Questions for the Ctte:

- Do we want to investigate initiating an FEP?
- What is the next logical step?