Ecosystem-based management: developing a framework for implementation

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and
Conservation International

Evidence for ecosystem effects

- Large declines in overall abundance of many stocks are have been documented even though the scientific debate continues regarding the magnitudes and implications of the declines.
- Effects of fisheries removals can cascade through marine ecosystems.
- Both fishing down the food web (sequential depletion) and fishing through the food web (sequential addition) occur.

National Academy of Sciences 2006. Dynamic Changes in Marine Ecosystems: Fishing, Food Webs, and Future Options

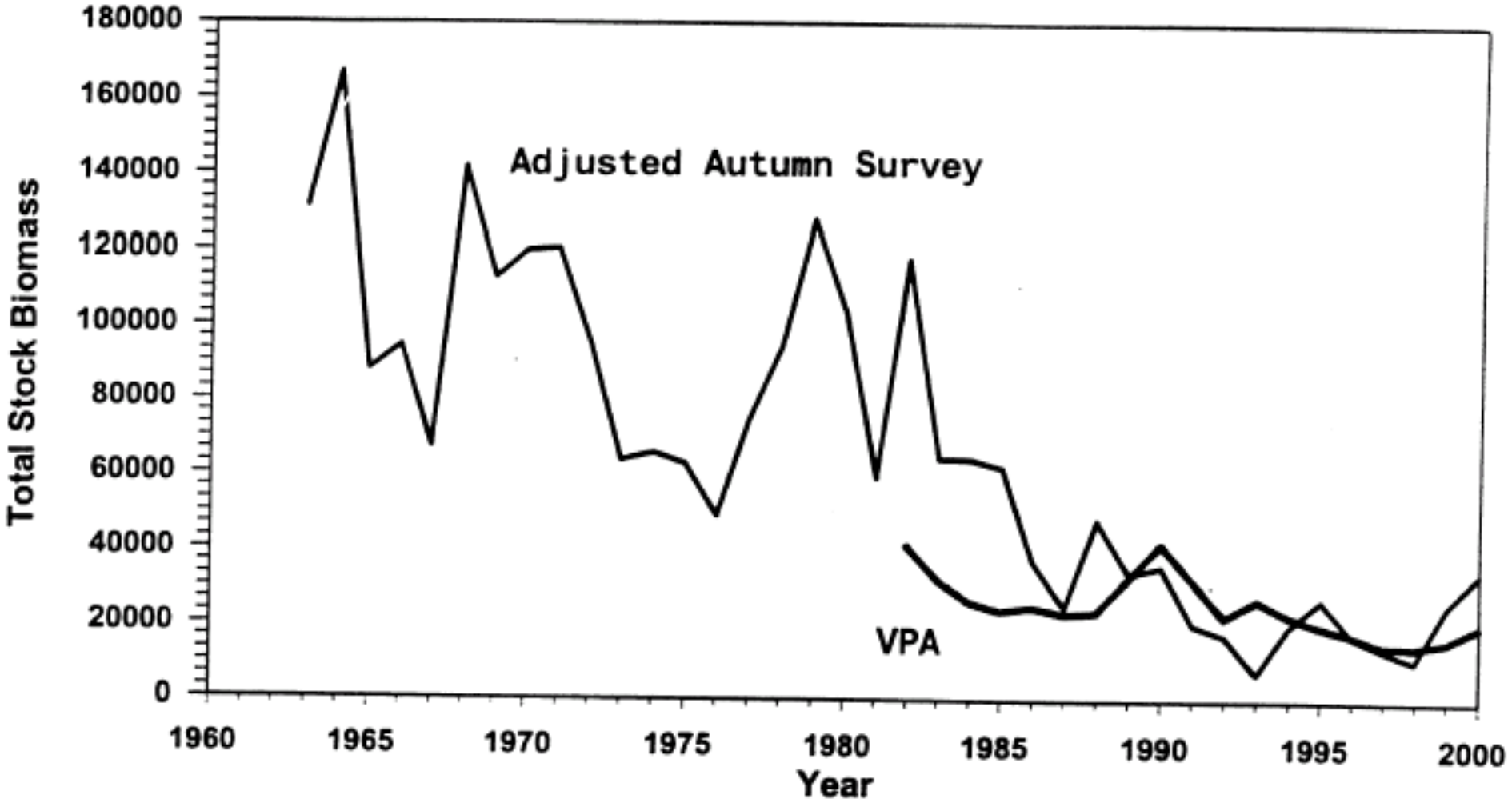
Evidence for ecosystem effects

- Regime shifts can be caused by physical forcing, fishing, or a combination of both.
- Shifting baselines alter perceptions of marine ecosystems, masking the extent of ecosystem change.
- Realizing that there is a theoretical limit to the productivity that can be taken from the oceans and that we may currently be at or approaching that limit, food-web interactions will become increasingly important in future fisheries management decisions.

National Academy of Sciences 2006. Dynamic Changes in Marine Ecosystems: Fishing, Food Webs, and Future Options

Gulf of Maine Cod

Trends in Total Biomass



Minimum Catch for Downeast Maine – 1861

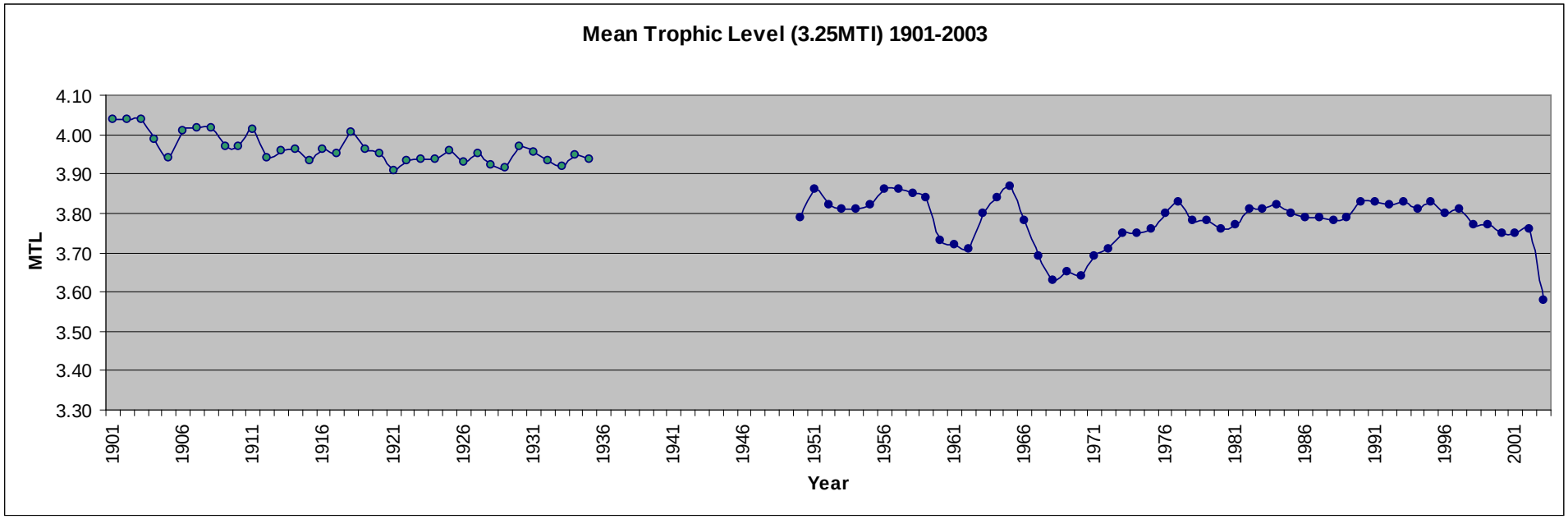
223 vessels averaging 45 tons caught:

12,456 mt of cod

Est. total Gulf of Maine Catch 1861
78,600 mt

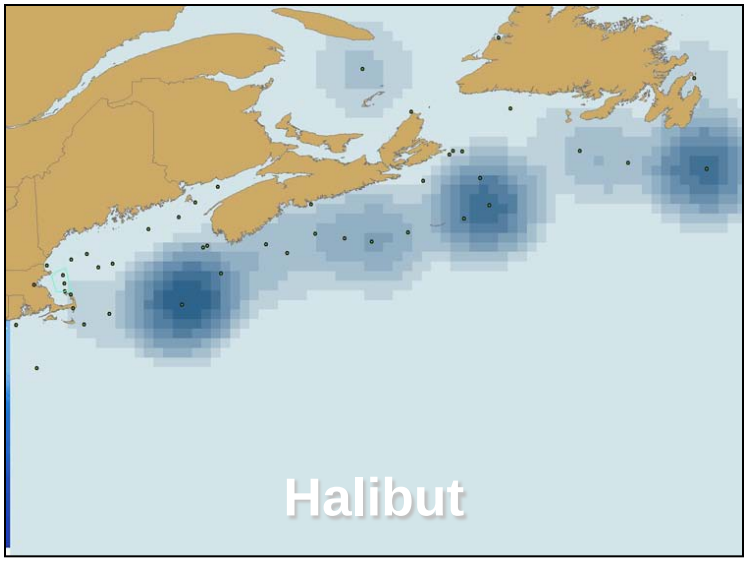
Total Gulf of Maine Cod Catch
1998 - 4156 mt
1999 - 1646 mt
2000 - 3730 mt
2007 - 3440 mt

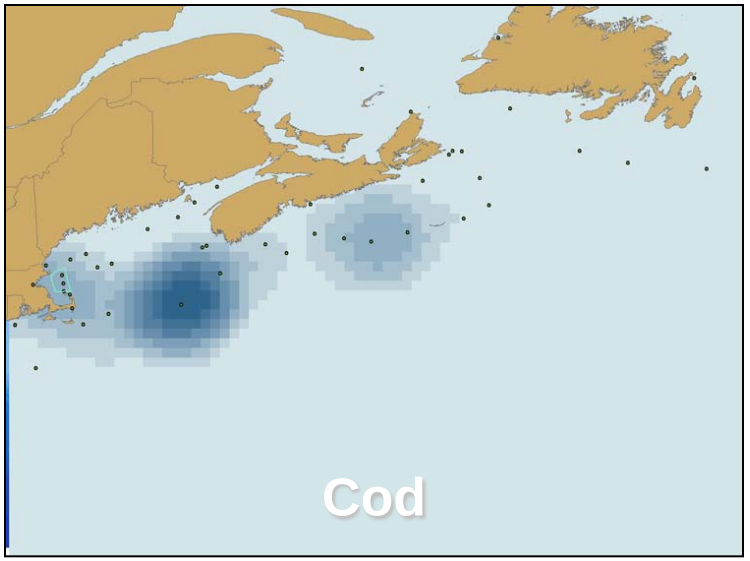
Mean Trophic Levels from Statistical Bulletin Landing Data (1901-1935) and LME Northeast US Continental Shelf Landings (1950-2003)

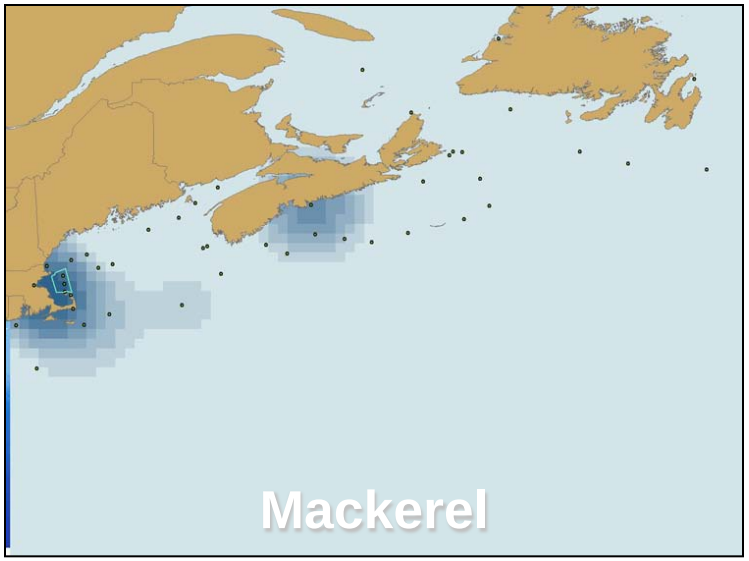


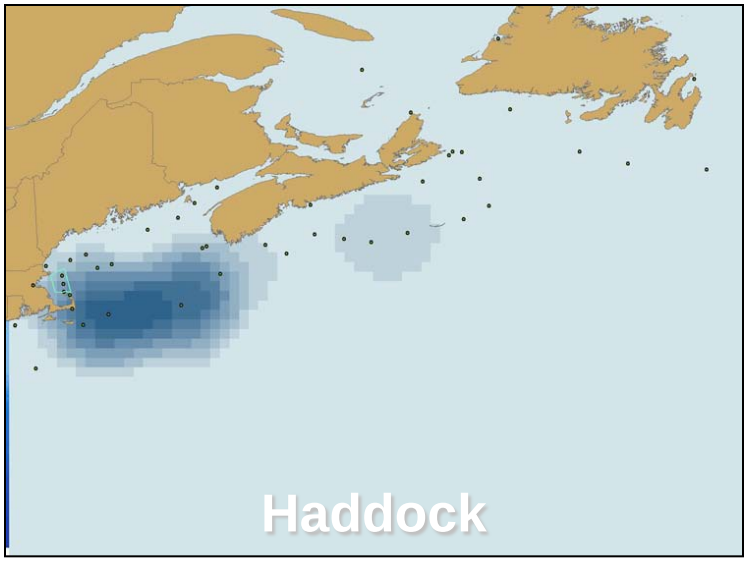
Trophic Level: Position in the food chain, determined by the number of energy-transfer steps to that level. A number indicating the position of a species within an ecosystem. By definition, plants have a TL = 1, herbivores TL = 2, and so on, up to a TL = 5 in killer whales.

Spatial Distribution of Landings 1901-1935









THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release June 12, 2009

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MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

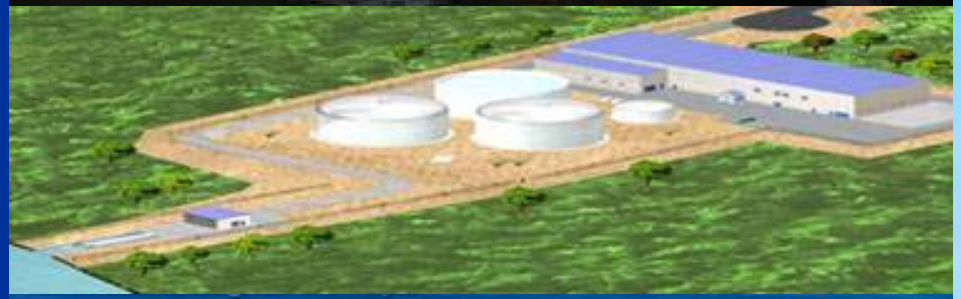
SUBJECT: NATIONAL POLICY FOR THE OCEANS, OUR COASTS, AND THE GREAT LAKES

The oceans, our coasts, and the Great Lakes provide jobs, food, energy resources, ecological services, recreation, and tourism opportunities, and play critical roles in our Nation's transportation, economy, and trade, as well as the global mobility of our Armed Forces and the maintenance of international peace and security. We have a stewardship responsibility to maintain healthy, resilient, and sustainable oceans, coasts, and Great Lakes resources for the benefit of this and future generations….

To succeed in protecting the oceans, coasts, and Great Lakes, the United States needs to act within a unifying framework under a clear national policy, including a comprehensive, ecosystem-based framework for the long-term conservation and use of our resources.

Existing Uses

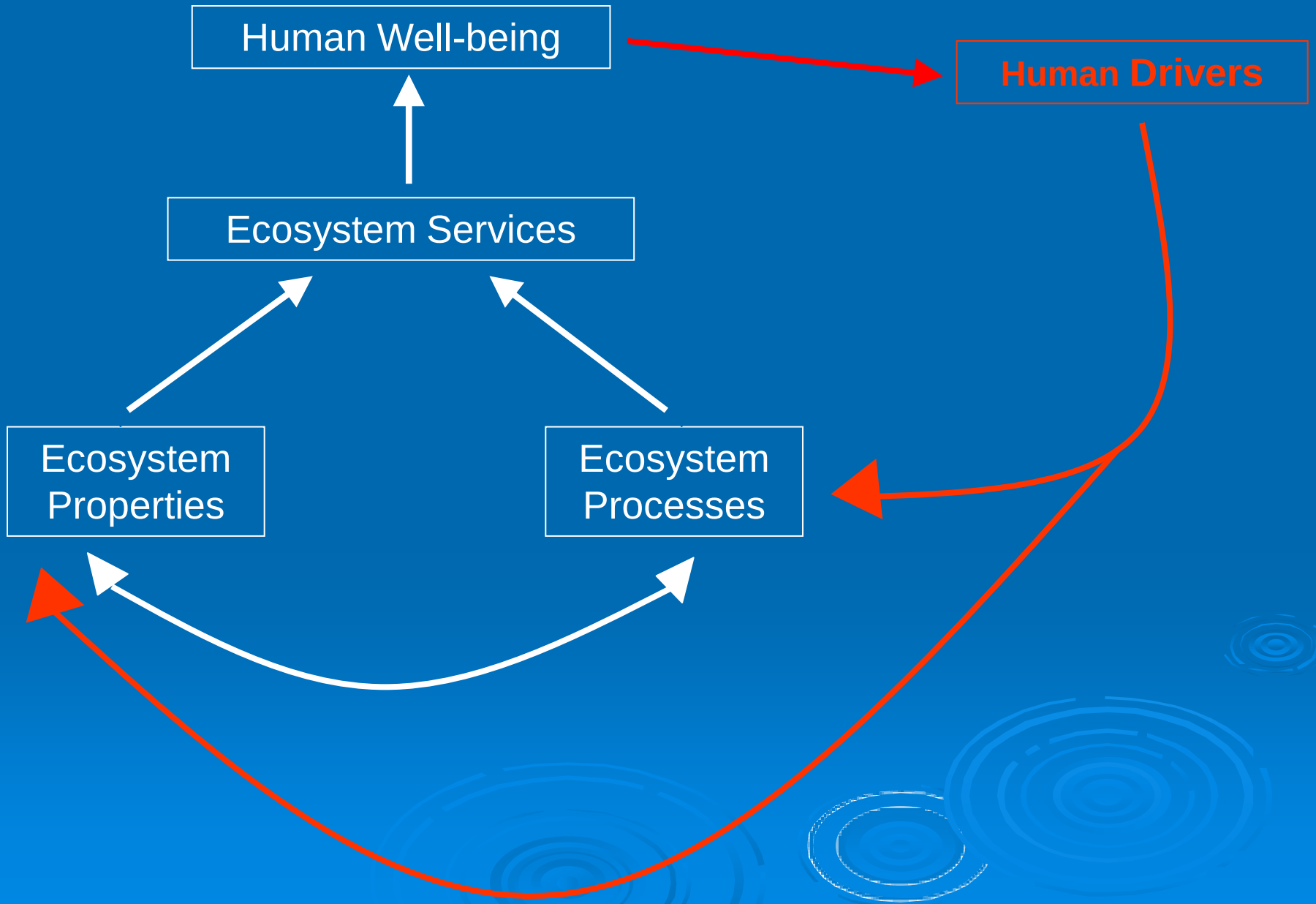
Changing Uses



Five Features of EBM

1. Focus on the ability of the ecosystem to support human well-being through the provision of ecosystem services.
   - **Services occur at multiple scales**
   - **Services are not independent between scales**
     - **e.g., Nutrient cycling, natural hazard protection, fish production**
2. Natural boundaries are most relevant to the conservation of ecosystem services
   - There are multiple boundaries that are hierarchical
   - All boundaries are leaky not absolute

3. Various sectors of human activity interact so management should be integrated
   - Interactions local and at larger scales
4. Impacts of human activities on an ecosystem are often cumulative across both time, space and scale
5. Tradeoffs in services among sectors must be made and should be explicit – locally and LME wide


Human Well-being
Human Drivers
Ecosystem Services
Ecosystem Properties
Ecosystem Processes

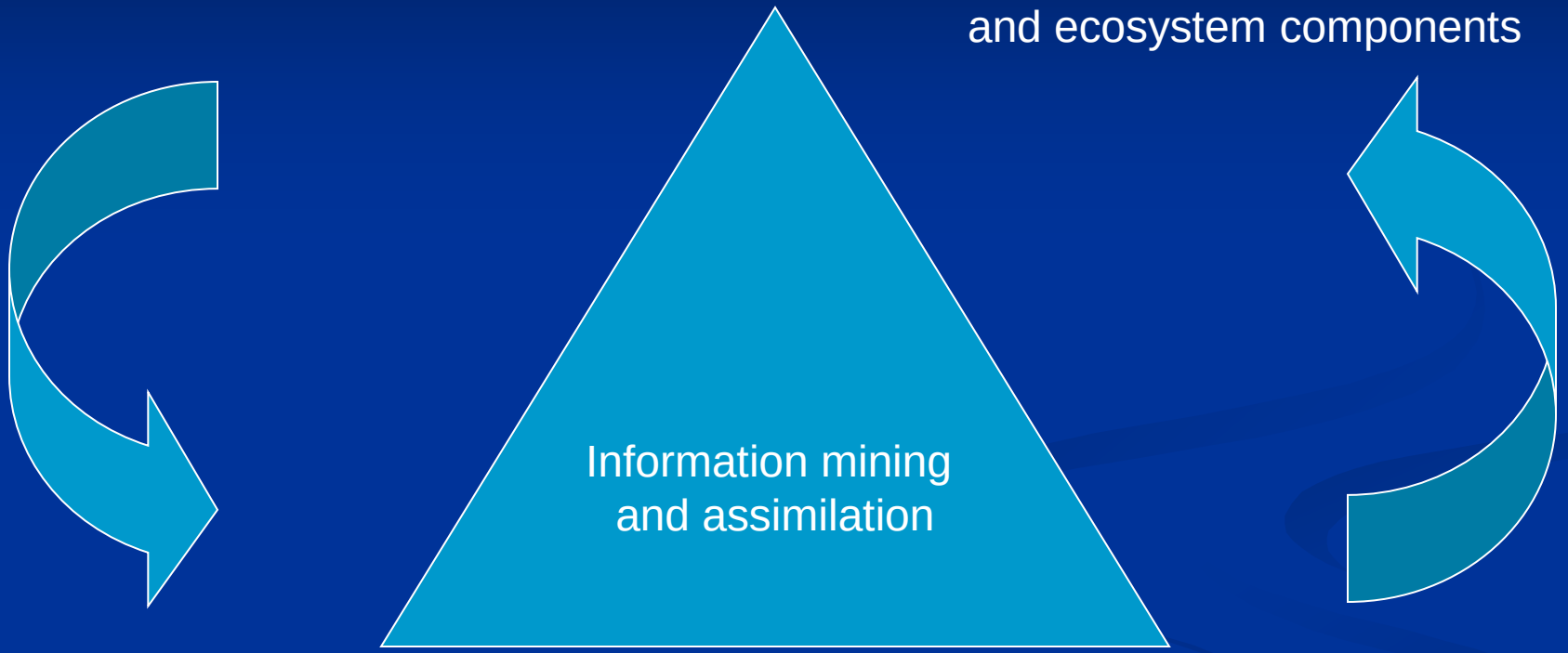
NCEAS Science Frameworks Working group – Micheli and Rosenberg

Boundary delineation

Identification of activities and ecosystem components

Input to management **goals and objectives**

Prioritization of activities and ecosystem components



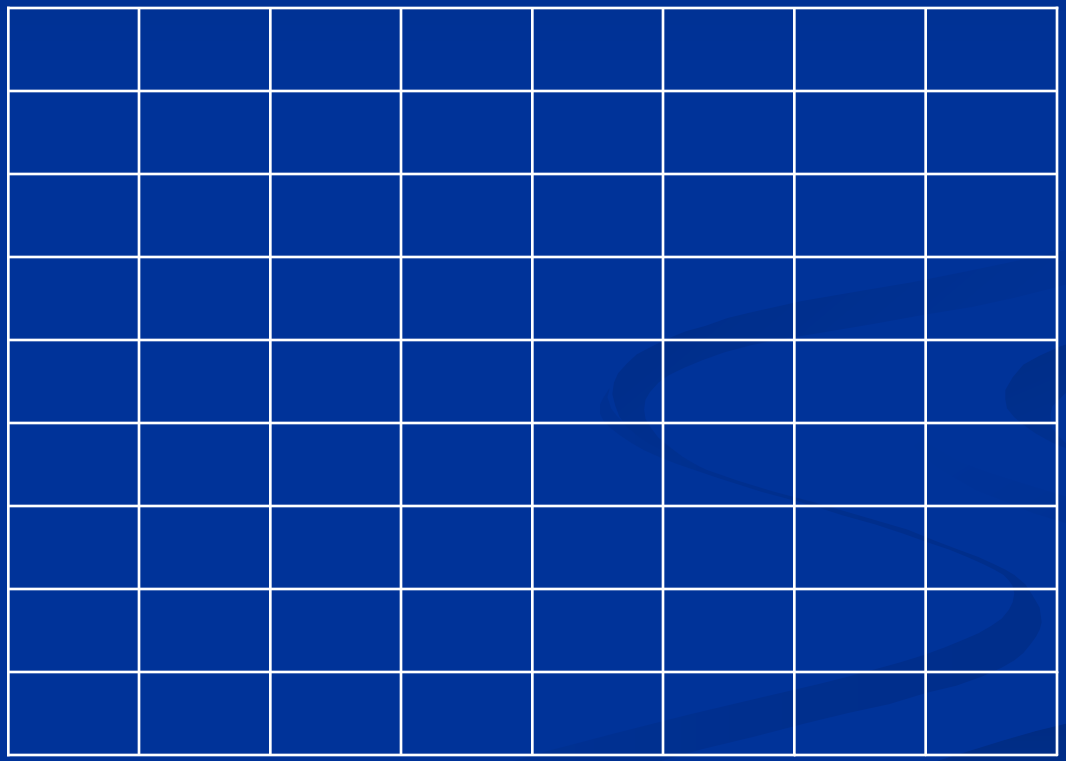
Evaluate activities:
Location, intensity, ecosystem vulnerability, benefits, linkages value, tradeoffs among them

Evaluate strategies:
Generating functions for ecosystem components
Feedback loops
Decision analysis

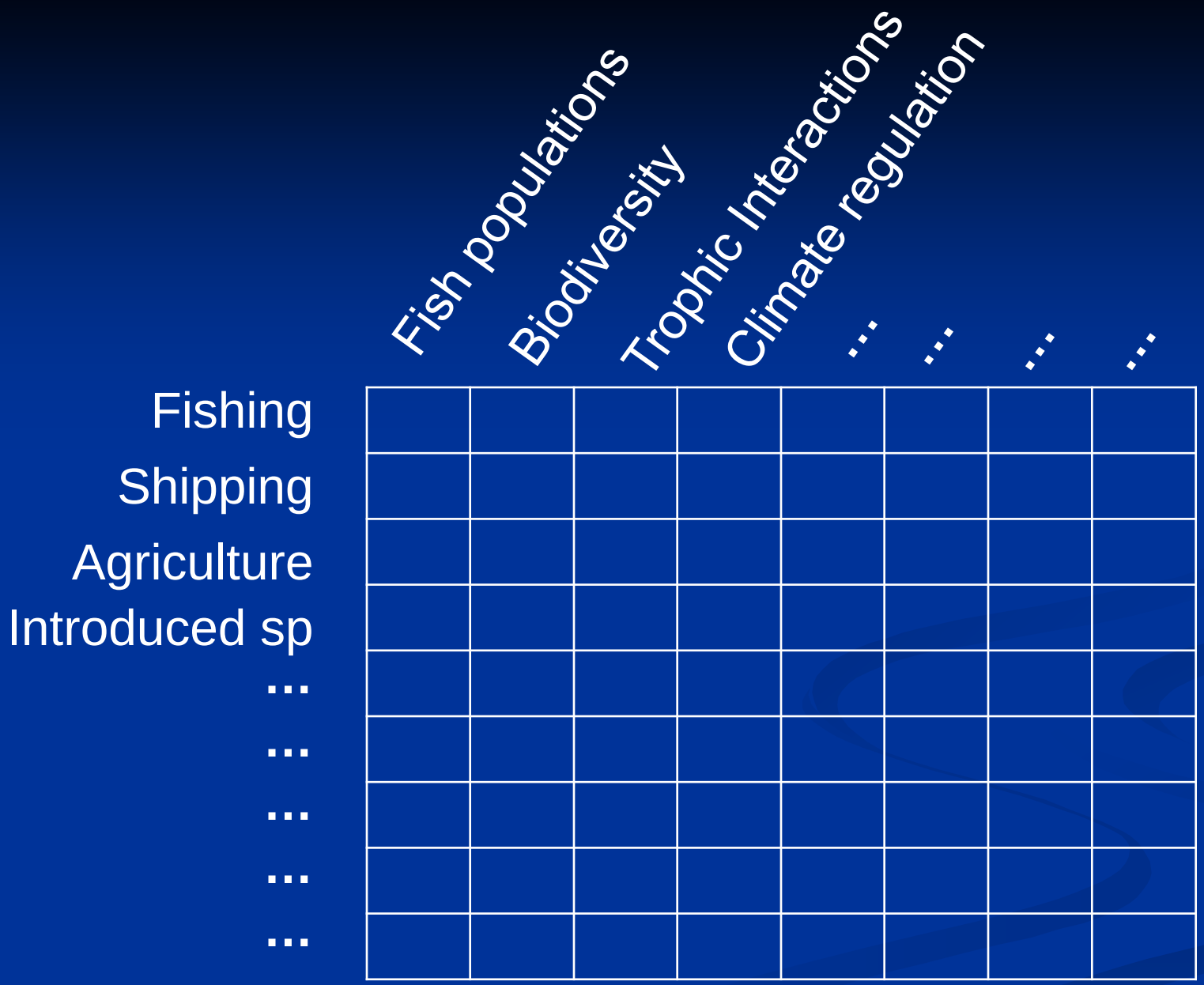
Interaction Matrix

Ecosystem Services

Human Drivers



From: Altman et al. in press. Frontiers in Ecology and Evolution


Fish populations
Biodiversity
Trophic Interactions
Climate regulation
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Fishing
Shipping
Agriculture
Introduced sp
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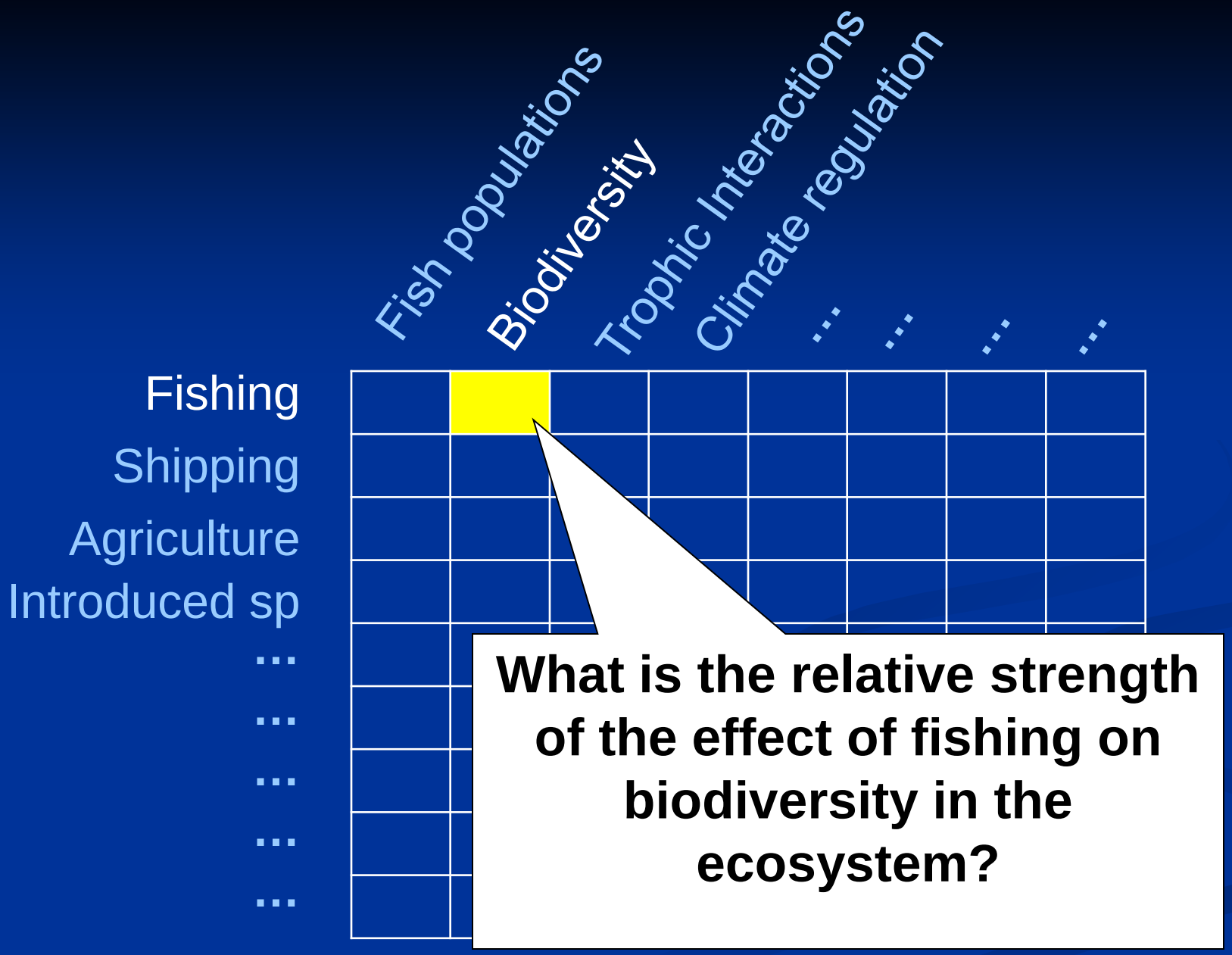
Fish populations
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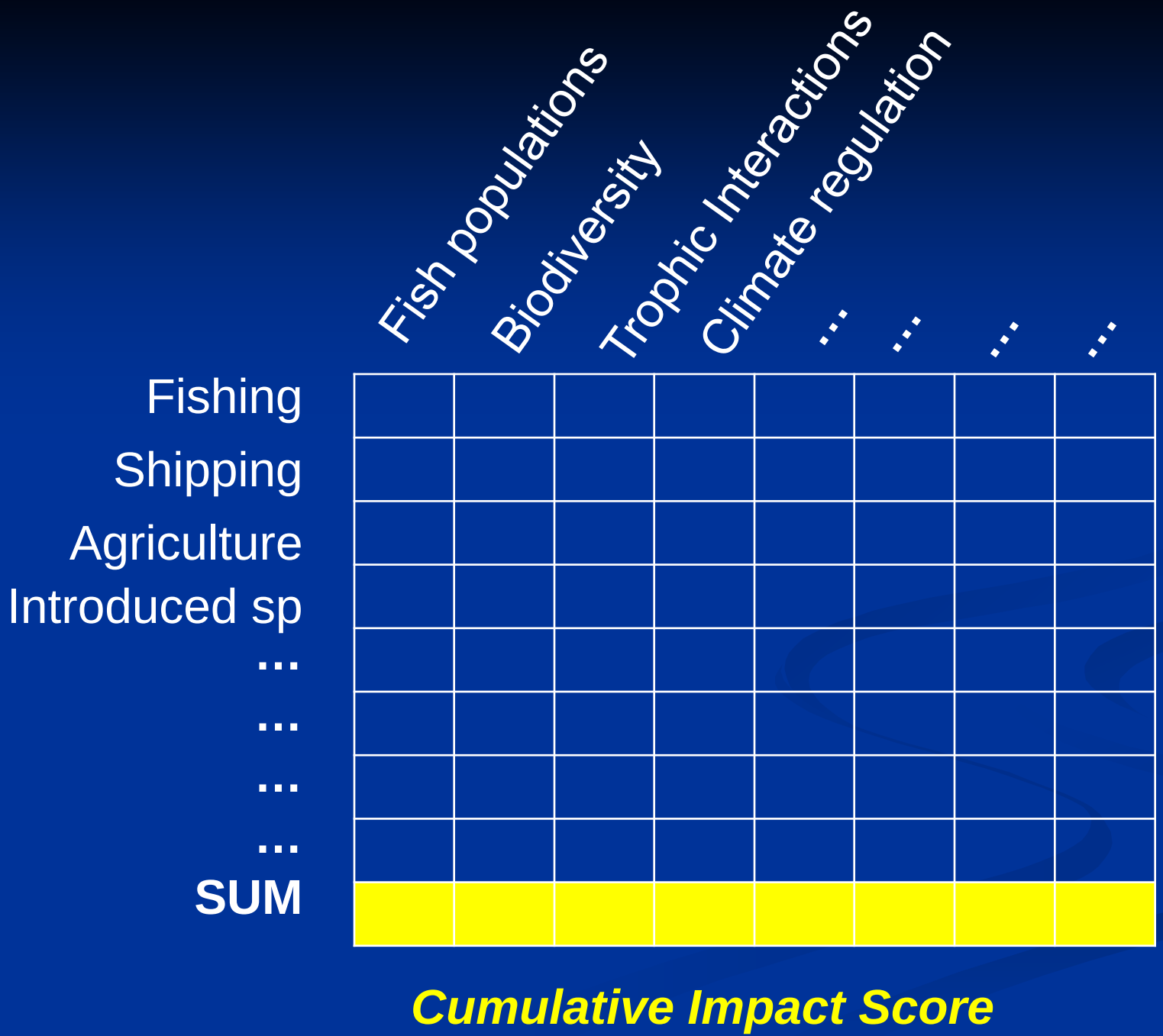
What is the relative strength of the effect of fishing on biodiversity in the ecosystem?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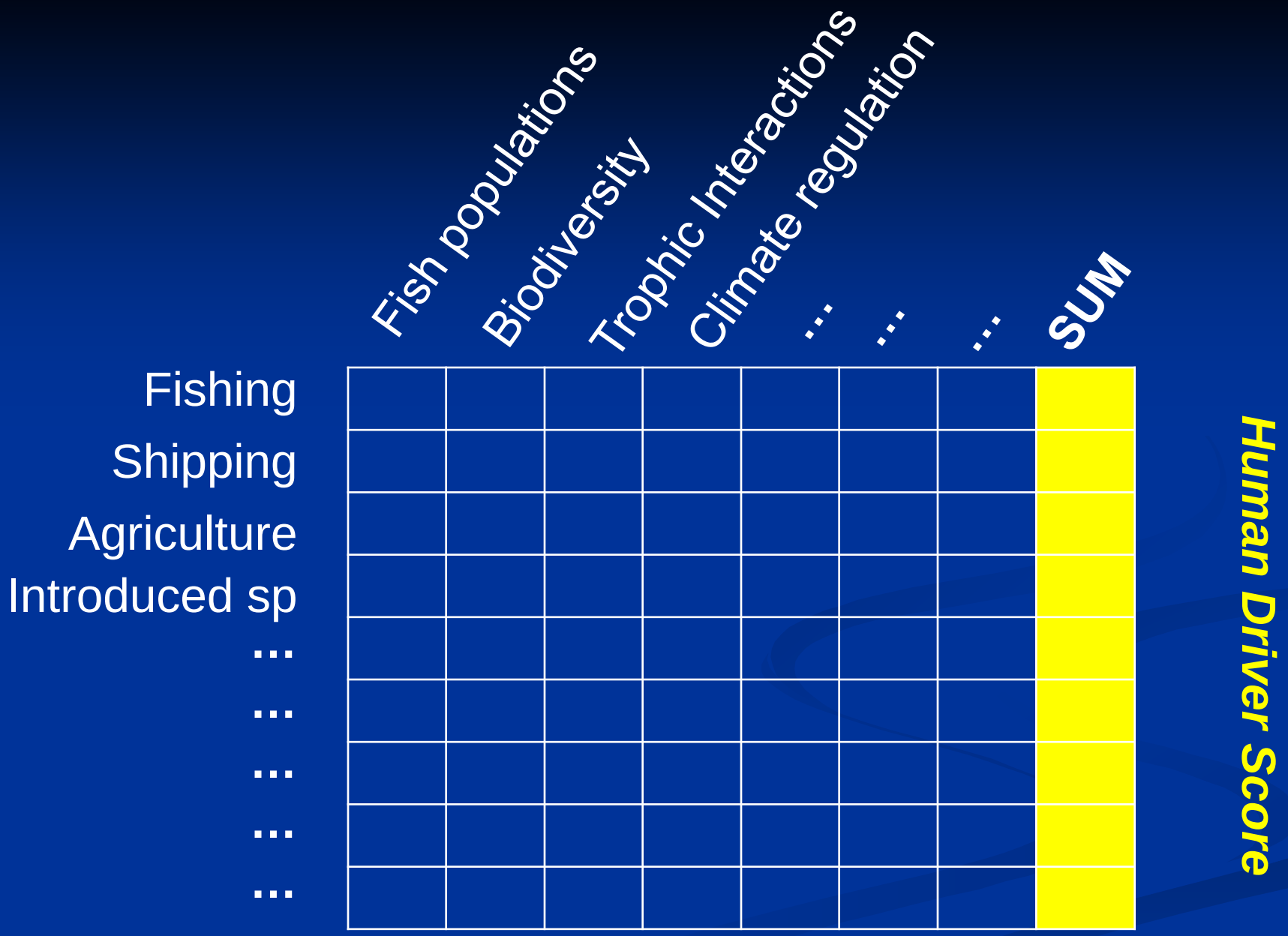
SUM
Cumulative Impact Score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Human Driver Score

NCEAS Science Frameworks Working group – Micheli and Rosenberg

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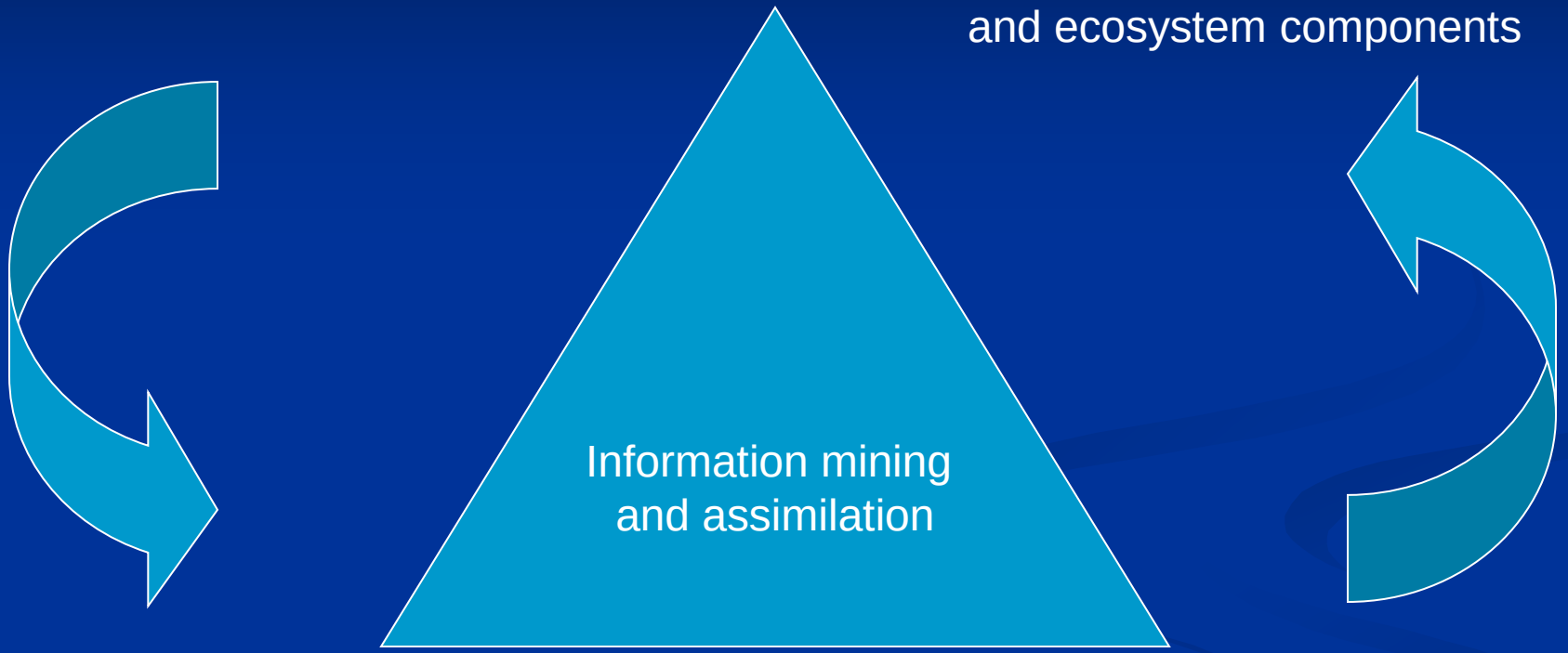

Evaluate activities:
Location, intensity, ecosystem vulnerability, benefits, linkages value, tradeoffs among them

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Decision analysis

Informing EBM

- Models
  - Organize data,
  - Synthesize knowledge
  - Explore uncertainties
  - Evaluate
- Decision Support Tools
  - Inform management decisions
  - Provide opportunities for stakeholder input,
  - Visualize information and outcomes
  - Explore scenarios
- Indicators
  - Monitoring ecological or socio-economic
  - Measure progress
  - Inform adaptation
  - Communicate results

Integrated Ocean Management Plan Options

Goals/Principles/Objectives/Strategies

Legal Authority of the Plan

- Option 1: Existing authority
- Option 2: Comprehensive authority
- Option 3: Supplement or amend existing authorities

Organizational/Institutional Structure

- Option 1: Networked
- Option 2: Centralized
- Option 3: Decentralized

From: Mass. Ocean Partnership, UMass Boston Urban Harbors Institute and MRAG Americas Inc

Integrated Ocean Management Plan Options (4-5)

Inter-jurisdictional Coordination

- Option 1: CZMA authority
- Option 2: Special Area Management Plan (SAMP)
- Option 3: Programmatic General Permit (PGP)
- Option 4: Comprehensive intergovernmental agreement
- Option 5: New interagency management network

Public and Stakeholder Involvement

- Option 2: Advisory Council
- Option 3: Public Private Partnership
- Option 4: Existing public participation opportunities
- Option 5: Regional advisory committees

From: Mass. Ocean Partnership, UMass Boston Urban Harbors Institute and MRAG Americas Inc

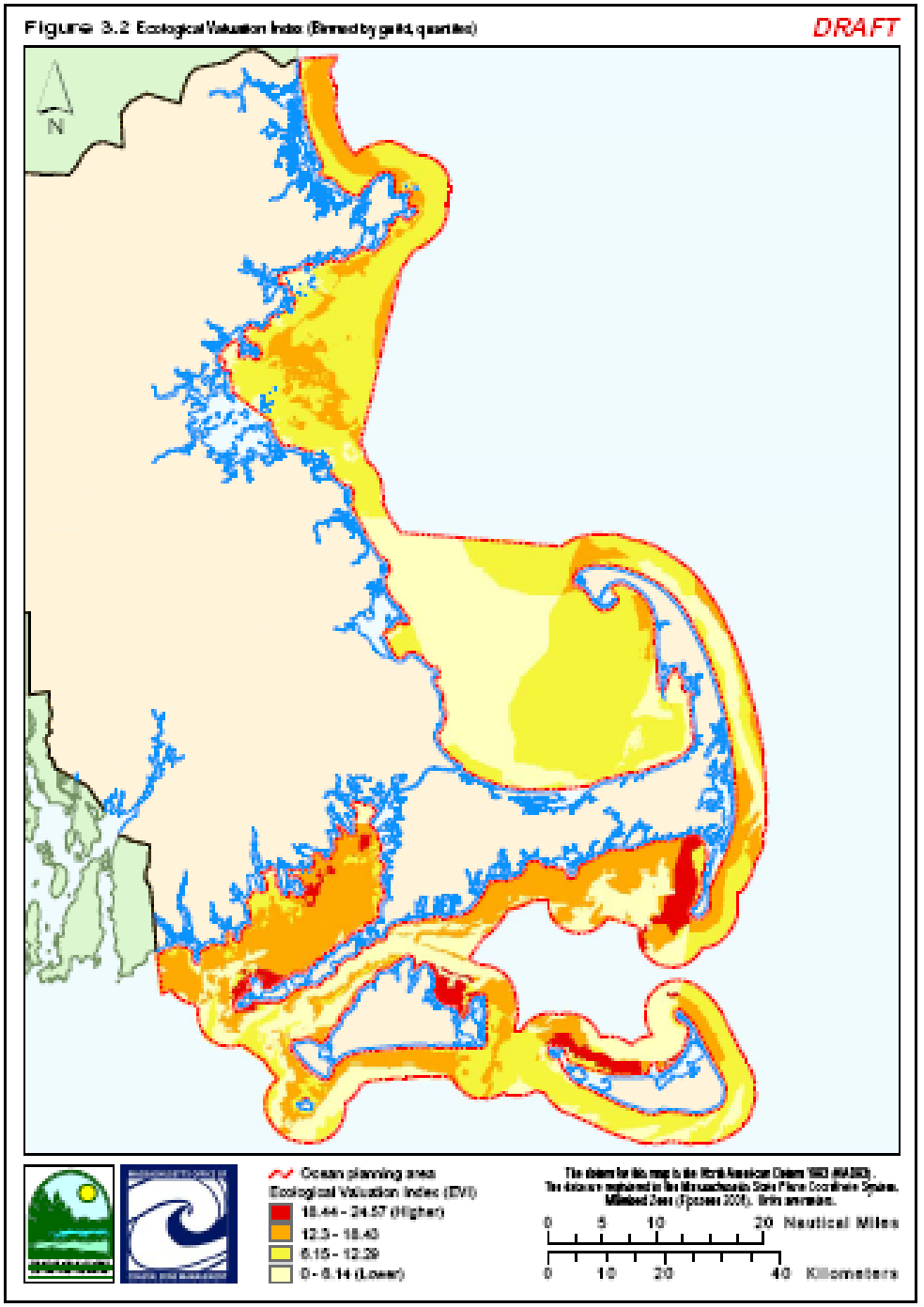
Integrated Ocean Management Plan Options

Management Approaches

Marine Spatial Planning

- Option 1: Comprehensive management areas
- Option 2: Specific areas for protection
- Option 3 Performance standards for allowed uses
- Option 4: Opportunity maps for new activities

From: Mass. Ocean Partnership, UMass Boston Urban Harbors Institute and MRAG Americas Inc



From: Massachusetts Draft Ocean Plan 2009