

Integrated Ecosystem Assessments: Their Role in Moving Towards Ecosystem Approaches to Management

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Integrated Ecosystem Assessments (IEAs) Overview

- What are Ecosystem Approaches to Management, and what science products support them?
- What are IEAs?
- How are IEAs developed (scale & content)?
- Where is NOAA proposing to develop IEAs?
- Have IEAs ever been done before?
- What are the IEA products and outcomes?

What is an Ecosystem Approach to Management (EAM)?

**“Look at the whole picture,
not just the parts.”**

Dave Goethel

New England Fishery Management Council
SIMOR Fisheries Constituent Listening
Session - October 2006

“An ecosystem approach to management is one that provides a comprehensive framework for living marine resource decision making. In contrast to individual species or single issue management, EAM considers a wider range of relevant ecological, environmental, and human factors bearing on societal choices regarding resource use.”NOAA EGT



The #1 Myth Concerning EAM:
“Ecosystem approaches to ocean resource management are not well defined and we do not know how to implement them”
UN Law of the Sea Meeting, April 2006

NOAA Working Definitions for EAM*

- An *ecosystem* is a *geographically specified* system of organisms (including humans), the environment, and the processes that control its dynamics.
- Characteristics of EAM are:
 - adaptive,
 - incremental,
 - takes account of ecosystem knowledge and uncertainties,
 - considers multiple external influences,
 - strives to balance diverse social objectives, and
 - geographically specified.

Operational Objectives for EAM

- (1) Develop broad Stakeholder-Based Governance system**
- (2) Conserve essential Parts of the ecosystem**
- (3) Conserve essential ecosystem Processes**

Question, if (2) is done well, is (3) necessary?

**Many Recent Publications Proposing
General Objectives for EAM, EBM**

Develop Ecosystem Governance System

➤ **Manage Tradeoffs**

- assess management allocation among sectors, optimize benefits, use management processes that are fair, equitable and transparent, consider cumulative impacts, evaluate impacts of non-consumptive sectors, include diverse stakeholder views

➤ **Use Adaptive Approaches to Management**

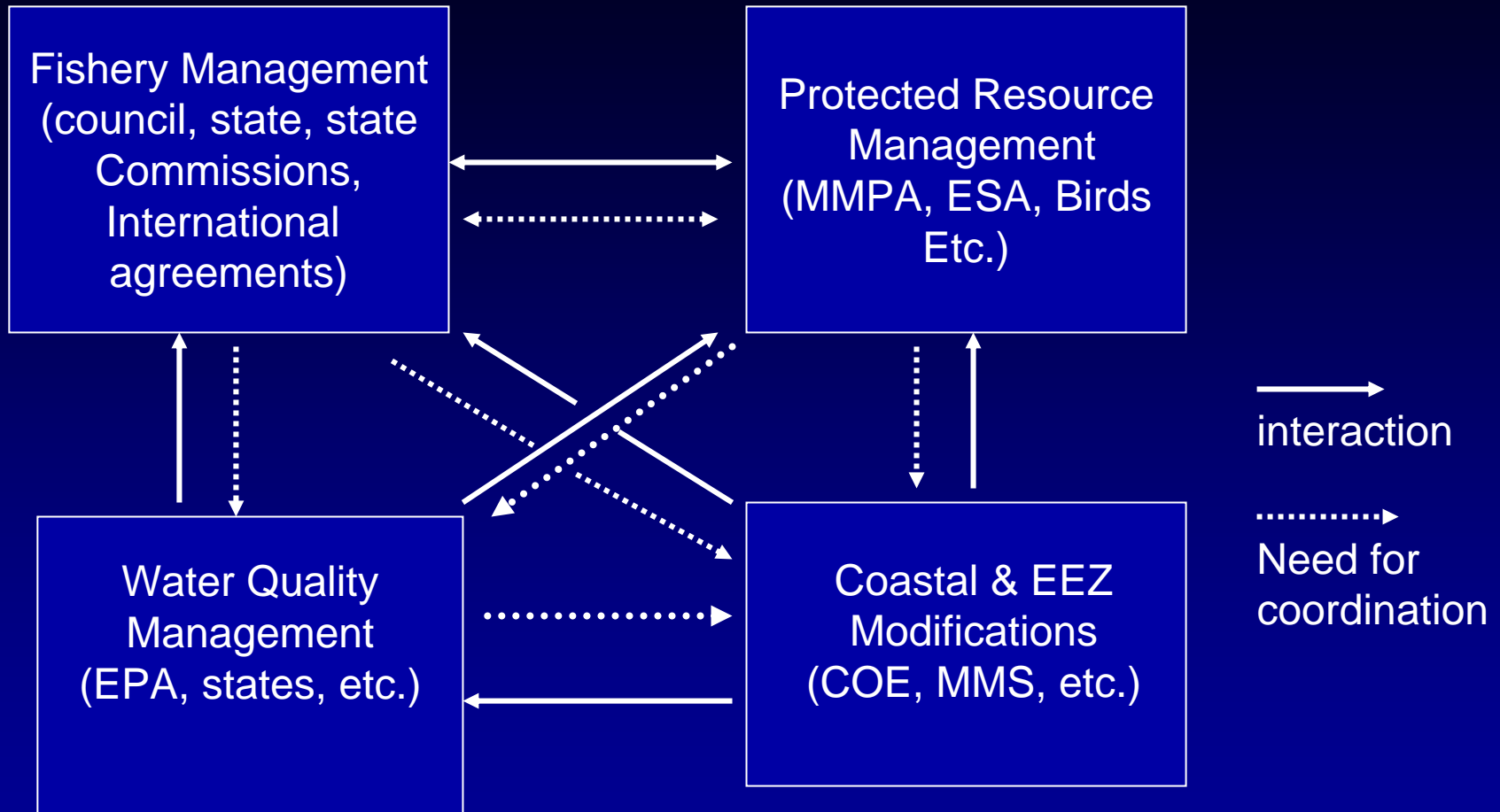
- consider multiple causes for observed changes and sources of uncertainty in assessment & prediction, reverse burden of proof where consequences are great, imbed experiments in management approaches to increase ecosystem knowledge

➤ **Establish Appropriate Ecosystem Boundaries**

- allows for interconnections between adjacent ecosystems, allows for imports and exports, includes multiple spatial scales depending on issue - paradox of scale

Elements of Regional Ecosystem Governance

Asymmetric costs and benefits among sectors



Other management authorities for navigation, sanctuaries, food quality/safety, international agreements, climate change, etc.

Conservation & Management of Ecosystem Parts – the prime directive

➤ **Conserve and Manage Species**

- *Target species, non-target species, protected species, biodiversity protection – continuum of protection*

➤ **Minimize non-target damage**

- *e.g., bycatch of target, non-target & protected species, impacts on vulnerable habitats*

Account for Ecosystem Processes

➤ Evaluate & Inform Feedback Effects

- predator-prey relationships, impacts on habitat productivity, irreversibility of direct impacts, harvesting-induced regime change

➤ Maintain Ecosystem Productivity, Balance Ecosystem Structure

- evaluate ecosystem carrying capacity, maintain resilience/resistance to perturbations, attain trophic balance

➤ Account for Climate Variability

- low-frequency variation (decadal scale changes), High-frequency variation (year-to-year or more frequent), climate-based regime change

Who Moves First, Science or Management, or Both?

Current Mandates

Individual Species

Narrow Perspective & Scale

Human Activities Evaluated for
Individual activities

Resource Management by Sectors

Scientific Monitoring programs
Focused narrowly

Single Use and Purpose Observations

Focus on Managing
Ecosystem parts



Future Mandates

Multiple Species

Broad Perspective & Scale

Humans Integral to Ecosystem

Integrated Resource Management

Adaptive Management Based
On Scientific Monitoring

Shared and Standardized Observations

Focus on Ecosystem Relationships,
Processes, and Tradeoffs

Key Science Needs Supporting EAM

- ***Operational Ocean Observation System integrating biology, physical oceanography, chemistry, ocean-atmosphere links and socio-economic data (at appropriate geographic scales) ~ ½ built***
- ***Systematic reporting on the status of marine and coastal ecosystems through Integrated Ecosystem Assessments (IEAs), including key indicators of pressures on ecosystems and their state***
- ***Ecosystem research plan that enables linking of human activities to incremental change in ecosystem state indicators***
- ***Modeling, experimental ecology, and observation systems linked to support adaptive approaches to human uses of marine ecosystems consistent with goals of sustainable use***



What are Integrated Ecosystem Assessments?



Integrated Ecosystem Assessment (IEA):

- “A synthesis and quantitative analysis of information on relevant physical, chemical, ecological and human processes *in relation to specified ecosystem management objectives*”.

An IEA:

- Incorporates multiple indicators of the environment and ecosystem, including human factors
- Is geographically specified
- Establishes target levels and thresholds for important ecosystem components
- Evaluates the impacts of management options and risks of not attaining target ecosystem states





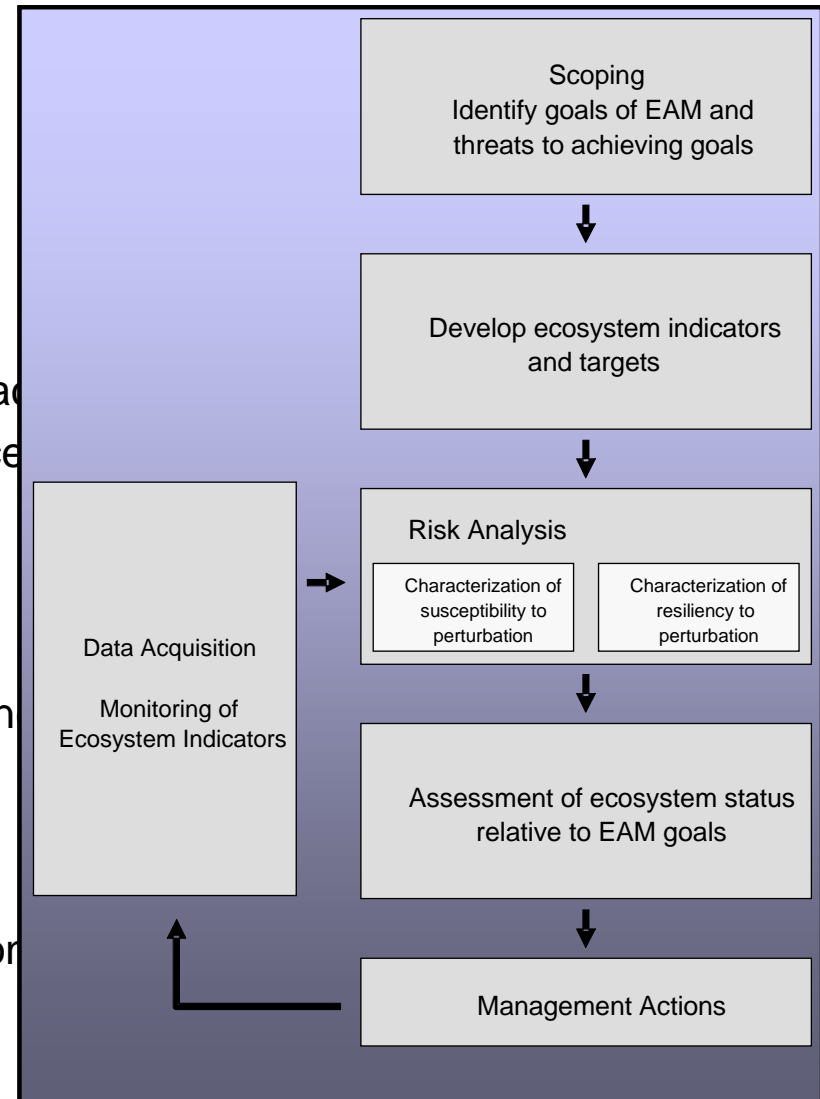
Dimensions and Outcomes of IEAs

An IEA addresses five dimensions:

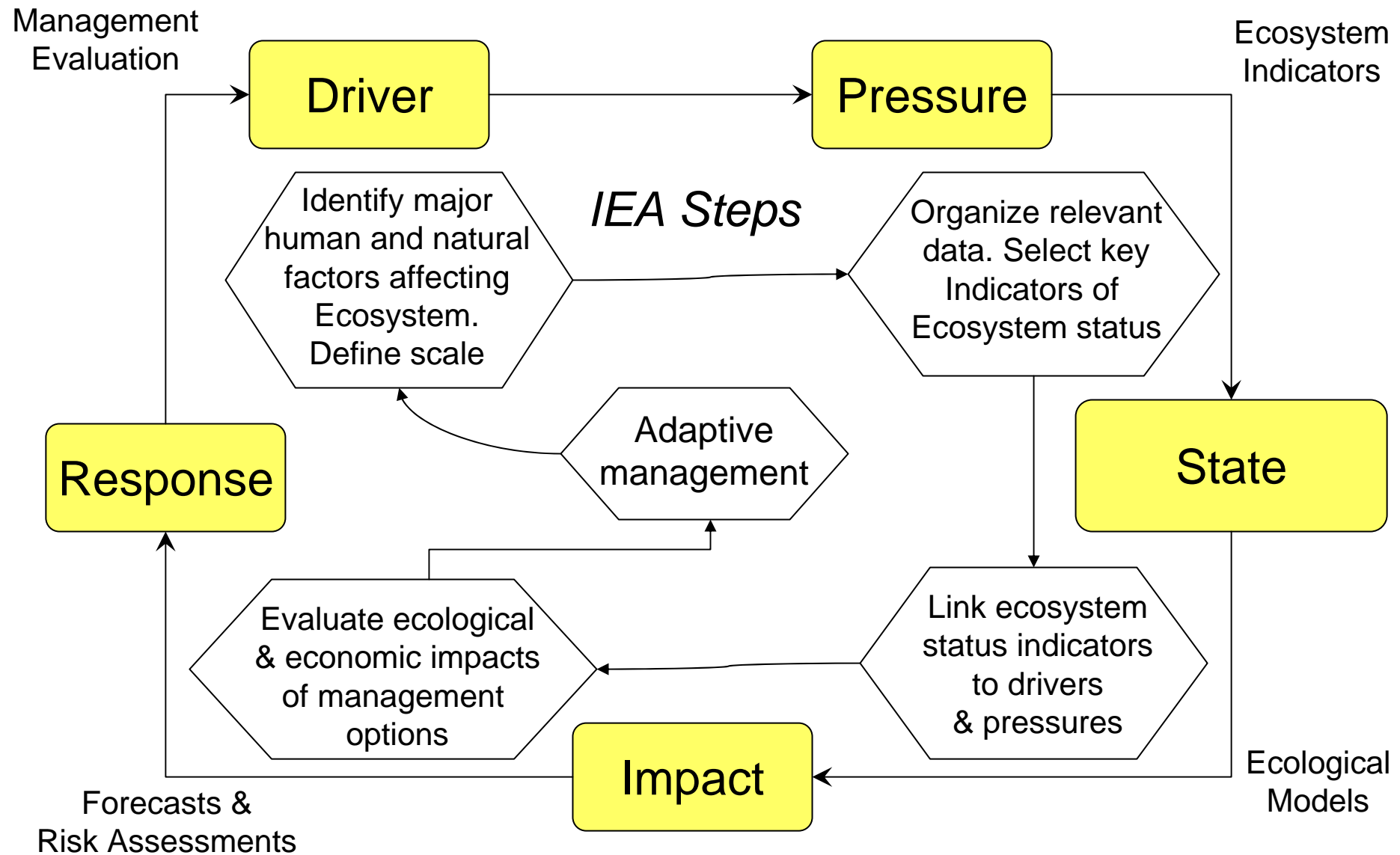
- Status of the topic being considered
- Causes and consequences of the status
- Forecast of future status with and without management action
- Costs and benefits of possible management actions
- Evaluation of past management actions' success or failure.

A successful IEA:

- Responds to policy relevant questions
- Quantitatively identifies uncertainties in existing data and information
- Includes public participation and peer review
- Integrates data across multiple disciplines:
- Uses existing high-quality data and information
- Forecasts future conditions and outcomes.

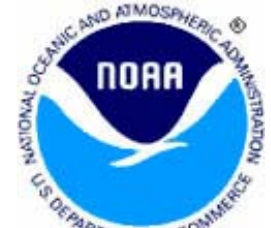


How are IEA's developed (scope & scale)?



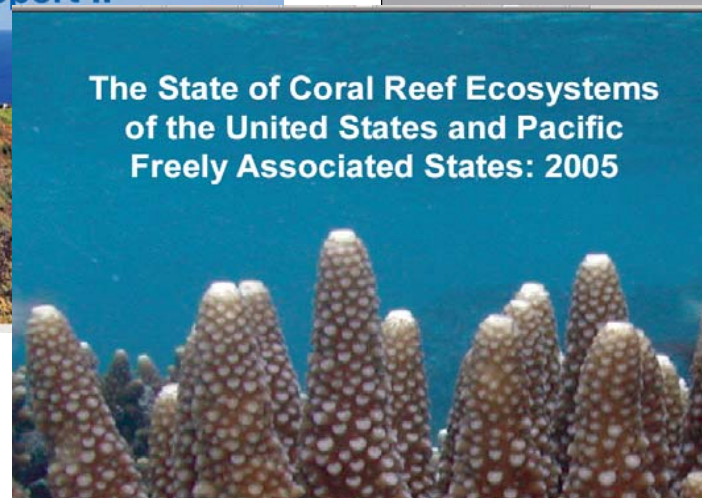
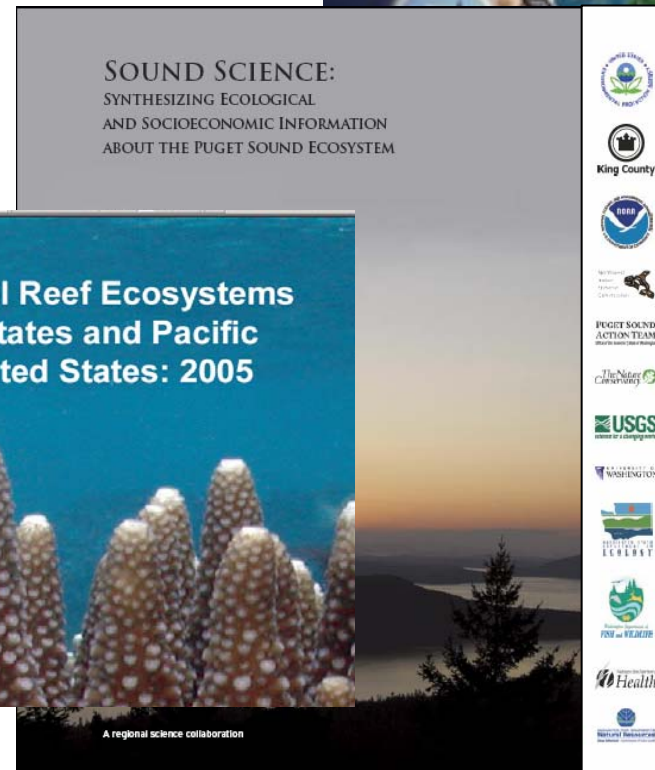
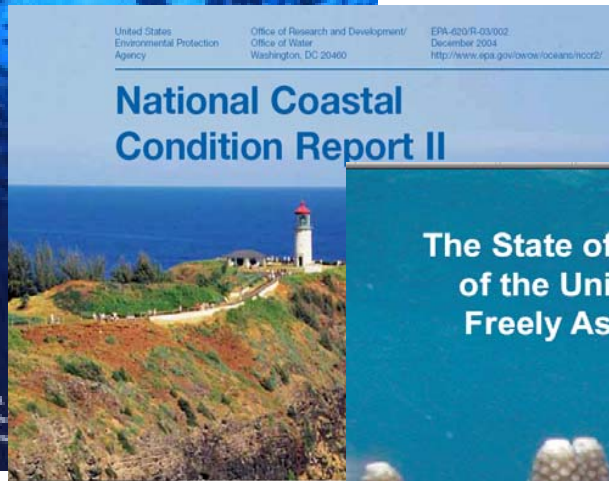


NOAA & other Agencies currently assess many ecosystem components



Our Living Oceans

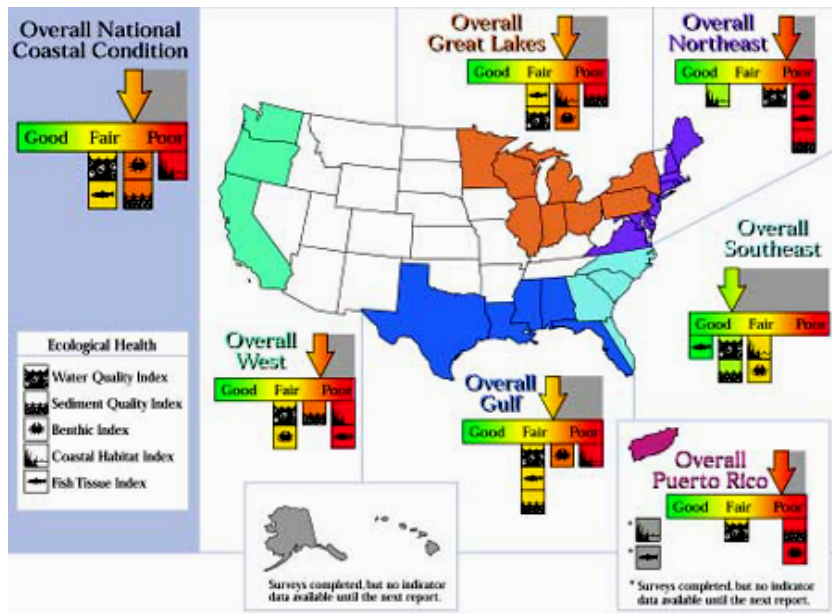
Primary Focus:
Ecosystem indicators





National Dimensions

Comprehensive reporting supports prioritization



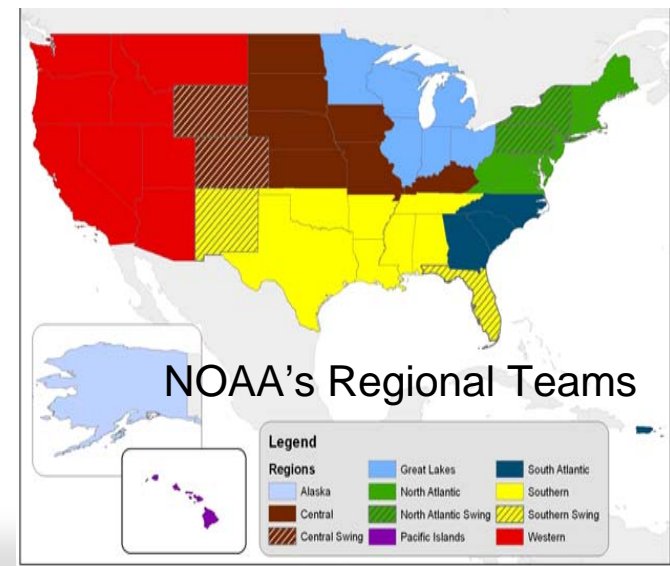
not
IEAs
as
defined



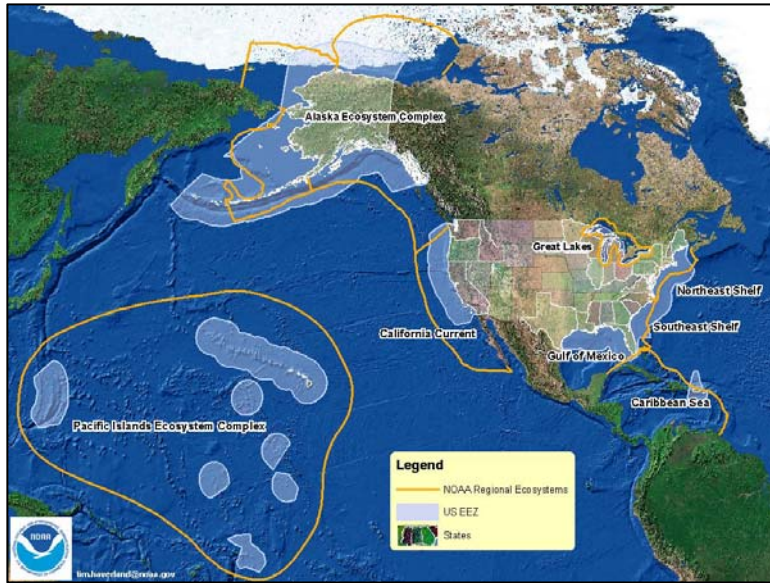
An Opportunity:

Consistent reporting of a subset of variables will allow a national overview, viz:

“An Integrated Assessment of the Status of the Coastal and Ocean Ecosystems of the United States”



What are the appropriate scales for IEAs?



Assessing the Status of Ocean and Coastal Ecosystems of the United States

National Overview

Extra-basin assessments

Basin-Wide

- National jurisdictions
- International collaborations

Regional

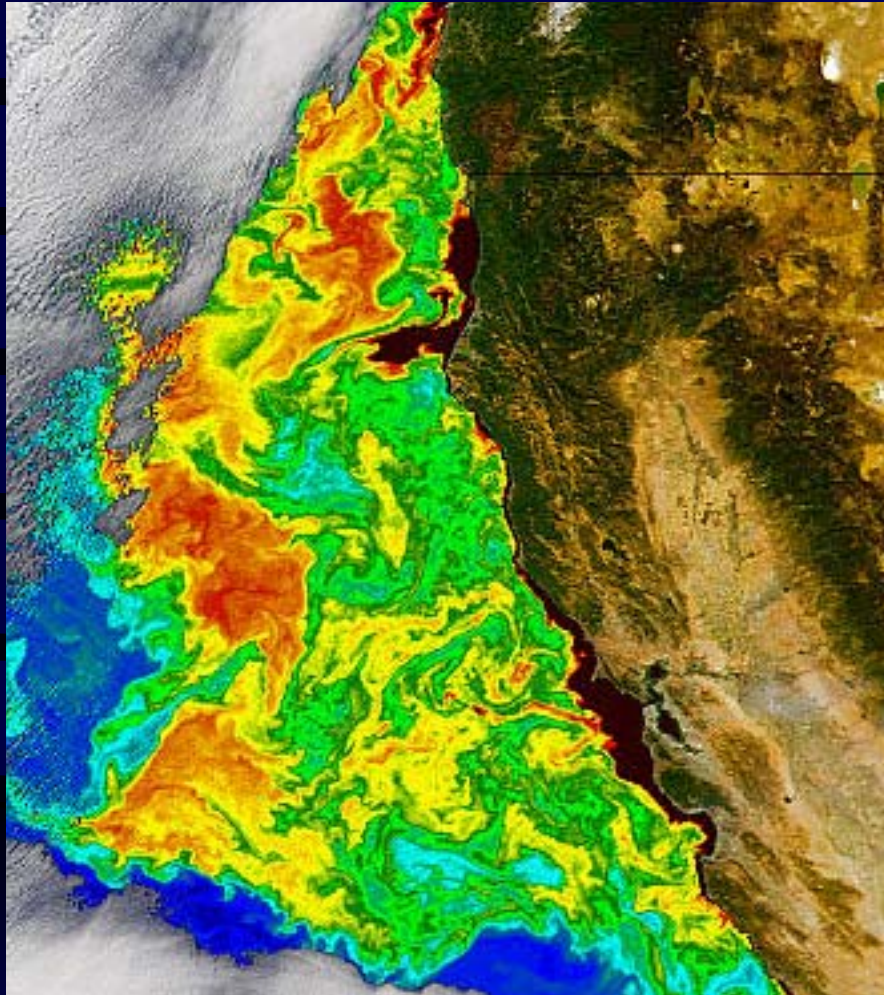
- Large Marine Ecosystems
- Sub-Regional Ecosystems (as appropriate)

Local

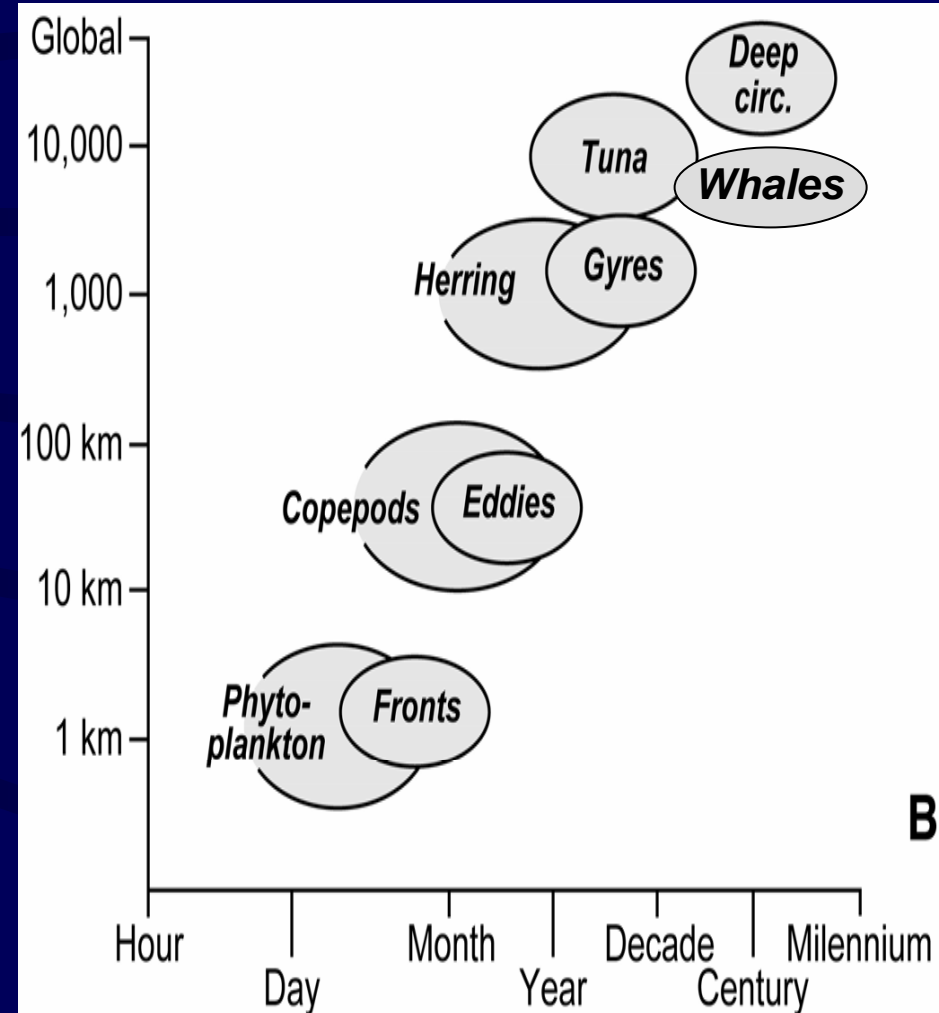
- Place based (e.g., sanctuaries, NERRs)
- Bays, Harbors, Estuaries

Heirarchical Structure

Geographic Continuum - Scales of Ecosystem Processes



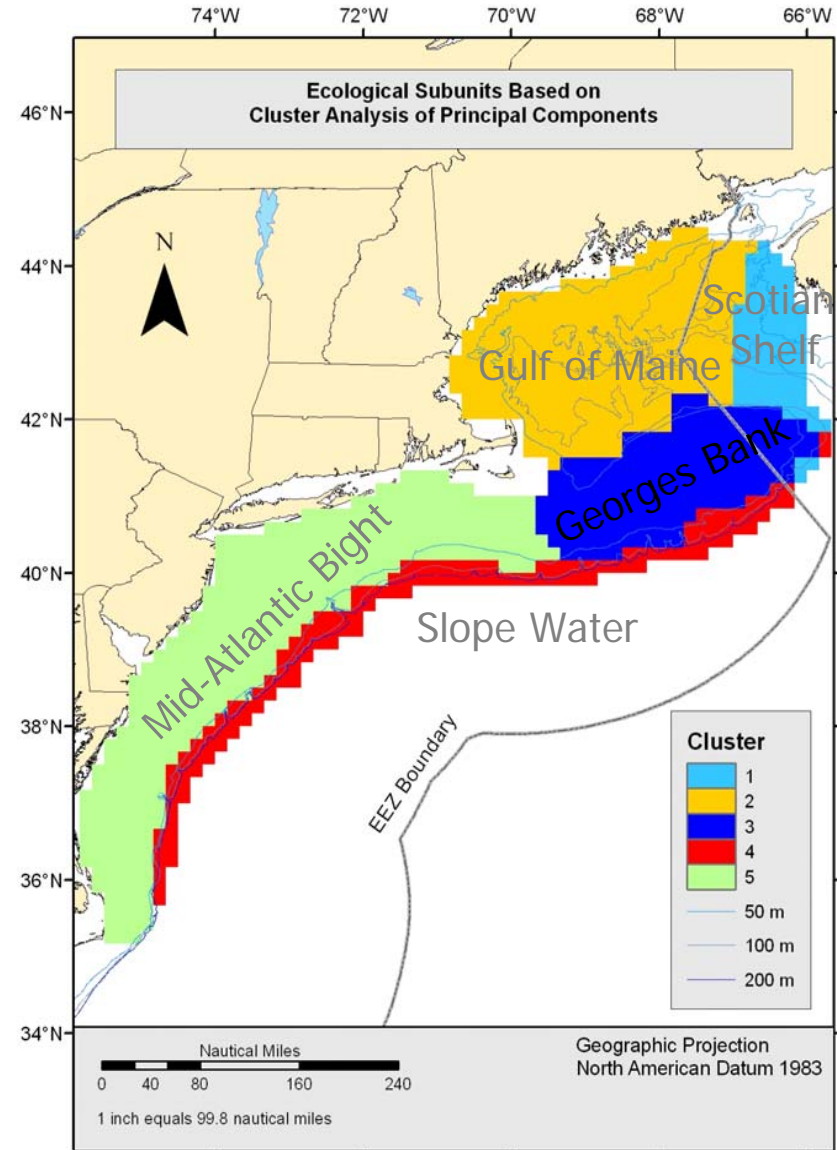
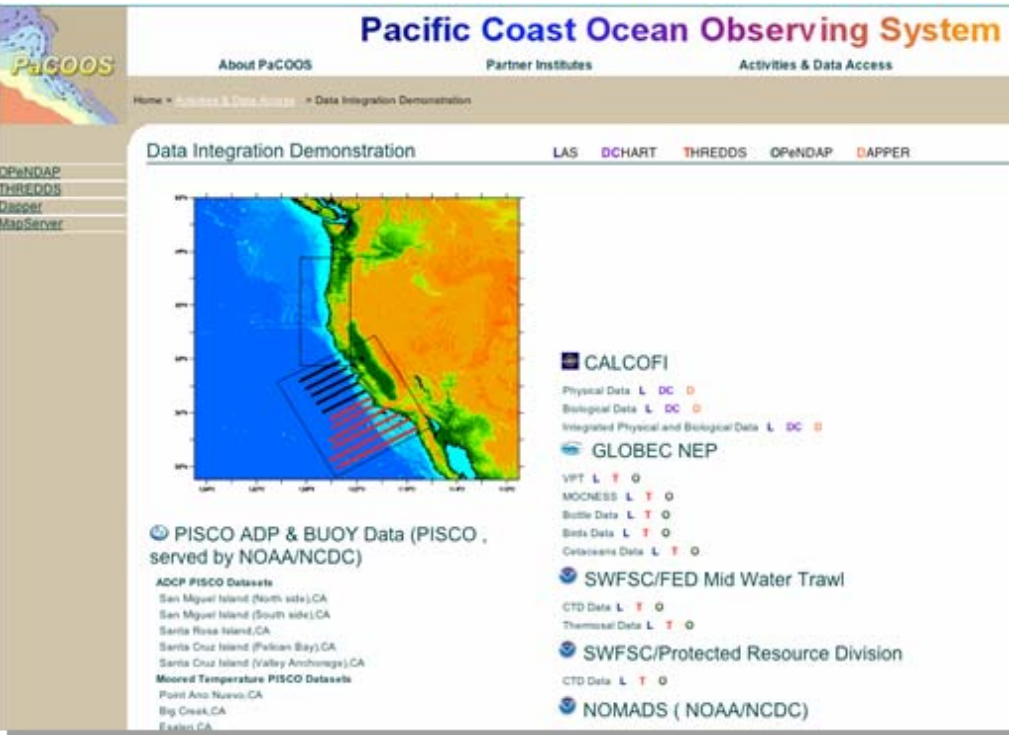
Surface chlorophyll



Time/Space Scales

Sub-Regional Dimensions

Determining the appropriate spatial scale for IEAs

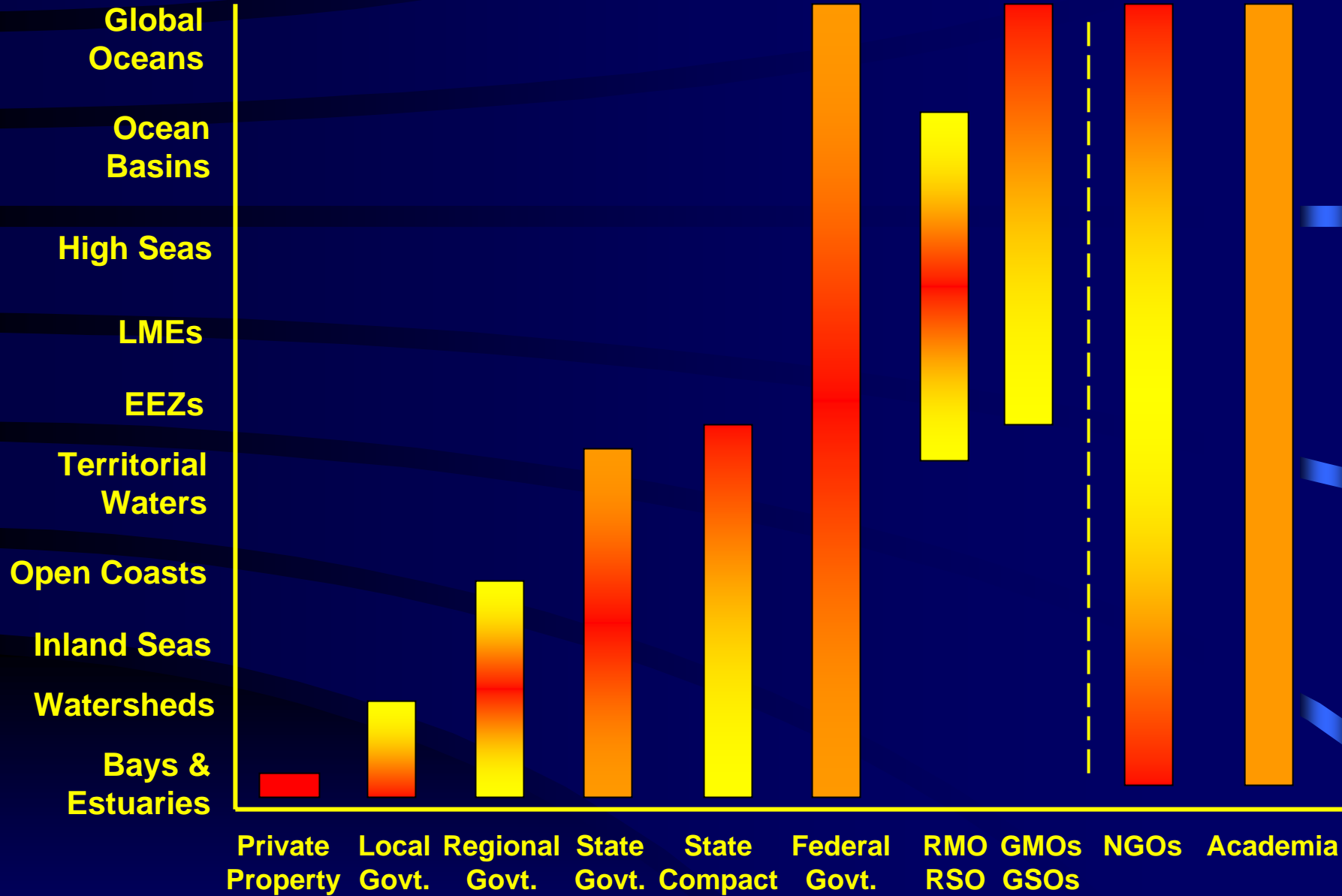


LME → Sub-Region → Local Area

Data systems should allow hierarchical assessment

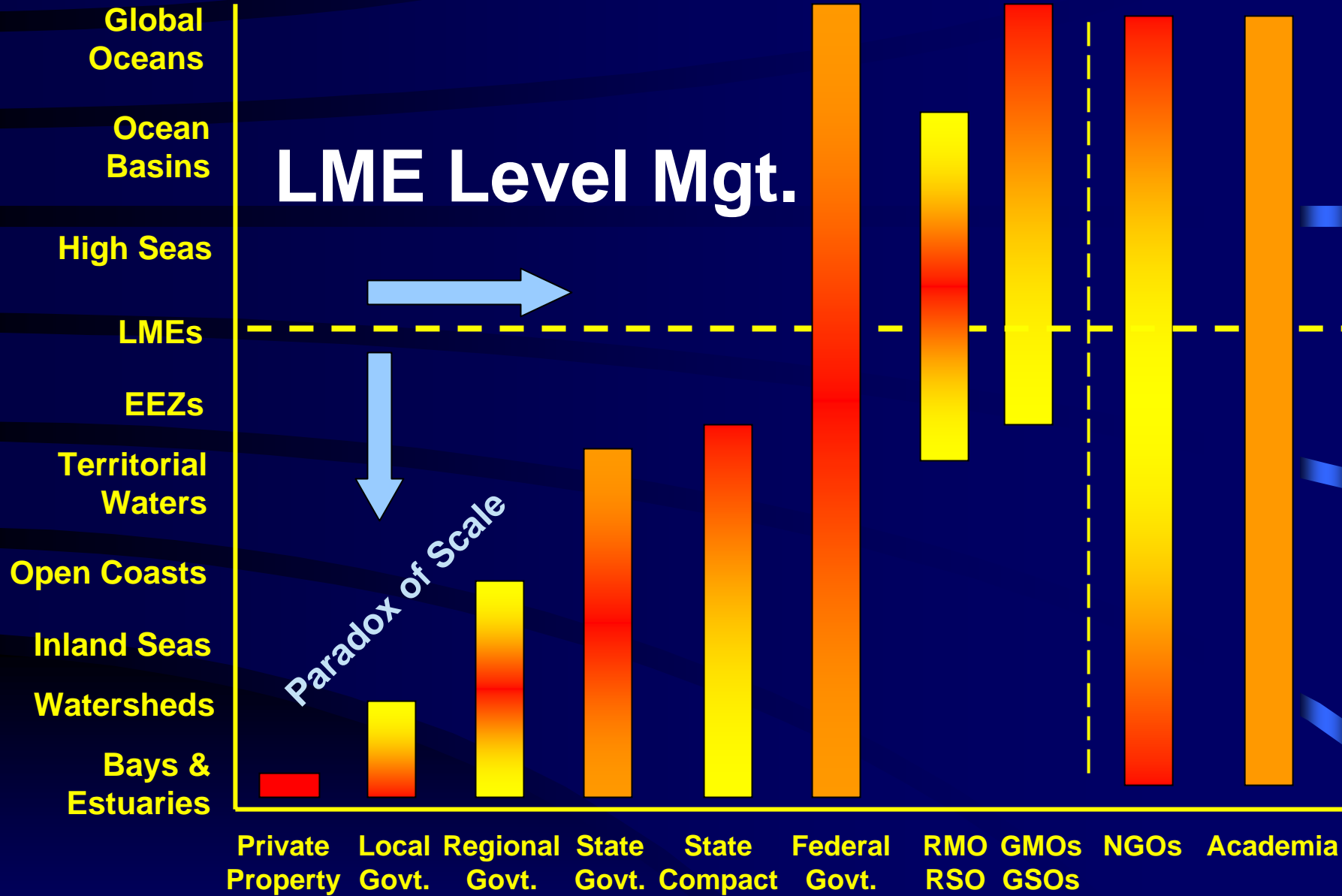
[political and management boundaries need to be

Marine Ecosystem Geography



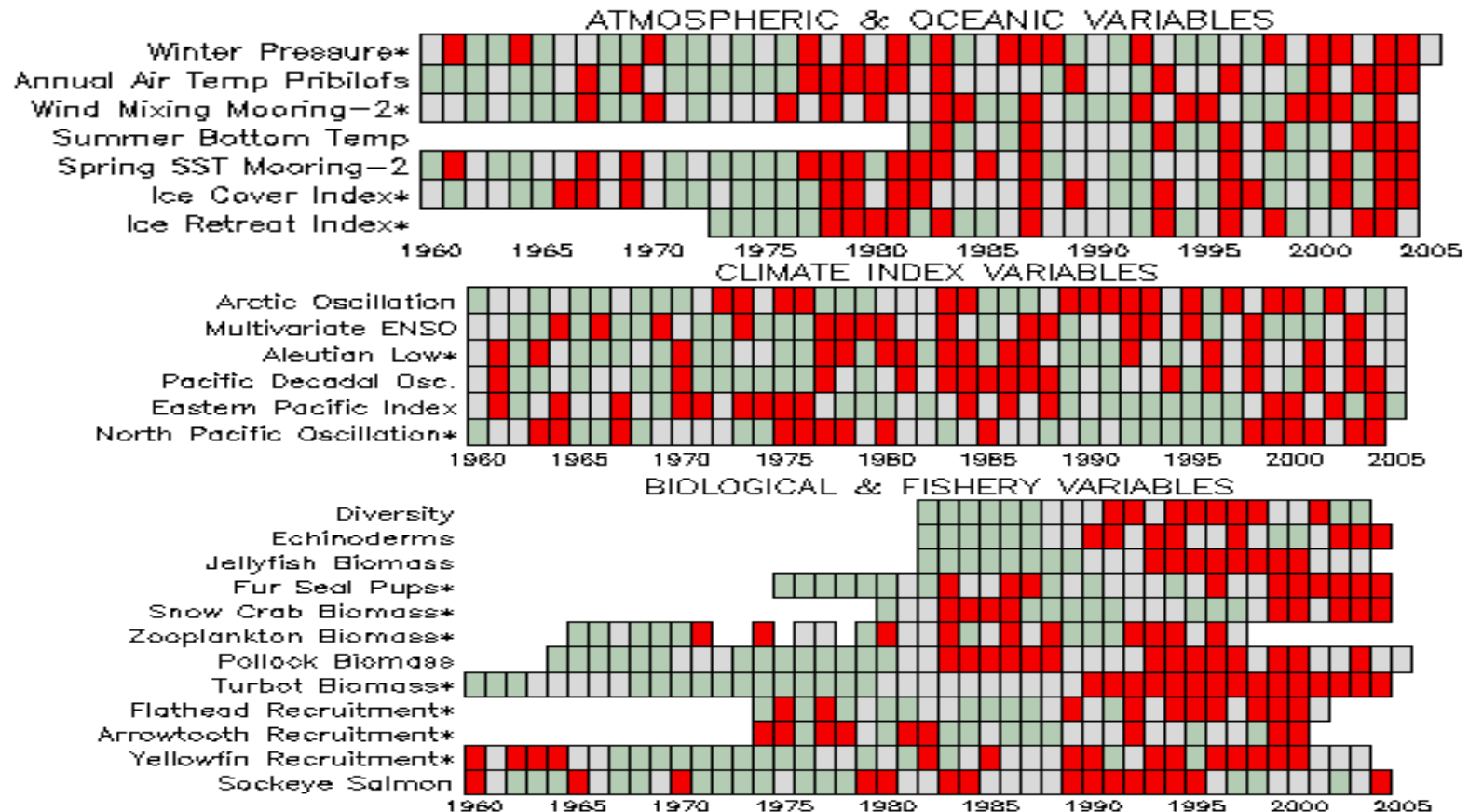
Governance Hierarchy & Advisory Services

Marine Ecosystem Geography



IEA Components

Alaska Ecosystem Conditions Report – Trends

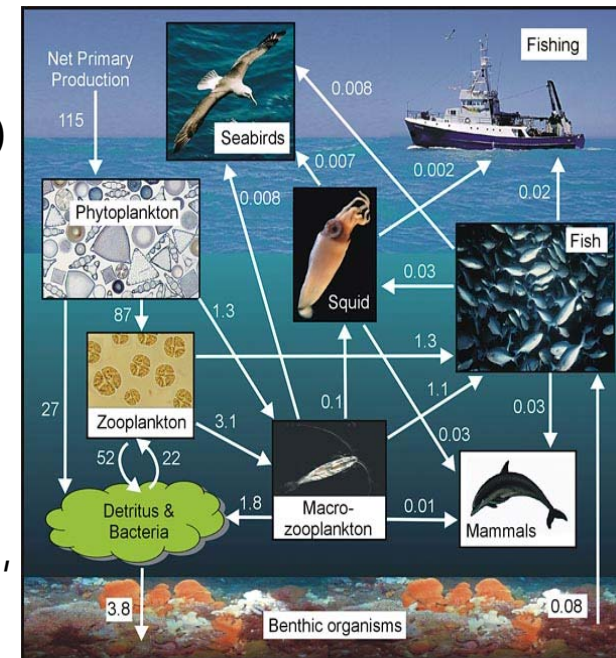


Red indicates the largest 1/3 of values in the record. The middle third are shown in grey and the lowest third are shown in green. To demonstrate covariability over time, the values in some series have been inverted, as noted by a star.

Ecosystem Models & Forecasts to be a Key Element of IEAs vs. Indicators

Types of Models Used in IEAs

- Food web dynamics & species interactions (tradeoffs)
- N-P-Z-D Models (nutrients, phytoplankton, zooplankton, detritus)
- Population dynamics models
- Habitat selection models (benthic habitats, ocean conditions)
- Spatial dynamics (hydrodynamics, movement models, human responses)
- Risk assessment & management strategy evaluation (MSE) models
- Models necessary to understand complex multispecies and non-linear relationships between pressures, states and impacts
- Quantitative risk assessments determine the probability and consequences of not attaining target ecosystem states
- Impact analyses evaluate the benefits and costs of options to attain desired ecosystem states





Partnership Roles

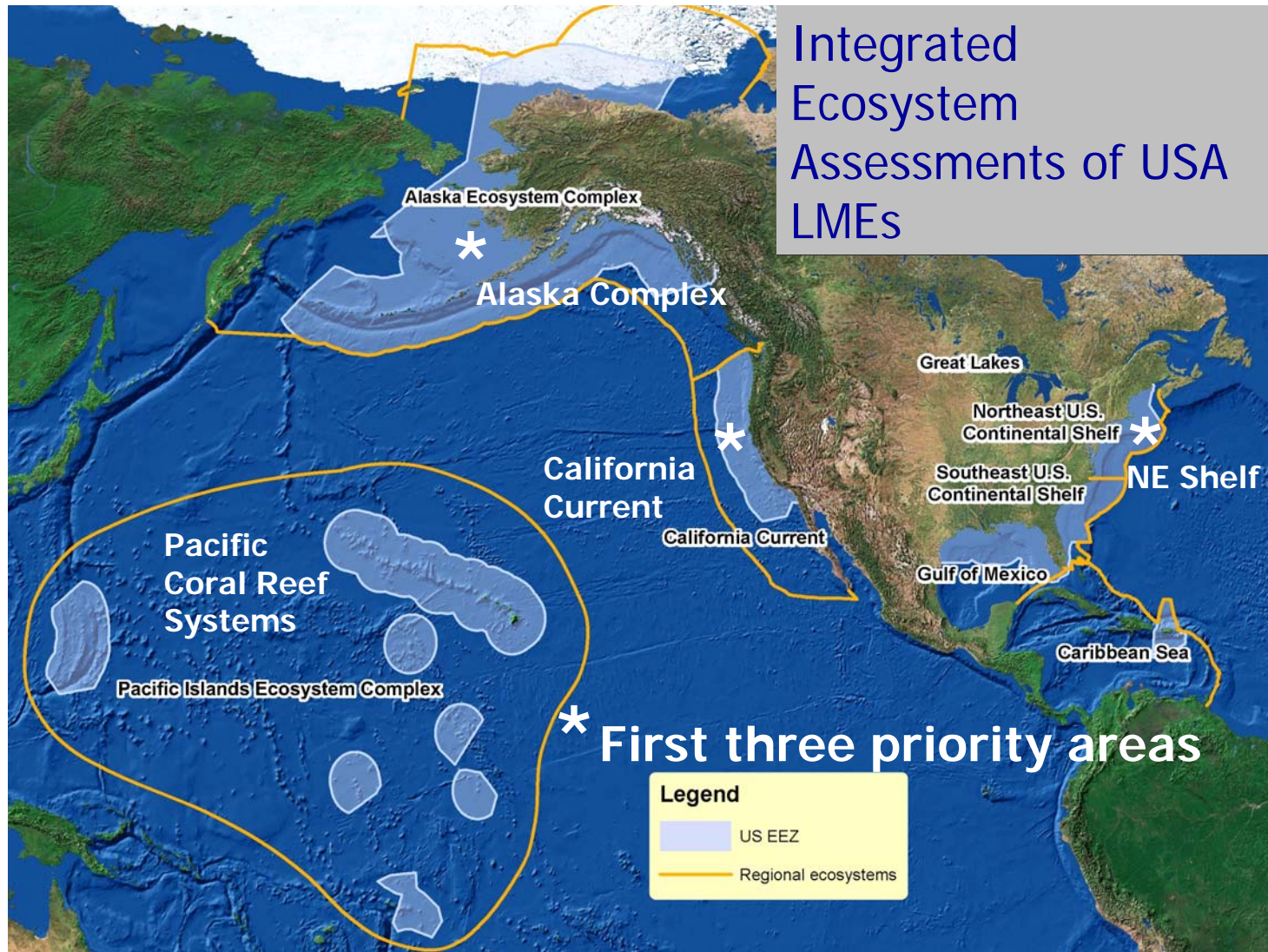
Acting in concert with
constituents & partners



- Identify appropriate spatial scales for IEAs
- Determine key ecosystem issues
- Incorporate all relevant ecosystem information and to prioritize the development of indicators
- [determine targets and thresholds for management-related indicators, consistent with legislative authorities]
- Evaluate the relationships between pressure and status indicators using appropriate research, models and forecasts
- Provide routine reporting and updates on the status of the nation's coastal and ocean ecosystems



Where is NOAA proposing to develop IEAs?



Two West Coast IEA Pilots



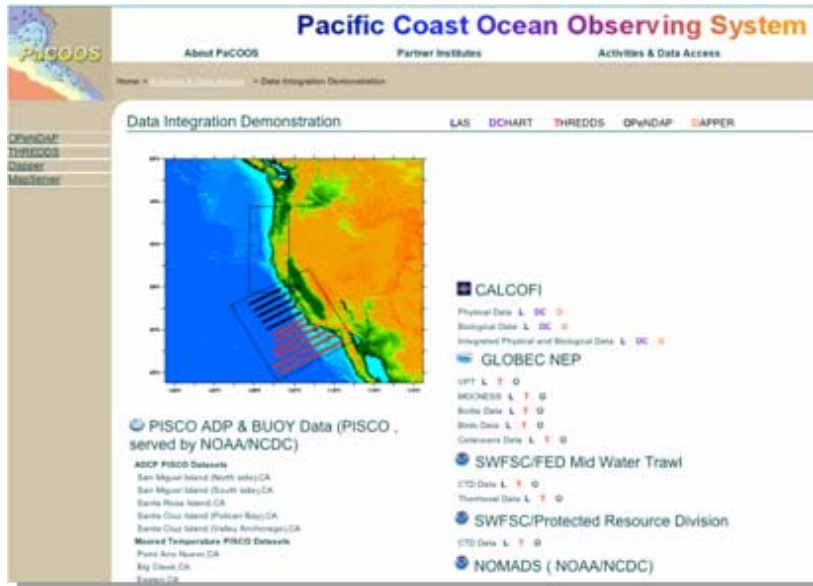
Alaska

California

Current



What are IEA Products? Paper or Plastic?



‘Plastic’ = Dynamic, web-based IEAs

- IEA products created on demand on-line
- Local or ‘place based’ scales
- ‘If-then’ scenarios and other assessment tools to inform specific management questions

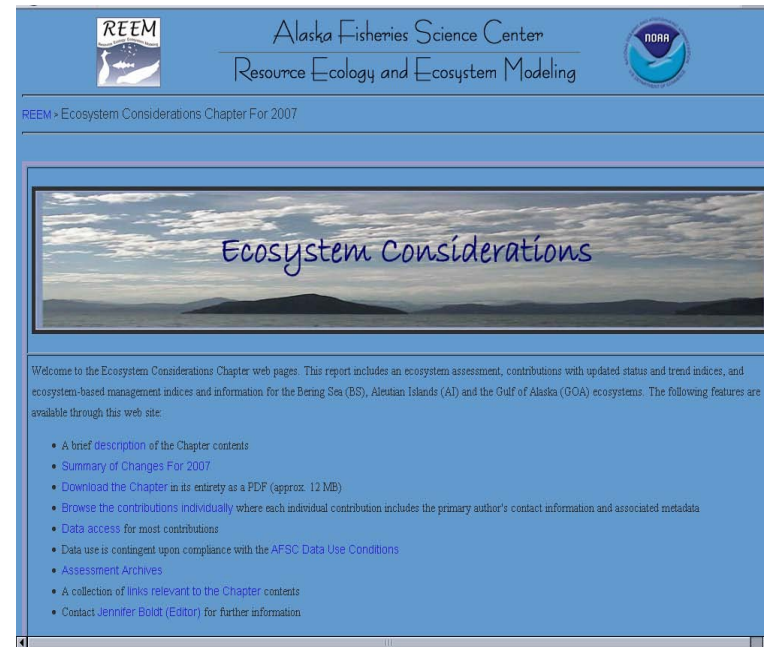
Pacific Ocean Observing System (PaCOOS Website)

← “Google ocean”

‘Paper’ = Regional Ecosystem IEA Reports

- Produced routinely (~4 years)
- Peer-reviewed
- 8 Regional Ecosystem-scale IEAs + 1 National Synthesis Report

→
E.g. Alaska Ecosystem Considerations Report used by the North Pacific Fisheries Management Council



Have IEAs Ever Been Done Before ?

YES!

www.defra.gov.uk

Charting Progress

An Integrated Assessment of the State of UK Seas

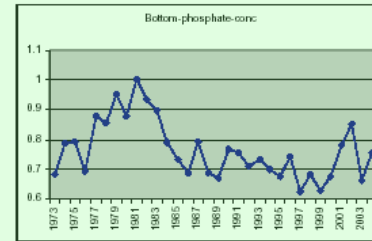
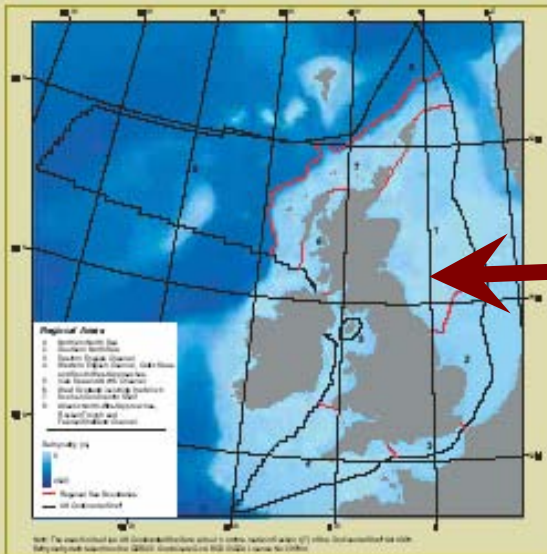


Figure 18: Annual mean values of bottom phosphate for the North Sea between 1973 and 2004

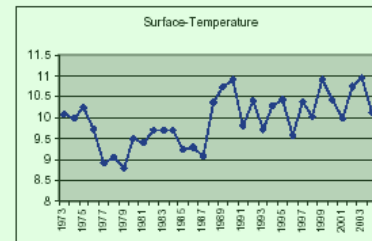
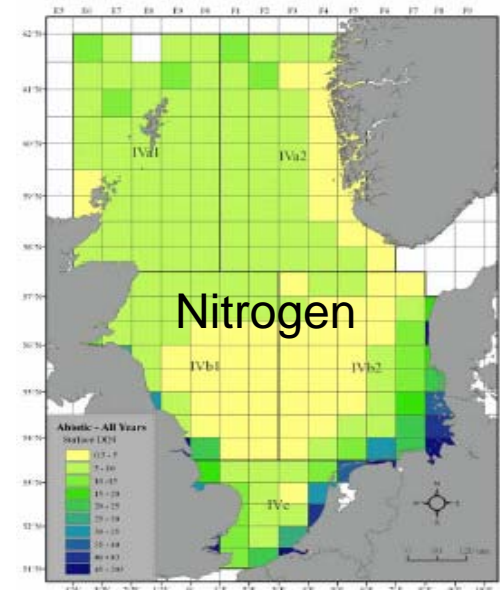


Figure 19: Annual mean values of surface temperature for the North Sea between 1973 and 2004



issues & challenges differ by sub-region

Table 5.1: Main Issues for each region*

Region	1. North Sea	2. Southern North Sea	3. Eastern English Channel	4. Channel and Approaches	5. Irish Sea	6. Western Scotland	7. Scottish Continental	8. Scottish Offshore
Climate Impacts								
Fisheries								
Nutrients		Coastal						
Microbiological Contaminants								
Hazardous Substances								
All oil Industry								
Radioactivity								
Construction								
Dredging								
Sedimentary and Coastal Erosion								
Litter								

* See also Map (Figure 5.2).

Considered important issue per region



SCOTTISH GOVERNMENT



defra
Department for Environment
Food and Rural Affairs

Next Steps: Science Strategies for Implementing IEAs

- Develop consistent data standards and procedures among and within IEA regions to allow comparability and synthesis
- Propose, develop and test suites of pressure and state indicators (some common to all regions, some unique to each)
- Determine research priorities for understanding ecosystem responses to changes in physical and human pressures
- Develop periodic reporting mechanisms for IEAs
- Pilot the concepts (for NOAA – California Current & Alaska - seeking International Collaboration)