Integrated Ecosystem Assessments for the South Atlantic: the time has come

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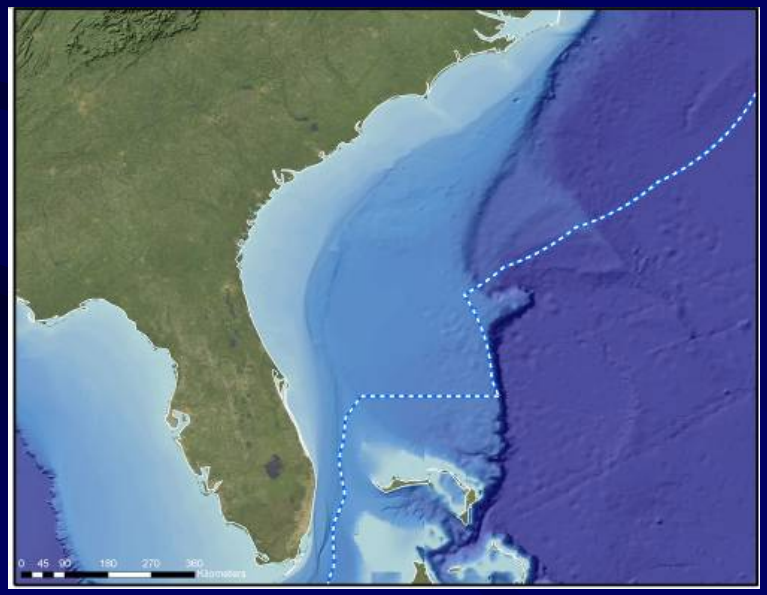
NOAA in the Carolinas

February 6, 2008

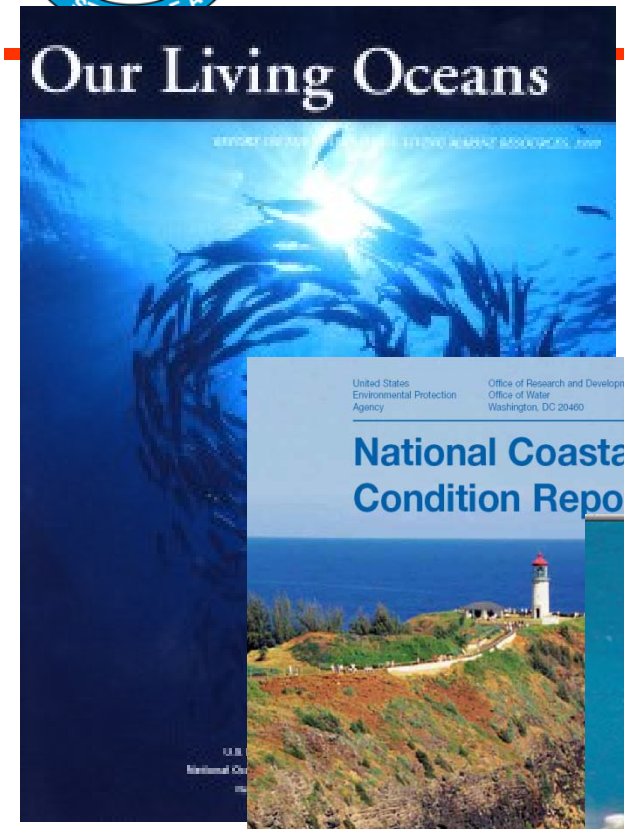


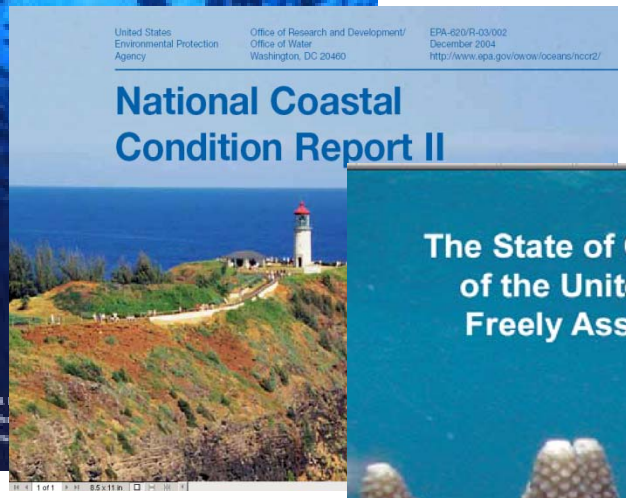
Integrated Ecosystem Assessments (IEAs) Overview

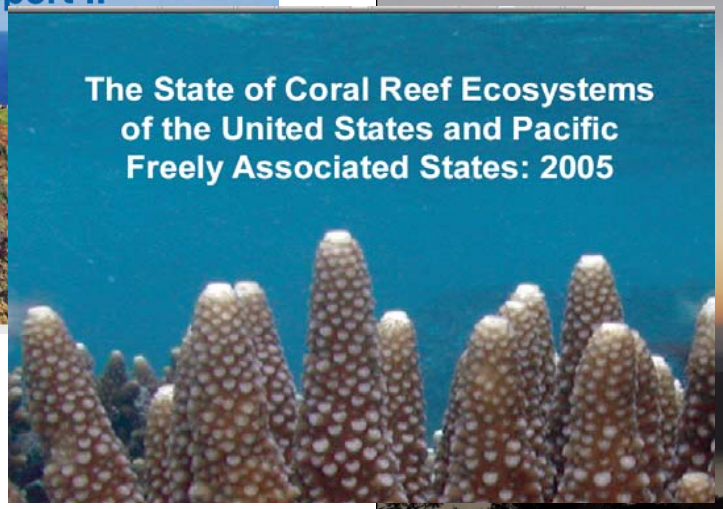
- What are Ecosystem Approaches to management, and what science products support them?
- What are IEAs?
- Why is it appropriate for NOAA to conduct them?
- How do IEAs impact NOAA's statutory responsibilities?
- How are IEAs developed (the steps & content)?
- Where is NOAA proposing to develop IEAs?
- Have IEAs ever been done before?
- Who in NOAA is appropriate to develop IEAs (e.g., NOAA's FY-09 proposal)?
- What are the IEA products and outcomes?

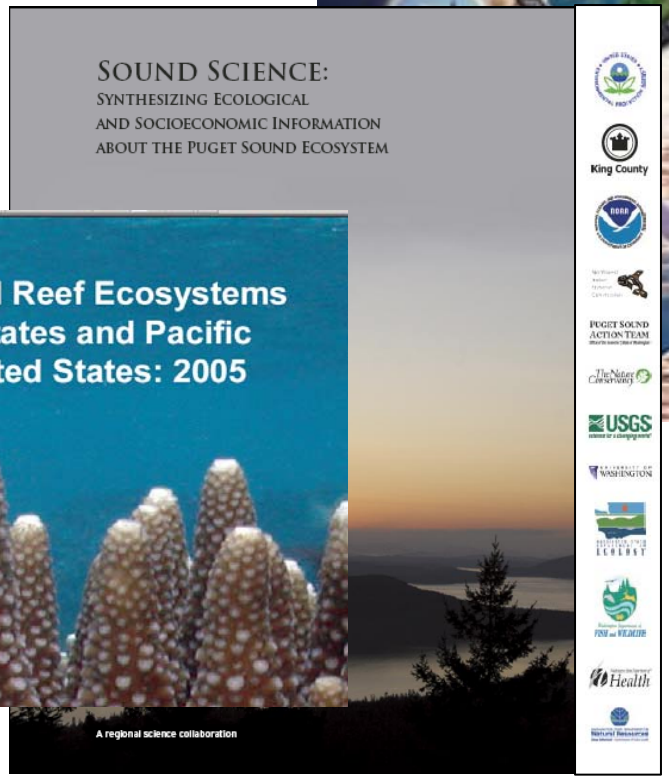
NOAA & other Agencies currently assess many ecosystem components

Primary Focus:
Ecosystem indicators









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.

* NOAA's Ecosystem Goal Team (EGT)

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

Operational Objectives for EAM

(1) Develop broad Stakeholder-Based Governance system

(2) Conserve essential Parts of the ecosystem

(3) Conserve essential ecosystem Processes

Key Question:
What are the science processes and products necessary to support 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

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 <u>key indicators</u> of pressures on ecosystems and their state***

- ***Ecosystem research plan that enables linking of human activities to incremental change in ecosystem state indicators***

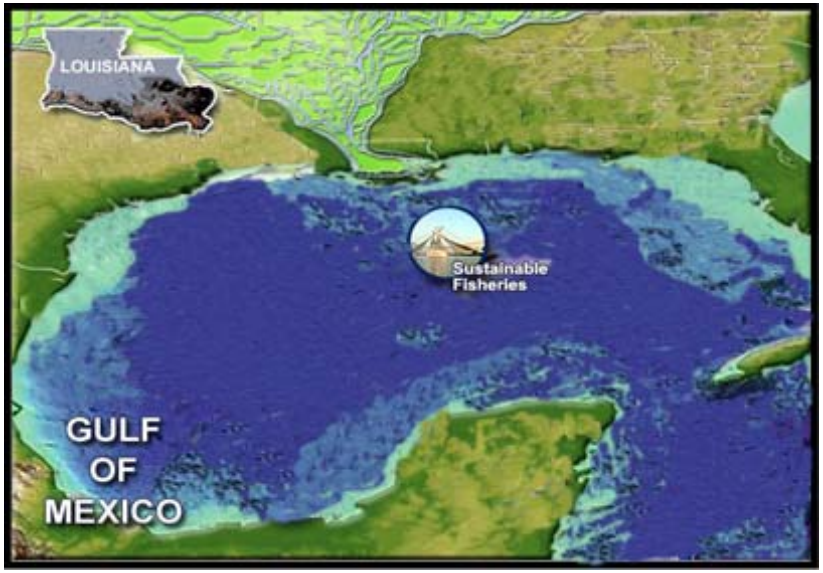
- ***Modeling, experimental ecology, and observation systems linked to support adaptive approaches to human uses of marine ecosystems consistent with goals of sustainable use***

Decision Support Tools for EAM

- Decision support systems include tools such as:
  - Management information system (data collection, management, and use)
  - Ecosystem Indicators
  - Integrated Ecosystem Assessments (IEAs)
  - Bioeconomic, ecosystem, social choice, stock assessment models
  - Risk assessments

What are Integrated Ecosystem Assessments?

Single Sector Assessment



- Assesses individual species.
- Narrow perspective and spatial scale.
- Short-term perspective.
- Humans are independent of ecosystem.
- Conservative resource management.
- Single use observations.

Integrated Ecosystem Assessment (IEA)

- Provides a “big picture” of an ecosystem.
- Broad perspective and scale.
- Long-term perspective.
- Human impacts considered in models.
- Adaptive and integrated management.
- Shared and standardized observations.

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 IA:
  - 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.

Why is it Appropriate for NOAA & Partners to Conduct IEAs?

- **Increasing risk of litigation due to poor scientific basis for decision-making**
- **Increasing demand on NOAA to improve status of stocks -- beyond ending overfishing in 2010**
- **Increasing pressures among coastal states to balance competing uses of ecosystem goods and services using science**
- **NOAA has data, research, models, and science components needed to conduct IEAs…..**

….and could do the integration.

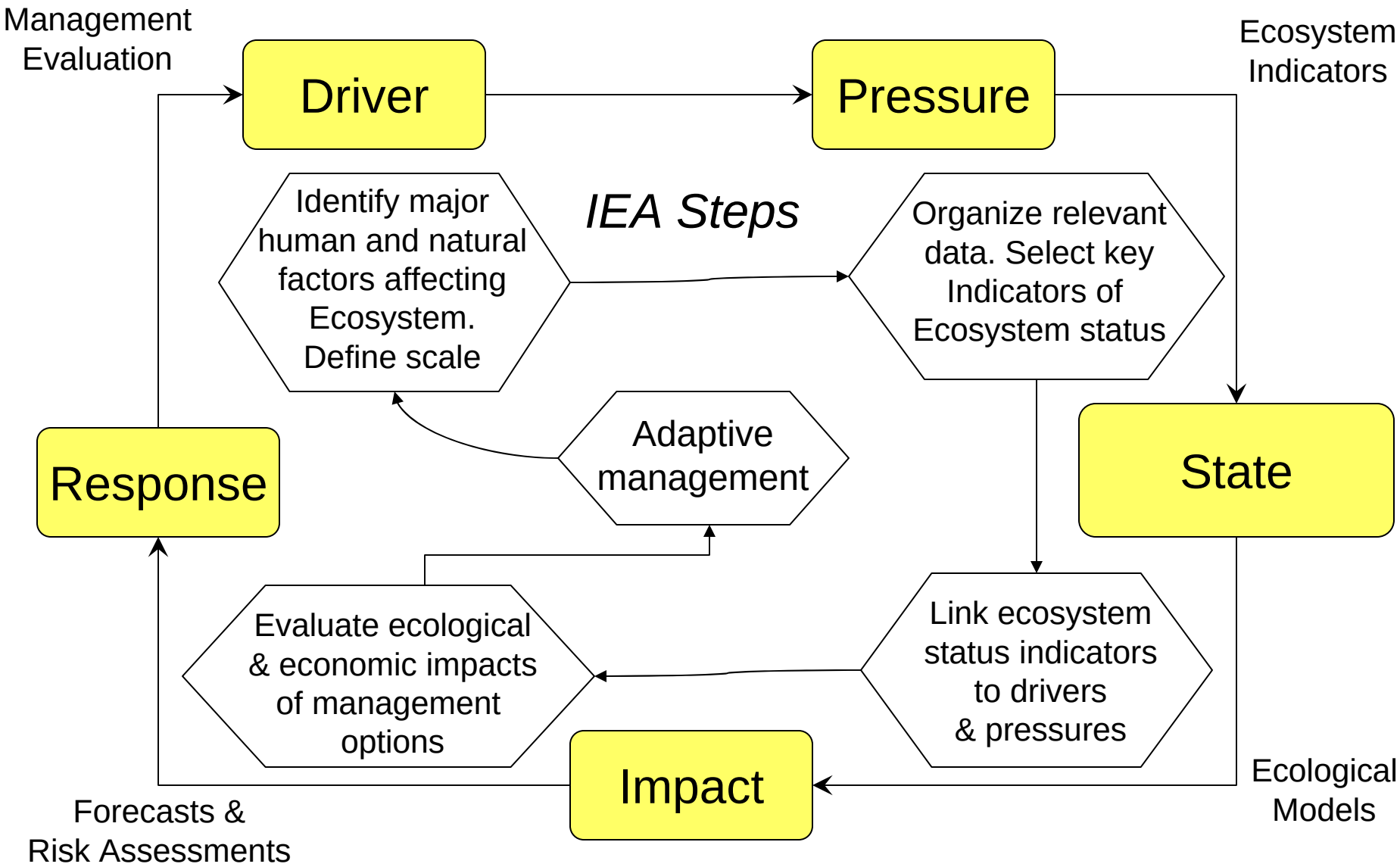
How do IEAs impact NOAA's statutory responsibilities?

- Magnuson Stevens Fishery Conservation & Management Reauthorization Act – provides more complete information on factors affecting regulated species & ecosystems
- Marine Mammal Protection Act – allows consideration of the impacts of cumulative human impacts on marine mammals
- Coral Conservation Act – enables coral reef management to consider ocean and land-based threats to corals
- Endangered Species Act – allows comprehensive ecosystem considerations to be included in endangered species recovery
- Marine Sanctuaries Act – allows sanctuary managers to monitor ecosystem status in relation to threats and conditions in broader regional ecosystems
- Coastal Zone Management Act – incorporates watershed, coast, nearshore and offshore ecosystem conditions into comprehensive coastal zone planning

Components of an IEA

- An IEA typically consists of the following components:
  - Assessment of ecosystem baseline conditions (States)
  - Assessment of stressors on the ecosystem (Drivers, Pressures)
  - Prediction of the ecosystem status with no change in management actions (status quo response)
  - Prediction of the ecosystem status under different management strategies to meet target states (optional responses)
  - Evaluation of the success of management actions (update states relative to targets and thresholds)
- N.B. Ecosystem status reports ARE NOT integrated ecosystem assessments (DPSIRs)

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



Some Desirable Characteristics of Ecosystem Indicators to Describe Ecosystem Pressures and States

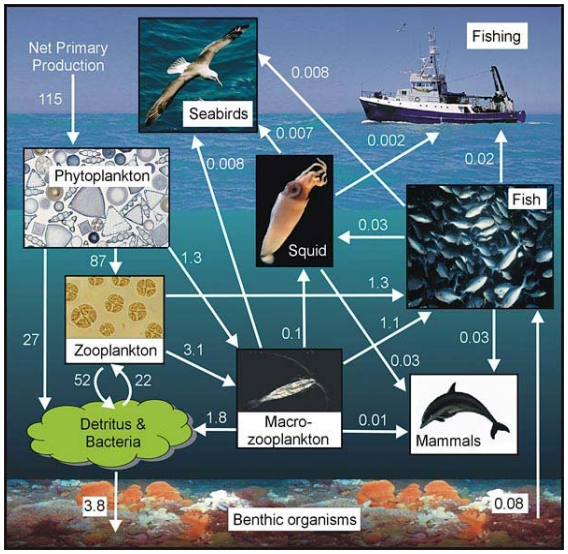
- Easy to Understand
- Responsive to Manageable Human Activities
- Responses Linked in Time to Management Action
- Easily and Accurately Measured
- Low Responsiveness to Other Factors (e.g., multiple factors)
- Measurable Over Large Portion of Area
- Existing Data to Provide Historic Perspectives to inform the selection of Targets and Thresholds

Source: ICES Working Group on Ecosystem Effects of Fishing

Ecosystem Models & Forecasts to Assess Responses & Understand Relationships

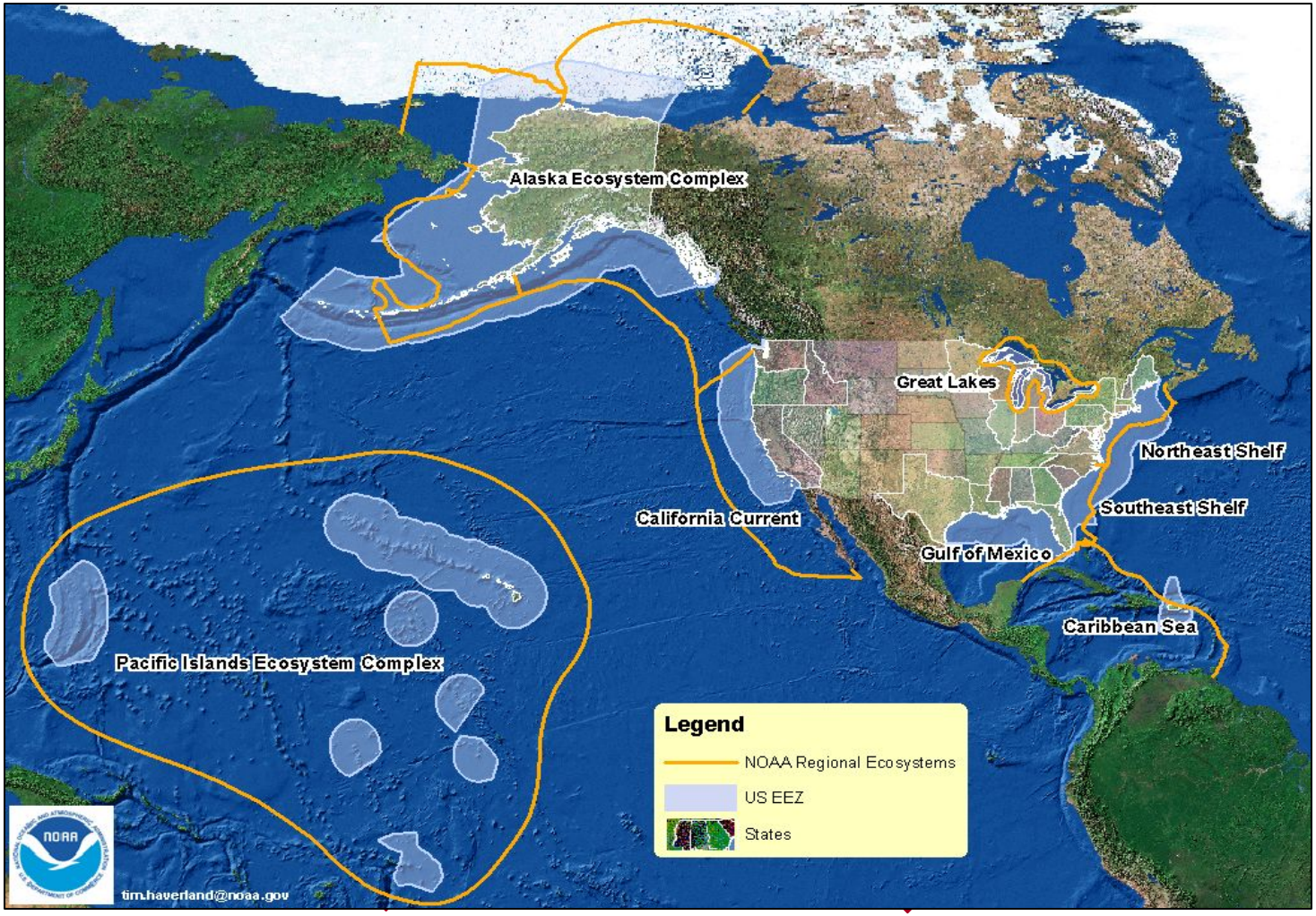
Types of Models Used in IEAs

- 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

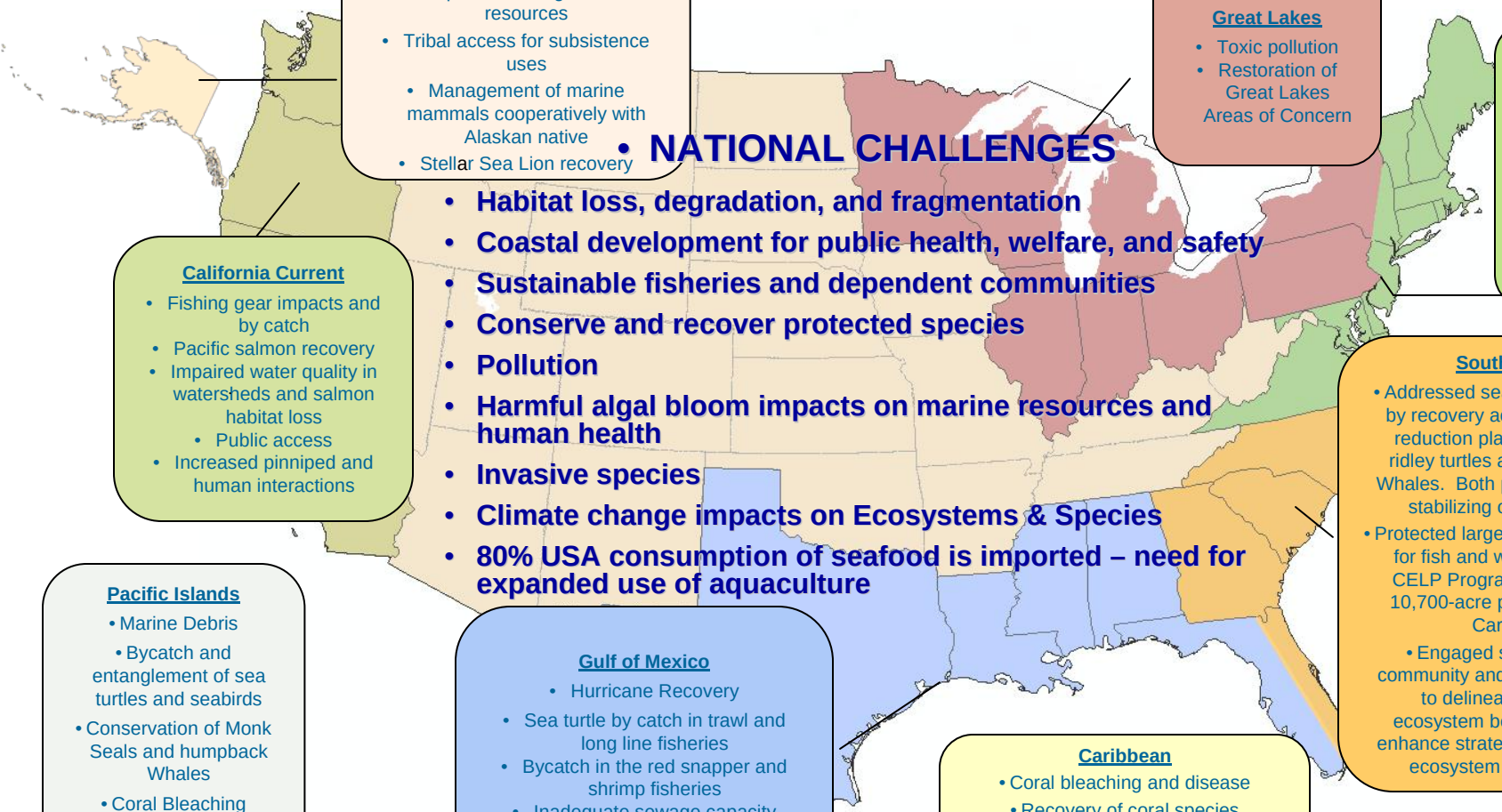


- Models necessary to understand complex multispecies and non-linear relationships between pressures, states and impacts
- Quantitative risk assessments determine the probability and consequences of not attaining target ecosystem states
- Impact analyses evaluate the benefits and costs of options to attain desired ecosystem states

NOAA's Eight Regional Ecosystems: Ecosystems: A common Scale for EAM



National and Regional Ecosystem Challenges – Scope Varies Across the nation



Alaska
- Impacts of sea ice reduction dependent living marine resources
- Tribal access for subsistence uses
- Management of marine mammals cooperatively with Alaskan native
- Stellar Sea Lion recovery

Great Lakes
- Toxic pollution
- Restoration of Great Lakes Areas of Concern

Northeast
- Overfished groundfish stocks, fishing gear impacts, and bycatch
- Right Whale ship strikes and entanglements
- Urban runoff

- **NATIONAL CHALLENGES**
  - **Habitat loss, degradation, and fragmentation**
  - **Coastal development for public health, welfare, and safety**
  - **Sustainable fisheries and dependent communities**
  - **Conserve and recover protected species**
  - **Pollution**
  - **Harmful algal bloom impacts on marine resources and human health**
  - **Invasive species**
  - **Climate change impacts on Ecosystems & Species**
  - **80% USA consumption of seafood is imported – need for expanded use of aquaculture**

California Current
- Fishing gear impacts and by catch
- Pacific salmon recovery
- Impaired water quality in watersheds and salmon habitat loss
- Public access
- Increased pinniped and human interactions

Southeast
- Addressed sea turtle bycatch by recovery actions and take reduction plans for Kemp's ridley turtles and Humpback Whales. Both populations now stabilizing or increasing
- Protected large tracts of habitat for fish and wildlife through CELP Program, including a 10,700-acre parcel in South Carolina
- Engaged stakeholder community and other agencies to delineate regional ecosystem boundaries and enhance strategy to implement ecosystem approaches

Pacific Islands
- Marine Debris
- Bycatch and entanglement of sea turtles and seabirds
- Conservation of Monk Seals and humpback Whales
- Coral Bleaching
- Sea Level Rise
- Overfishing

Gulf of Mexico
- Hurricane Recovery
- Sea turtle by catch in trawl and long line fisheries
- Bycatch in the red snapper and shrimp fisheries
- Inadequate sewage capacity
- Pollution related marine mammal strandings
- Offshore oil and gas production

Caribbean
- Coral bleaching and disease
- Recovery of coral species
- Urban Runoff
- Sea turtle recovery
- Growth of tourism industry placing demands on limited resources

Beyond LMEs: appropriate geographical scales for EAM IEAs and Ecosystem

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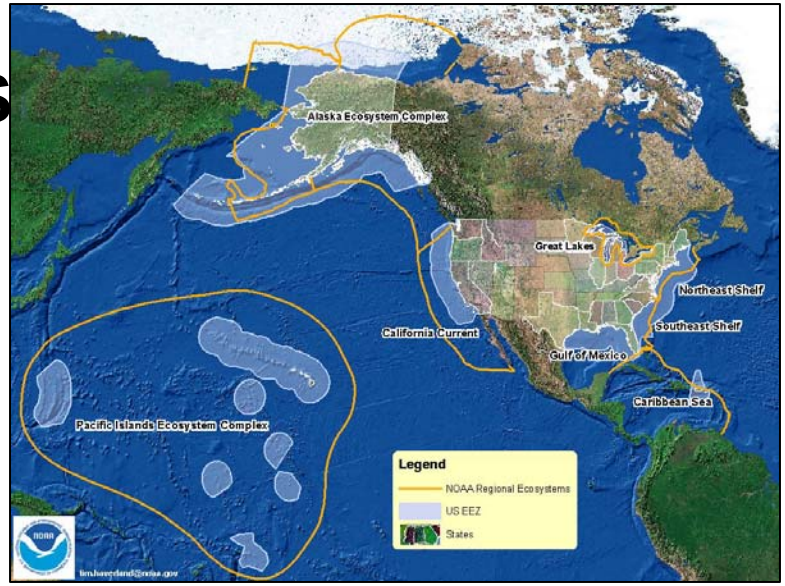


Assessing the Status of Ocean and Coastal Ecosystems of the United States

National Overview

+ International collaborations

National

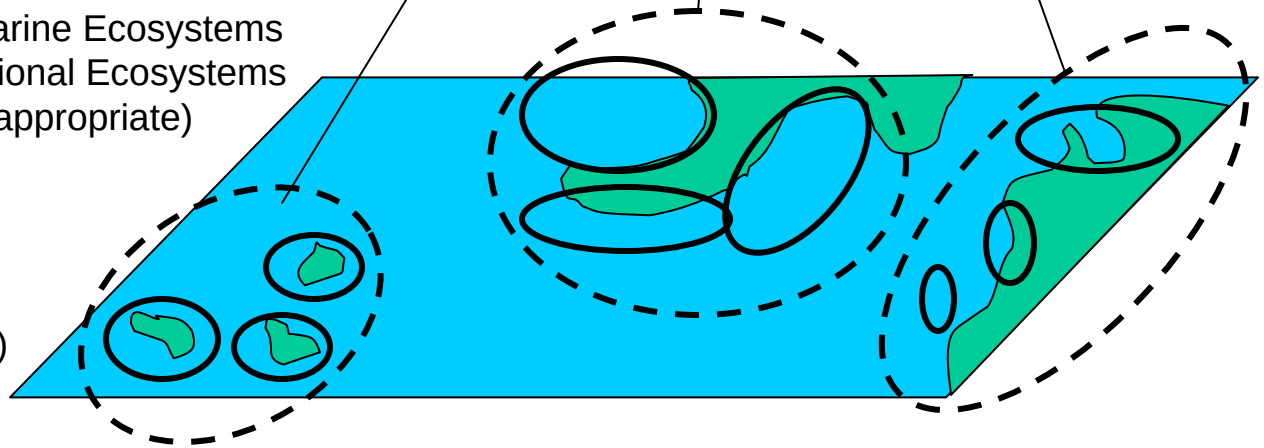
Hierarchical Structure of IEAs

Regional

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

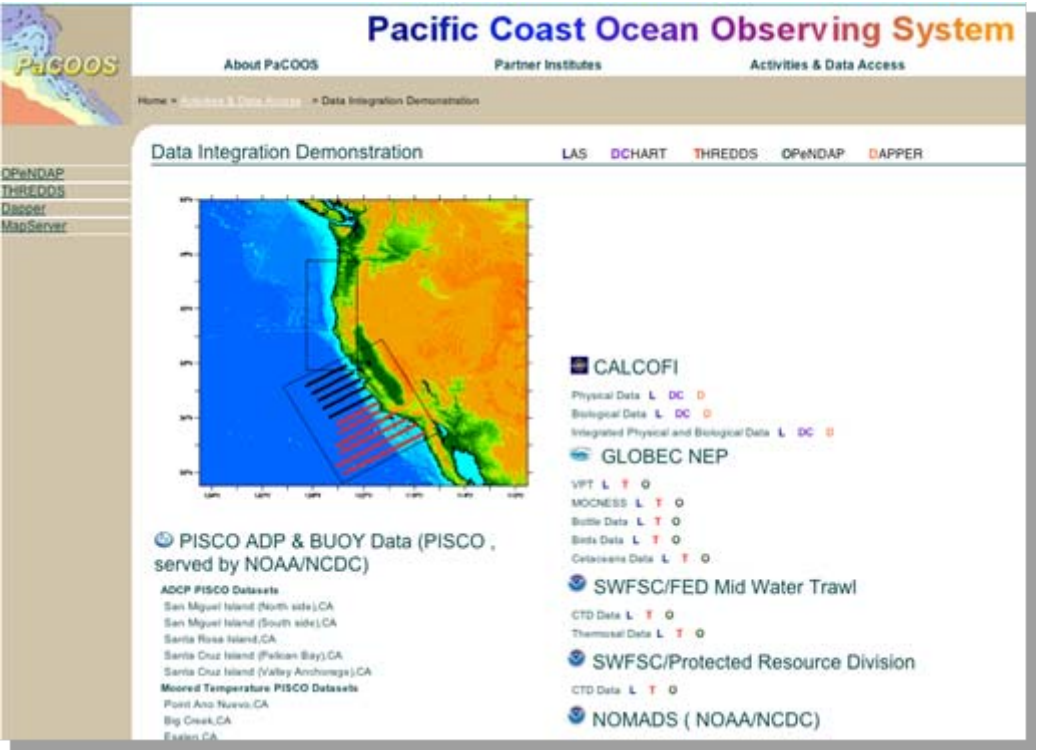
Local

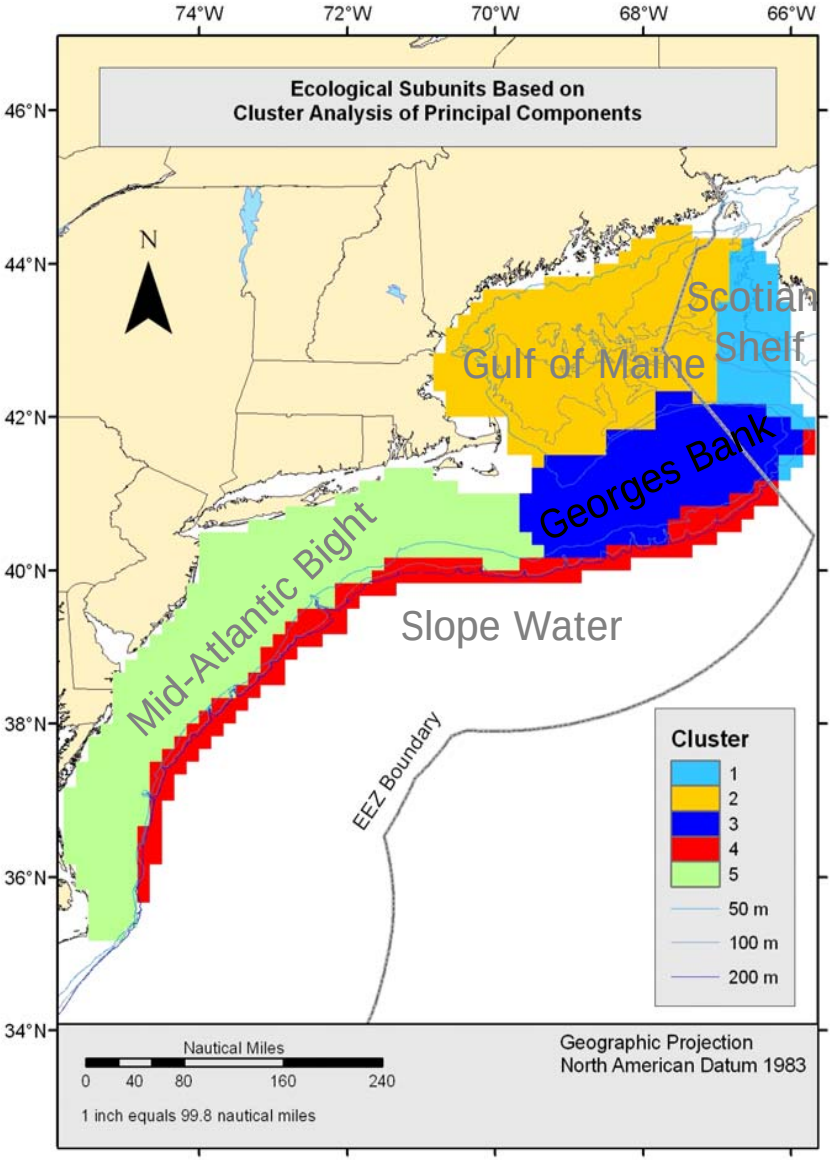
-Place based
(e.g., sanctuaries, NERRs)
-Bays, Harbors, Estuaries



Regional Dimensions

Determining the appropriate spatial scale for IEAs





<u>LME → Sub-Region → Local Area</u>

Data systems should allow hierarchical assessment

[political and management boundaries need to be

NOAA's IEA Implementation Strategy:

- California Current
- Alaska
- Northeast
- *Capacity to develop?*
- Gulf of Mexico
- South Atlantic
- Great Lakes
- Pacific Islands
- Caribbean

Implementation dictated by:

- strength of NOAA statutory missions
- regional NOAA capabilities to support IEA development
- emerging regional needs
- broad-based external partnerships (states, academia, regional govts., federal agencies)

Can we develop the Infrastructure for SA IEAs?

A Management-Science Process for IEAs

Acting in concert with constituents & partners

- Identify appropriate spatial scales for ecosystems of interest
- 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

Managers, Scientists, Users Avoiding the Mexican Standoff

"Uh, Trudy, how's the coffee coming?"

- Managers need to frame important questions
- Scientists need to think beyond their domains
- User sectors need to cooperate with each other

How is NOAA merging efforts to deliver IEA products and outcomes?

- Overall Planning currently provided by the Ecosystem Goal Team and IEA Task Team to assure consistency
- Regional collaborations among NOAA Line Office elements and external partners to take “ownership” of the regional and local process
- FY-09 Proposal provides resources to the regional collaborations to develop data and models & manage the process of IEA production
- Using an IEA Task Team to define criteria and standards for data, reporting and peer review
- FY-09 Proposal will use expertise of NESDIS to develop overall data framework to achieve seamless data integration among local → regional → national levels. Resources would move regionally to build data systems.
- Define an overall office lead (NOS NCCOS) to prepare the national synthesis report of regional IEAs
- Envision an IEA coordinating office as the program matures

What are IEA Products?
Paper or Plastic?

‘Plastic’ = Dynamic, web-based IEAs

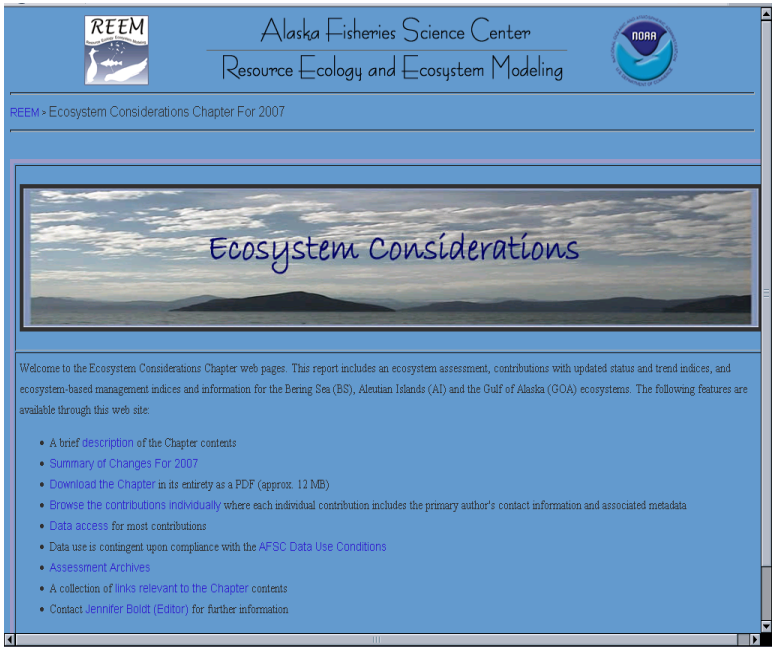
- IEA products created on demand on-line
- Local or ‘place based’ scales
- ‘If-then’ scenarios and other assessment tools to inform specific management questions

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

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

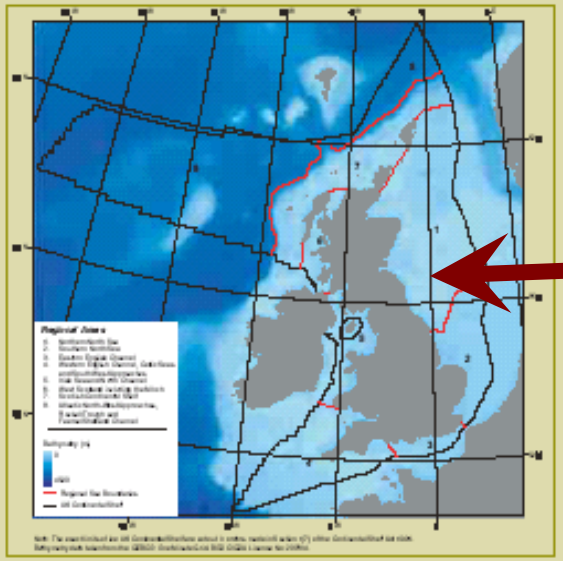
Have IEAs Ever Been Done Before ?

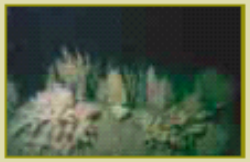
YES!

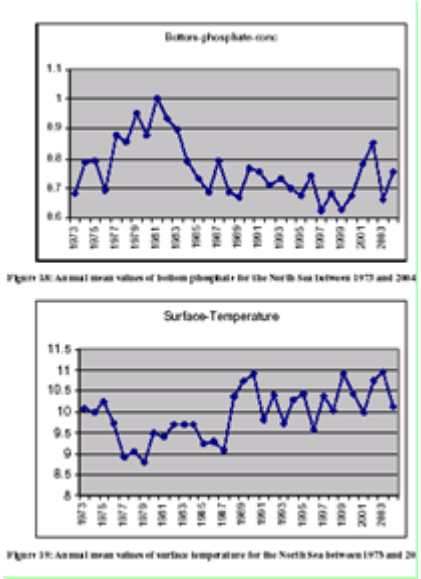
www.defra.gov.uk

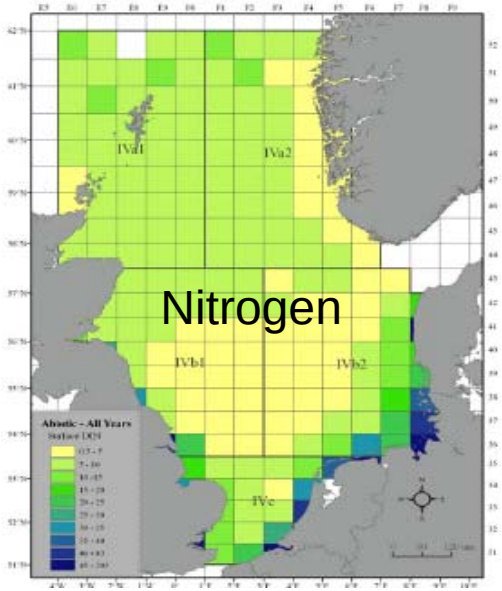
Charting Progress

An Integrated Assessment of the State of UK Seas









issues & challenges differ by sub-region

Table 5.1: Main Issues for each region*

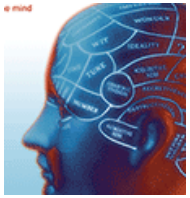
Region	1. North Sea	2. Southern North Sea	3. Eastern English Channel	4. Channel and Approaches	5. Irish Sea	6. Western Scotland	7. Scottish Continental	8. Scottish Offshore
Climate Impacts	■	■	■	■	■	■	■	■
Fisheries	■	■	■	■	■	■	■	■
Nutrients		Coastal	■		■			
Microbiological Contaminants				■	■			
Hazardous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

* See also Map (Figure 5.2).

■ Considered important issue per region

Six Climate Change Issues Involving Ecological Resources

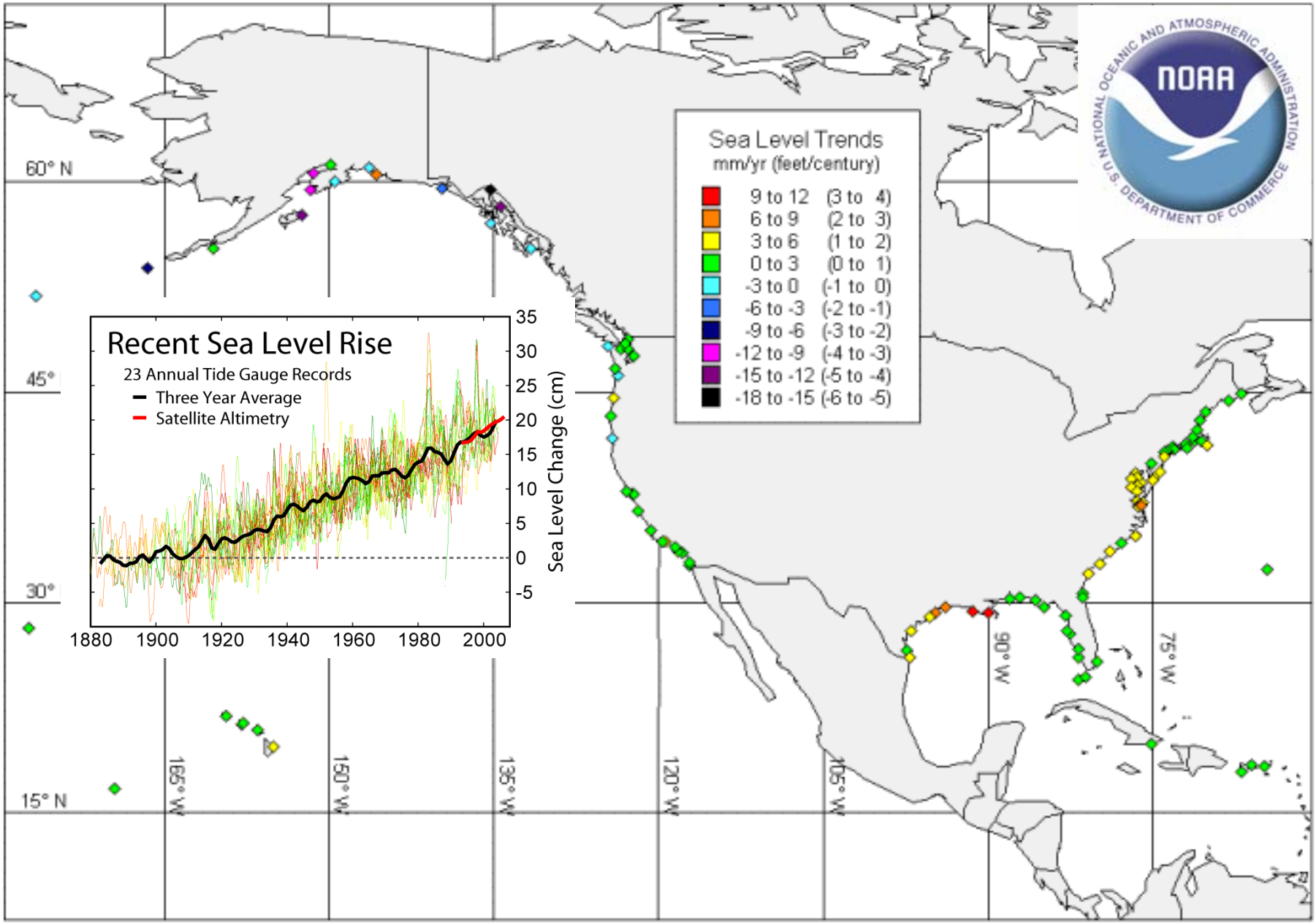
- Attribution of climate signals impacting ecosystems: long term change & natural variability
- Ocean warming: impacts on distribution & productivity (phenology, production, invasives)



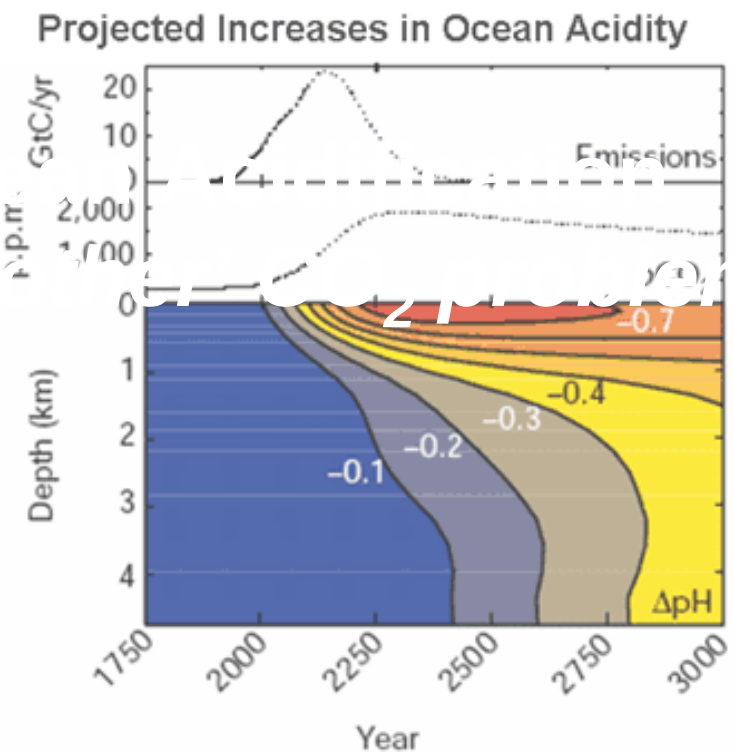
- Impacts of loss of sea ice on living marine resources (at both poles)*
- Ocean acidification impacts on marine biota*
- Freshwater supply & resource management*
- Sea level rise (natural resource implications)*

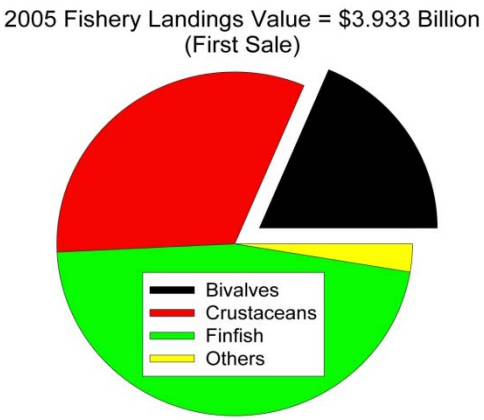
Source: OAR-NMFS Retreat, August 2007, Boulder Co.

Trends in Sea Level Rise & Resource Impacts



Ocean Acidification: A Consequence of Human Production of Greenhouse Gasses – Ocean Impacts & NOAA Responsibilities





Value:

Bivalves: $732M ex-vessel commercial value

Crustaceans: $1,265M ex-vessel commercial value

Combined : $1,997M ex-vessel commercial value (51% of commercial catch by $)

- Potential impacts on shelled plankton, coral reefs (shallow and deep), bivalves and crustaceans, and food chains

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)