

# Ecosystem Approaches to Fisheries Management: Why the Interest and Aren't we Doing this Already?

- Why do we need more focus on ecosystems?
- What are the important objectives of an Ecosystem Approach to Fisheries (EAF)?
- To what extent are they addressed now by the Councils?
- Some ongoing efforts to coordinate science & management



Steve Murawski  
Chief Scientist, NOAA Fisheries Service

New Council Member Training  
October 31, 2006, Washington, DC

# NOAA Fisheries Service - Mission



**Stewardship of living marine resources through science-based conservation and management and the promotion of healthy ecosystems**



# Why Do We Need More Emphasis on Ecosystems in Fisheries Management?

- **more credibility in “non-fisheries” governance forums and with wider groups of stakeholders**
- **get “credit” for what councils are already doing**
- **better, more integrated management**
- **leverage more and different resources to understand complex relationships affecting fisheries**

# Ecosystem Mandates: A Paradigm Shift or Evolution?

## 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

# 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.*



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, June 2006

# What is an Ecosystem?

**An *ecosystem* is a geographically specified system of organisms (including humans), the environment, and the processes that control its dynamics.**

**The *environment* is the biological, chemical, physical, and social conditions that surround organisms.**

**When appropriate, the term environment should be qualified as biological, chemical, physical, and/or social.**



# Definitions\*

- An *ecosystem* is a *geographically specified system* of organisms (including humans), the environment, and the processes that control its dynamics.
- An *ecosystem approach to management (EAM)* is one that is *geographically specified*, adaptive, takes account of ecosystem knowledge and uncertainties, considers multiple external influences, and strives to balance diverse social objectives
- Implies expanding mandates of existing institutions, better coordination among them, or creation of new ones, to address broader suites of societal goals

\* NOAA Ecosystem Goal Team (EGT)

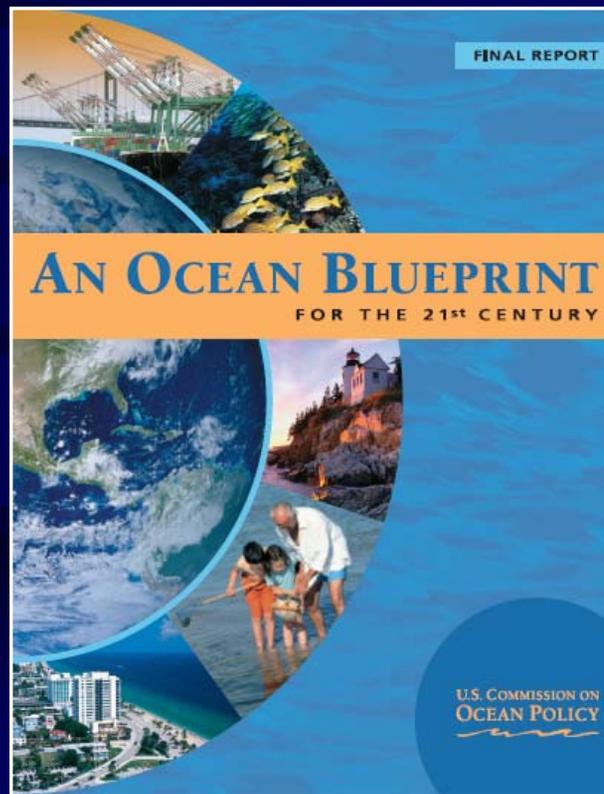


# Why an Ecosystem Approach to Management?

**Oceans Act  
2000**



**USCOP Report  
2004**



**Bush Response  
2004**



# Committee on Ocean Policy

Chair: CEQ

Members: As Identified in Executive Order (Cabinet Level)

Expanded  
ORAP

Interagency Sub-Committee on Ocean  
Science and Resource Management  
Integration

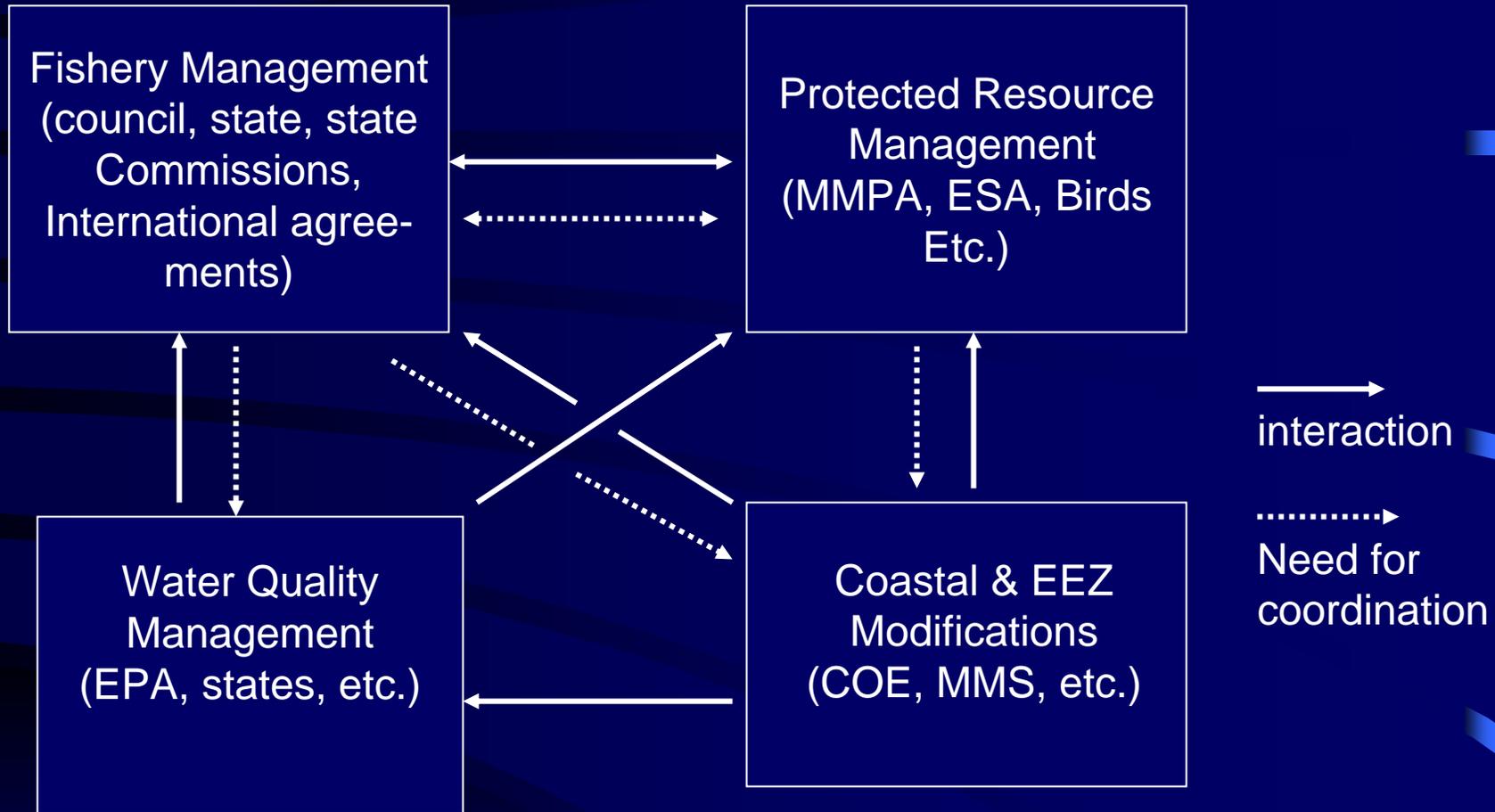
Chair: OSTP, CEQ

NSC PCC  
Global  
Environment  
Chair NSC

NSCT Joint Sub-  
Committee on Ocean  
Science & Technology  
JSOST  
Chairs: OSTP, Agencies  
Halpern, Leinen, Spinrad

Sub-Committee on  
Integrated Management  
of Ocean Resources  
SIMOR  
Chair: CEQ/Agency  
Onley, Glackin, Regas

# Elements of Regional Ecosystem Governance

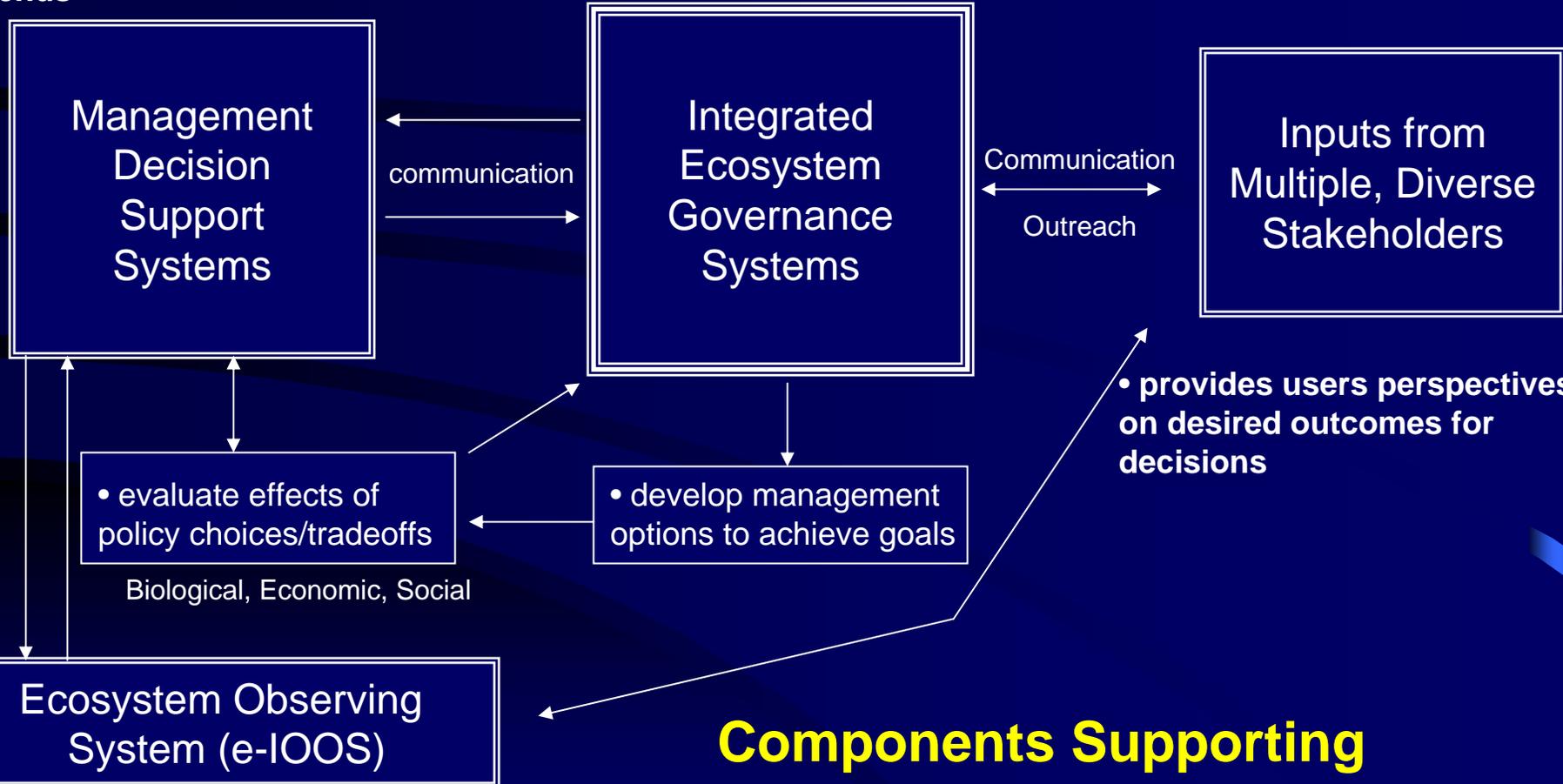


Other management authorities for navigation, food quality/safety, International agreements, climate change, etc.

- synthesizes observations
- conducts process research to link dynamics between components
- develops status indicators for individual components & ecosystems
- provides forecasts of status & trends

- provides forum for resolving conflicting uses of ecosystems

- develops management measures to achieve strategic goals for species & ecosystems



- provides users perspectives on desired outcomes for decisions

## Components Supporting Ecosystem Approaches to Management

- develop types, frequency & spatial density of observations

# Operational Objectives for EAF

## ➤ **Conserve and Manage Species**

- *Target species, assemblages, non-target species, PET\* species, biodiversity protection*

## ➤ **Minimize Bycatch**

- *target, non-target & PET species, and minimize waste*

## ➤ **Manage Tradeoffs**

- *among fisheries sectors, optimize fishery benefits, prevent sequential depletion/effort transfer, use management processes that are fair, equitable and transparent, consider cumulative impacts, evaluate impacts of non-fishery sectors, include diverse stakeholder views*

\* PET = Protected, Endangered or Threatened Species

# Objectives for EAF, continued...

## ➤ **Account for Feedback Effects**

*- predator-prey relationships, gear impacts on habitat productivity, irreversibility of fishing impacts, harvesting-induced regime change*

## ➤ **Establish Appropriate Ecosystem Boundaries**

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

## ➤ **Maintain Ecosystem Productivity, Balance Ecosystem Structure**

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

# Objectives for EAF, continued.

## ➤ **Account for Climate Variability**

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

## ➤ **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*

# Operational Objectives for EAM-(EAF)

- (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?

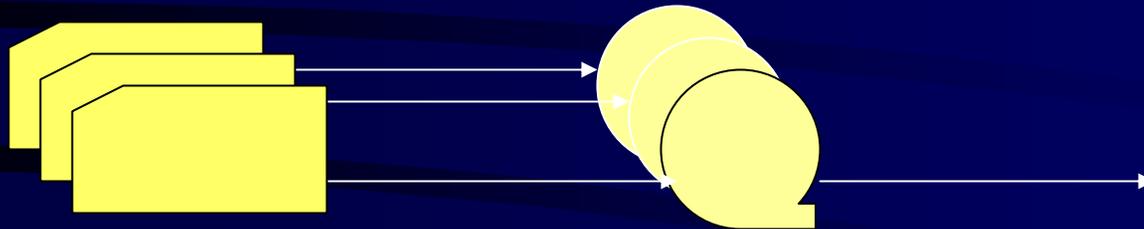
Many Recent Publications Proposing  
General Objectives for EAM, EMB

# Science Support: Integrating Data, Assessments, Models & Forecasts: A priority supporting EAM

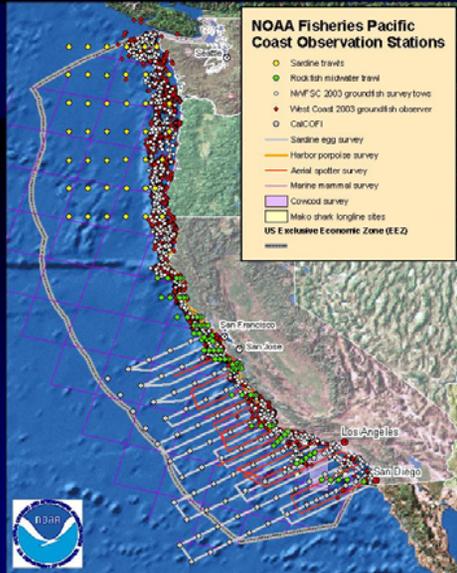
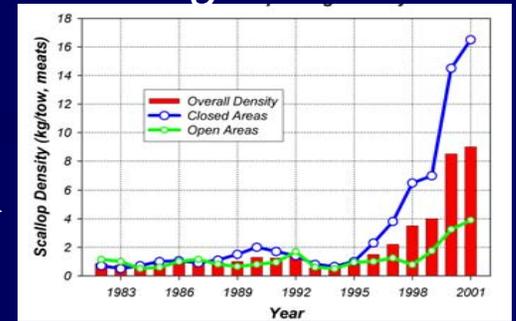
NOAA's Current Ecosystem Data Streams

Each with individual data archives

Serving specific Management needs

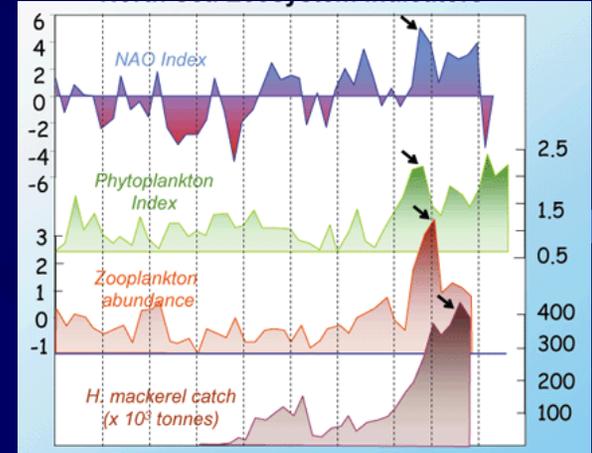


Ecosystem Vision:



Integrated regional data prioritization, collection & archival

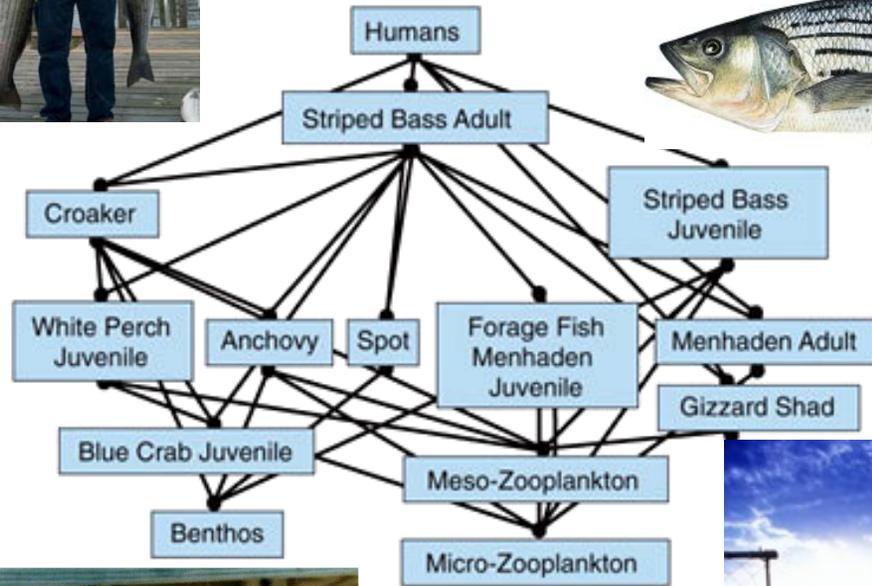
Enabling: Regional Integrated Ecosystem assessments



Supporting: enhanced Modeling & forecasting

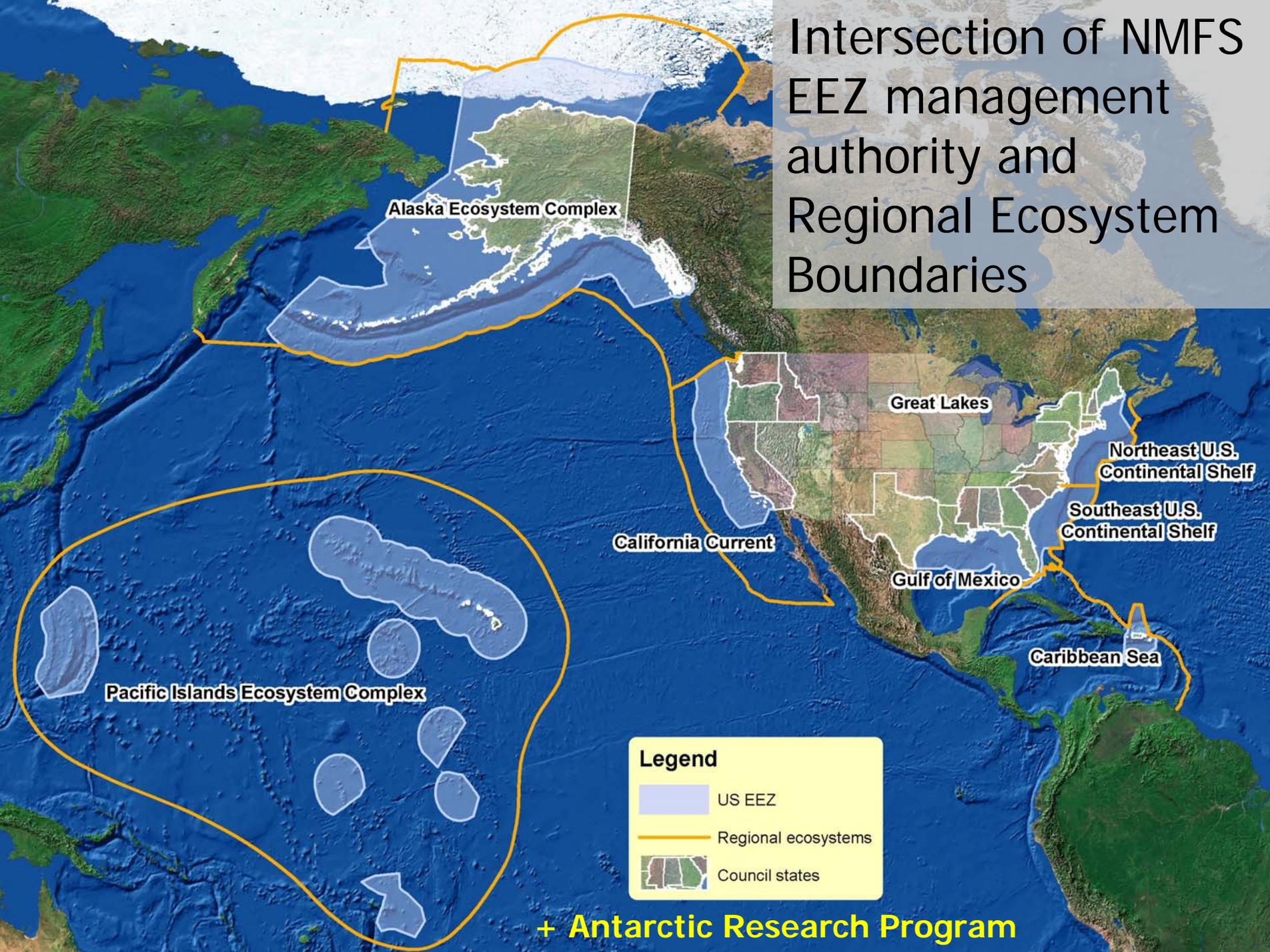


# Chesapeake Bay

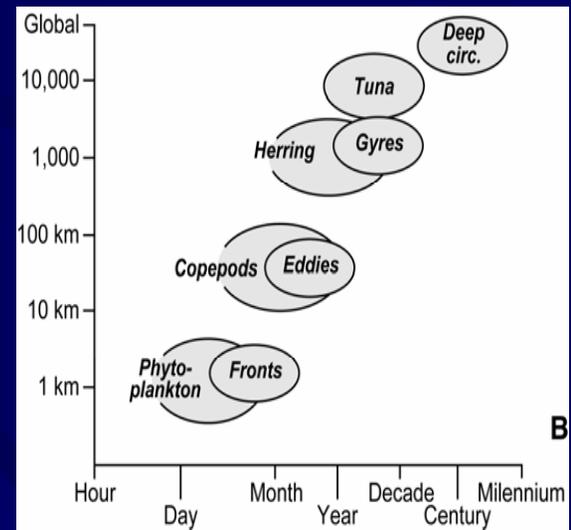
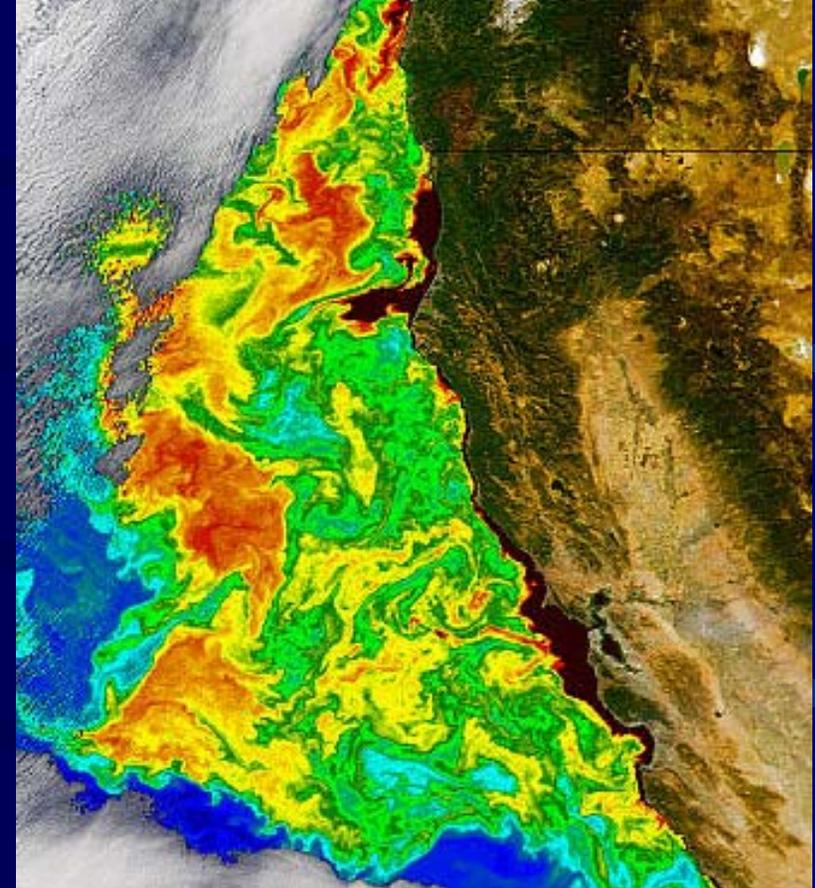
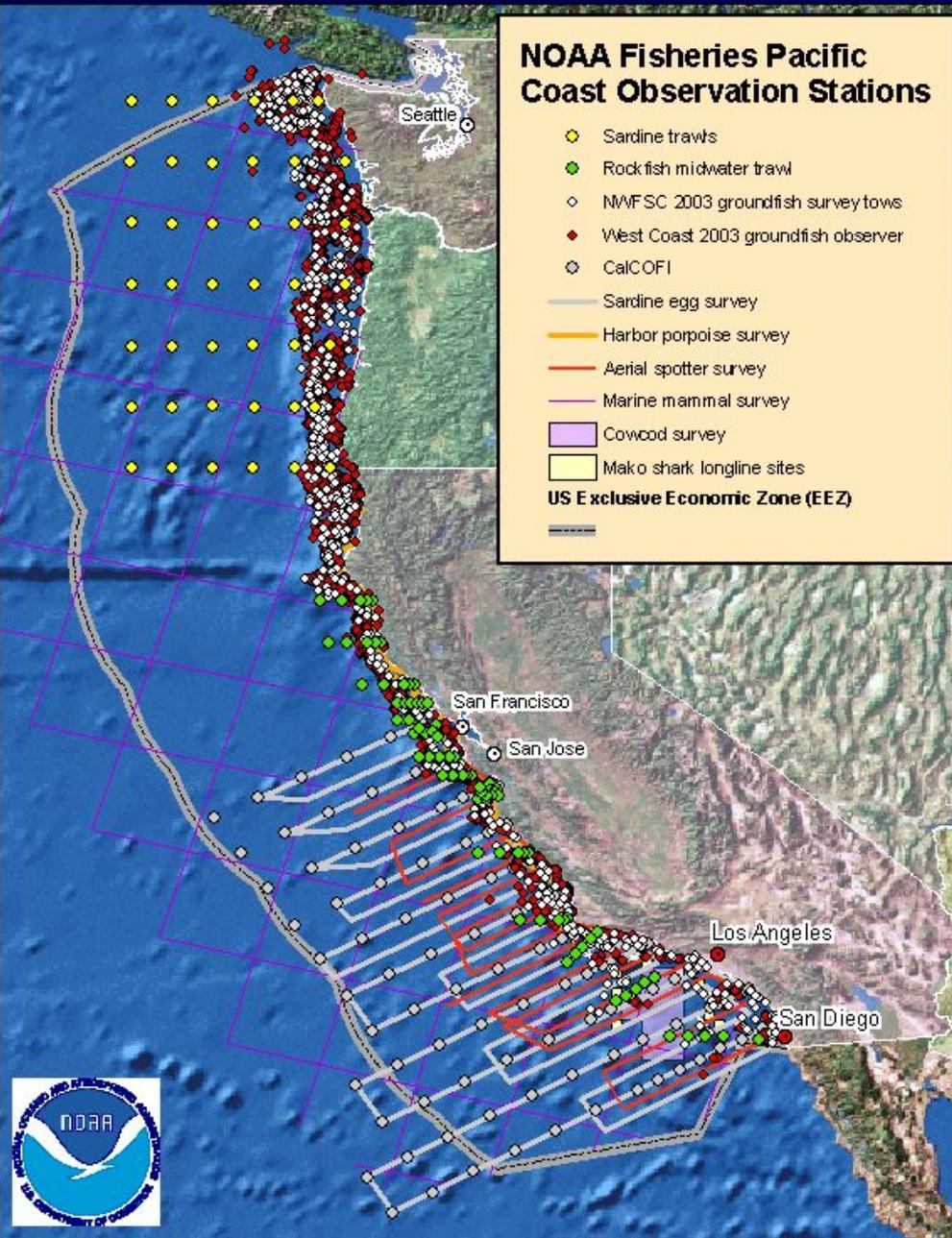


- Urbanization, invasives
- Natural resource management
- Agricultural run-off

# Intersection of NMFS EEZ management authority and Regional Ecosystem Boundaries



# Scales and Observations



# How are Councils Implementing EAF Now?

- Management of target species
- minimization of bycatch
- consider habitat impacts
- consult with diverse groups
- use management measures that have wide spread benefits
- understand and incorporate species interactions

# Applications of Reasoning Models in Alaskan Marine Science



# Research Priorities for Ecosystem Studies in Alaska

Define Natural Range of Variability  
In Ecosystem-Level Measures

LH, Distribution, Functional role  
Of HAPC Biota

Climate and Fishing Effects on Forage  
Species Dynamics

Relation between Climate and  
Ecosystem Production

Assessing Genetic Diversity

Improving predictions of multi-species  
And ecosystem models

System for prioritizing research  
On non-target species

Defining Spatial-temporal Needs  
Of Predators

# Ecosystem-based Management Actions

- TAC less than ABC for individual stocks.
- OY Cap on total groundfish yield.
- No target fisheries on forage species.
- Short-tailed albatross take restrictions, Seabird bycatch mitigation devices.
- No fishing in Steller sea lion foraging area and minimum biomass threshold for sea lion prey.
- Trawl closures, bottom trawling restrictions.
- Bycatch and discard controls.

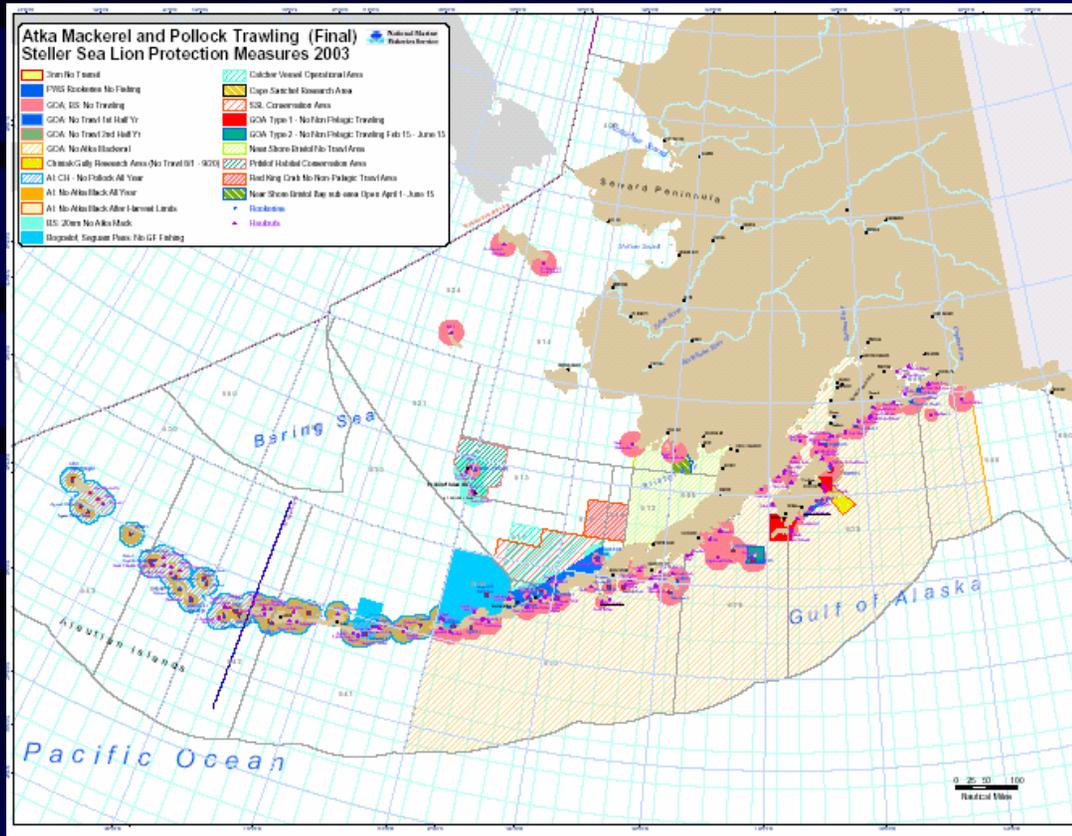


**CAP on TOTAL TARGET CATCH  
BSAI Total Yield < 2 million mt**



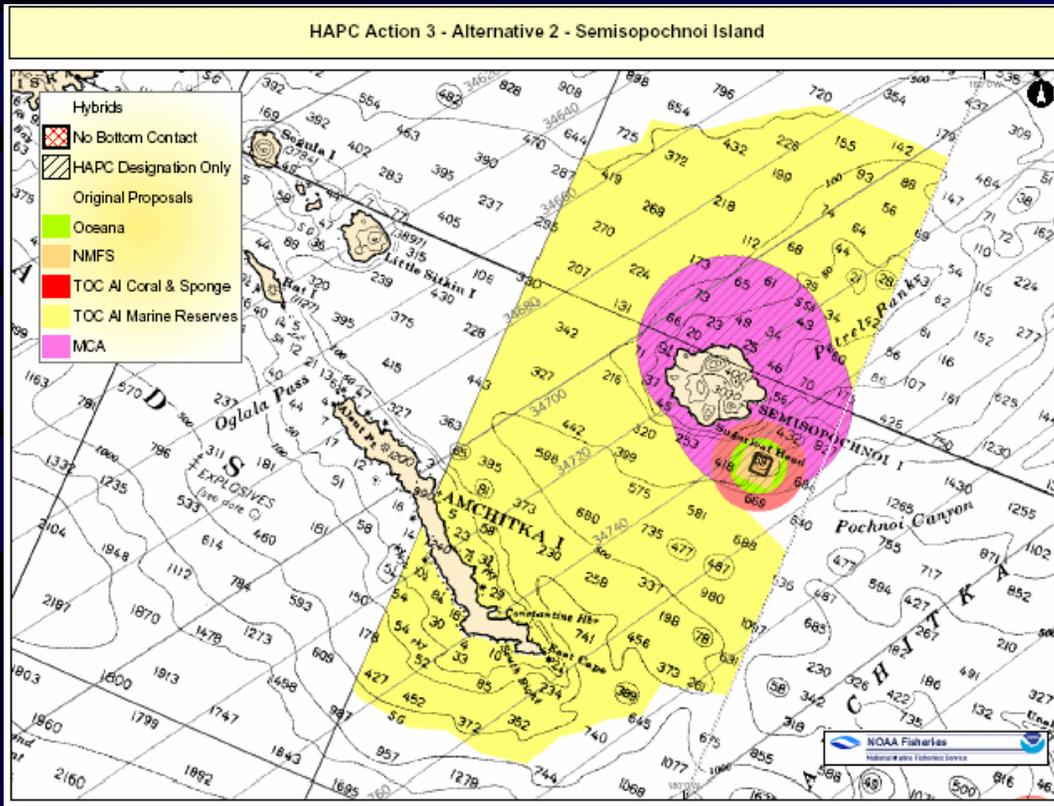
**Conservative single-species targets**

# Steller Sea Lion Protection Measures



No Trawl Areas and Seasonal Closures

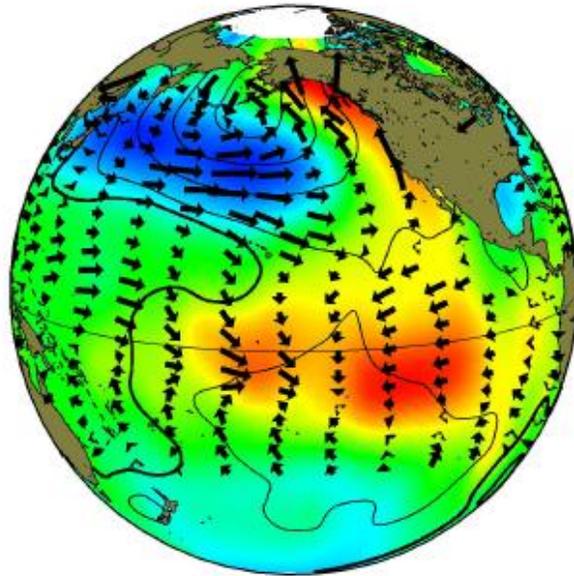
# Cold-water Coral Research and Protection



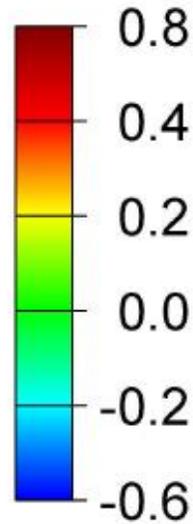
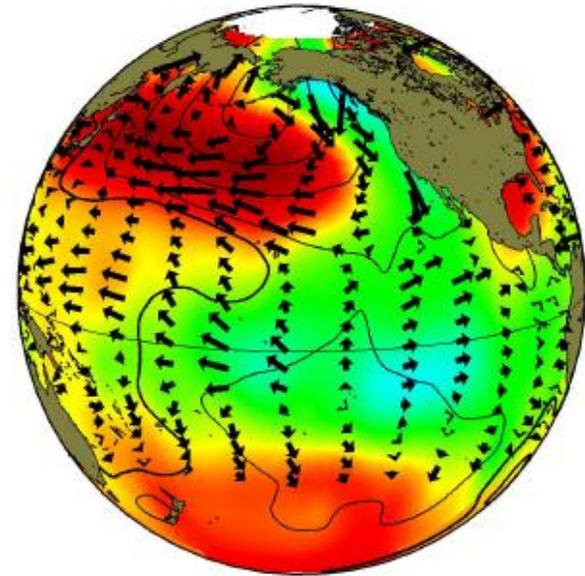
Habitat of Particular Concern

# Pacific Decadal Oscillation

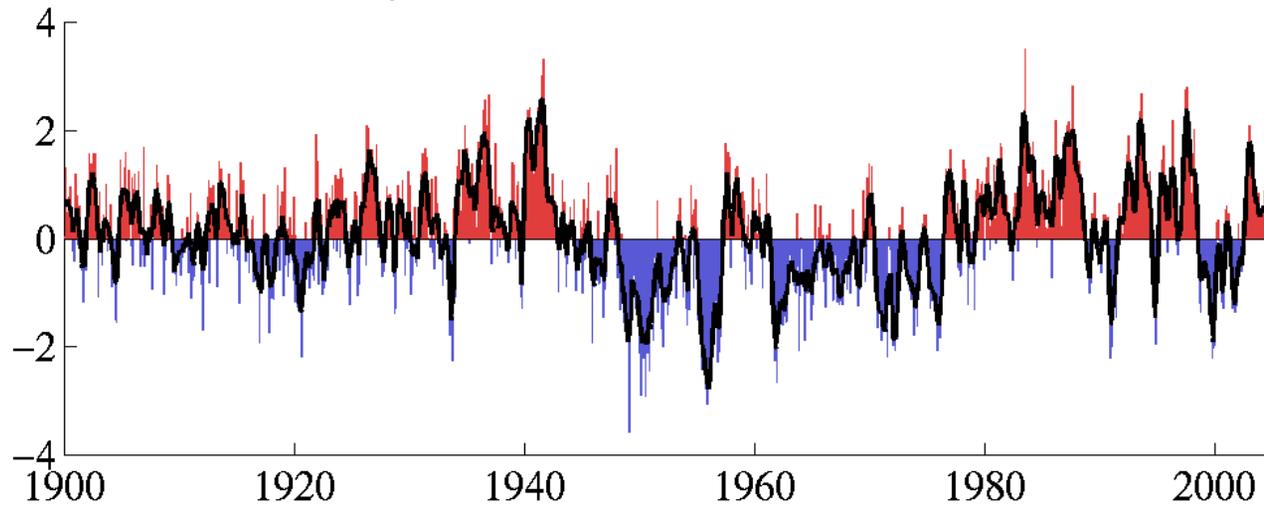
positive phase

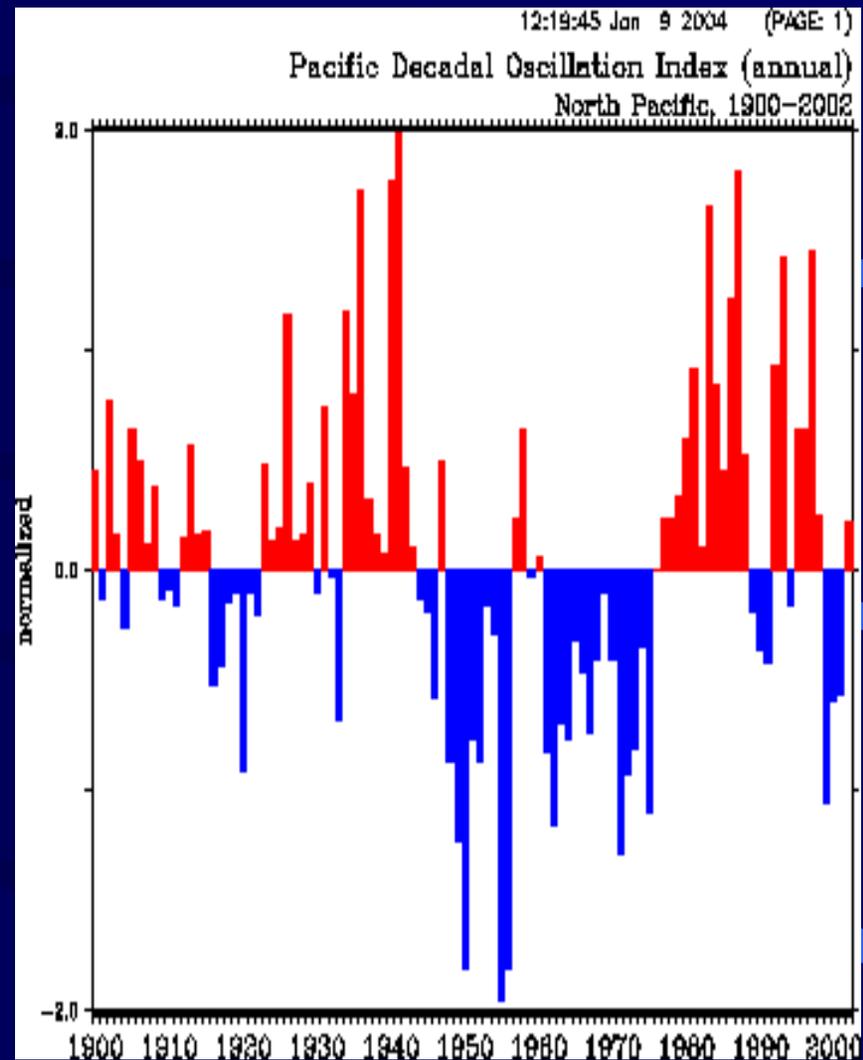
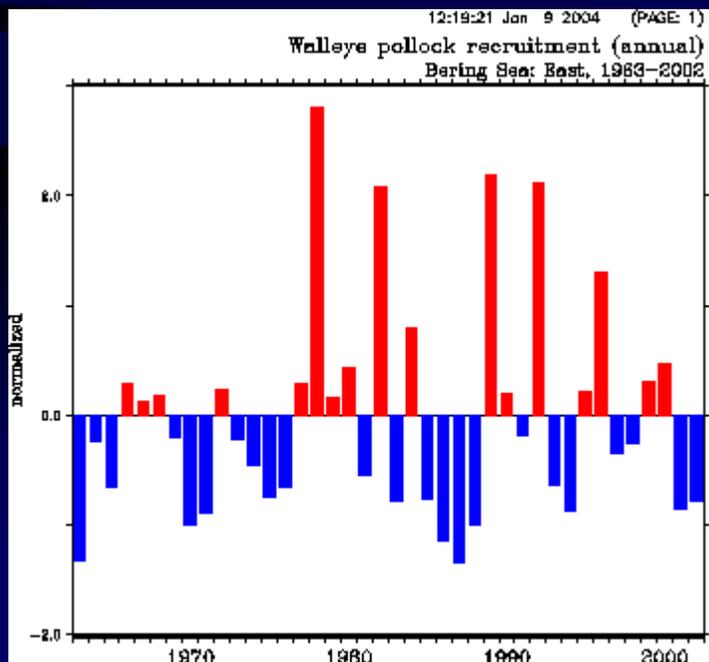


negative phase



monthly values for the PDO index: 1900–2004





Role of Correlation: PDO & Pollock Recruitment

# Integrated Assessment Reports for Alaska Groundfish Ecosystems

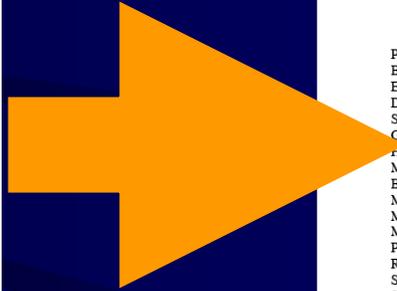
**Bering Climate**  
[Home](#) [About](#) [Data](#) [Science](#) [Essays](#) [Info](#)

Data Information: [Description](#) [Relevance](#) [Recent Trend](#) [All Info](#) [Reset](#)

Data Access: [List Data](#) [Display](#) [Download](#) [Correlation](#)

Climate Indices	Atmosphere	Ocean	Fishery	Biology
<input type="checkbox"/> AOI	<input type="checkbox"/> SAT_Pribilof, winter	<input type="checkbox"/> Ice cover	<input type="checkbox"/> Pollock	<input type="checkbox"/> Zooplankton
<input type="checkbox"/> ALPI	<input type="checkbox"/> SAT_Pribilof, annual	<input type="checkbox"/> Ice extent	<input type="checkbox"/> Pacific cod	<input type="checkbox"/> Jellyfish
<input type="checkbox"/> PDOL_winter	<input type="checkbox"/> Wind_Pribilof	<input type="checkbox"/> SST_Pribilof, winter	<input type="checkbox"/> Yellowfin sole	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> PDOL_summer	<input type="checkbox"/> Wind mixing, Pribilofs	<input type="checkbox"/> Surface temperature, M2	<input type="checkbox"/> Greenland turbot	
<input type="checkbox"/> PDOL_annual	<input type="checkbox"/> Favorable wind, M2	<input type="checkbox"/> SST in Mix	<input type="checkbox"/> Arrowtooth flounder	
<input type="checkbox"/> NPI-CPC	<input type="checkbox"/> Strong wind, M2	<input type="checkbox"/> Bottom temperature, summer	<input type="checkbox"/> Rock sole	
<input type="checkbox"/> NPI-NCAB	<input type="checkbox"/> Wind mixing, M2		<input type="checkbox"/> Flathead sole	
<input type="checkbox"/> EPI_Dec-Mar	<input type="checkbox"/> Wind stress, Unimak, Nov-Apr		<input type="checkbox"/> Alaska plaice	
<input type="checkbox"/> EPI_Apr-Jul	<input type="checkbox"/> Wind stress, Unimak, May-Jun		<input type="checkbox"/> Pacific perch	
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<input type="checkbox"/> WPI_spring	<input type="checkbox"/> PNA:		<input type="checkbox"/> Salmon	
<input type="checkbox"/> PNA:	<input type="checkbox"/> BSPI, winter			
<input type="checkbox"/> MEI	<input type="checkbox"/> BOP, spring			
<input type="checkbox"/> DI				
<input type="checkbox"/> AI				
<input type="checkbox"/> SAI				

- Mouseover dataset name
- Click on dataset name
- Access data, metadata, desired functionality.



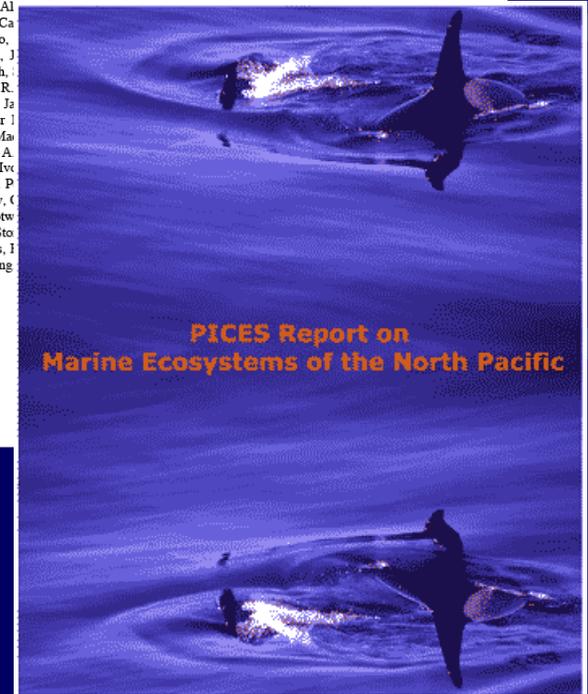
## APPENDIX C

### Ecosystem Considerations for 2005

Reviewed by  
 The Plan Teams for the Groundfish Fisheries  
 of the Bering Sea, Aleutian Islands, and Gulf of Alaska

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With contributions from  
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# OECA – 2001 vs 1995

In 2001, there were:

- More groupers.
- Larger groupers.
- More male gag & scamp.

*(protogynous  
species, become  
male when large)*

- More juvenile speckled hind.

*(a candidate species  
under ESA)*



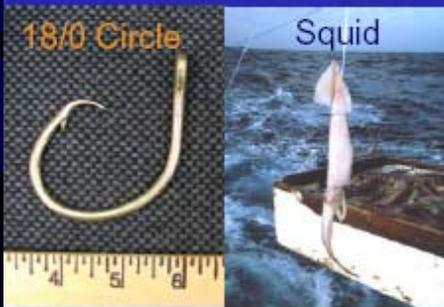
Gag  
*Myctoperca microlepis*

# Sea Turtle Mitigation Research Results

## Treatments



Loggerhead Turtles 71% Reduction  
 Leatherback Turtles 66% Reduction  
 Swordfish 63% Increase  
 Bigeye Tuna 90% Reduction

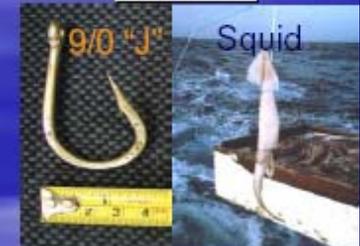


Loggerhead Turtles 74% Reduction  
 Leatherback Turtles 75% Reduction  
 Swordfish 30% Reduction  
 Bigeye Tuna 24% Increase

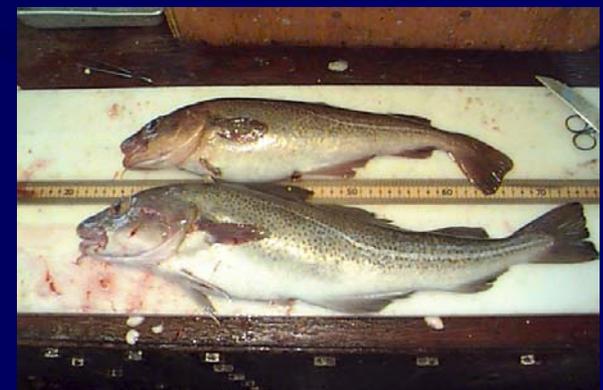
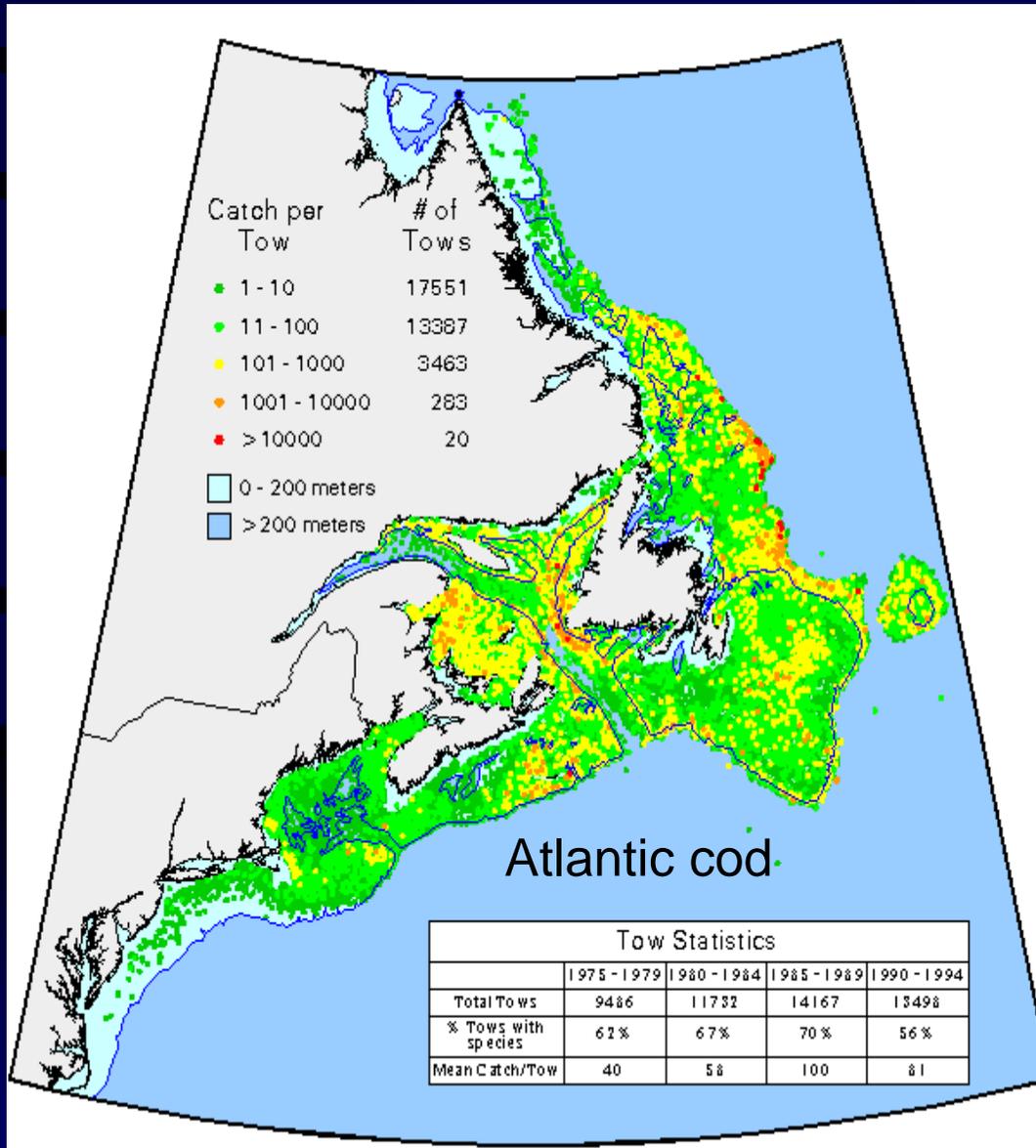


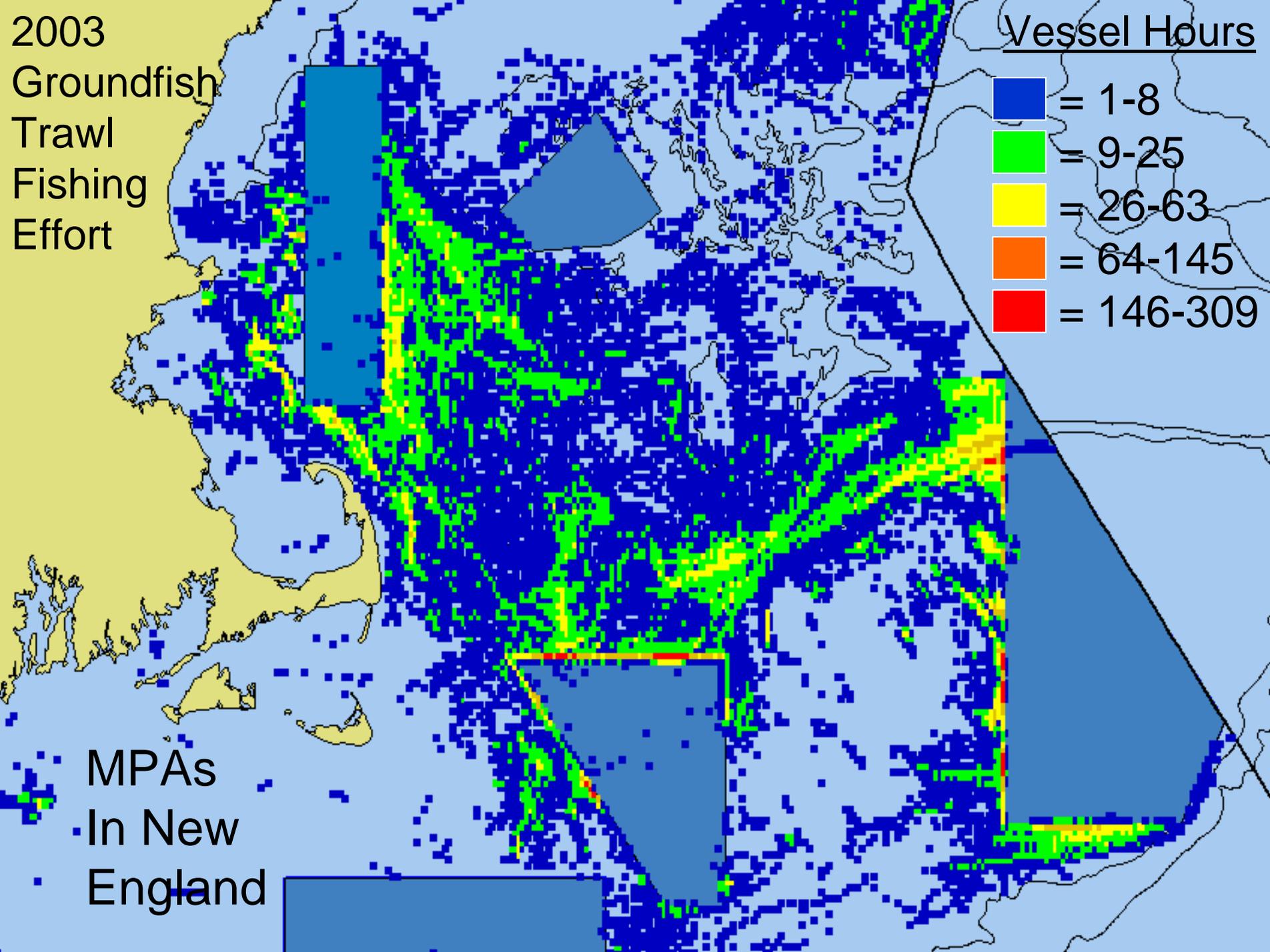
Loggerhead Turtles 88% Reduction  
 Leatherback Turtles 63% Reduction  
 Swordfish 20% Increase  
 Bigeye Tuna 80% Reduction

## Control

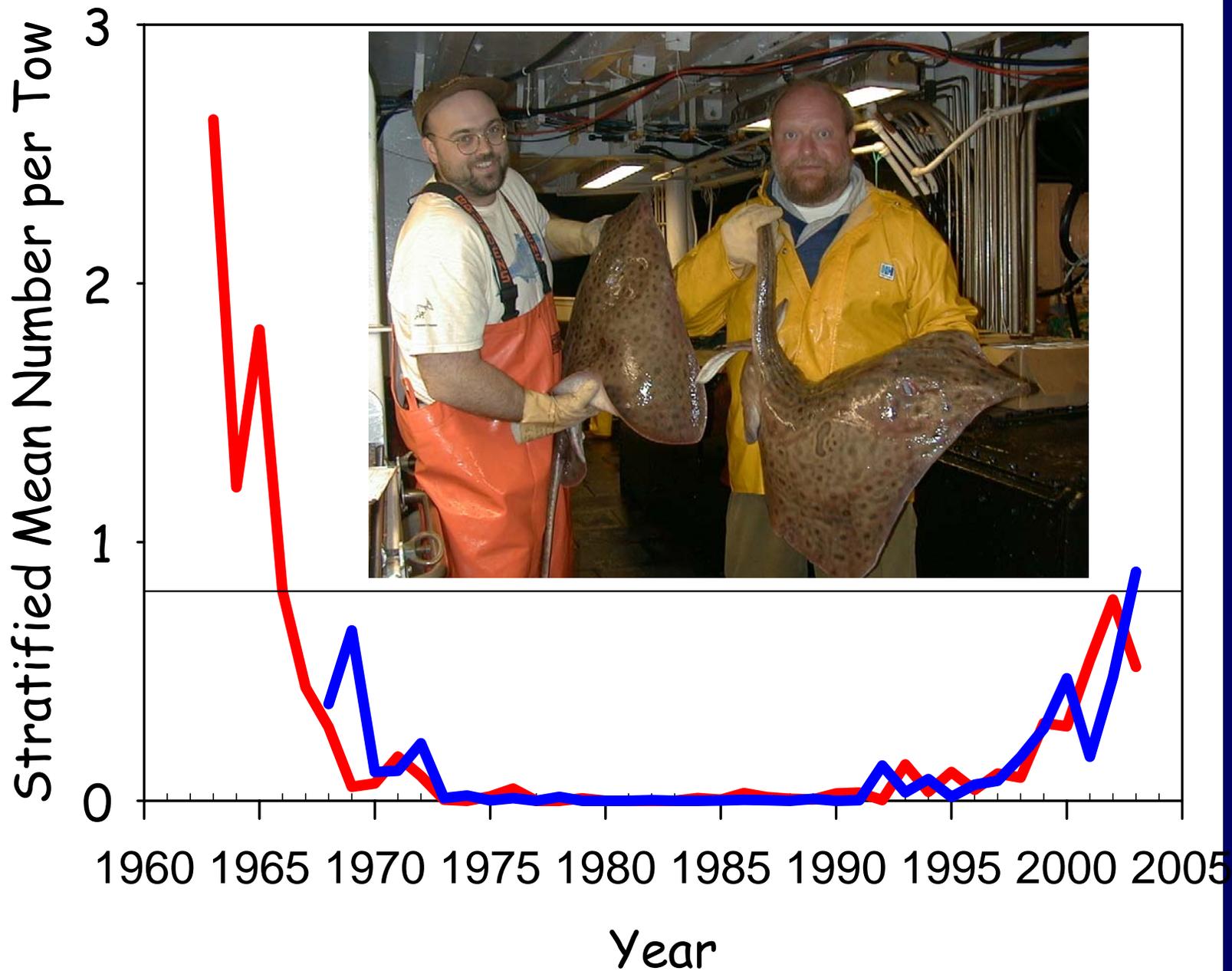


# New England Examples: Impacts of Groundfish Mgt.

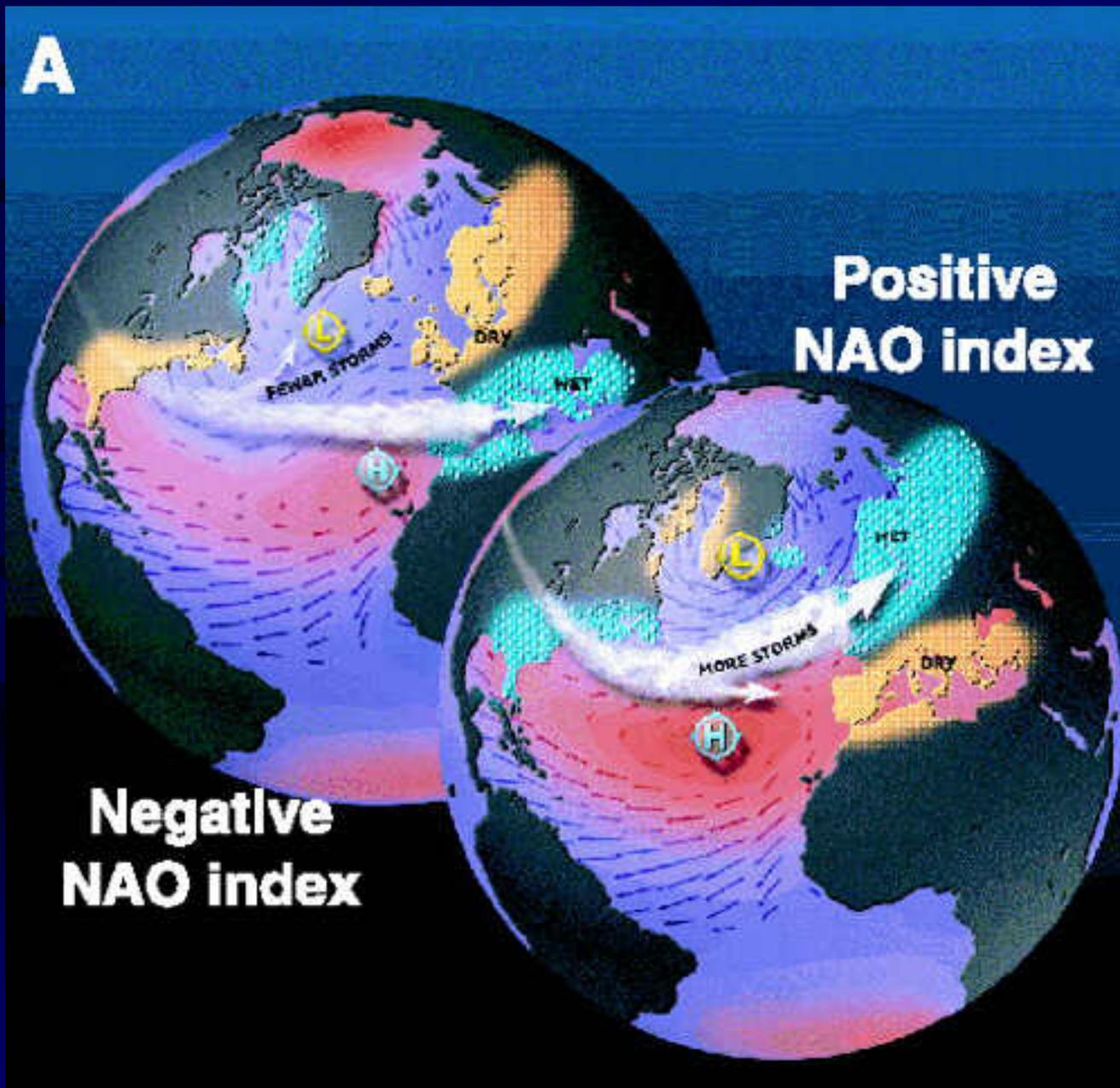




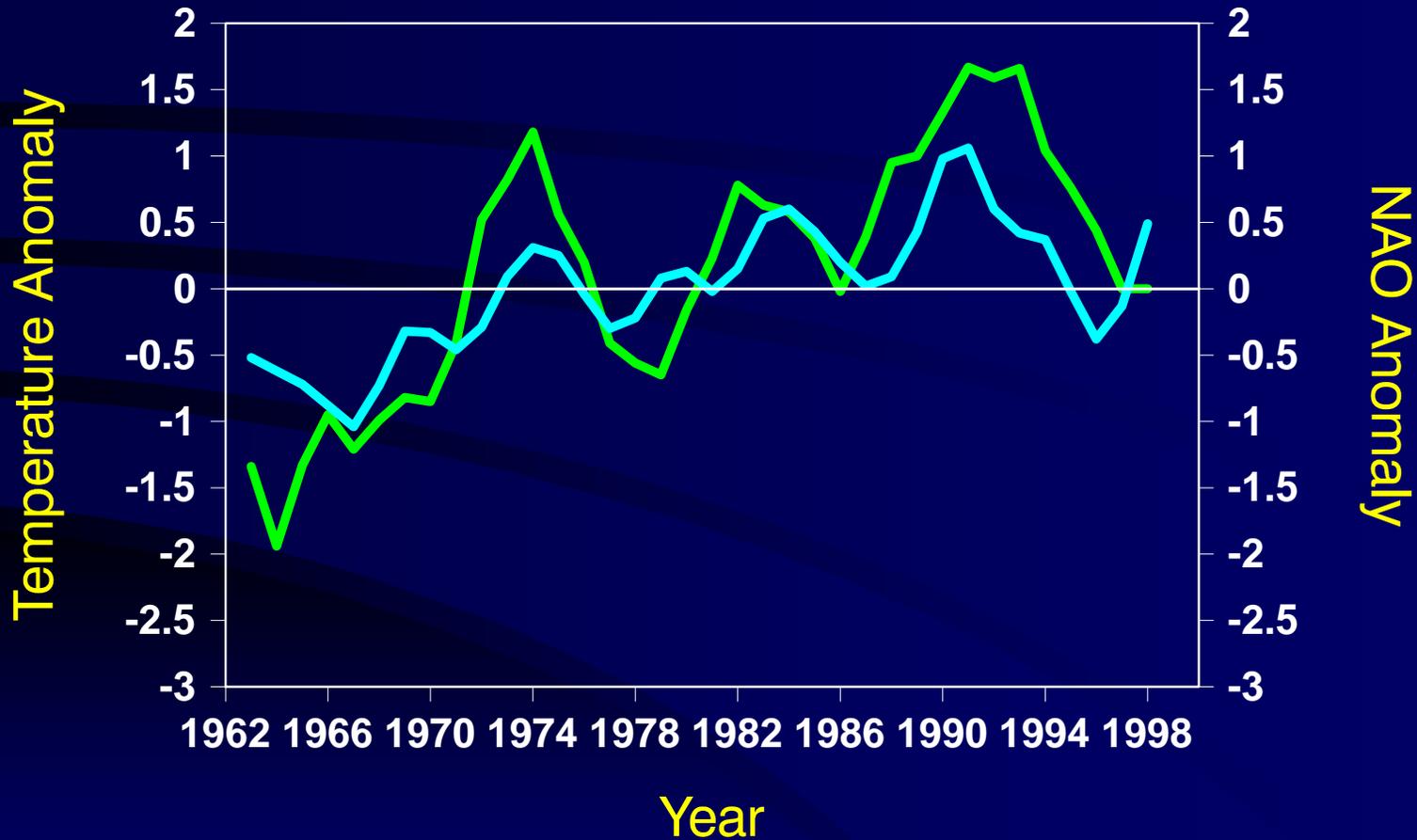
# Non-Resource Species: Barndoor Skate



# Regional Climate Affects Ecosystems & Fisheries



# Woods Hole Temperature - NAO



Courtesy D. Mountain

# Fisheries Ecosystem Pilot Projects

In FY04, Congress allocated ~\$2 million for NOAA-Fisheries to conduct ecosystem management pilot projects in four regions:

- ▶ New England
- ▶ Mid-Atlantic
- ▶ South Atlantic
- ▶ Gulf of Mexico



Report language from the Senate further explains -

*“The pilots purposely cover bodies of water that are contiguous, because the one influences the others. “*

*“Ultimately, should the pilots prove successful, the Committee would expect to fold more specific initiatives into the larger ecosystem approach.”*

*“NMFS is directed to report to the Committees on Appropriations not later than December 1, 2003 on its plans for implementing the pilots.”*

# National Research Council Study

- Evidence for reversibility of fishing effects
- Evidence for ecosystem change due to predator overfishing
- Fishing Impacts on System-wide Productivity
  - Sequential fishing down trophic levels
  - Trophic Cascades
  - Control hypotheses for fishery ecosystems
  - Fishing-Induced regime change
- Shifting Baselines – pristine, utilized, degraded ecosystems
- Global syntheses (& generalities) regarding fishery effects
- Effectiveness of MPAs for ecosystem objectives and fishery management
- Adequacy of data, indices & models

# Development of Ecosystem Guidelines

- **Ongoing Activity among all councils & NMFS**
- **Topic area guidelines follow 8 themes (above)**
- **Ongoing discussions on form of ecosystem planning**

**Protect, Restore, and Manage the Use of  
Coastal and Ocean Resources through an  
*Ecosystem Approach to Management***

**Ecosystem Goal**

**FY09-13 Program Plan**

Steve Murawski

Ecosystem Goal Lead

October 30, 2006



# Summary

- Trend to more ecosystem issues in fisheries management
- Need to work with more diverse communities of interests
- MSA and other laws will contain more ecosystem considerations
- NOAA and other federal agencies will work towards this goal
- Key is regional approaches that work