



Introduction & Overview: The Challenges of Managing Marine Resources in 5 Dimensions

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Abstract

The traditional paradigm for managing living marine resources is to index a species or species group over time, and adjust management measures until the trajectory and or level of stock abundance achieves some societal benchmark of success. This paradigm operated well for any number of fisheries and protected species management issues, and was the operating model for diverse issues including pollution abatement, eutrophication and other challenges of resource management in the coastal zone. Increasingly, managers are employing zoning of coastal ecosystems, which limits certain activities by place and time. Thus, for example, fishery closed areas are used on a seasonal or annual basis to restrict certain or all fishing activities, to improve conservation of target species, limit bycatch or to protect vulnerable habitat types. Space is not only two-dimensional (e.g., bottom habitats) since important ecological processes and interactions among components occur in the water column. The incorporation of ecosystem-level considerations into the management of living resources implies that feedback interactions between components such as effects of marine mammal predation on prey species, competition among fish and invertebrates for food, and habitat-modifying effects of various human activities, have assumed a higher profile in decision making. Accounting for these five dimensions: time, three dimensional space, and interactions/feedbacks between components, is the primary challenge for ecosystem science to inform management. The design of quantitative tools for assessing the status of resources, their distributions and interactions is a necessary component supporting ecosystem-based management. Visualizing and providing benefit/cost assessments of management alternatives considering these five dimensions is a unique challenge that can be met by developing the next generation of GIS applications.

Introduction & Overview

- Background - Ecosystems Approaches to LMR Management
- Ecosystems Pilot Projects and "EcoGIS"
- Goals and Questions for the Workshop
- Agenda and Practical Details



What is the definition of an ecosystem approach to management?

NOAA defines an ecosystem approach to management as one that is:

- Adaptive
- Regionally directed
- Takes account of ecosystem knowledge
- Takes account of uncertainty
- Considers multiple external influences
- Strives to balance diverse societal objectives

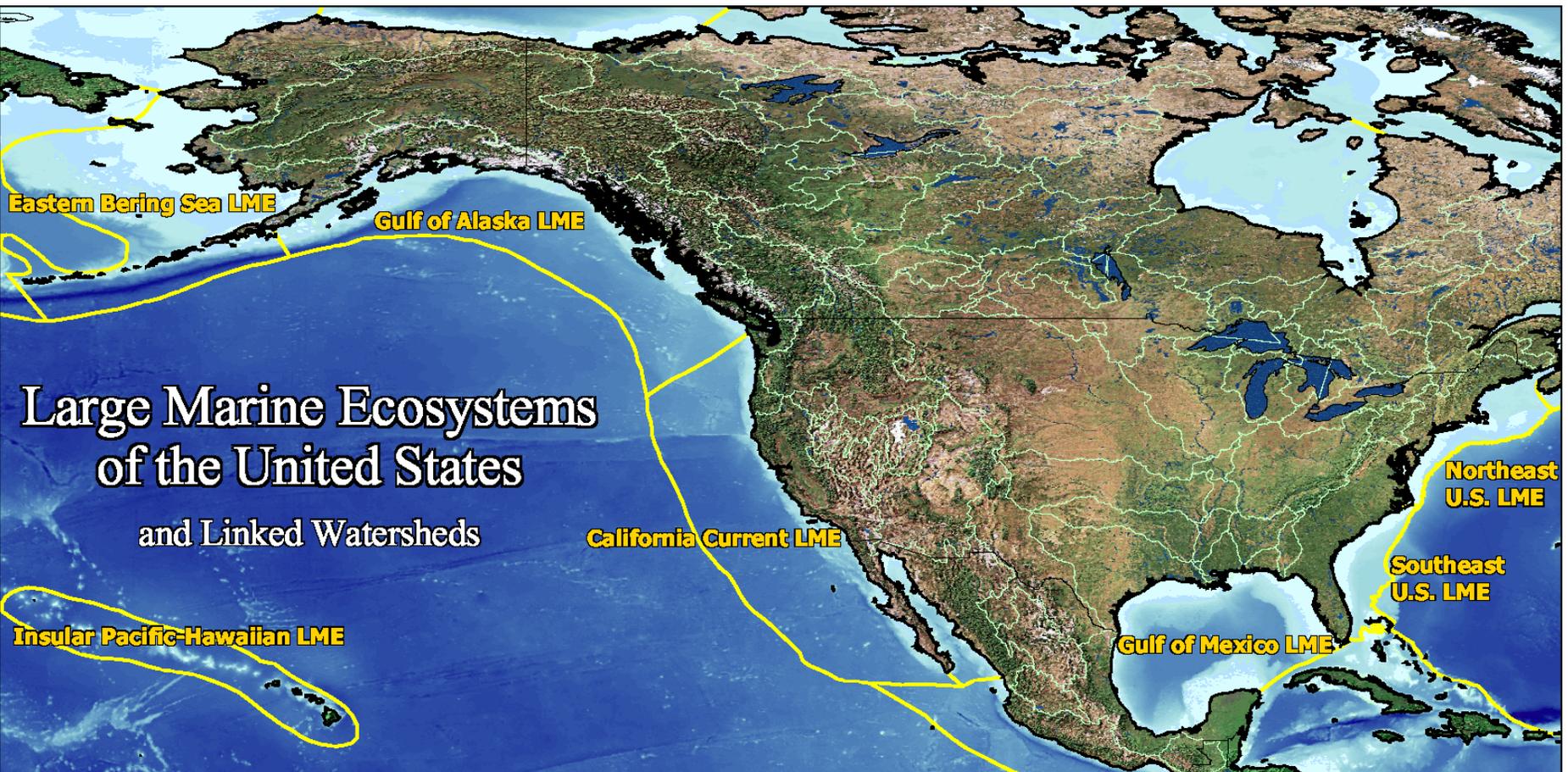
What are marine ecosystems, and how will they be delineated?

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

The **environment** comprises the biological, chemical, physical, and social conditions that surround organisms. Therefore, when appropriate, the term environment should be qualified as biological, chemical, physical, and/or social.

Delineation of the scale of individual ecosystems is based on the spatial extent of the system dynamics that are to be studied or influenced through management. Specific ecosystem boundaries are based on discontinuities in the geographic distribution of ecosystem characteristics and management jurisdictions. This will lead to specifying ecosystems at a hierarchy of scales with boundaries that sometimes overlap.

Example of Regional Ecosystem: Large Marine Ecosystems



Delineation workshop here last week among numerous agencies

How will an ecosystem approach to management be implemented?

NOAA recognizes that the transition to an ecosystem approach to management needs to be incremental and collaborative. Much of what exists in current laws mandating environmental protection and regulating fisheries, protected species, and essential habitats, form the building blocks of an ecosystem approach to management. NOAA's vision is to supplement existing governance structures and supporting science to better address issues on holistic rather species-by-species or issue-by-issue levels. By their nature, ecosystem approaches will be inclusive of a broader set of societal concerns than do each of the existing governance institutions, individually.

Main Ecosystems Issues relevant to LMR Management:

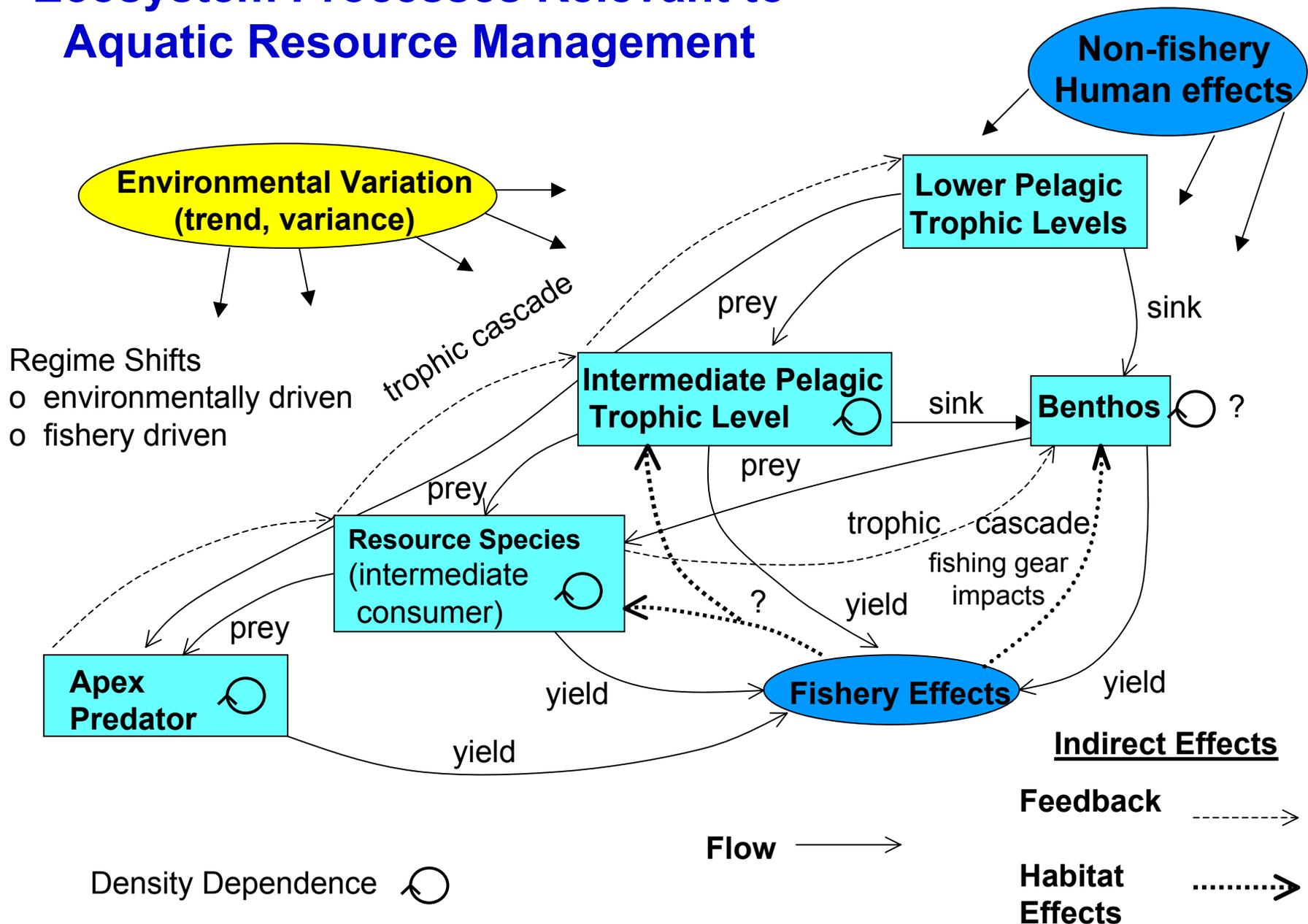
Indirect Effects of Harvesting: Indirect effects of harvesting through trophic interactions, and indirect effects through habitat-alteration, e.g. by fishing gear

Interactions between Biological and Physical Components of Ecosystems: Trends in environmental variables (e.g. temperature, other oceanographic attributes) may result in long-term re-structuring of ecosystems

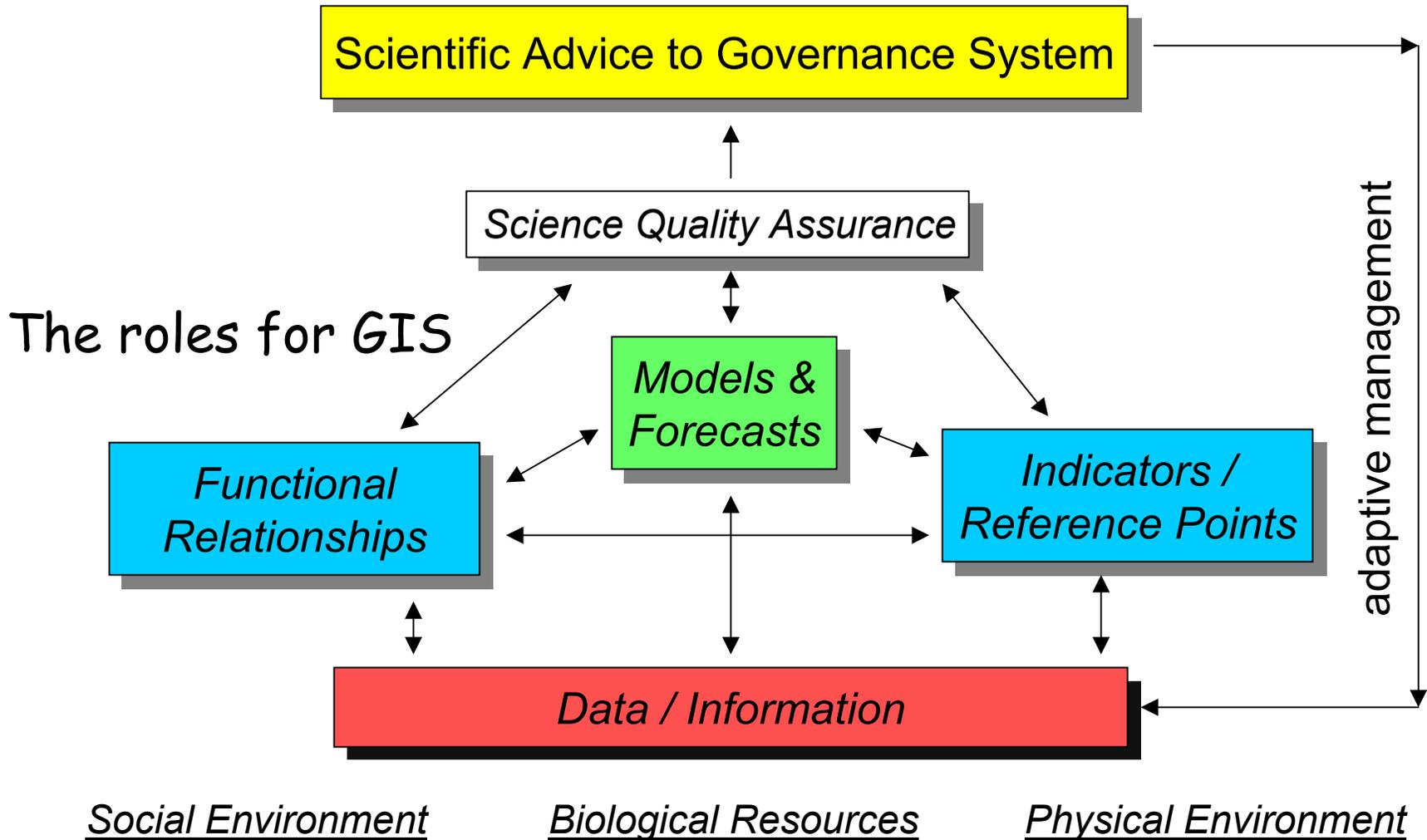
Bycatch or Fishery Interactions: Bycatch and fishery interactions including mortalities of non-target species arise when multiple fisheries share the same species.

Individual governance institutions do not have a sufficient authority to consider all critical issues affecting LMRs in regional ecosystems (e.g., nutrients, toxics, coastal modifications, etc.)

Ecosystem Processes Relevant to Aquatic Resource Management



Decision Tools Supporting Ecosystem Approaches for LMR management



Duality of Ecosystem Effects and Living Marine Resources

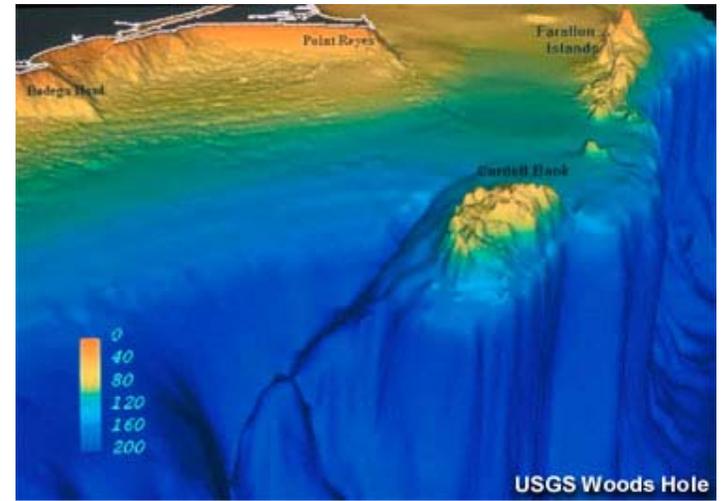
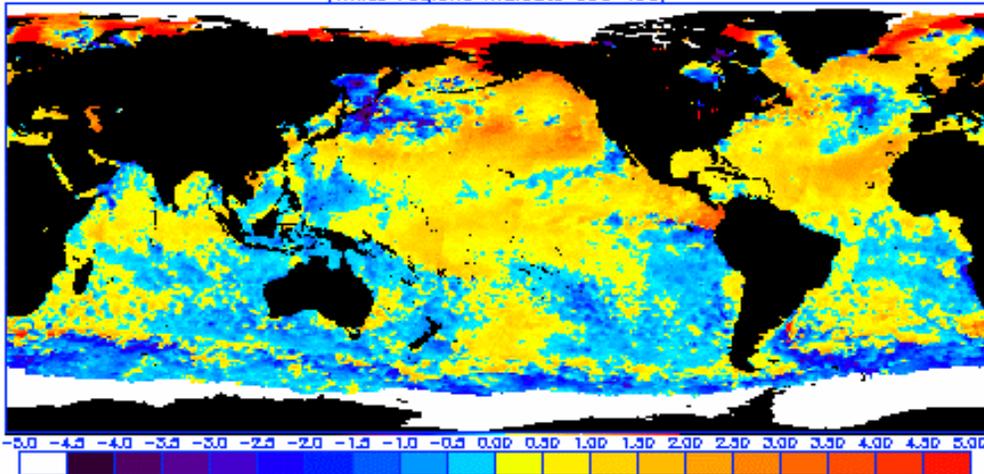
- Understanding ecosystem effects on individual stocks
- Understanding the effects of cumulative human effects and natural variability on Productivity, Structure, and Variability of ecosystems



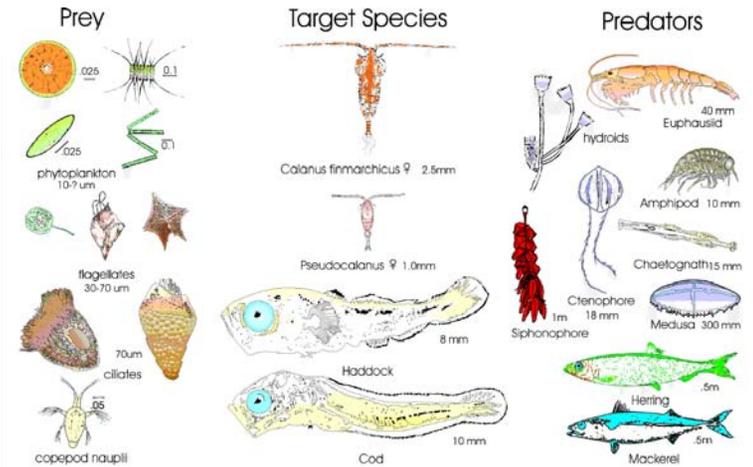
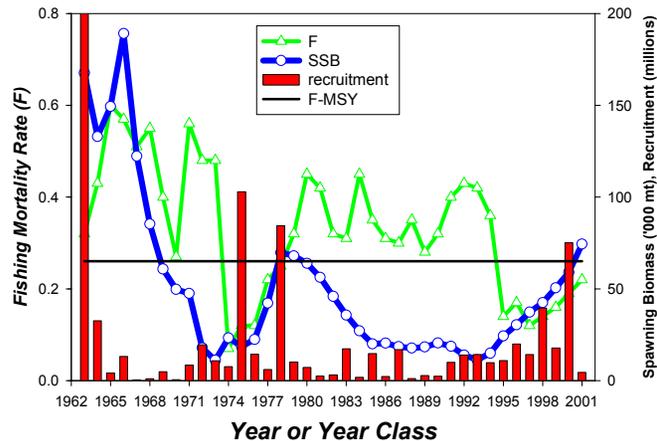


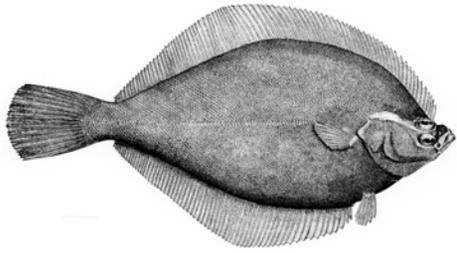
Challenges of Managing Marine Resources in 5 Dimensions

NOAA Current SST Anomalies (C), 8/31/2004
(white regions indicate sea-ice)



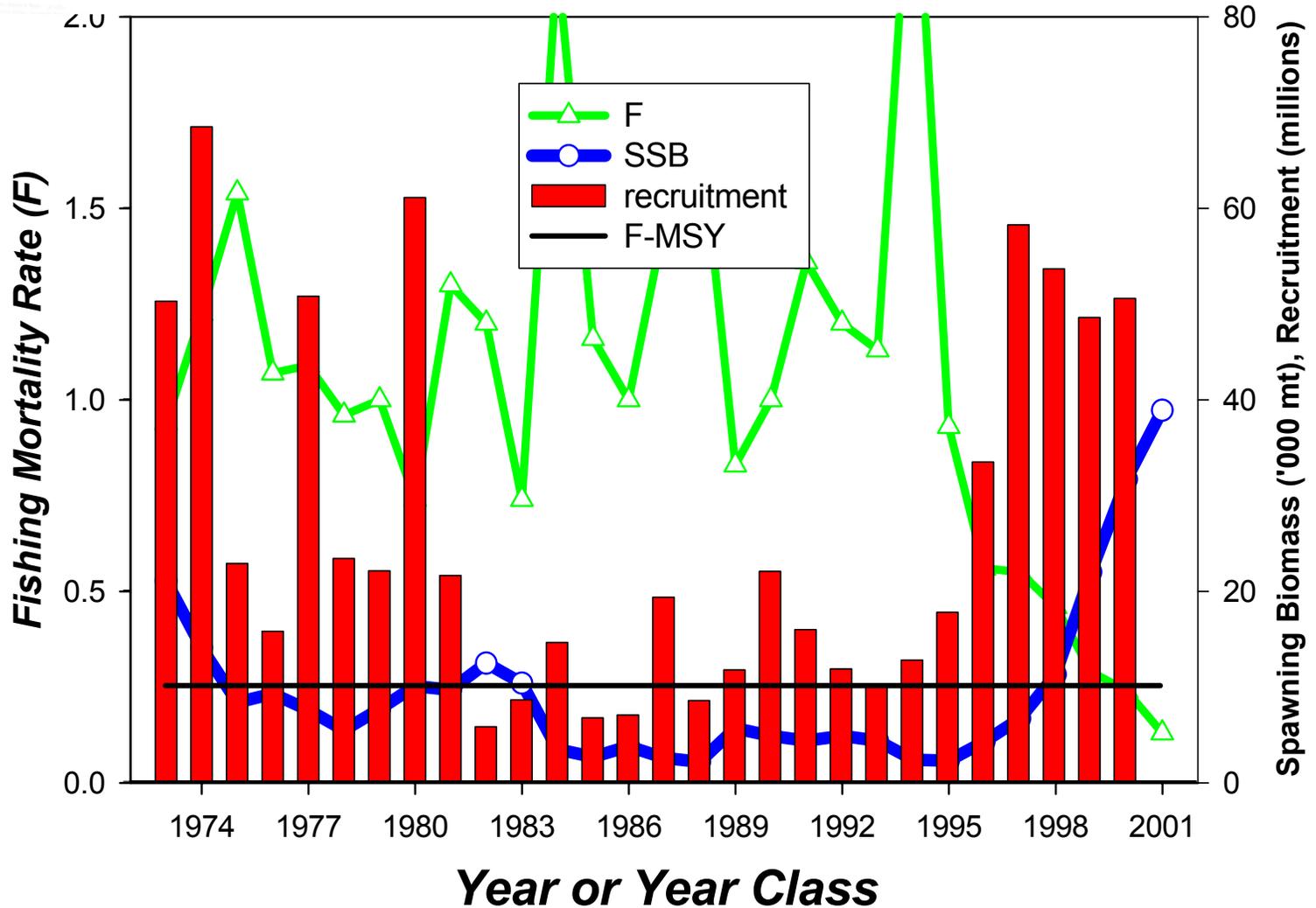
Georges Bank Haddock



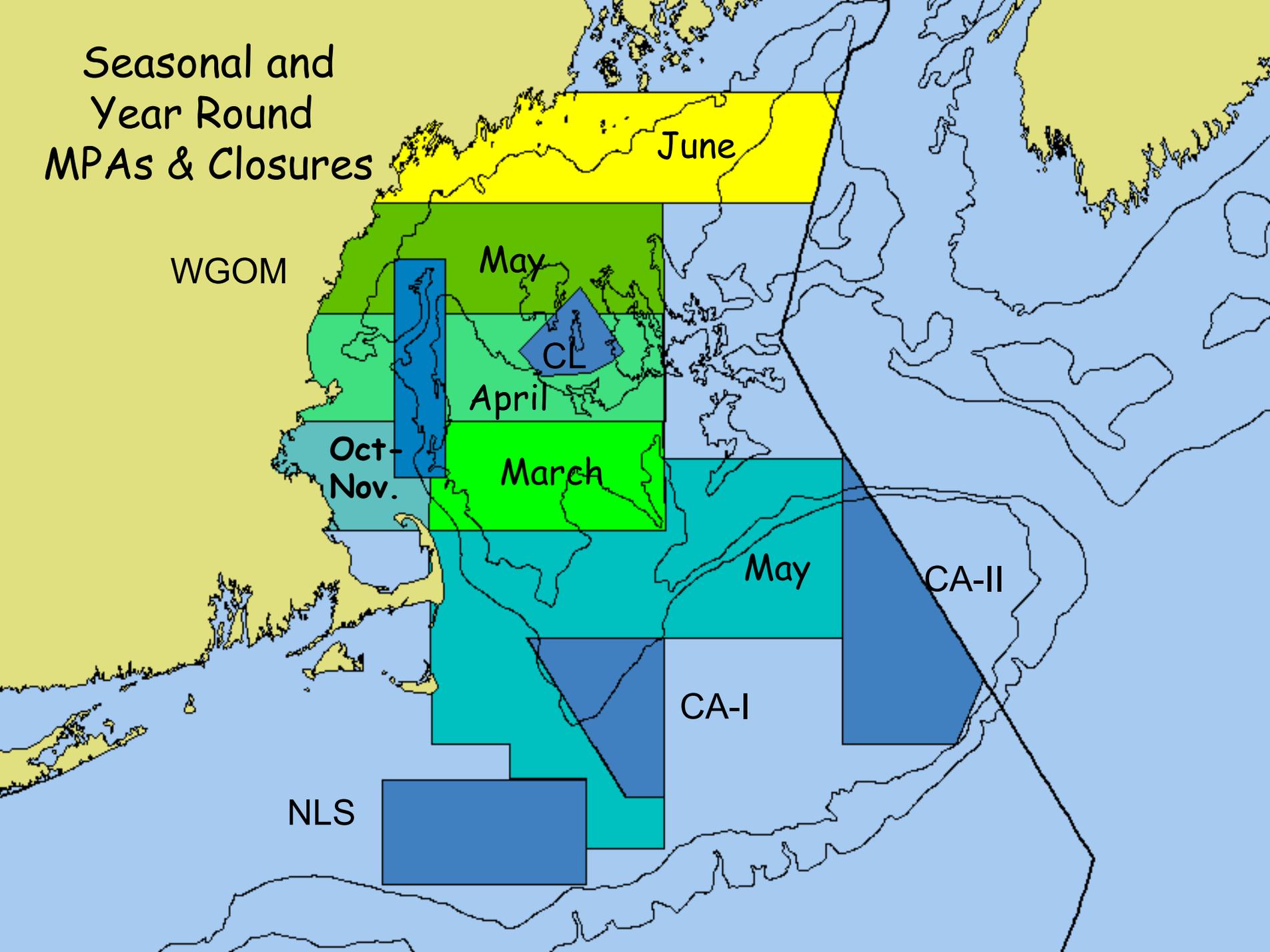


A Multidimensional example...

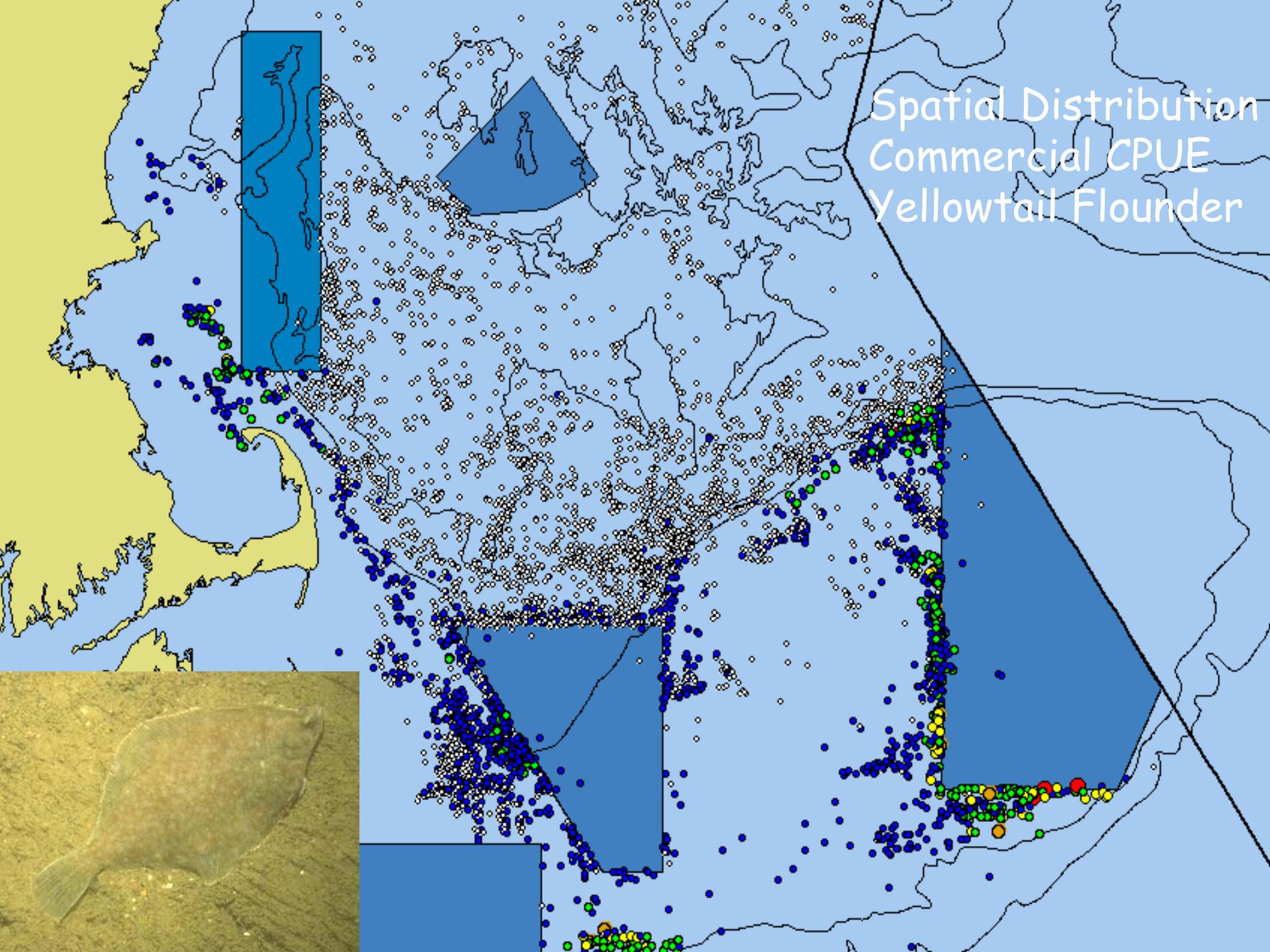
Georges Bank Yellowtail



Seasonal and Year Round MPAs & Closures



Spatial Distribution
Commercial CPUE
Yellowtail Flounder

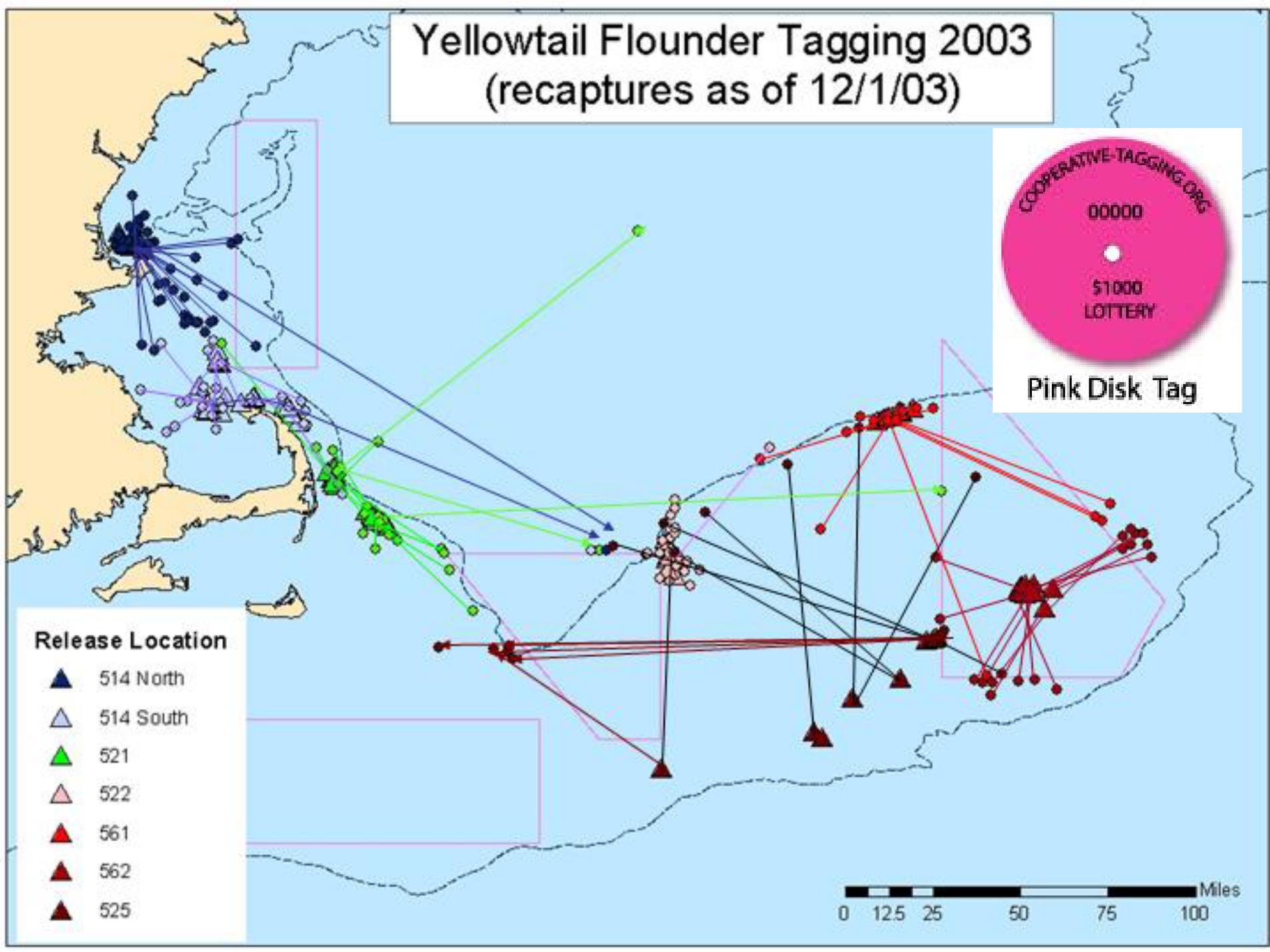


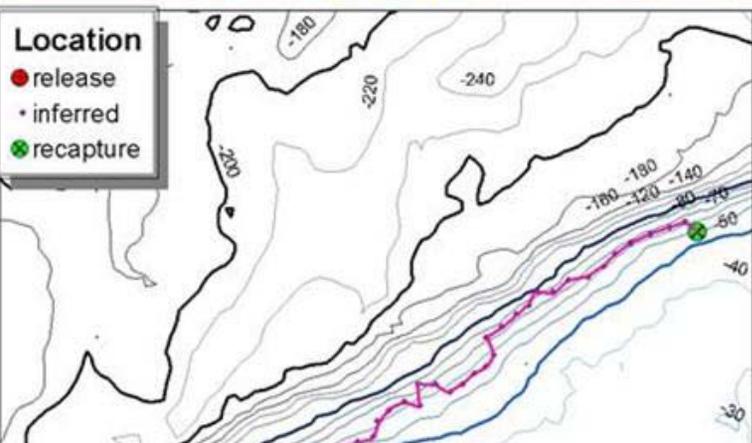
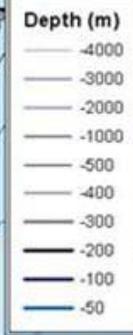
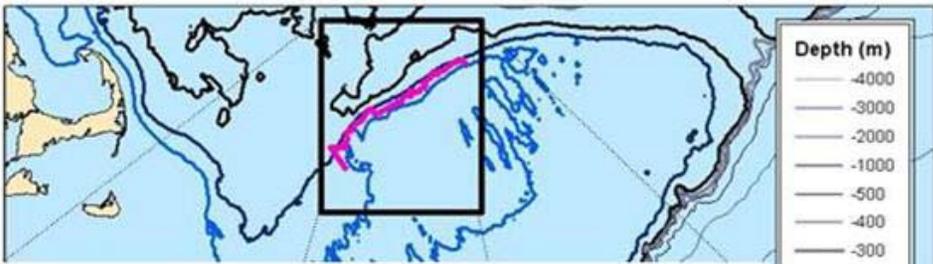
Yellowtail Flounder Tagging 2003 (recaptures as of 12/1/03)



Release Location

- ▲ 514 North
- ▲ 514 South
- ▲ 521
- ▲ 522
- ▲ 561
- ▲ 562
- ▲ 525

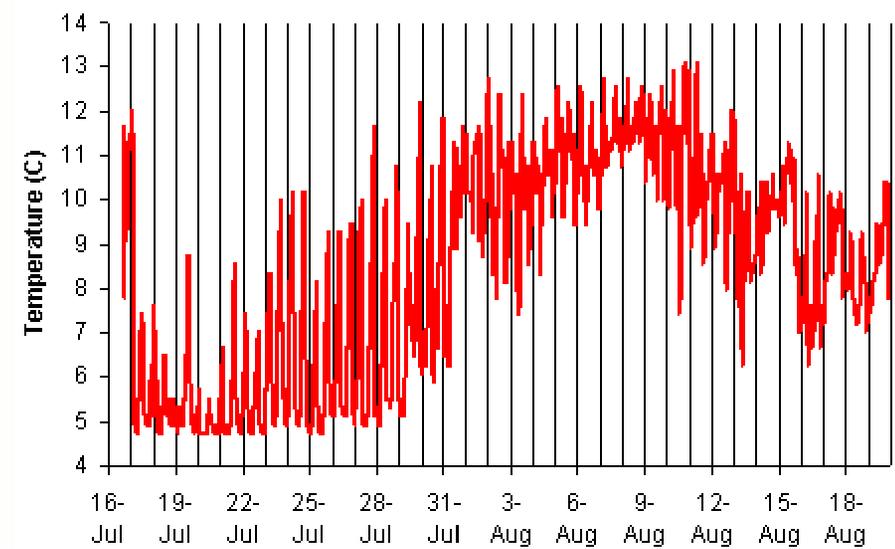
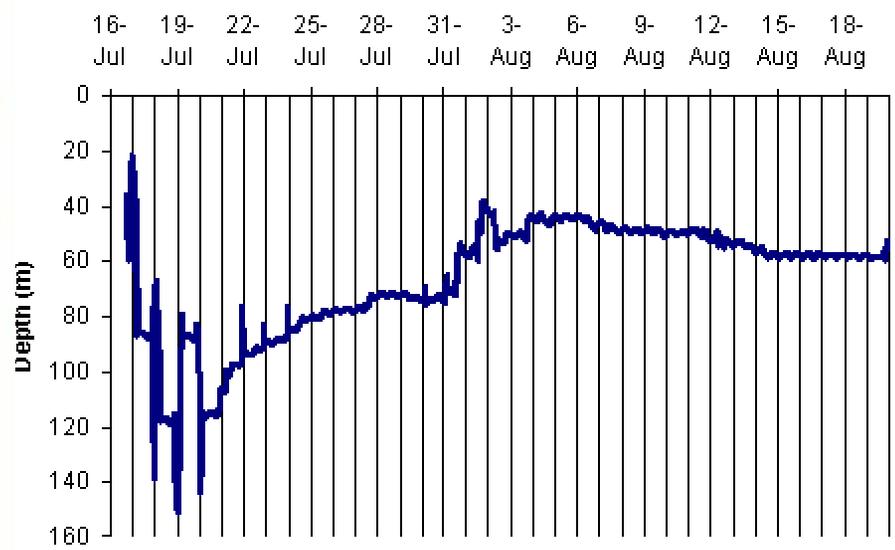




Data Storage Tag

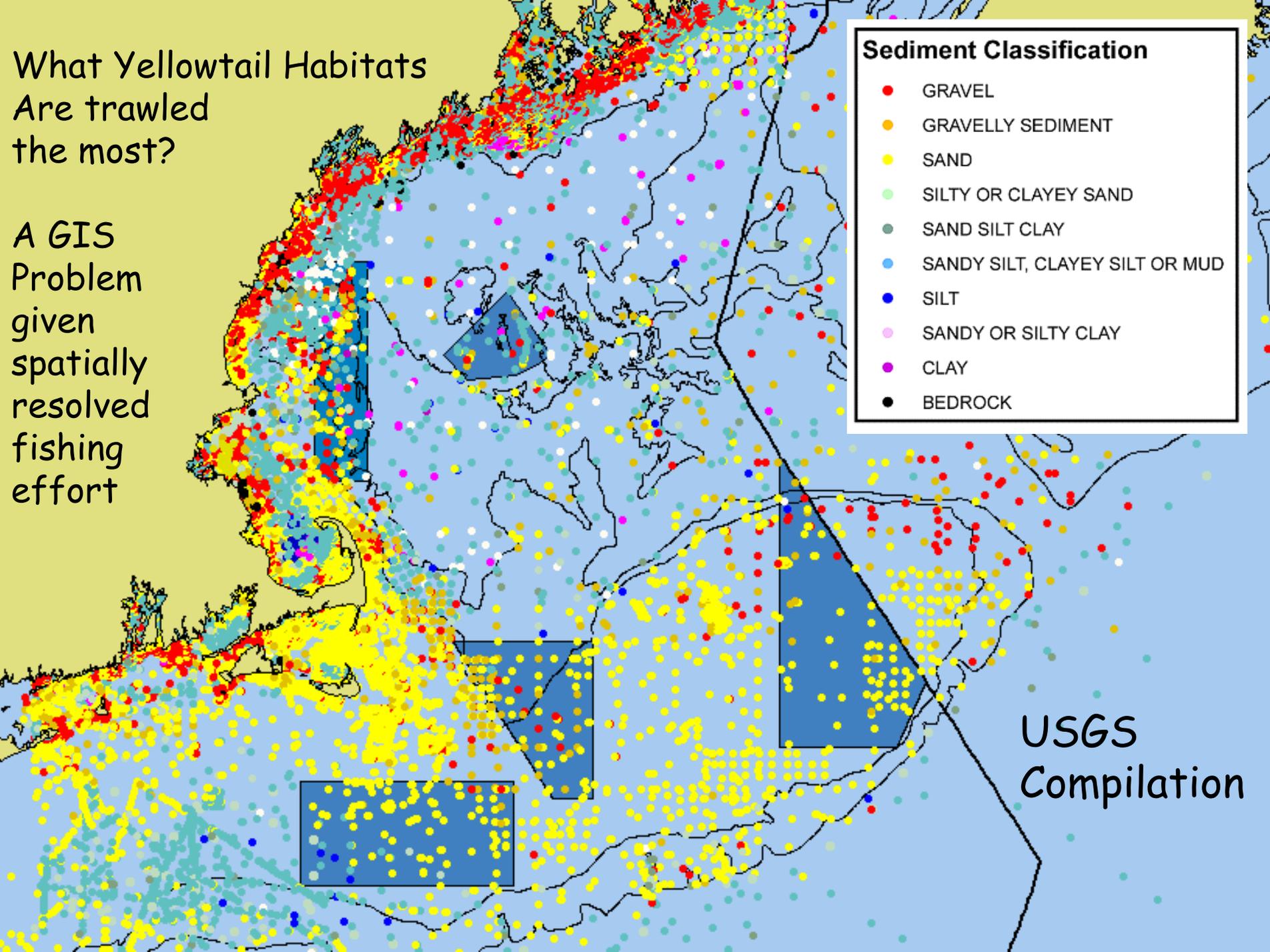
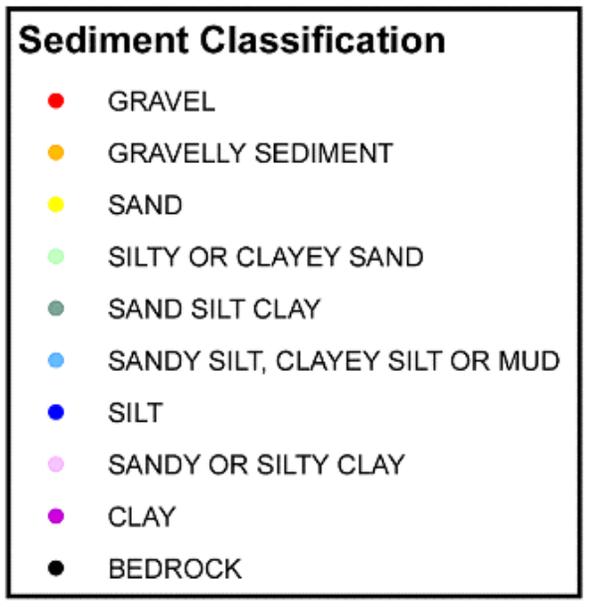


Depth in meters



What Yellowtail Habitats
Are trawled the most?

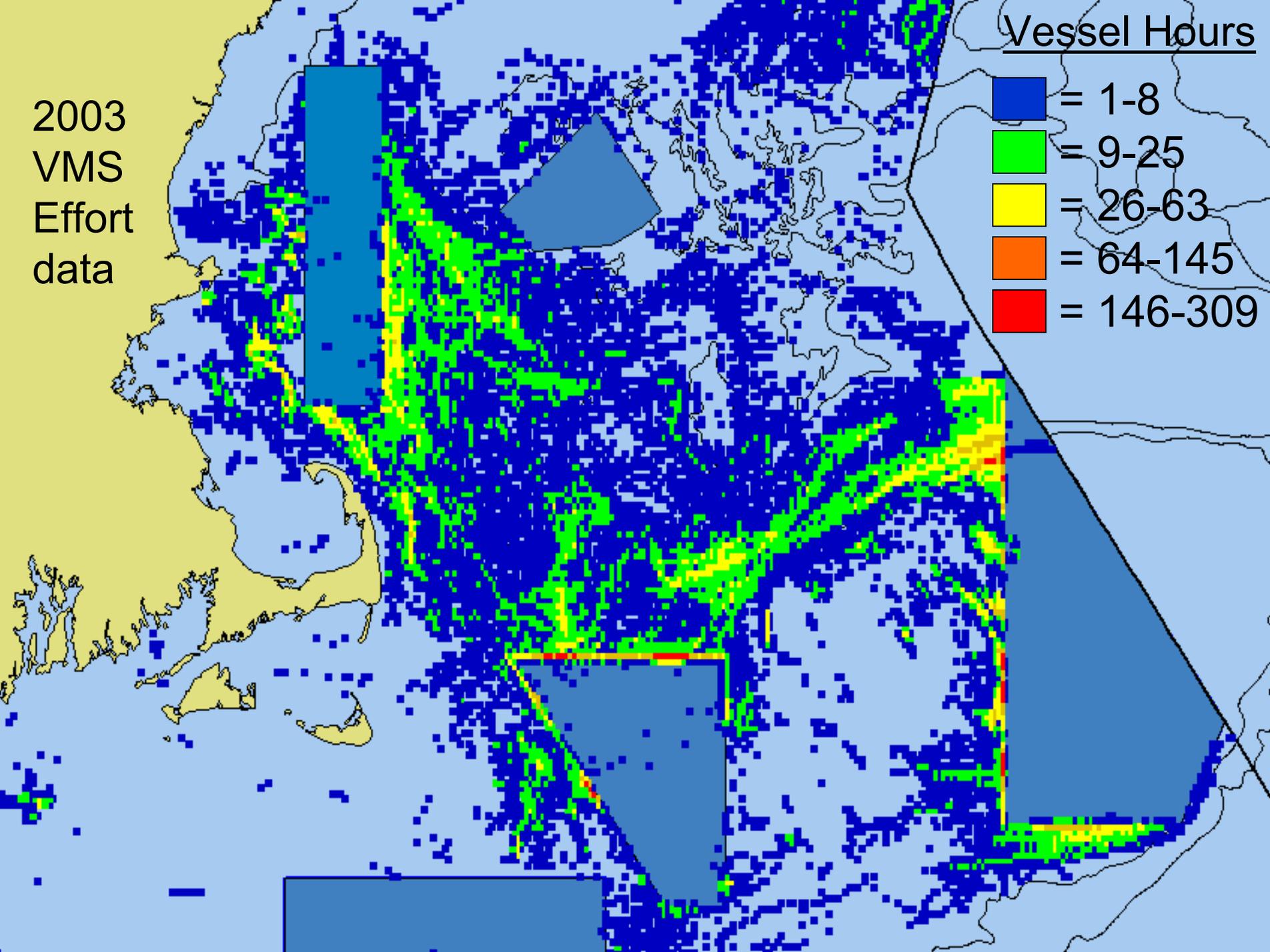
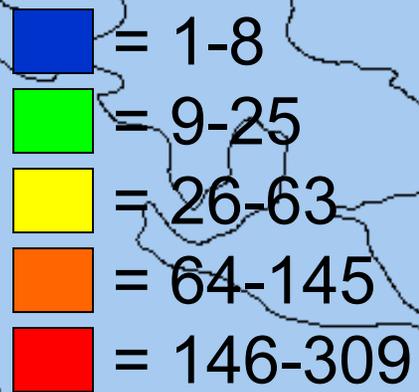
A GIS
Problem
given
spatially
resolved
fishing
effort



USGS
Compilation

2003
VMS
Effort
data

Vessel Hours



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.”

Spending Plan for Ecosystem Pilot Projects

Enhance Regional Ecosystem Governance Structures through Fishery Management Councils (FMCs)

- Determine Management Objectives, Threats, Options, and Alternatives – evaluate ability of Councils to expand their remit

Conduct Technical Workshops

- Establish dialog between science and management in applying ecosystem principles to fisheries
 - * Assess the state-of-the-art, and facilitate dialog
 - * Determine technical needs

Develop Quantitative Decision Support Tools

- Develop quantitative methods, frameworks and software to aid decision makers in evaluating management options and their consequences (models and GIS tools)

Fishery Management Council Projects

**NEW ENGLAND
FISHERY MANAGEMENT COUNCIL**



**Gulf of Mexico Fishery
Management Council**



Goals & Tasks:

- Conduct public meetings with stakeholder groups to identify and prioritize ecosystem-related issues
- Participate in coordinated opinions/attitudes survey with wider public input
- Identify technical needs & inventory existing regional Information (including that held by NOAA)
- Synthesize public input on Ecosystem Goals and Objectives

Developing Decision Support Tools Projects Funded for FY-04

Competitive RFP - 23 projects proposed, some w/university cooperators

- A Spatially-Explicit Ecosystem Model to Examine the Effects of Fisheries Management (NW Center, U Washington, CSIRO-Australia)
- Ecosystem-Based Decision Support Toolbox (NE Center)
- Development of Quantitative Performance Indicators for Ecosystem Management (SE Center)
- Ecosystem Attributes and Adaptive Approaches During Stock Rebuilding (SW Center & UC-Santa Cruz)
- Analytical Framework Development for EFH (SW Center, NW Region)
- Critical Evaluation of Ecopath and Ecosim Modeling Approaches (NW Center U Washington, U British Columbia)



GIS Applications in Support of Ecosystem Approaches to Fisheries Management (EcoGIS)

Goal is to develop analytic capabilities of advanced GIS to support Ecosystem Approaches (e.g., more than just drawing maps) – not necessarily just to provide specific applications for use by Councils

Two Types of GIS Products to be developed:

- Management-Level Applications with graphical user interface and ability to quickly and easily summarize data layers
- Science-Level Tools, with imbedded modeling and optimization capabilities

Primary Developers are several units of **National Ocean Service**. Test data series and project oversight by provided by S&T, HC, NE, SE Centers ~ This Workshop is the first step

~~ Workshop Goals ~~

- Increase awareness of the capabilities of ecosystem-based fishery management and how spatial data and geoprocessing techniques can be used to support these efforts - **Overview session to follow**
- Understand the priority issues facing fishery managers and scientists in developing and implementing ecosystem-based fishery management Plans - **Council Needs Session**
- Develop requirements for GIS tools to support the needs of fishery managers and scientists, and ensure that these requirements are broad enough to serve all regions of the country - **Science/Data Needs & discussion**
- Provide clear guidance for the joint NMFS/NOS GIS tool development project - **Breakout and plenary**

Management Needs - Some Starter Questions

- ✓ What spatial data, analyses, and mapping capabilities do FMCs need in order to manage fisheries from an ecosystem perspective?
- ✓ If you could design the ultimate map to communicate your management decisions or fishery ecosystem plans to stakeholders, what would the map contain?
- ✓ How do Council staff and your stakeholders use maps (e.g., hang on walls, draw on them, email them, interact with them online)?
- ✓ How would you evaluate the performance of an ecosystem plan?
- ✓ What issues does your Council have regarding EFH, trophic interactions, bycatch interactions, etc.? What spatial tools do you need to resolve these issues?
- ✓ What are the top 10 requests you get for spatial data or analyses?

Agenda

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- Broad-Based Discussion of GIS State-of-the Art
- Presentations and Discussion of management Needs

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- Data Currently available and Data Gaps
GIS Capabilities in NOAA Agencies
- Science needs in GIS to link structure and processes

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- "Straw man" for GIS Development Project & Discussion
- Wrap-up and Summary

Ecosystem Governance by FMCs

- Grants to Four Atlantic Fishery Management Councils (NE, MA, SA, GoM - \$225 k each)
- Evolving perspectives on ecosystem requirements (just as with single species approaches to management)
- Purpose is to engage Councils and their constituencies in public debate on goal setting, types of considerations to be included in EAF, and what issues are not covered under existing authorities (e.g, where other regional Governance Institutions must coordinate)
- Some Councils further along than others (e.g., **South Atlantic Council**), so One Size Does Not Fit All
- All Four Councils responded with proposals, (GoM and MA are signed)
- All four Councils have now established Ecosystem Committees



Ecosystem Pilot Projects ~ Next Steps

- Implement Council Grants by September (NOAA Grants)
- **EcoGIS Workshop** (this week, Charleston, SC)
- **Decision Support Tool Workshop** (September 13-17, Key Largo, FL, Ivan willing....)
- **Social Science Survey Instrument and Council Staffs Workshop** (September 13-14, Panama City, FL, Ivan dependent)

