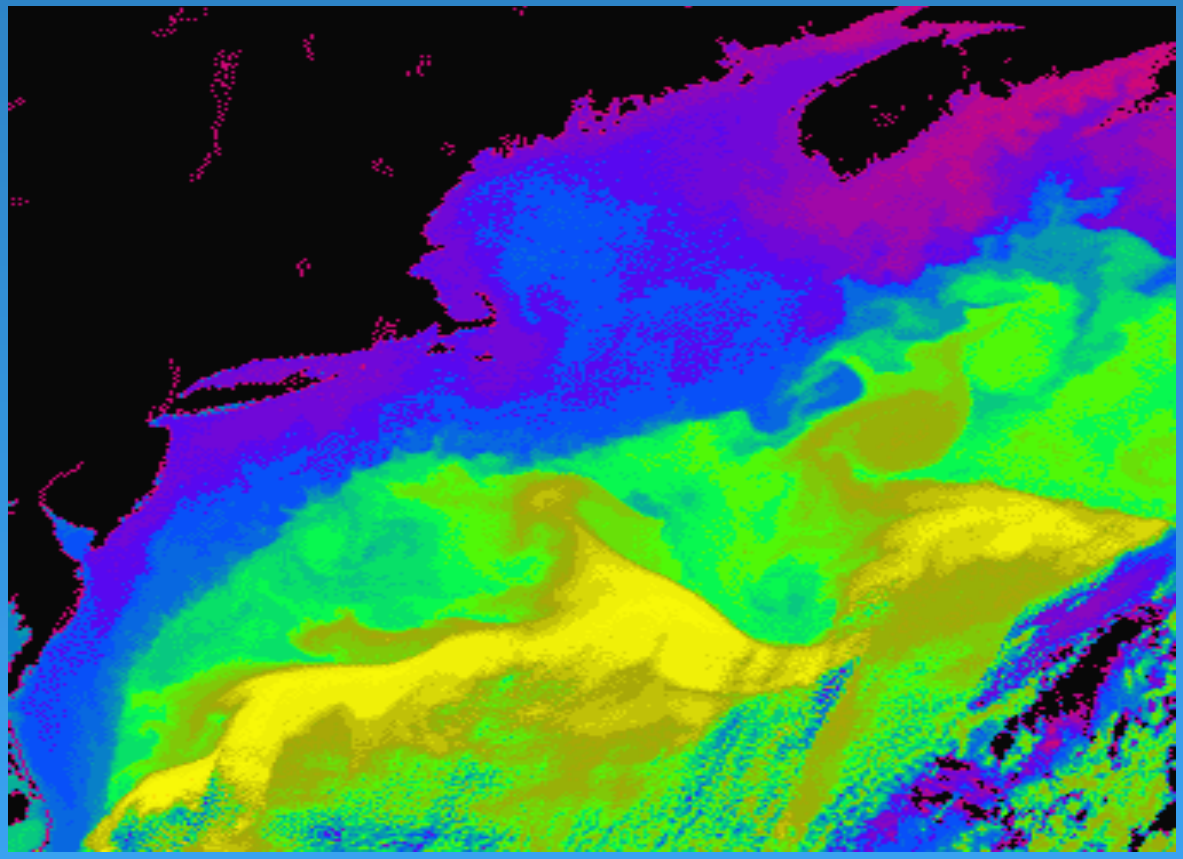
Use of High Resolution Data in NOAA's Fisheries Management



Steve Murawski

NOAA Fisheries

PRESENTATION OUTLINE

- Legislative Mandates
- NOAA Fisheries Programs
- Roles for Satellites supporting science & management for LMRs

LEGISLATIVE MANDATES

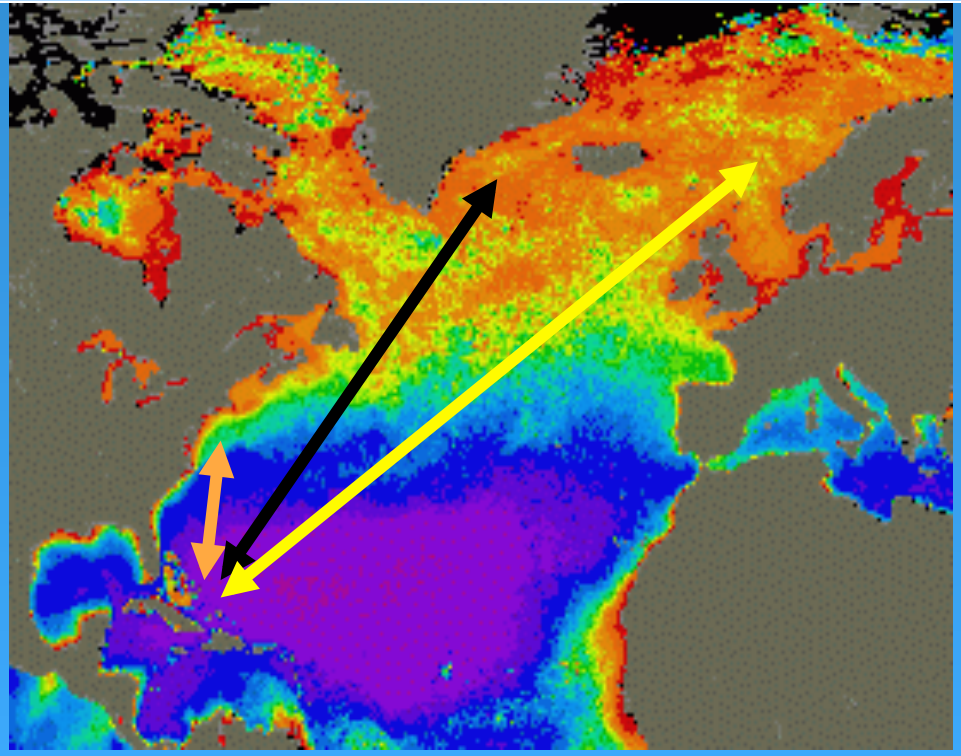
- Magnuson-Stevens Fishery Conservation and Management Act
- Marine Mammal Protection Act
- Endangered Species Act
- National Marine Sanctuary Act
- Coastal Zone Management Act
- Coral Reef Conservation Act
- Dozens more…

Marine Mammal Protection Act

- Controls take and importation of marine mammals
- Directs that stocks be maintained at or above optimum sustainable population level in order to be functioning element of their ecosystem
- Requires reports on status of stocks

Population Structure of Humpback Whales

- Complex biological structure across ocean basins
- Complicates spatial scale for management



For Fisheries - National Standard 1

- **Conservation and management measures shall *prevent overfishing* while achieving, on a continuing basis, the *optimum yield* from each fishery for the United States fishing industry.**

- **Cannot do both without accurate scientific information**

NOAA Fisheries Programs

- Program structure has already been described
- Major Functions
  - Science
  - Management
  - Enforcement

First Steps

- Biology –
  - How many fish can be caught each year on sustainable basis?
  - How many marine mammals / protected species can be accidentally killed without jeopardizing recovery?
  - Where are sensitive habitats?

Fishery – Protected Species Comparison

- For marine mammals, comparable population models are used and the "annual catch" becomes "allowable take", but the levels are more precautionary
- For endangered species, we already know they are far into depleted category, so focus is on extinction risk and sufficient recovery to hand-off to sustainable management

Fishery Management

- Output Controls –
  - Quotas
    - Forecast catch that matches policy
    - In-season monitoring to slow/halt as quota is reached
- Input Controls –
  - Allocation between User Groups
  - Effort
    - Limiting participation
    - gear and other restrictions to slow pace of fishery
  - Time/Space Controls
    - To spread out or concentrate fishing as necessary

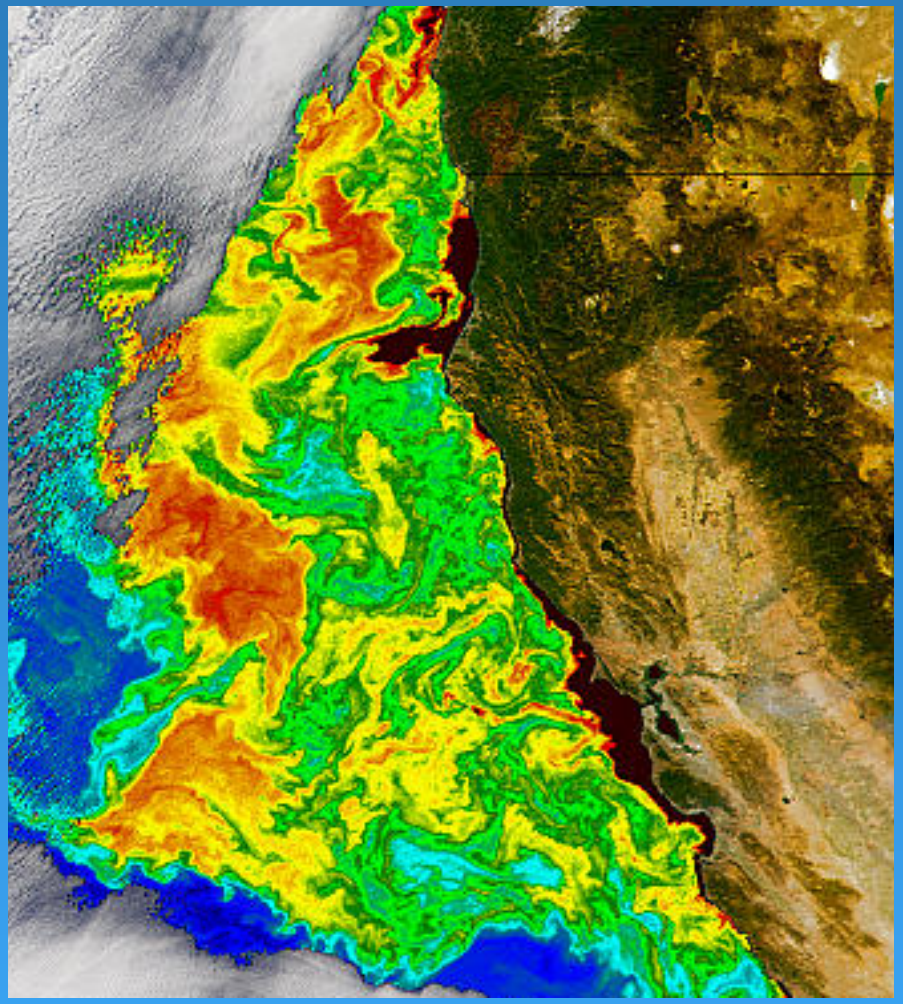
Enforcement

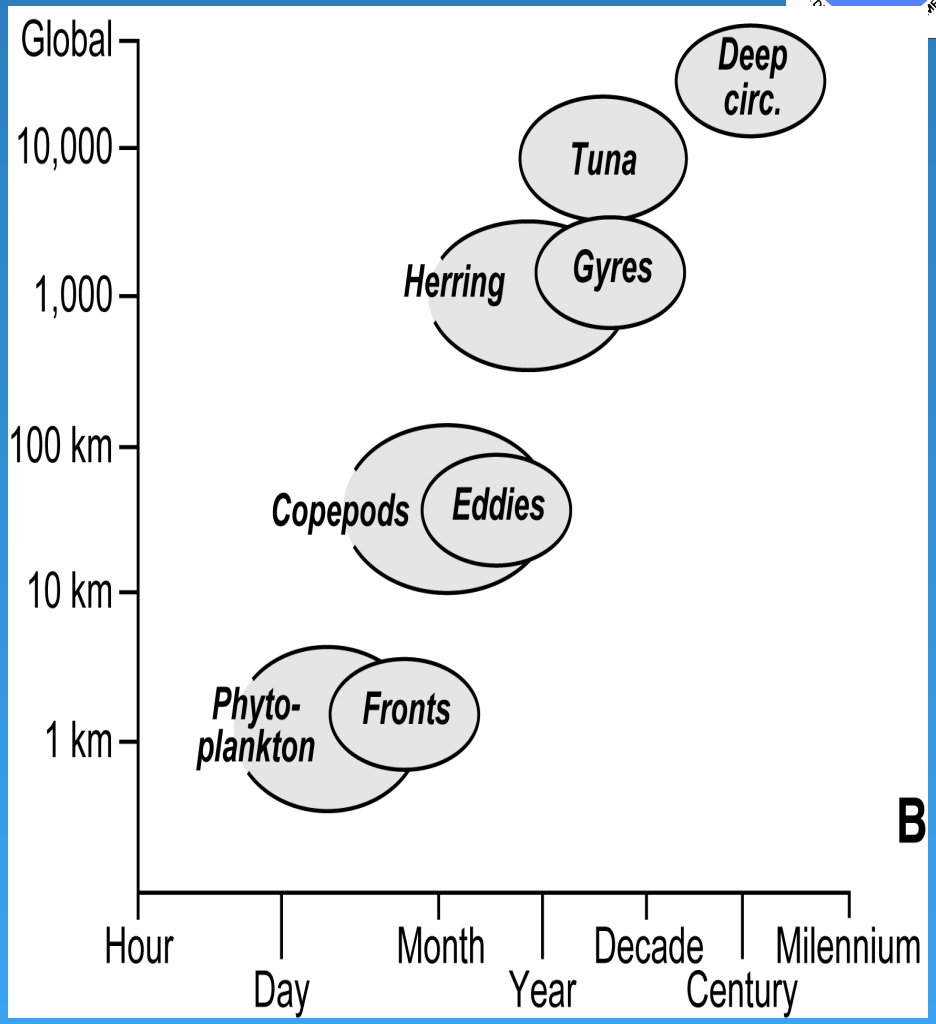
- Computer systems – tracking the paper trail of fish
- Forensics – What's really being caught and sold?
- At-sea and dockside patrols
- Where? – Satellite-based Vessel Monitoring Systems now on >1500 vessels

Some Roles for Satellites

- Tracking tagged animals (mammals, fish, turtles)
- Tracking fishing vessels (VMS)
- Supporting Spatial Management
- Synoptic maps of environmental conditions to understand and predict distribution patterns
- Understanding climate impacts on fisheries (trended and oscillating)
- Supporting Ecosystem Approaches to Management

Scales of Processes and Biota

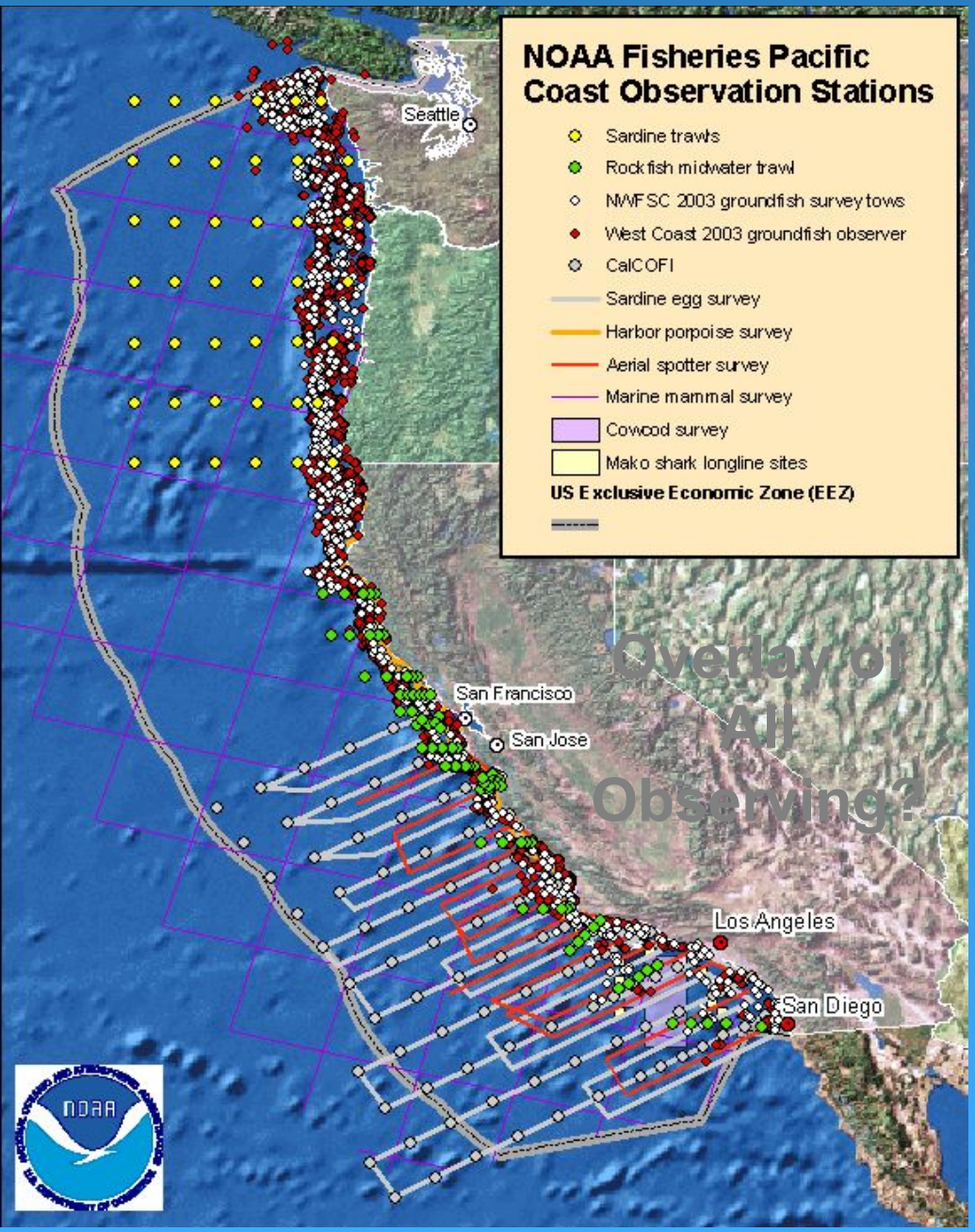




Surface chlorophyll

Time/Space Scales

Integrated Ocean Observing System (IOOS) critical to EAM



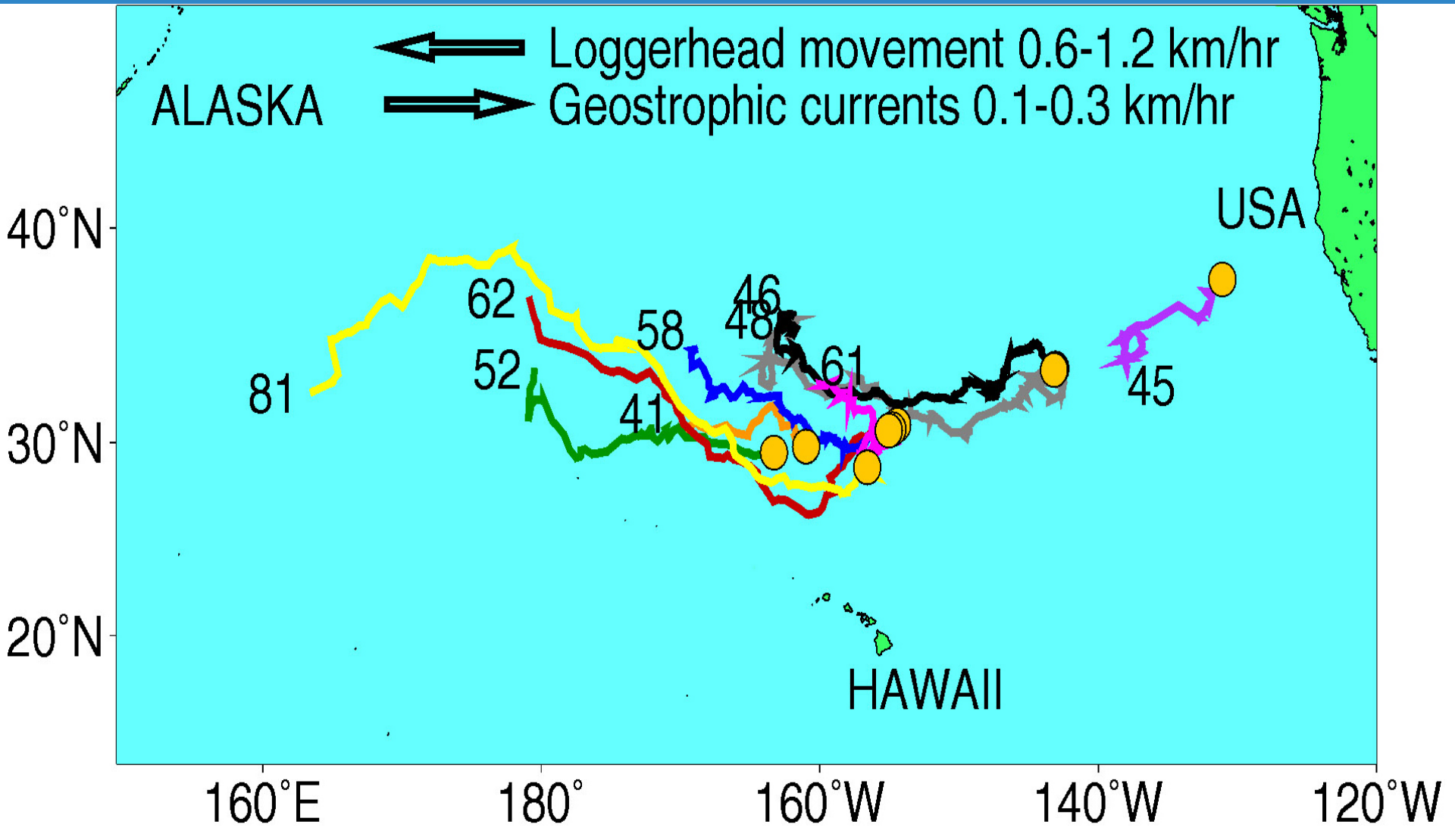
Scalable Ecosystem Observation & Research

- Combination of observations at fixed locations (e.g., NMSs NERRS sites, local interests) and ecosystem-wide observation

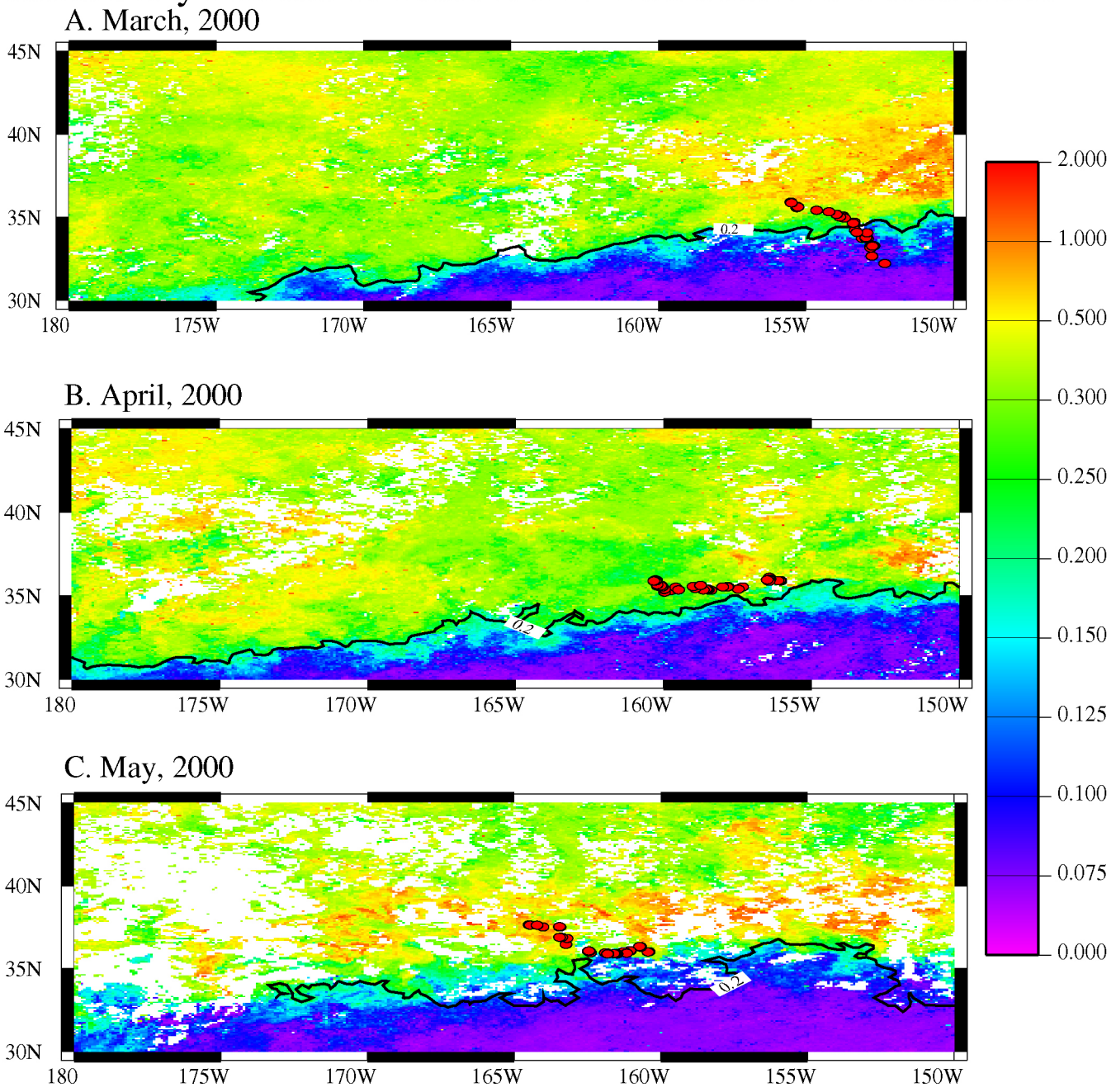
- The whole must be more than the Sum of the parts (avoid discontinuities in sampling density or type at political boundaries)

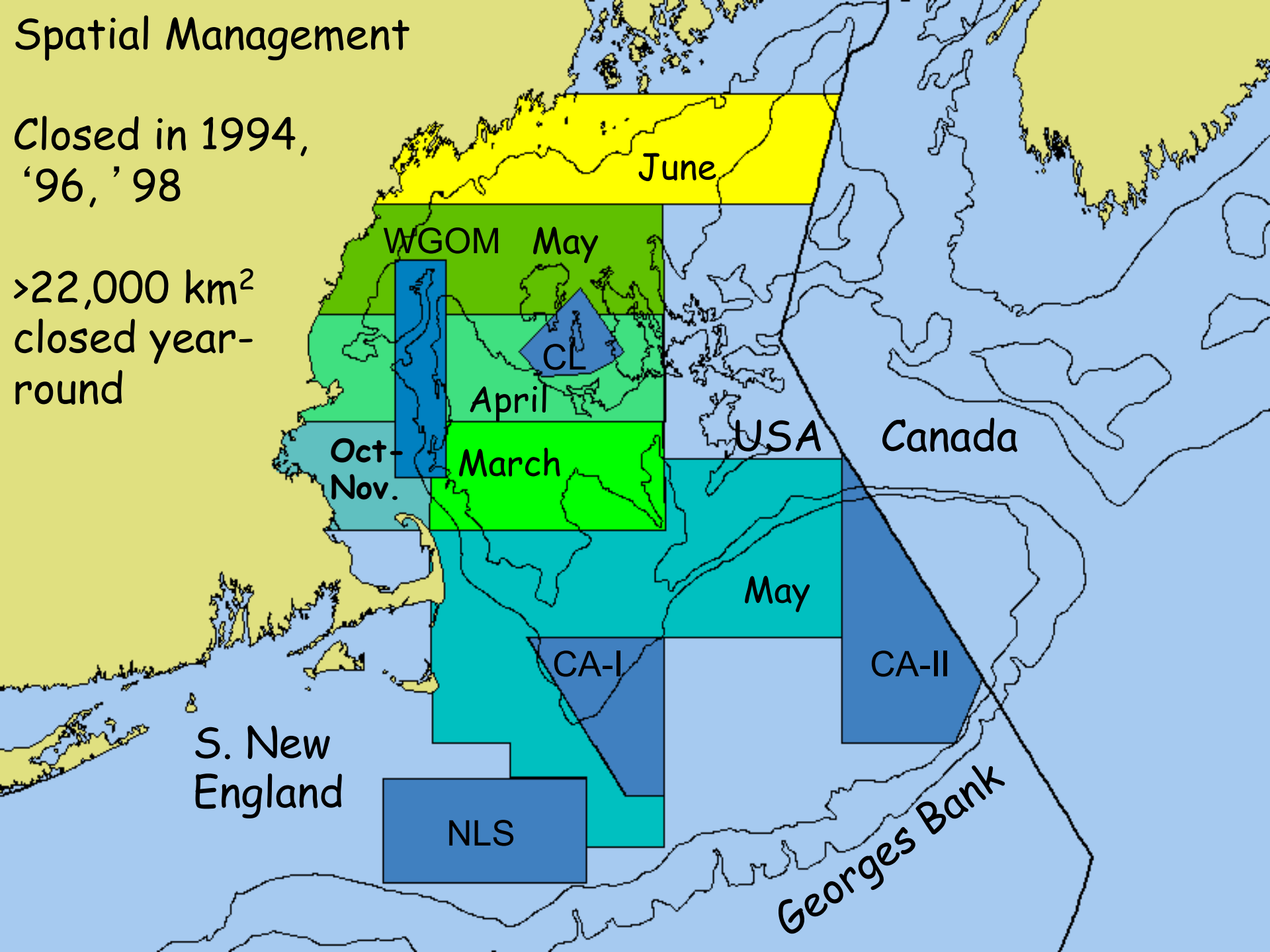
- Priorities for observing are:
  - Coordinating sampling,
  - DMAC,
  - Products

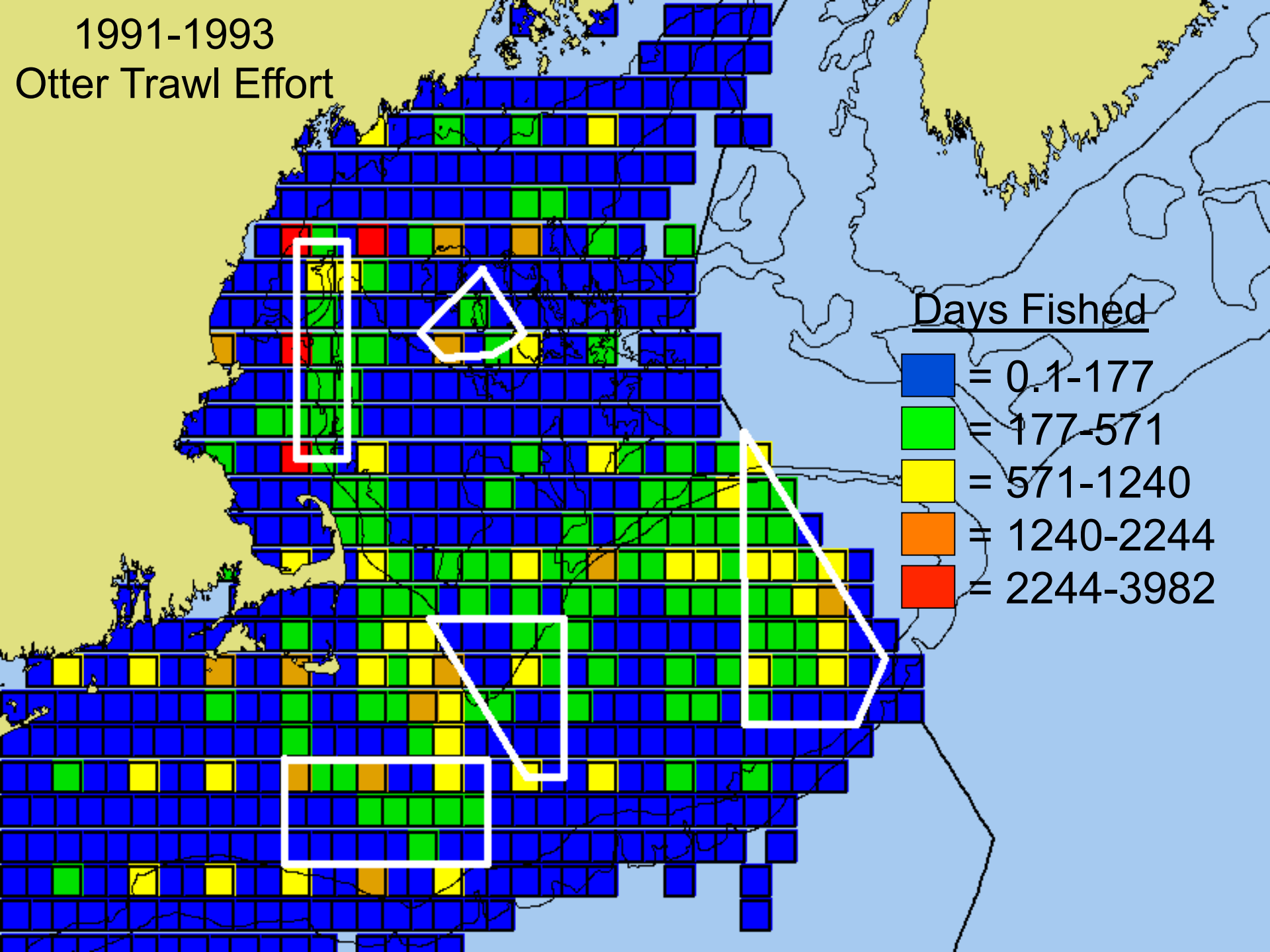
Loggerhead Turtle Movement

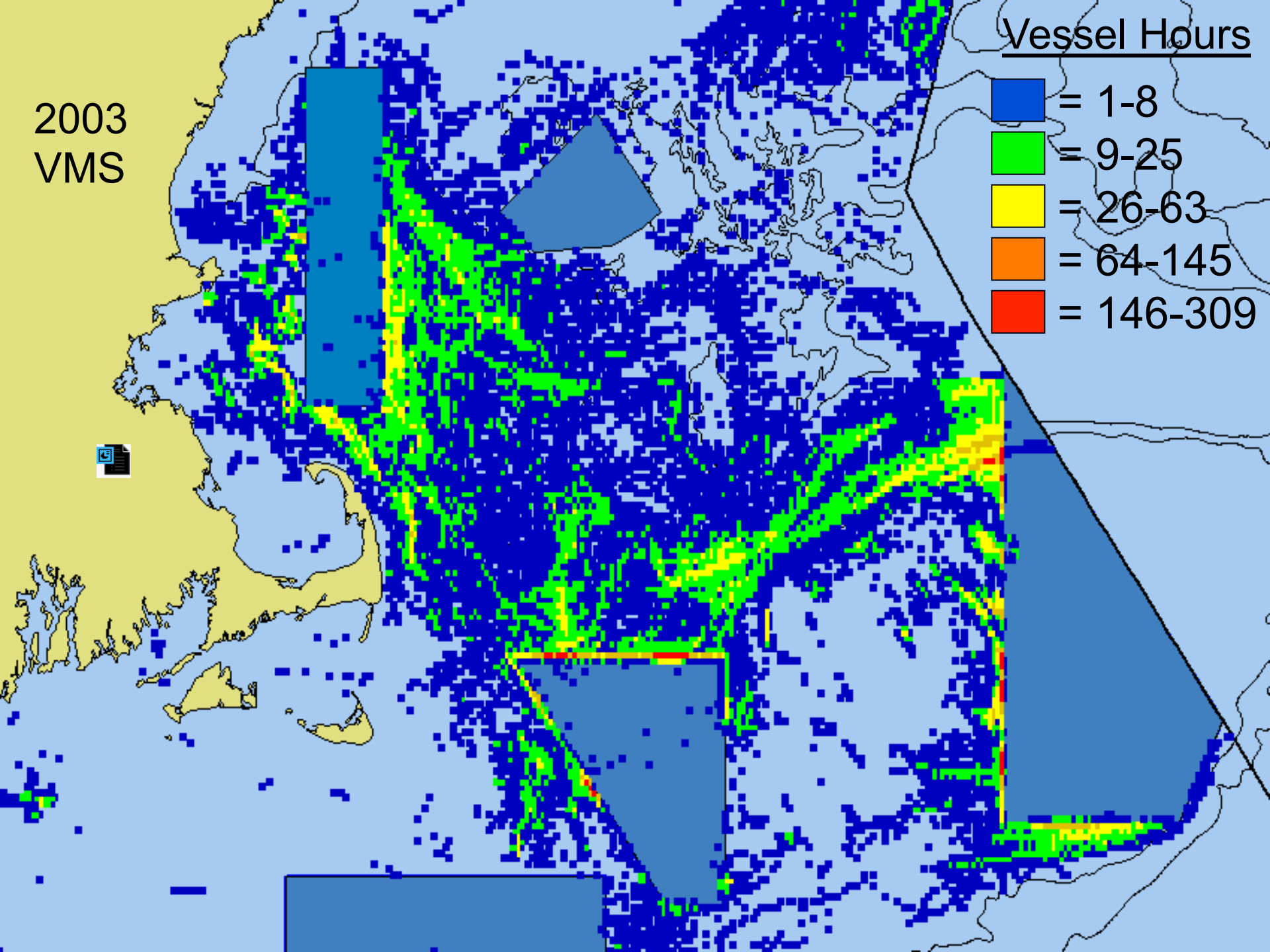


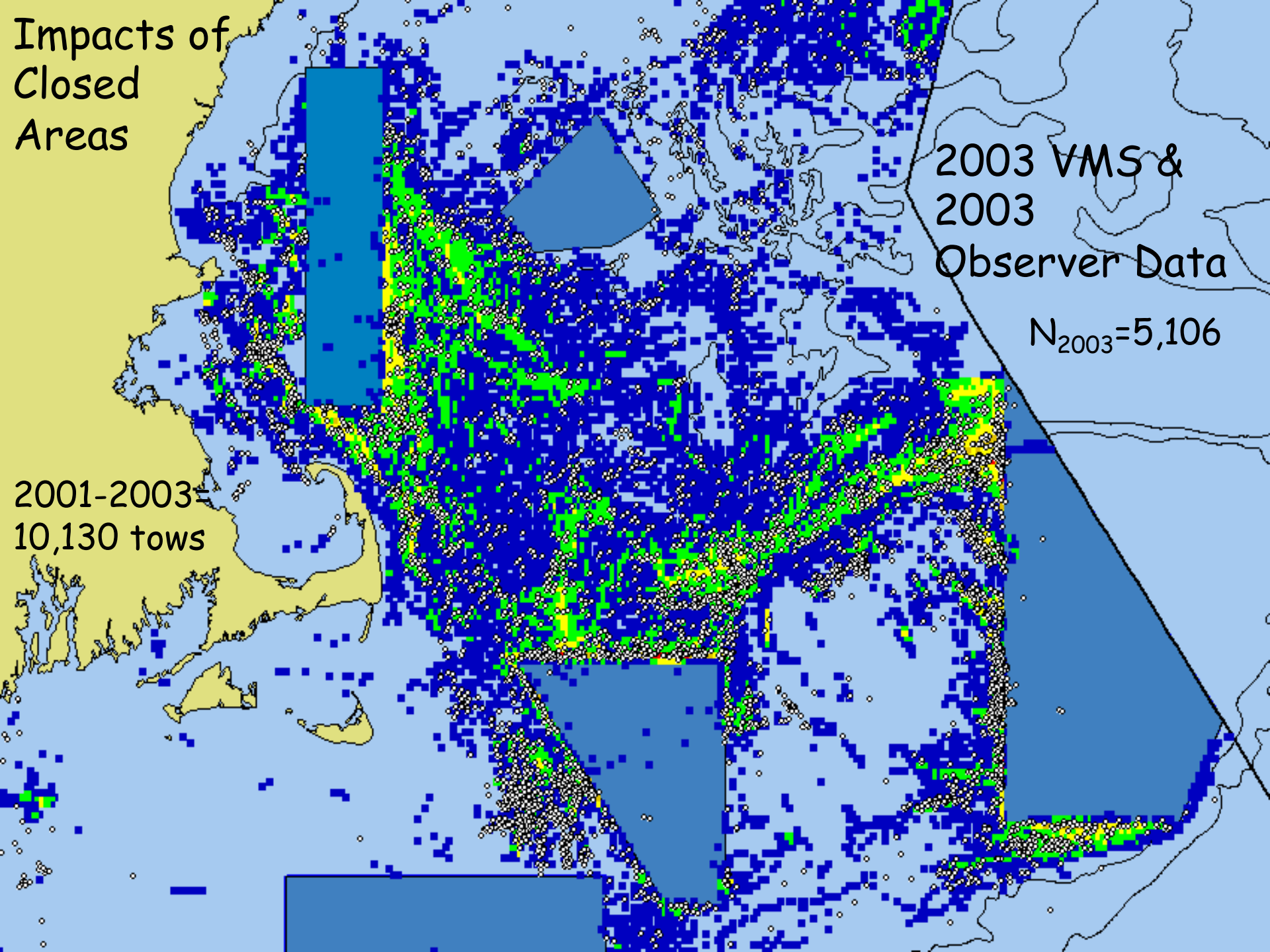
Mean Daily Position of Turtle 22174 With SeaWiFS Ocean Color

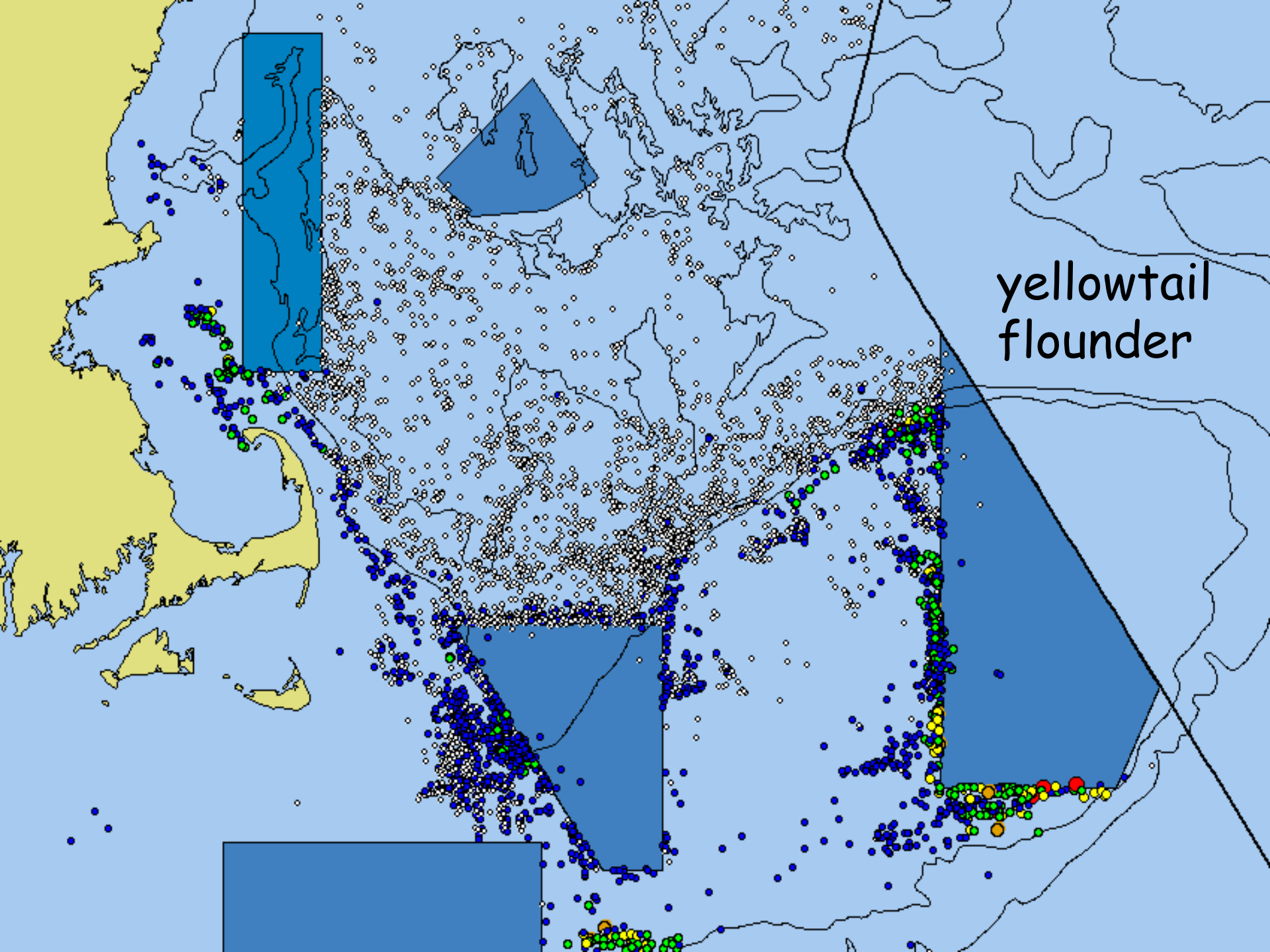



Spatial Management
Closed in 1994, '96, '98
>22,000 km² closed year-round
June
WGOM
May
CL
April
Oct-Nov.
March
USA
Canada
May
CA-I
CA-II
S. New England
NLS
Georges Bank


1991-1993
Otter Trawl Effort
Days Fished
= 0.1-177
= 177-571
= 571-1240
= 1240-2244
= 2244-3982

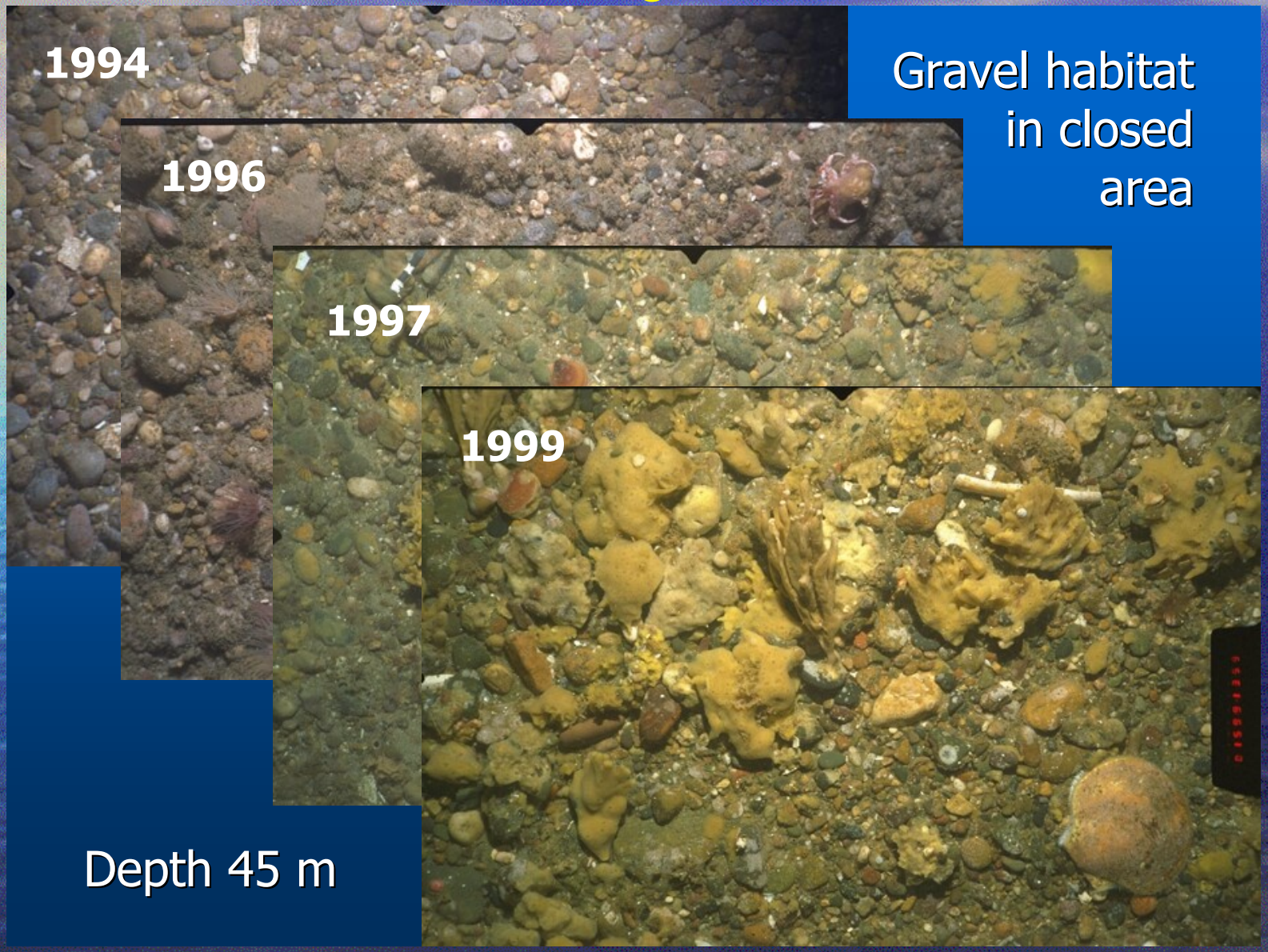

2003
VMS
Vessel Hours
= 1-8
= 9-25
= 26-63
= 64-145
= 146-309


Impacts of Closed Areas
2003 VMS & 2003 Observer Data
N_{2003}=5,106
2001-2003=
10,130 tows


yellowtail
flounder

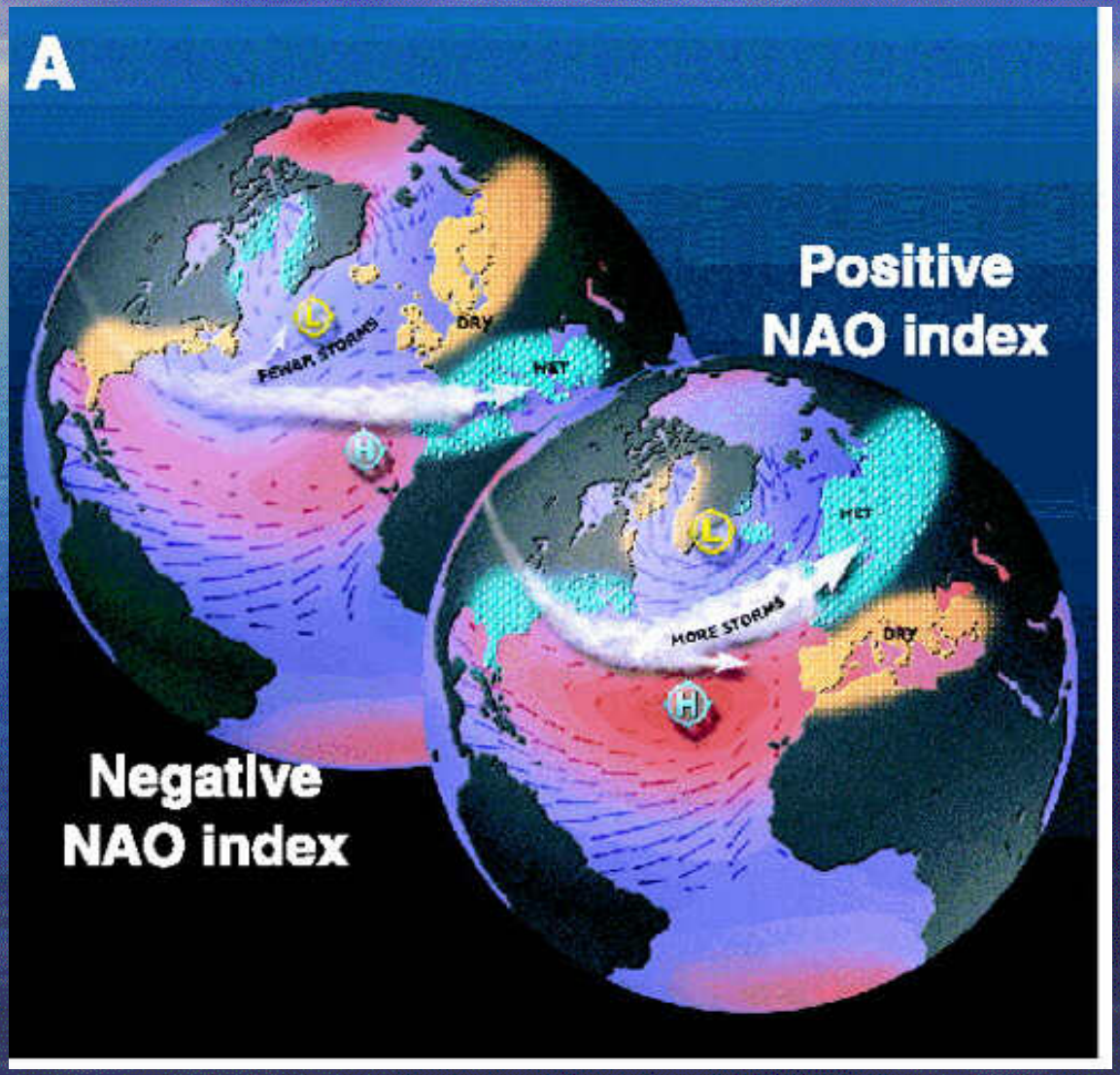
Habitat Recovery

In Dredged Area

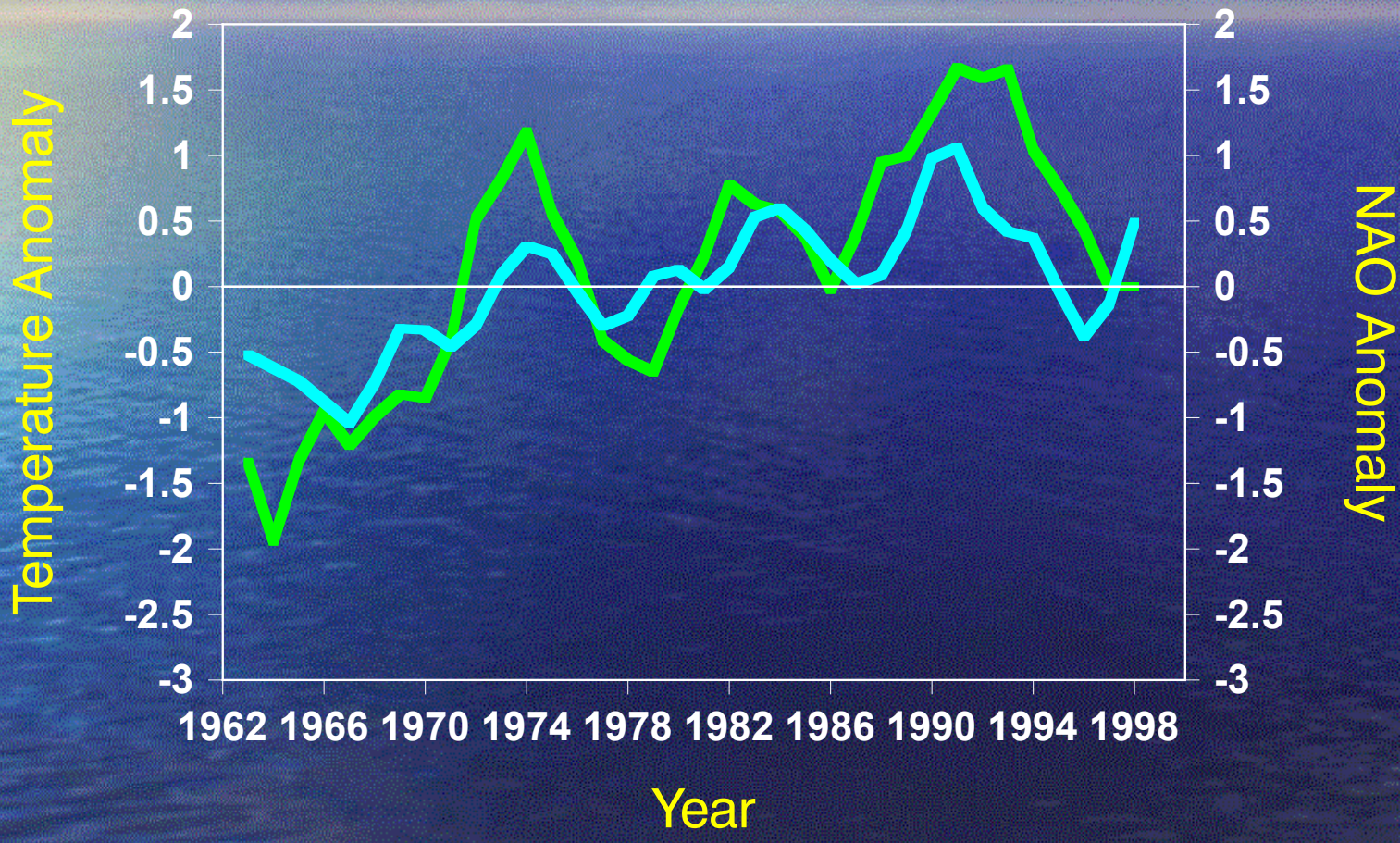


Courtesy J. Collie

Climate and Oceanography



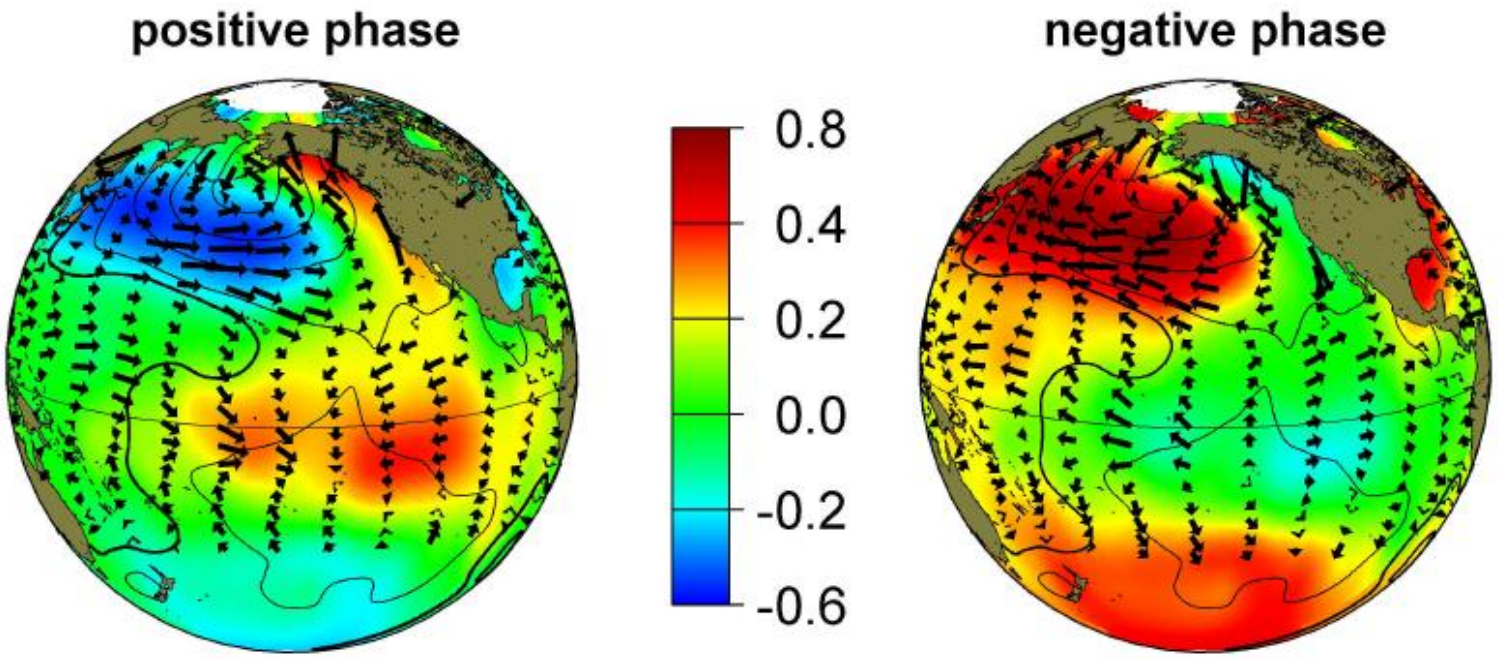
Woods Hole Temperature - NAO

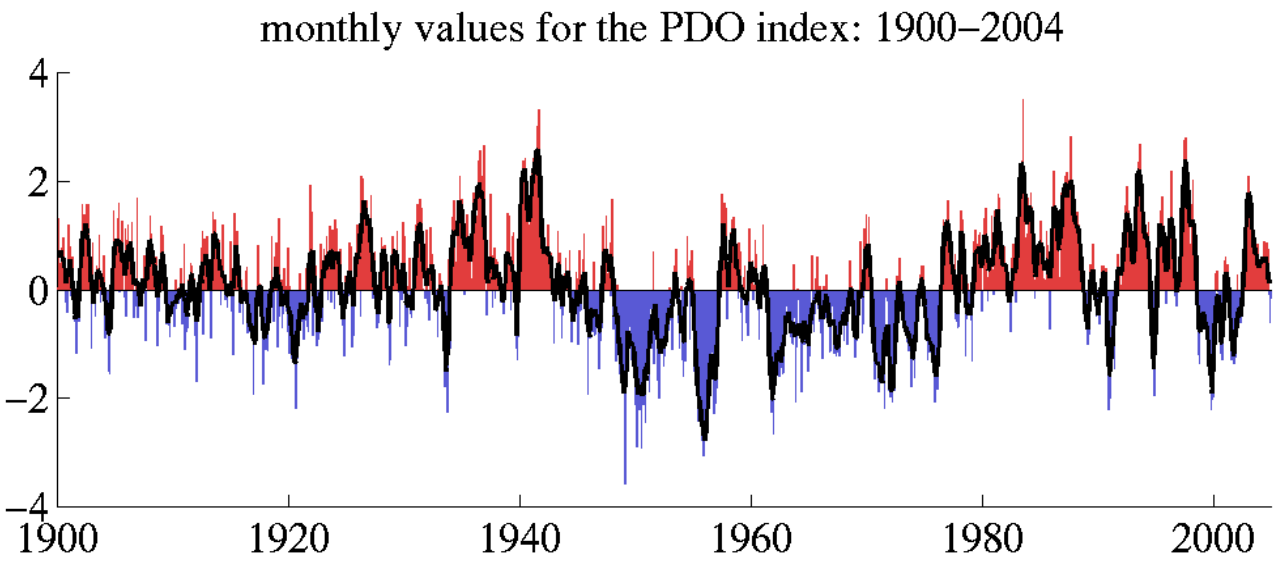


Courtesy D. Mountain

Both series smoothed

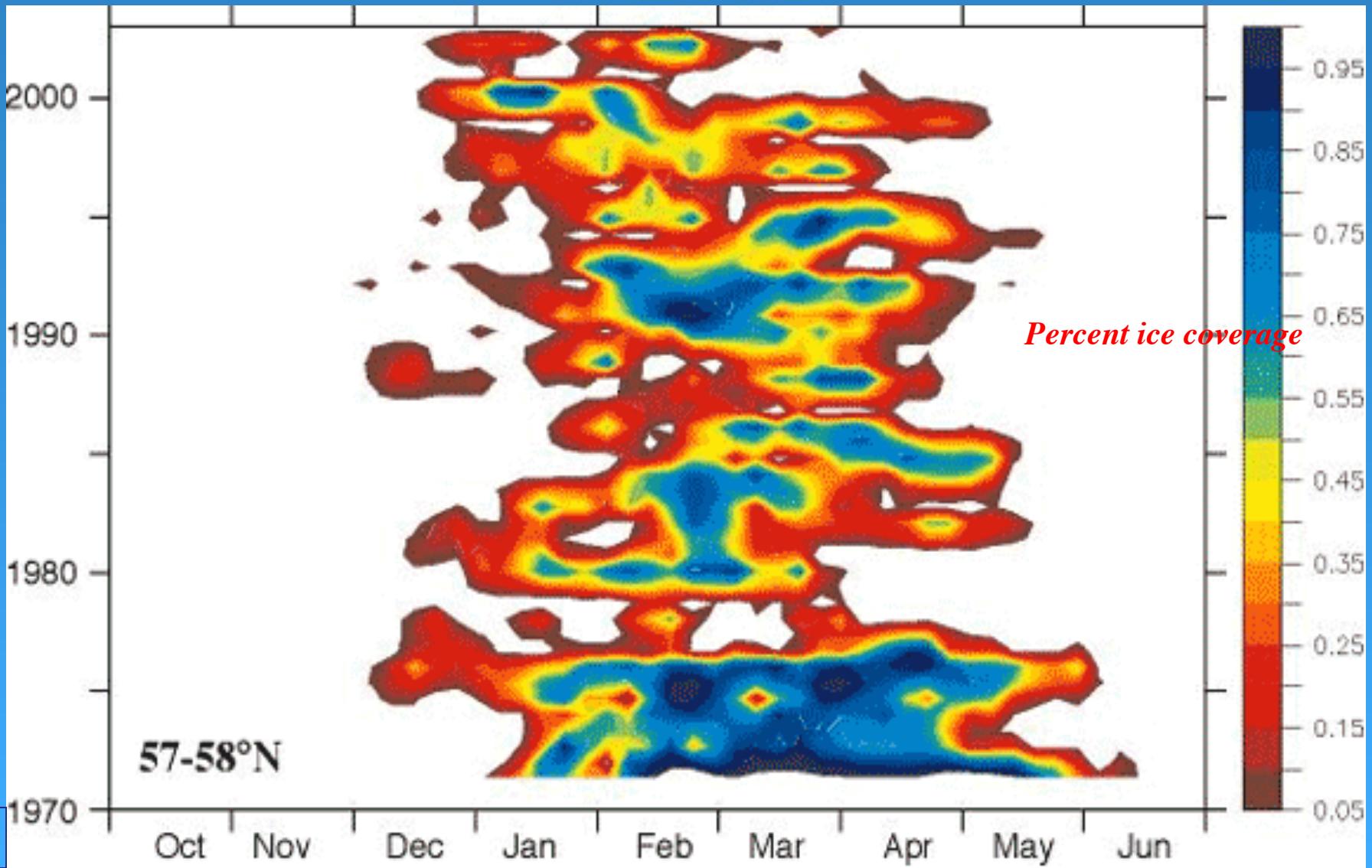
Pacific Decadal Oscillation



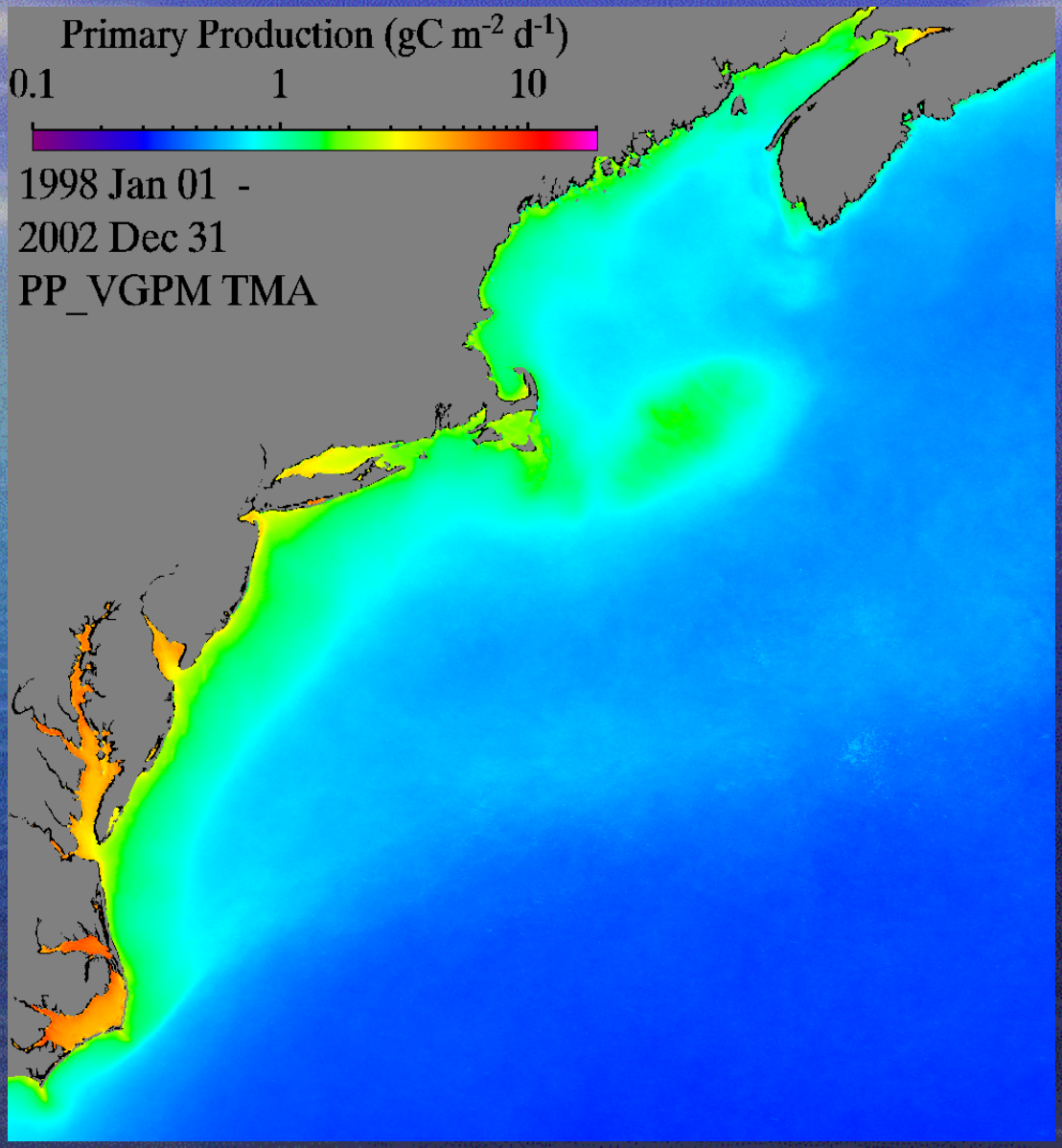


Changing climate:

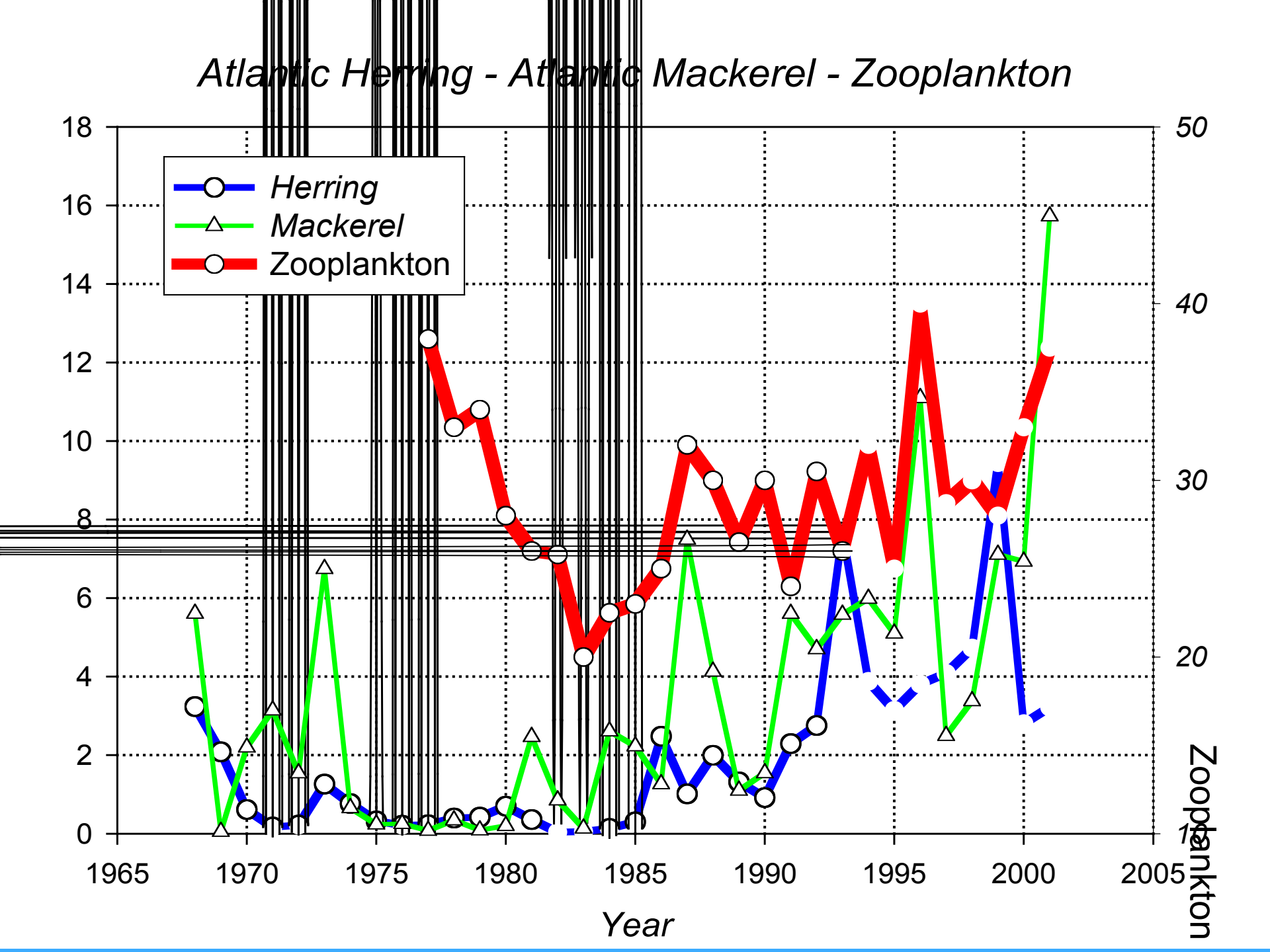
Bering Sea ice extent

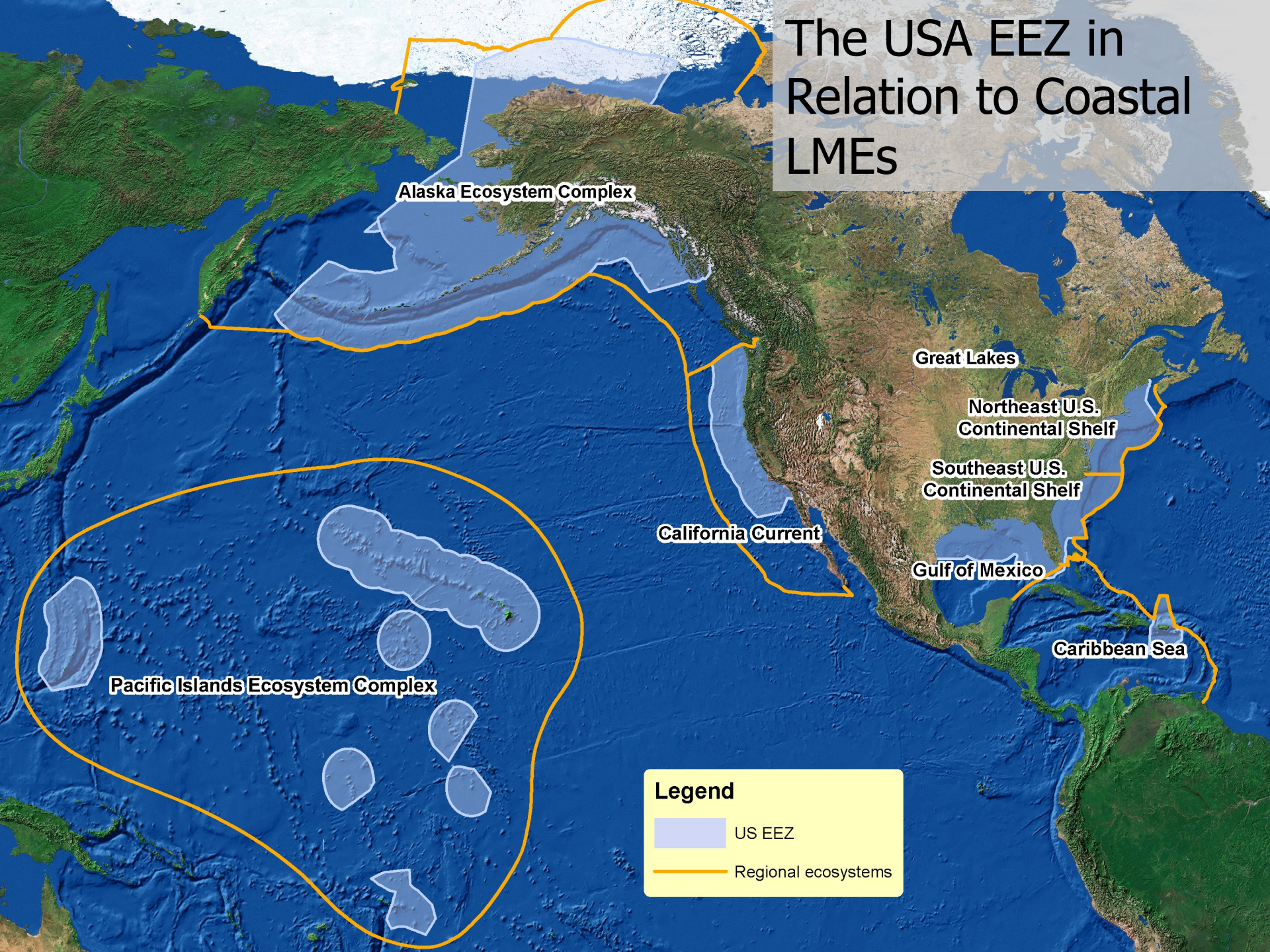


Primary Production Viewed From Space



Courtesy J. O'Reilly


Atlantic Herring - Atlantic Mackerel - Zooplankton
Herring
Mackerel
Zooplankton
18
16
14
12
10
8
6
4
2
0
50
40
30
20
10
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year
Zooplankton


The USA EEZ in Relation to Coastal LMEs
Alaska Ecosystem Complex
Great Lakes
Northeast U.S. Continental Shelf
Southeast U.S. Continental Shelf
California Current
Gulf of Mexico
Caribbean Sea
Pacific Islands Ecosystem Complex
Legend
US EEZ
Regional ecosystems

Fishery Ecosystem Indicators