So What Do We Do With This Stuff Now?

Innovative Uses of EMAP Data and Approaches

Kevin Summers
ORD

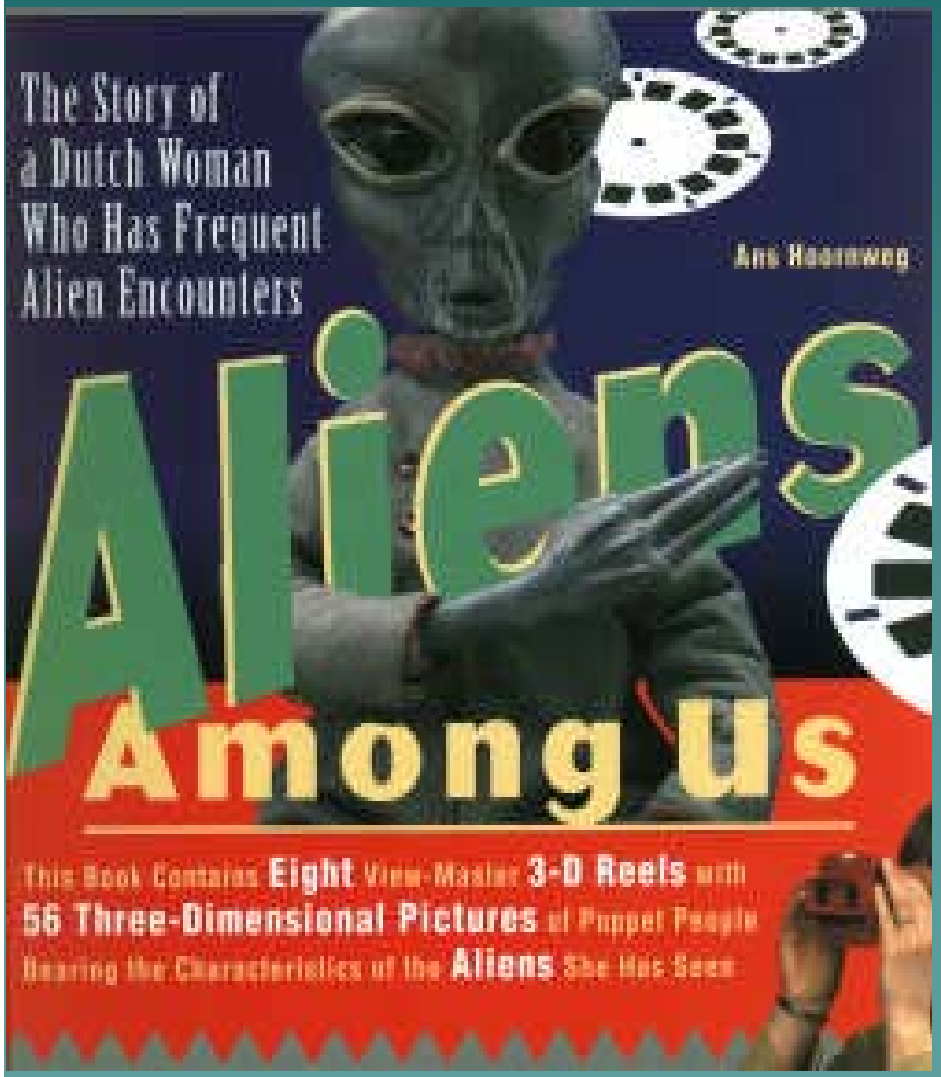
Session Organization

- Atypical Applications
  - – Habitat Evaluation and Restoration Potential (Lisa Smith)
  - - Basic Chemical Relationships (Spence Peterson)
  - - Nutrient Modeling (Richard Moore)
- Applications Outside US
  - – Mexico's Gulf of Mexico (Geraldo Gold)
- Uses of Data to Conduct Different Assessments
  - – Accountability Panel (OAR, OW, OPPTS, ORD)

Other Innovative Uses

- Invasive Species
- Biogeography
- Natural Disasters
- Ecosystem Classification
- Scale Evaluations
- Adaptations to Different Environments
- Habitat Mapping/Estimation

Invasive Species



How Invaded are We?
Extent and Patterns of Nonindigenous Benthic Macrofauna on the US West Coast

Henry Lee, II, Walt Nelson, Steven Ferraro, Faith Cole
Pacific Coastal Ecology Branch, Western Ecology Division
National Health and Environmental Effects Research Laboratory
U.S. EPA

U.S. EPA - National Coastal Assessment (NCA)

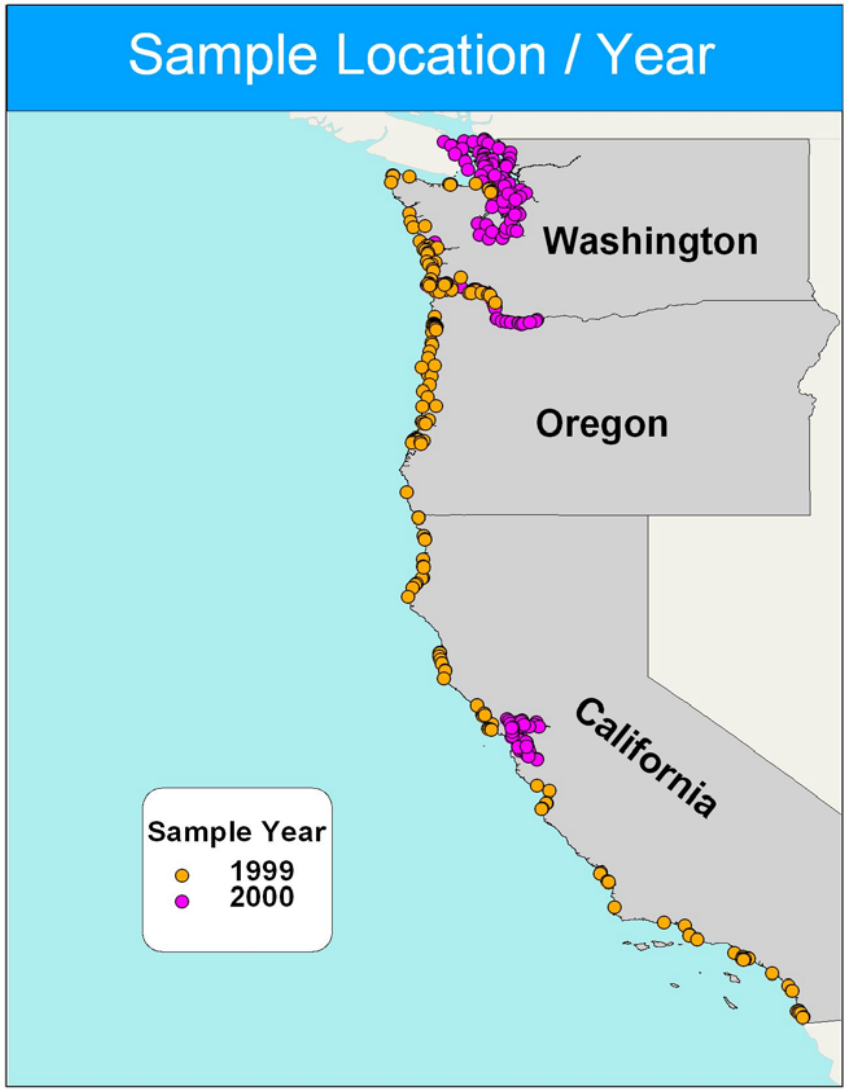
1999-2000 Sampling Effort

Multiyear, Probability Based Sample Design
Summer Index Period Sampling

1999
Washington: 50 stations
Oregon: 80 stations
(includes side channels of Columbia)
California: 80 stations

2000
Puget Sound: 71 stations
Columbia River: 50 stations
San Francisco Bay: 50 stations

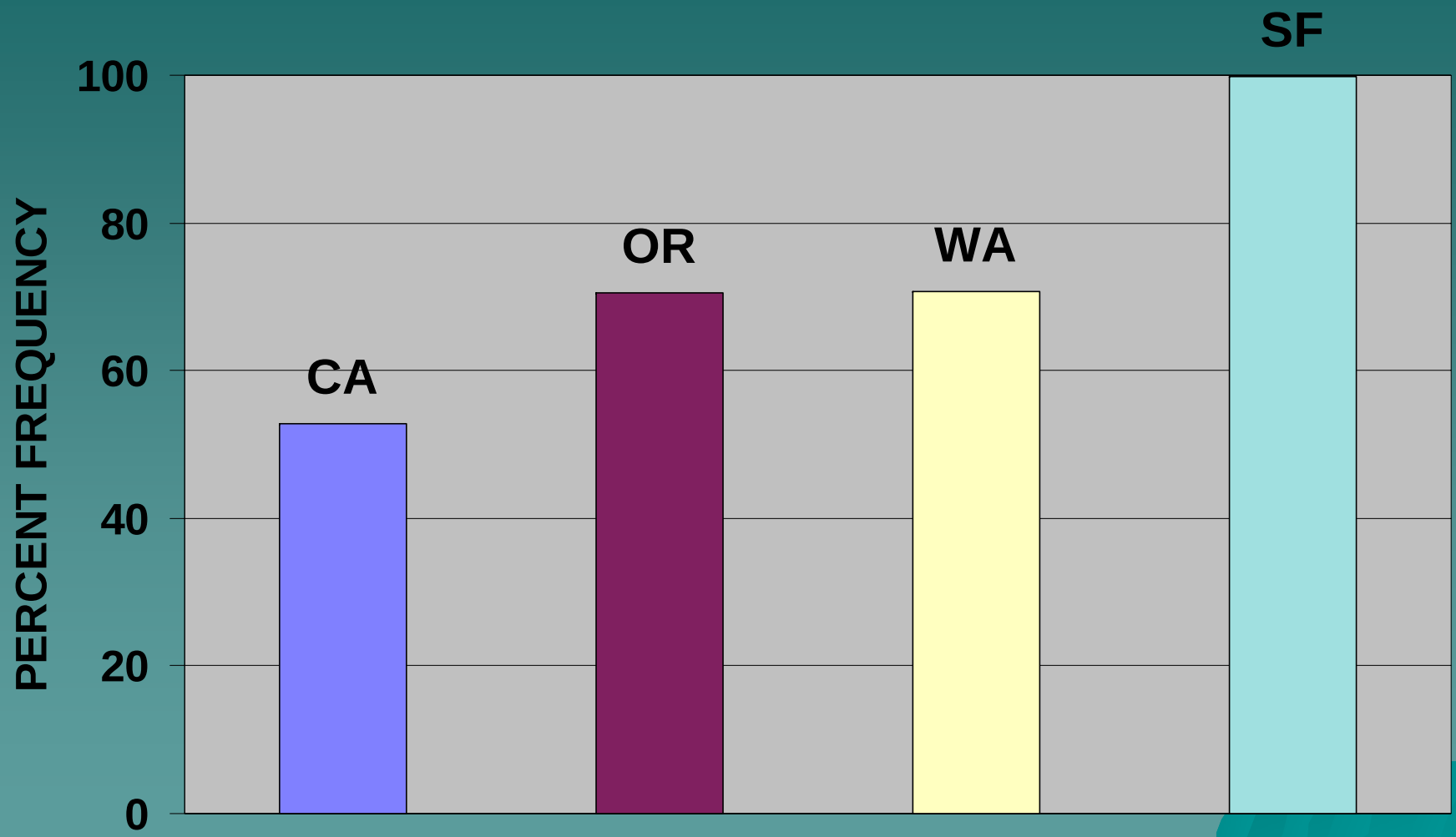
Total: 381 stations



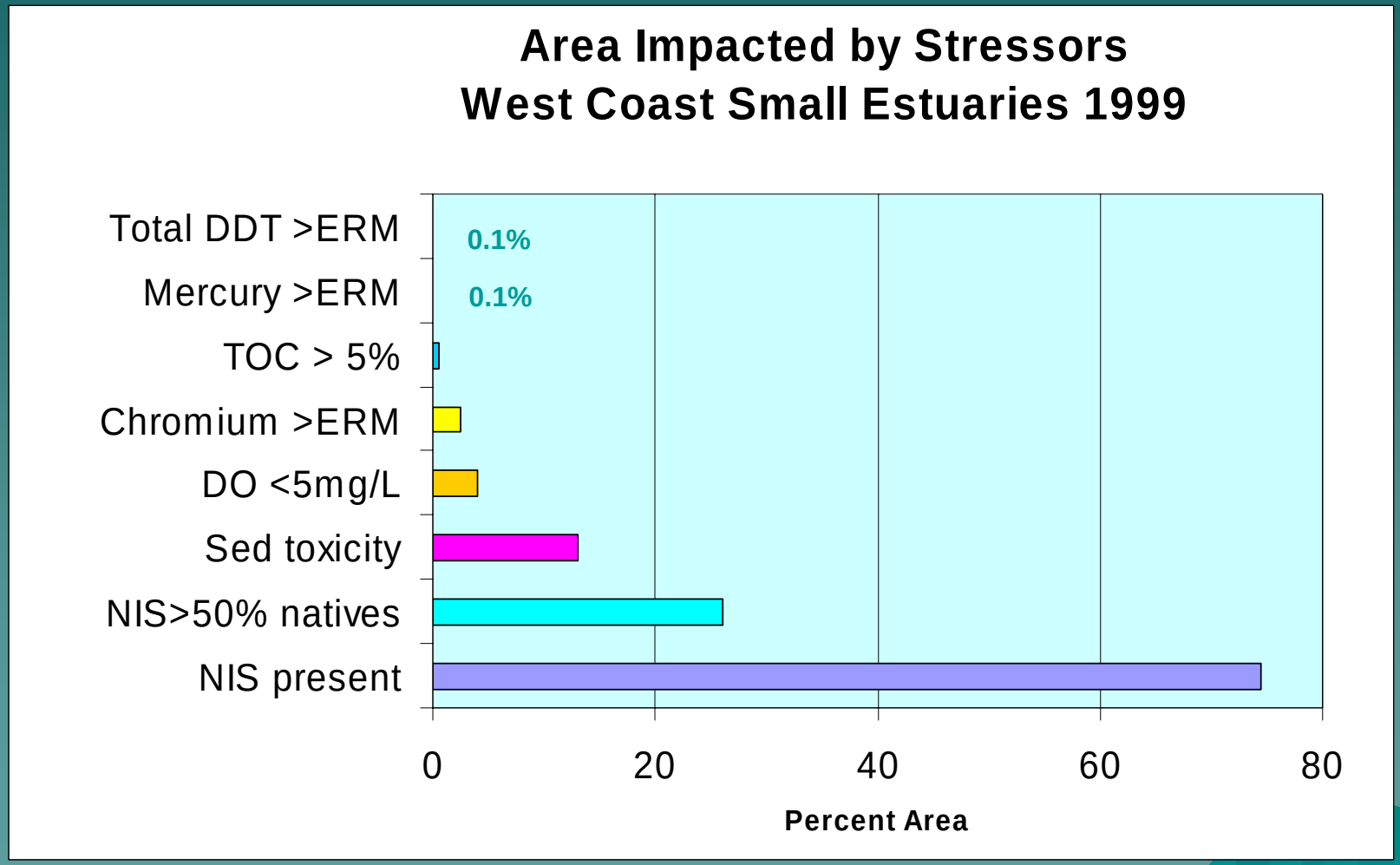
Summary of 1999 Sampling

- Nonindigenous species (NIS) collected at 123 out of 187 stations, 66%.
- 429 native taxa collected
- 57 NIS taxa collected
  - Annelids 40% (23 taxa)
  - Arthropods 37% (21 taxa)
  - Molluscs 14% (8 taxa)
  - Other 9% (5 taxa)

PERCENT FREQUENCY OF OCCURRENCE OF NONINDIGNEOUS SPECIES

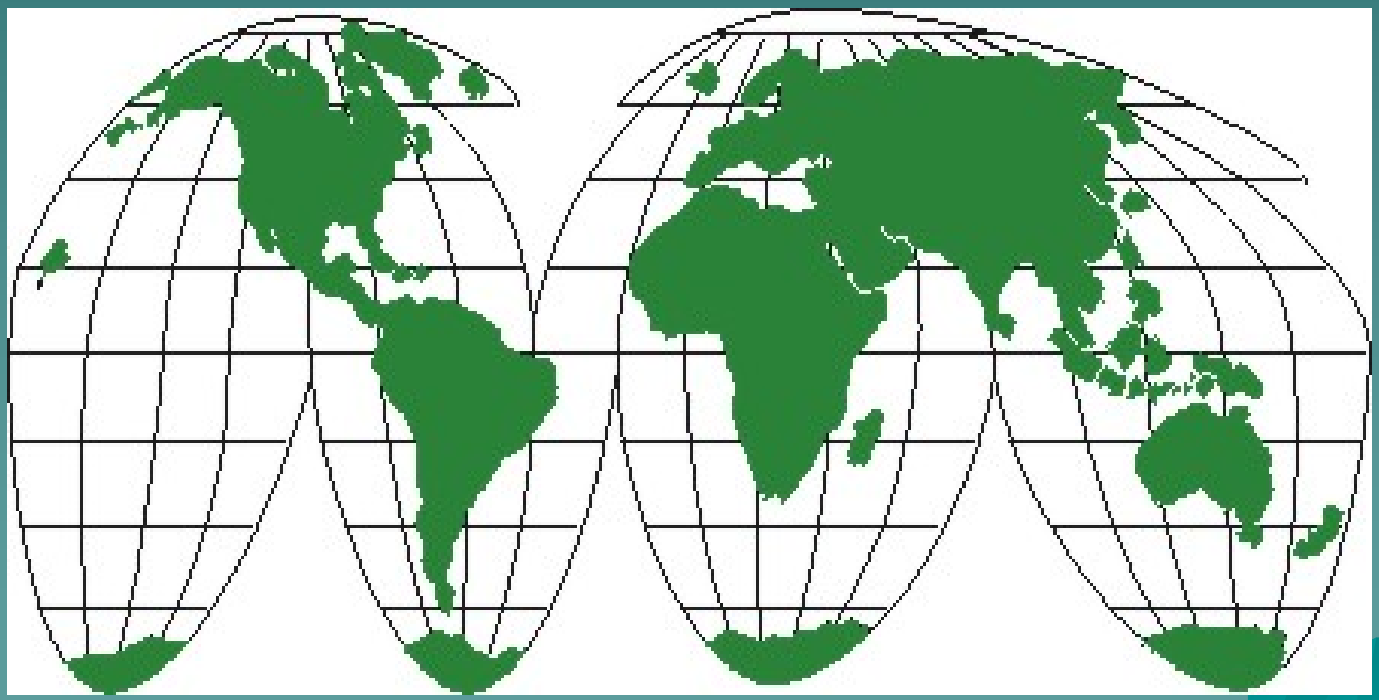


NCA - West
Comparison of Magnitude of Stressor Impacts



Biogeography

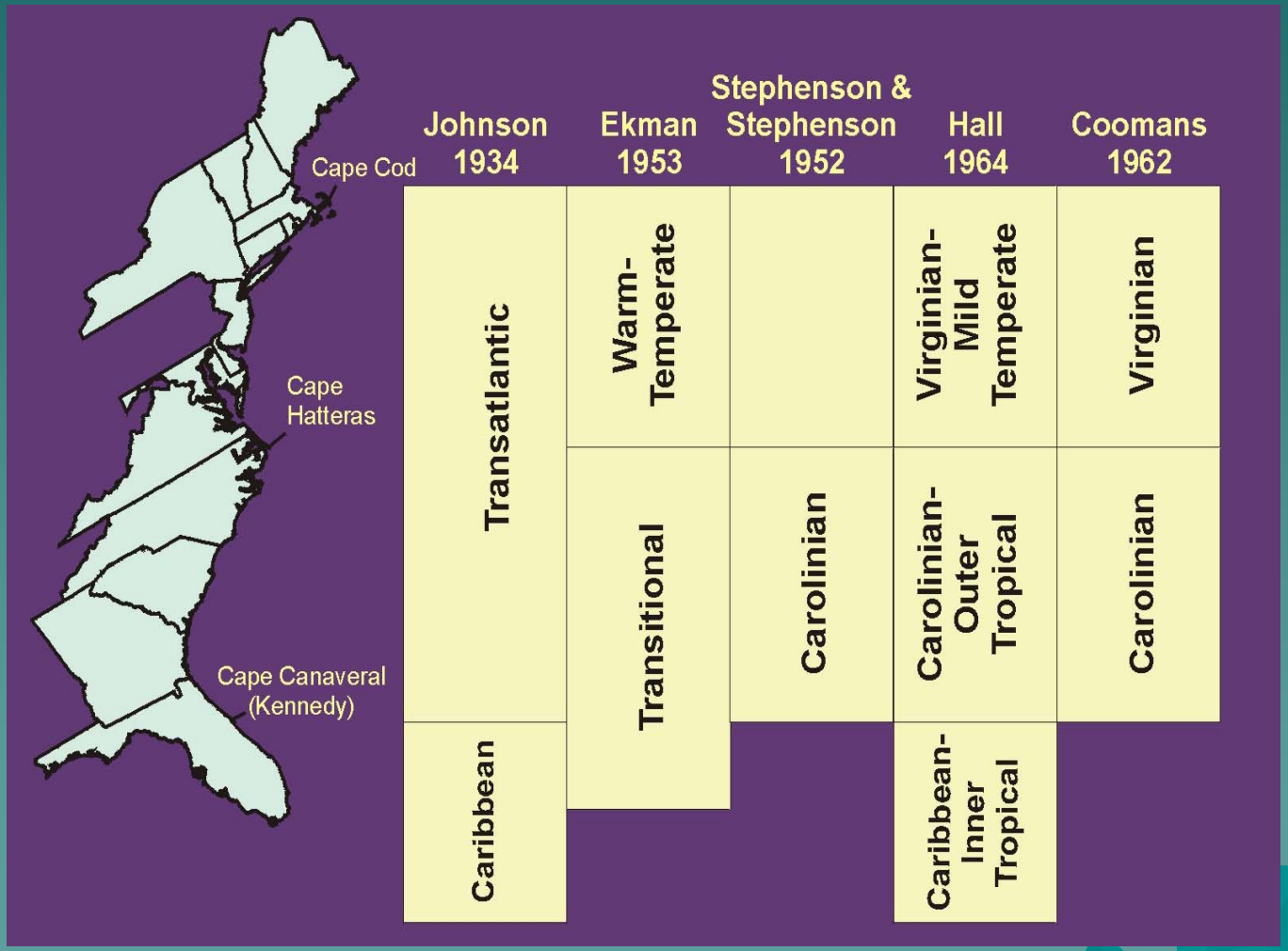
The analysis and explanation of observed patterns in the distribution of organisms



Biogeography of Benthic Macroinvertebrates in Estuaries Along the Gulf of Mexico and Western Atlantic Coasts

Virginia D. Engle and J. Kevin Summers
U.S. Environmental Protection Agency
Gulf Breeze, Florida

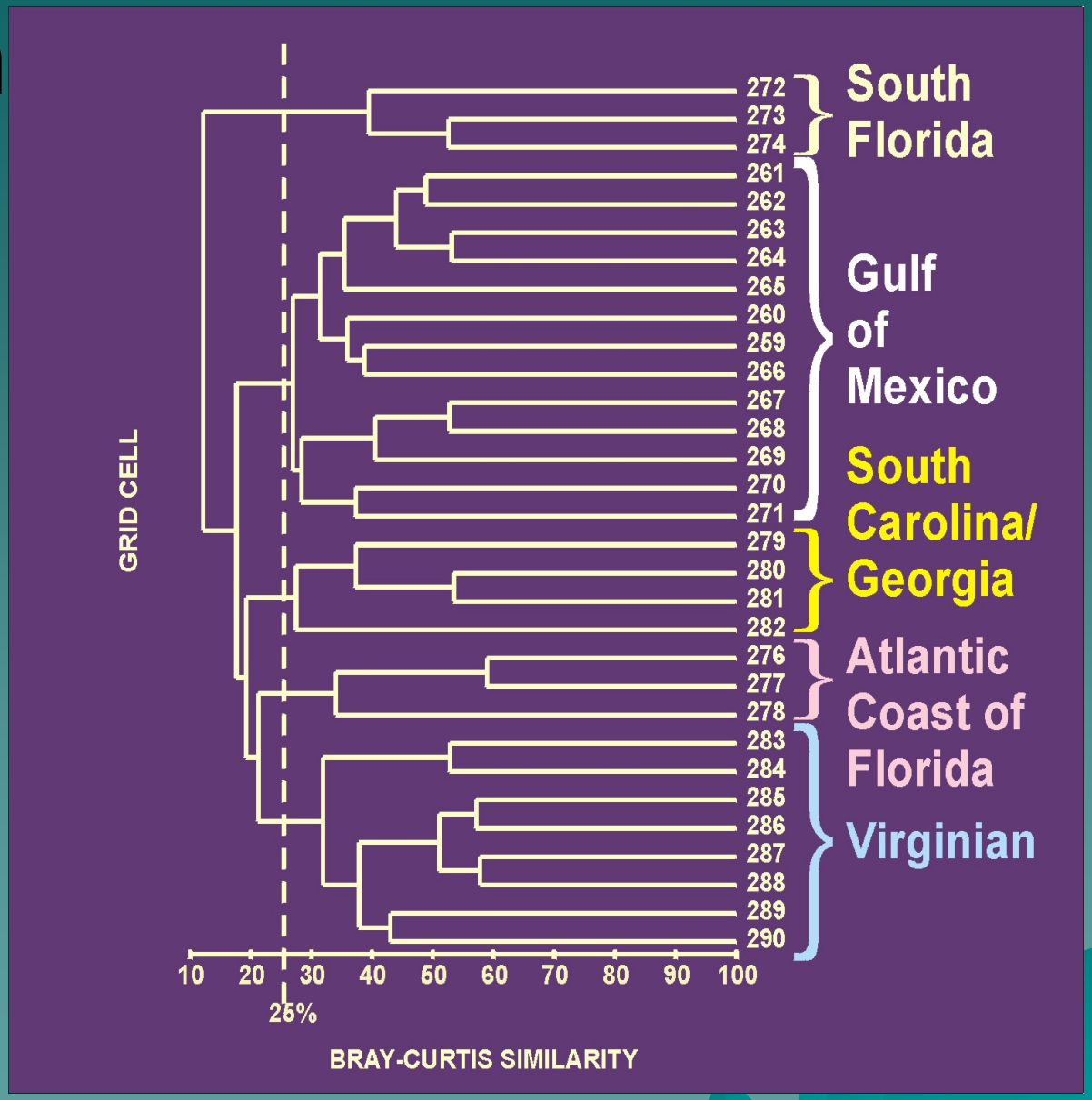
Historical Marine Provinces



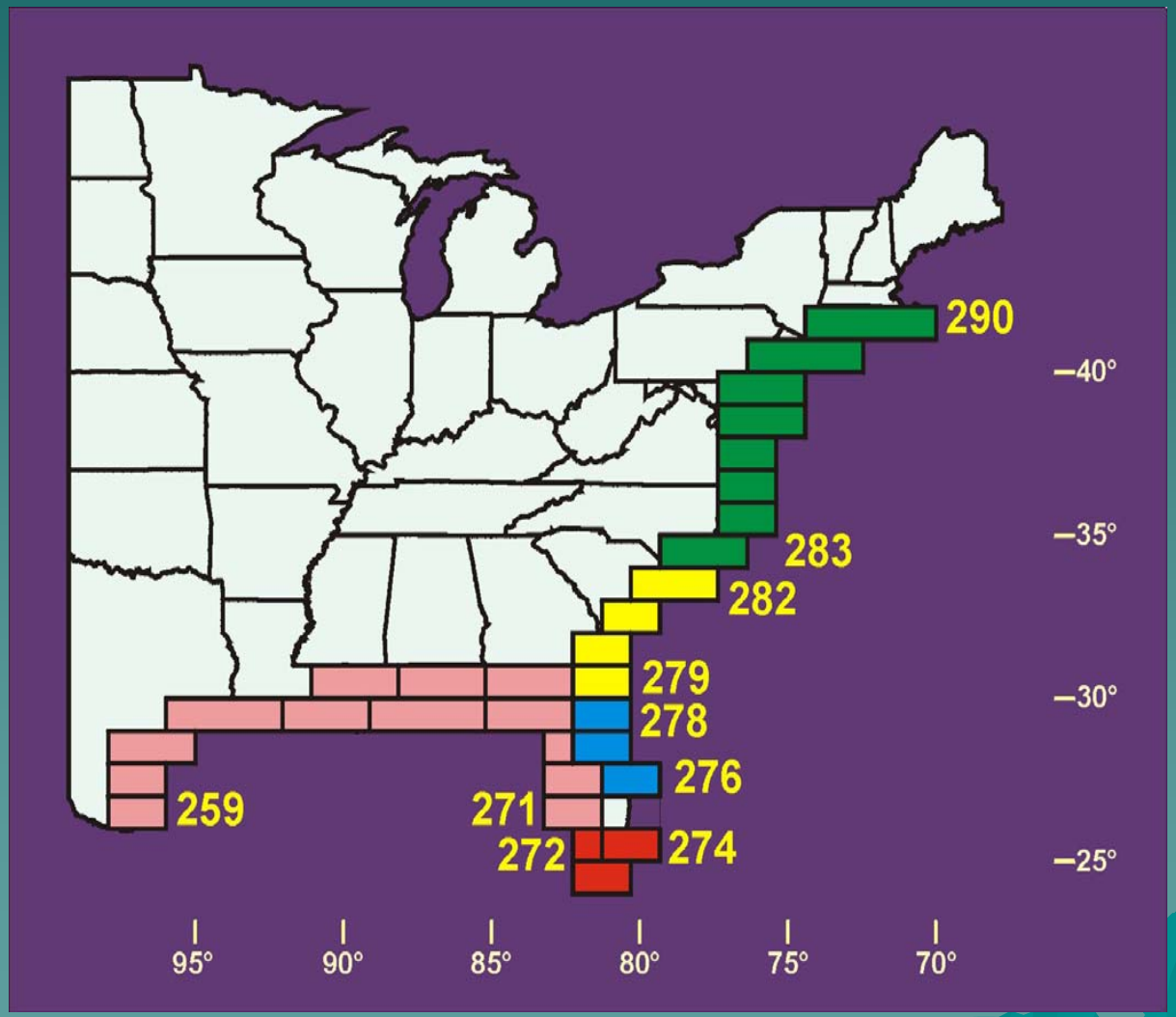
EMAP-E Data

- 1100 species from 870 undegraded stations
  - Virginian Province 1990-1993
  - Carolinian Province 1994-1997
  - West Indian Province 1995
  - Louisianian Province 1991-1994

Dendrogram for the Atlantic and Gulf Coasts

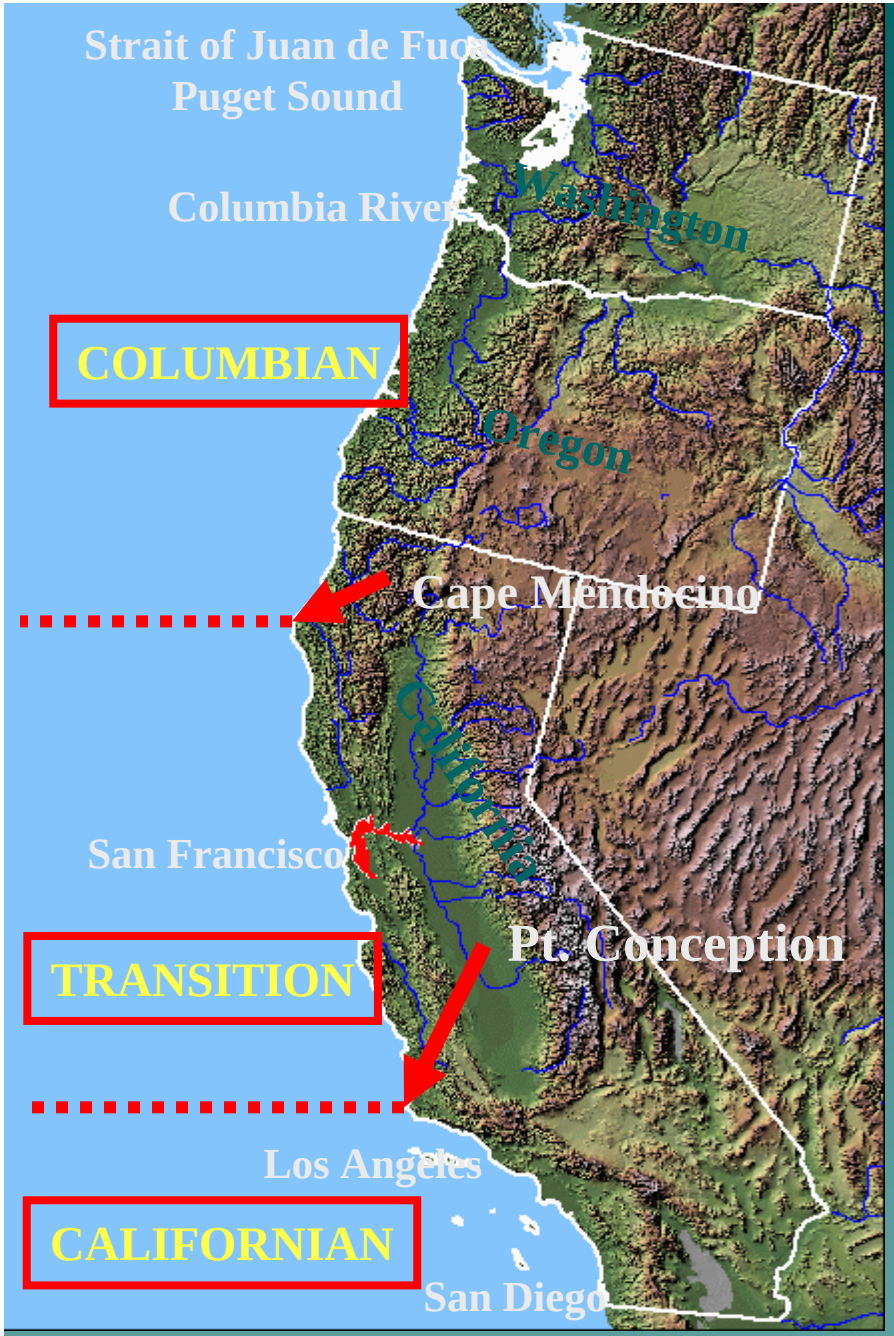


Clusters from Dendrogram



Conclusion

- Gulf of Mexico, south Florida, and Virginian clusters represent biogeographical provinces
- South Carolina, Georgia, and northern Atlantic Florida are transitional
- Biogeographical boundaries for estuarine species are not the same as for marine species



Biogeographic Provinces On The Pacific Coast

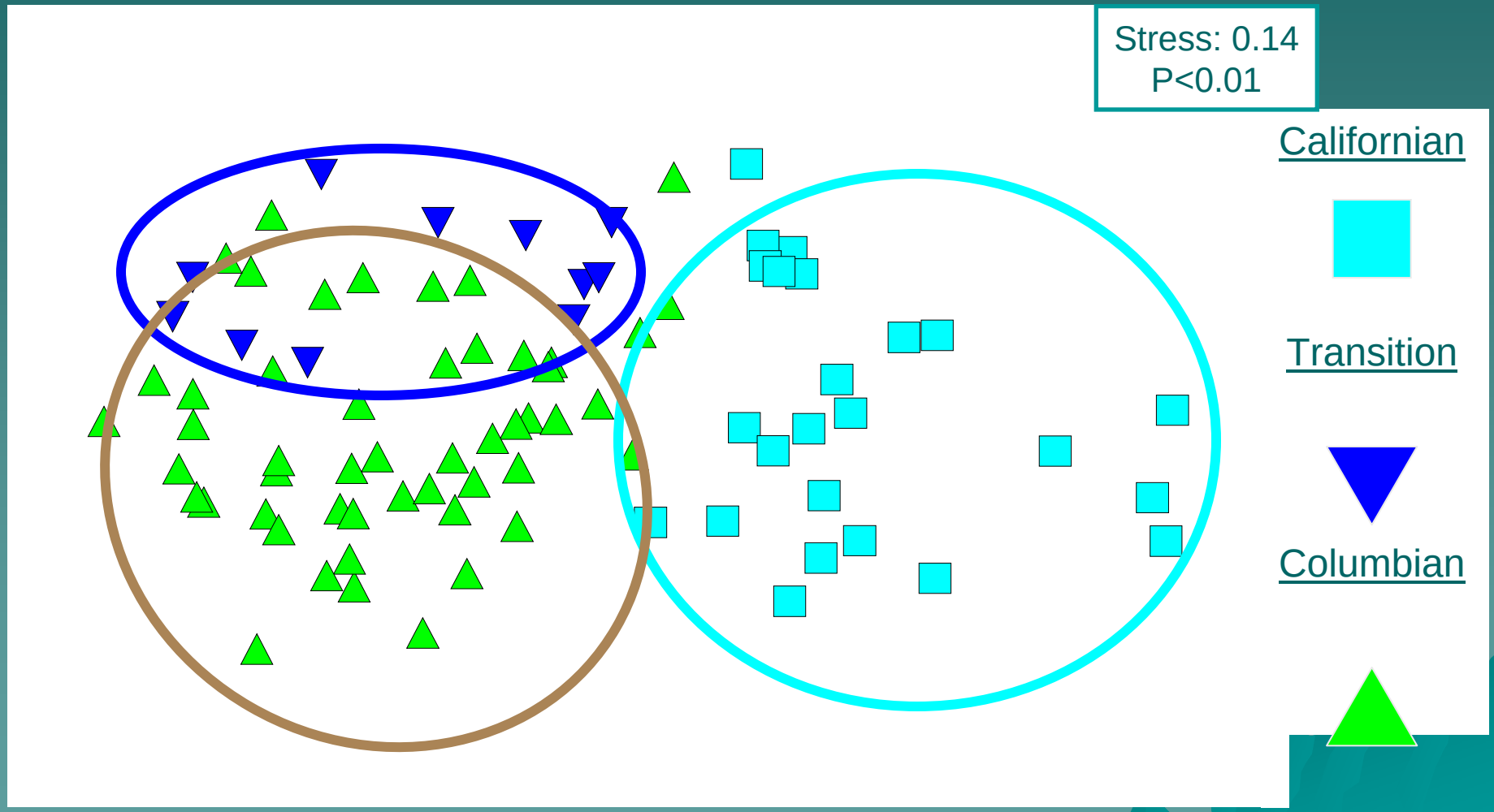
Columbian
Strait of Juan de Fuca, WA
to Cape Mendocino, CA

Transition or Montereyan
Cape Mendocino, CA
to Point Conception, CA

Californian
South of Point Conception, CA

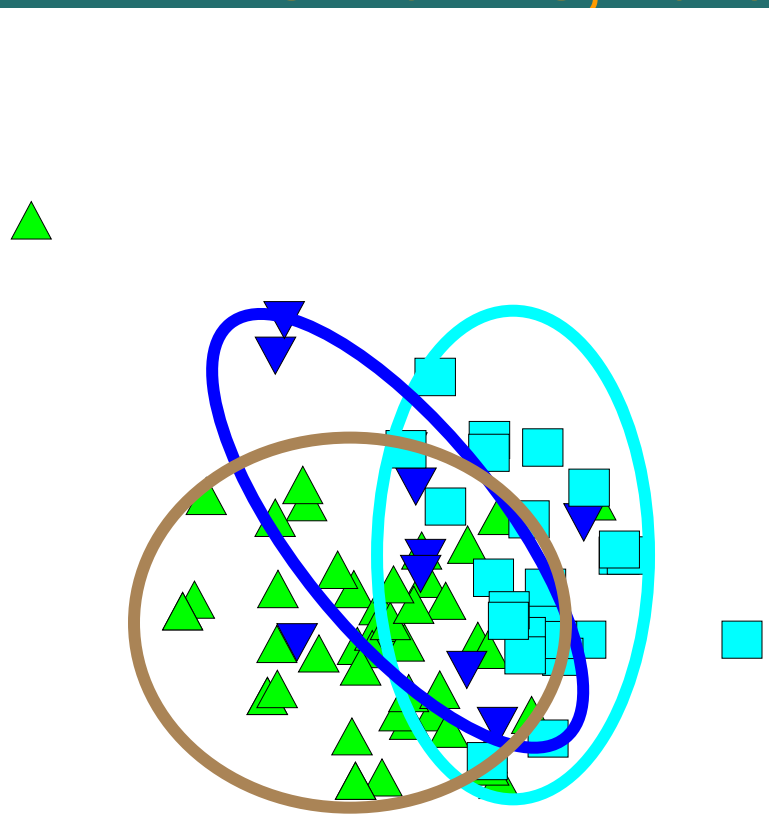
Does native infauna show expected biogeographic associations?

MDS with Natives; Euhaline & Polyhaline Sites



Does NIS fauna show any biogeographic associations?

MDS with NIS; Euhaline & Polyhaline Sites

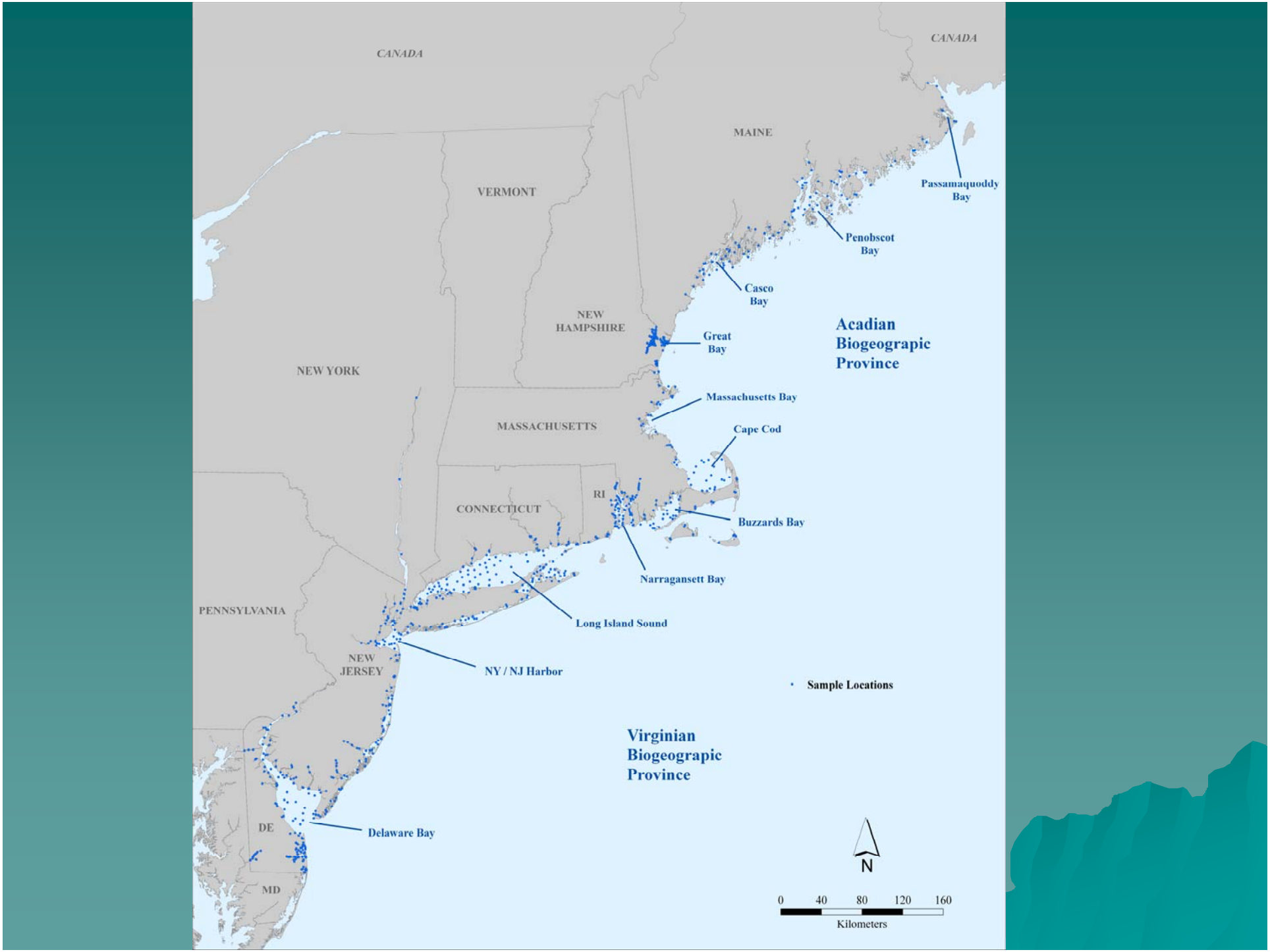


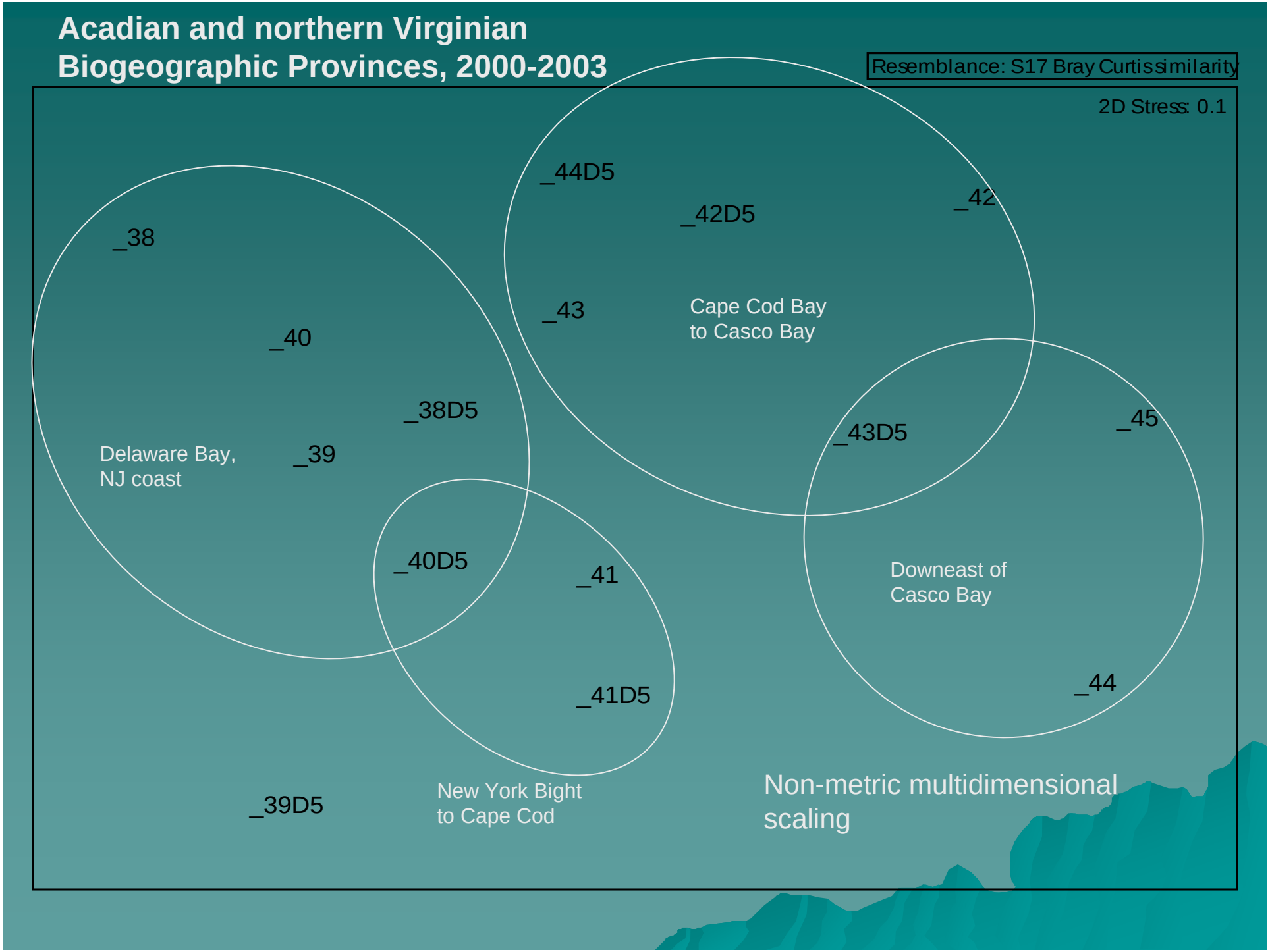
Stress: 0.13
P>0.05 n.s.

Californian

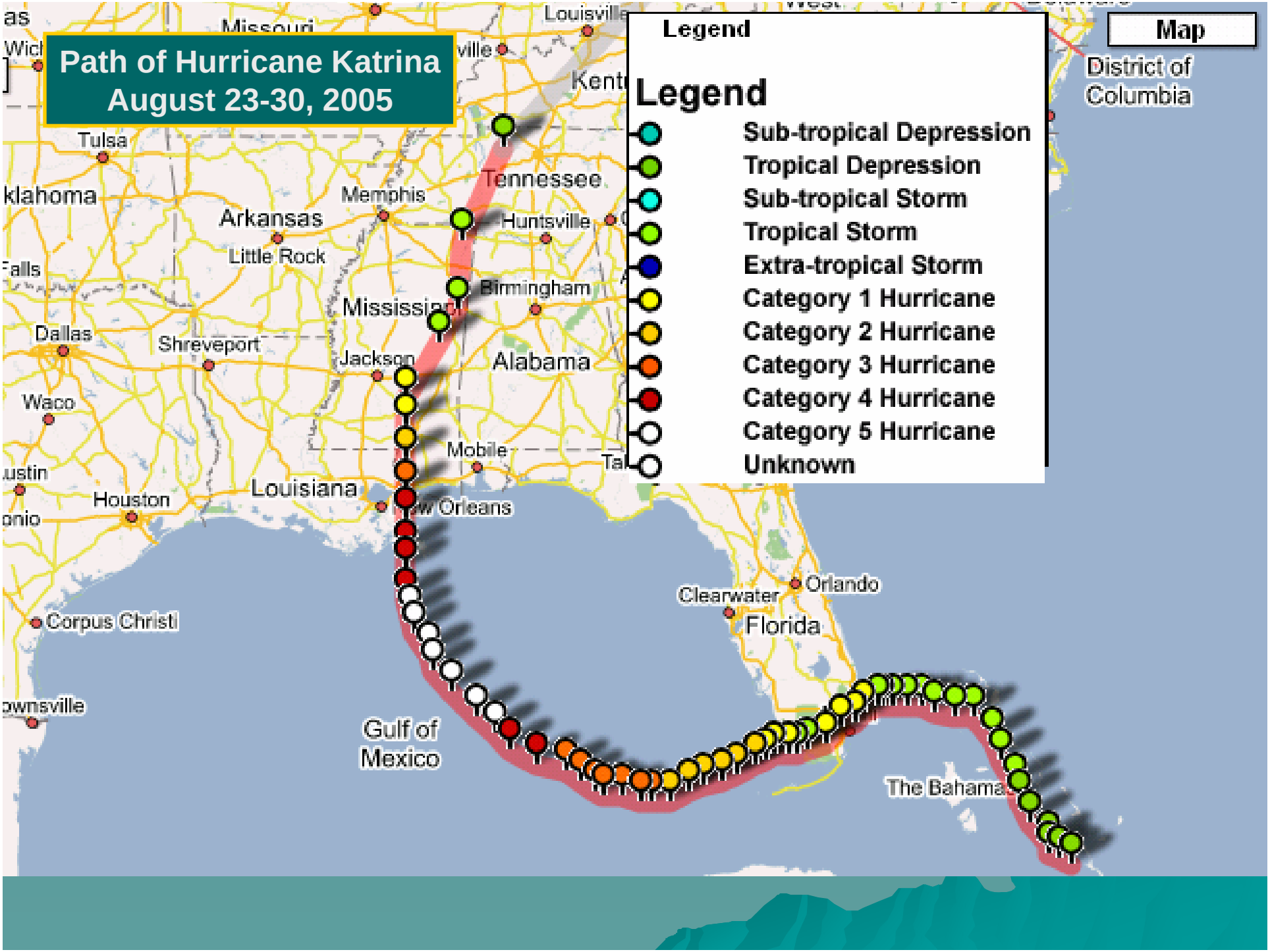
Transition

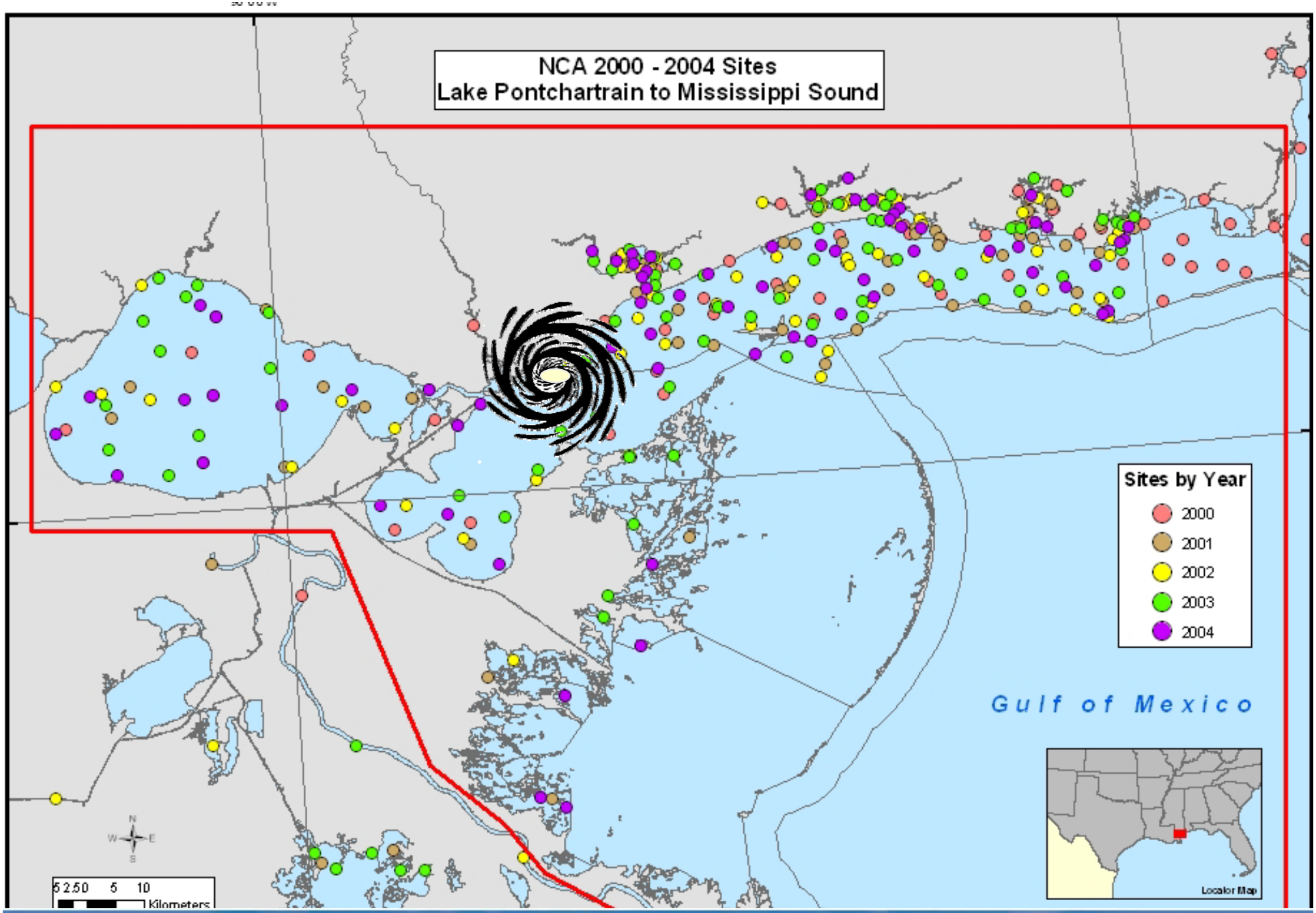
Columbian

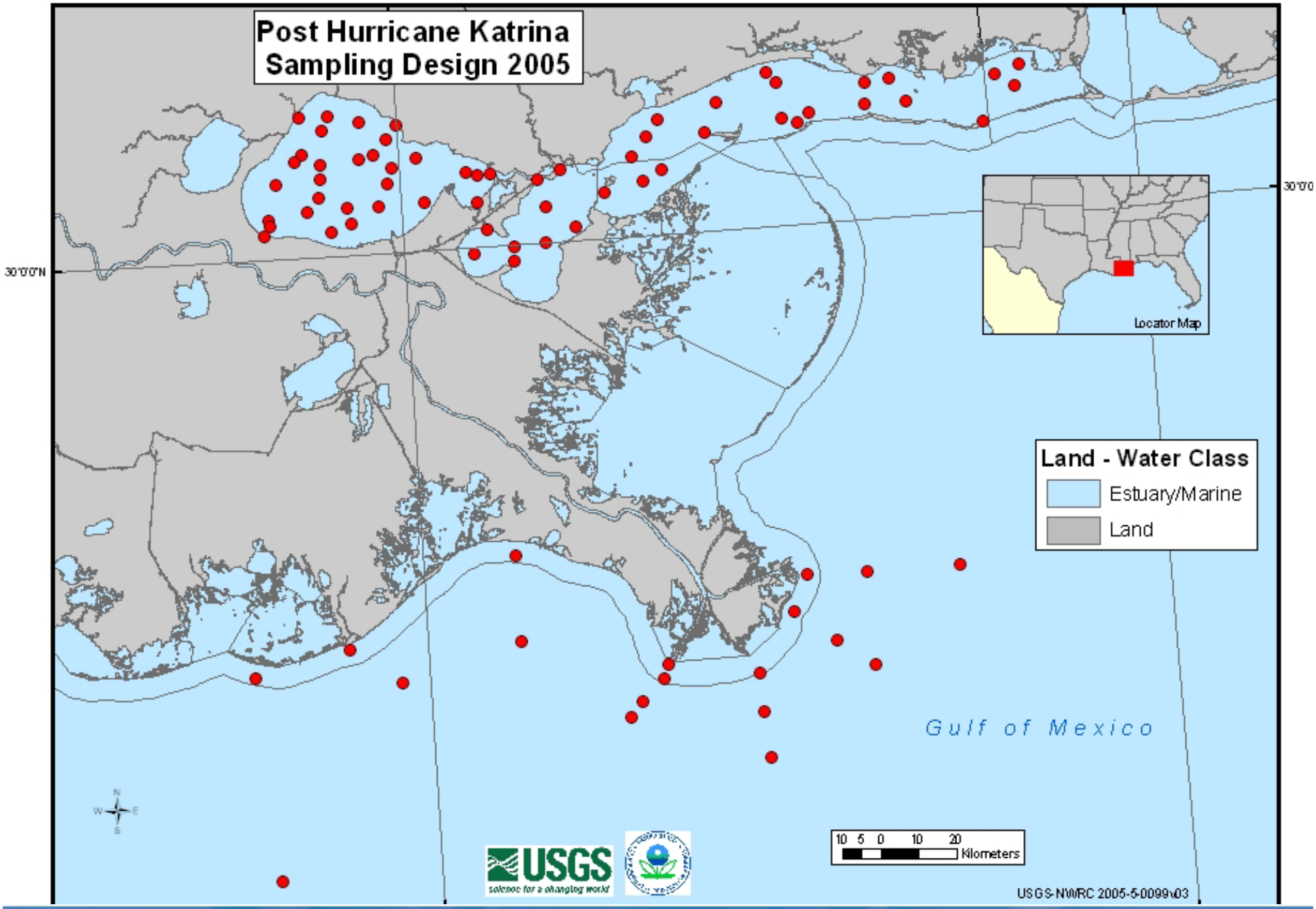

CANADA
CANADA
MAINE
VERMONT
NEW HAMPSHIRE
NEW YORK
MASSACHUSETTS
CONNECTICUT
RI
PENNSYLVANIA
NEW JERSEY
DE
MD
Passamaquoddy Bay
Penobscot Bay
Casco Bay
Great Bay
Massachusetts Bay
Cape Cod
Buzzards Bay
Narragansett Bay
Long Island Sound
NY / NJ Harbor
Delaware Bay
Acadian Biogeograpic Province
Virginian Biogeograpic Province
Sample Locations
N
0 40 80 120 160
Kilometers


Acadian and northern Virginian
Biogeographic Provinces, 2000-2003
Resemblance: S17 Bray Curtis similarity
2D Stress: 0.1
_44D5
_42D5
_42
_38
_43
Cape Cod Bay
to Casco Bay
_40
_38D5
_43D5
_45
Delaware Bay,
NJ coast
_39
_40D5
_41
Downeast of
Casco Bay
_41D5
_44
_39D5
New York Bight
to Cape Cod
Non-metric multidimensional
scaling

Natural Disasters


Path of Hurricane Katrina
August 23-30, 2005
Legend
Legend
Sub-tropical Depression
Tropical Depression
Sub-tropical Storm
Tropical Storm
Extra-tropical Storm
Category 1 Hurricane
Category 2 Hurricane
Category 3 Hurricane
Category 4 Hurricane
Category 5 Hurricane
Unknown
Map
District of Columbia
Louisville
Tulsa
Tennessee
Memphis
Arkansas
Huntsville
Little Rock
Birmingham
Dallas
Shreveport
Jackson
Alabama
Waco
Mobile
Louisiana
Houston
Orlando
Clearwater
Florida
Corpus Christi
Gulf of Mexico
The Bahamas

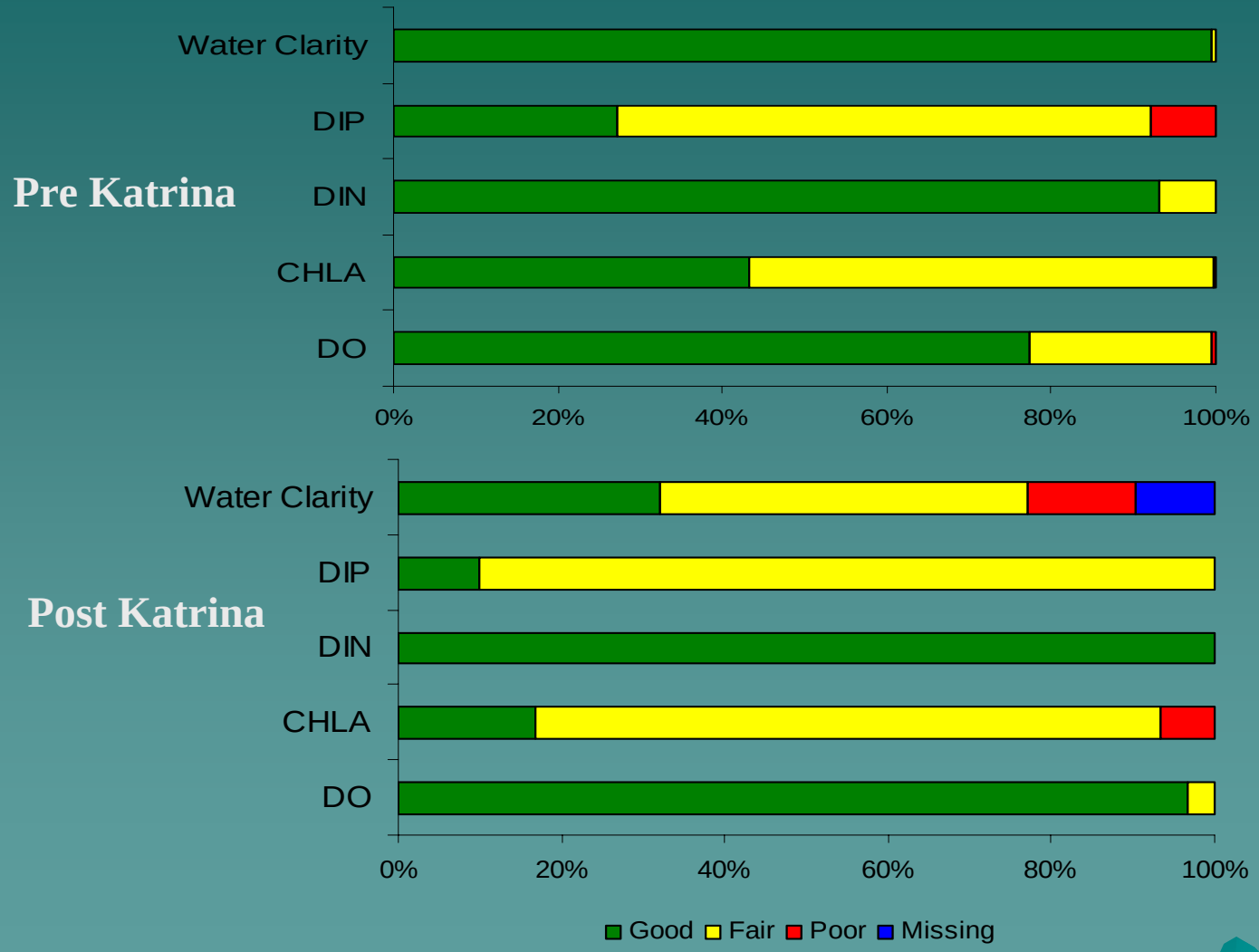

NCA 2000 - 2004 Sites
Lake Pontchartrain to Mississippi Sound
Sites by Year
2000
2001
2002
2003
2004
Gulf of Mexico
Locator Map
N
W
E
S
5 2.5 0 5 10
Kilometers


Post Hurricane Katrina
Sampling Design 2005
30°0'0"N
30°0'0
Locator Map
Land - Water Class
Estuary/Marine
Land
Gulf of Mexico
N
W
E
S
USGS
science for a changing world
10 5 0 10 20
Kilometers
USGS-NWRC 2005-5-0099\03

Hurricane Katrina

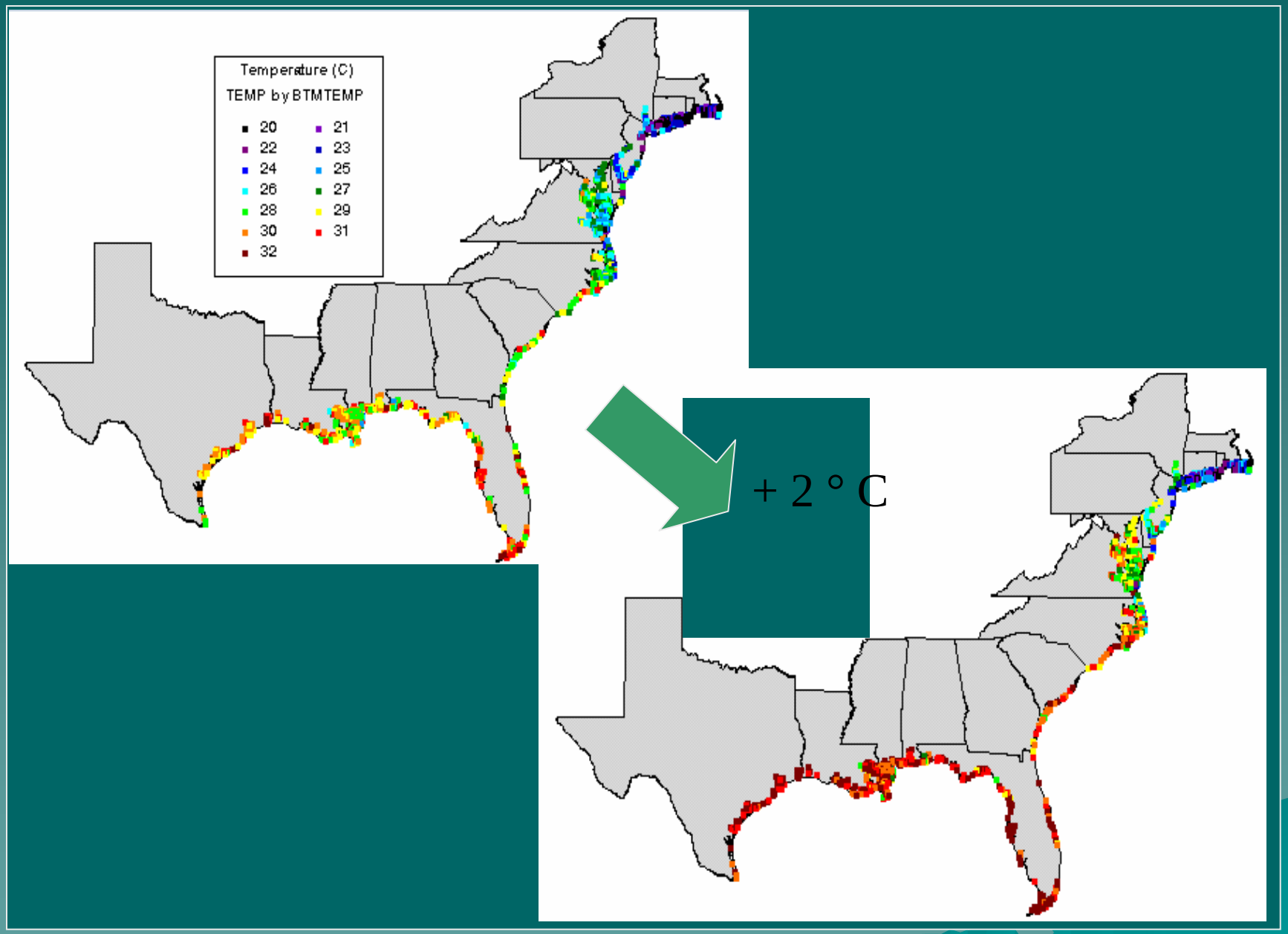
Post-Storm Ecological Assessment

Lake Borgne – Mississippi Sound
Water Quality



LESSONS LEARNED:

- Having strategies, polices, guidances, and sampling plans already in place helps to clarify needed activities, resources, in an expedient manner.
- Collaboration among federal, state, and local agencies is inevitable; establish relationships, processes, and functions prior to disasters; and then implement them (particularly for sampling, data sharing, cleanup responsibilities, etc.).
- Clear points of contact for specific tasks and regular, transparent communication among all staff would help the organization assist the effort more effectively.
- Pre-existing baseline assessments of environment and environmental performance of technologies (likely to be called upon in times of disasters) results in a more expedient response.

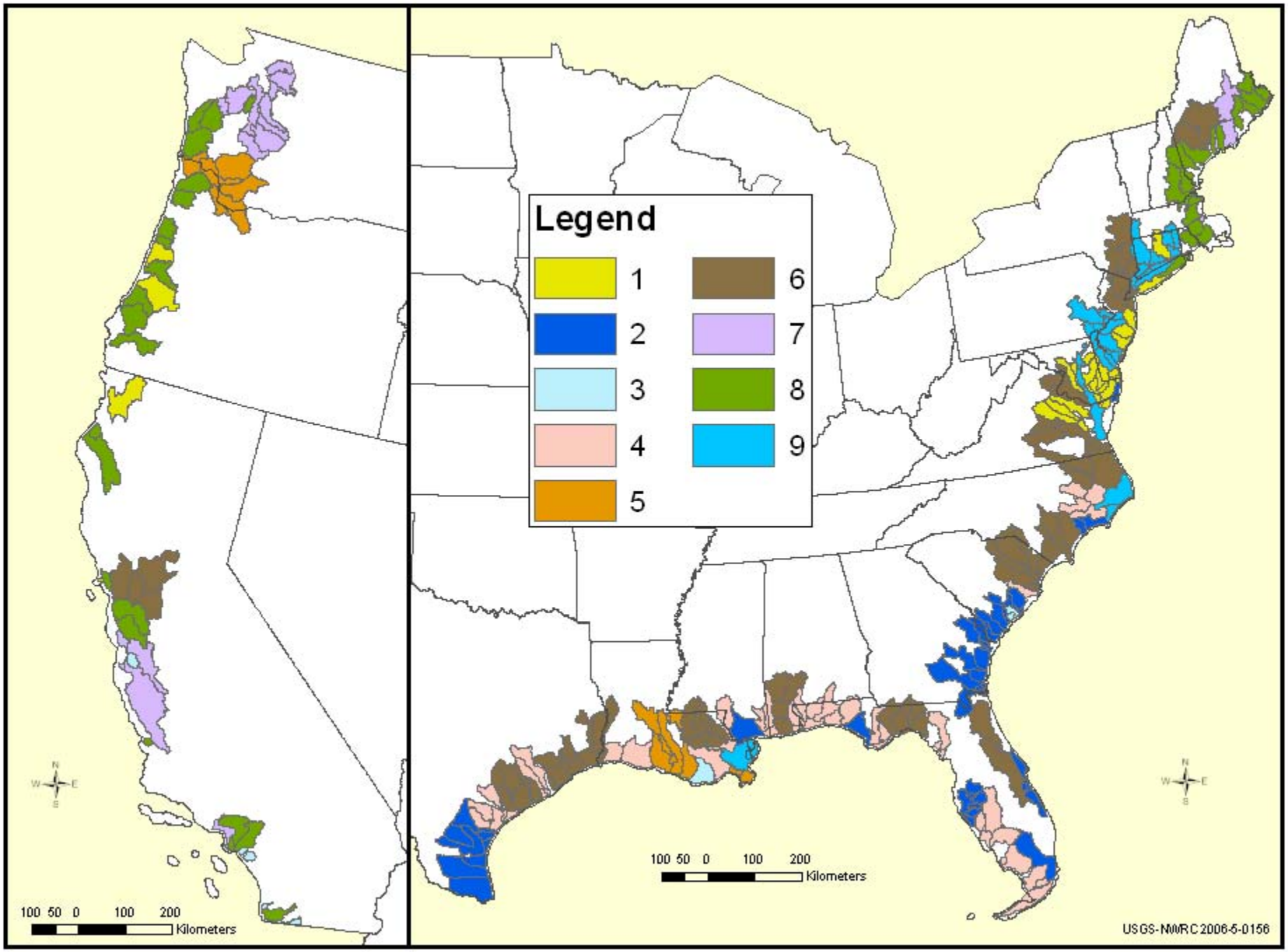

Temperature (C)
TEMP by BTMTEMP
20
21
22
23
24
25
26
27
28
29
30
31
32
+ 2 ° C

Estuarine Classification

- Engle, V.D., J.C. Kurtz, L.M. Smith, C. Chancy, and P. Bourgeois. In Press. A Classification of U.S. Estuaries Based on Physical and Hydrologic Attributes. Environmental Monitoring and Assessment

Classification

- Using EMAP data developed a classification systems based on six factors that created 9 estuarine classes
  - Example: Moderate Area, Low Volume, Moderate Flow, Moderate Depth, Moderate Salinity (Class #1)
  - Large Area, Highest Volume, Highest Flows, Deepest Depths, High Salinity (Class #9)

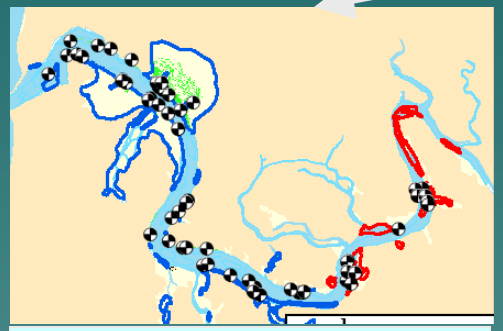

Legend
1
2
3
4
5
6
7
8
9
100 50 0 100 200
Kilometers
100 50 0 100 200
Kilometers
USGS-NWRC 2006-5-0156

Classification of Pacific Northwest Estuaries: Landscape, Wetlands, & Vulnerability to Nutrients

Delineation and analysis of 89 PNW estuarine watersheds (NLCD) and wetland patterns (NWI)

Henry Lee II, Cheryl A. Brown, Bruce L. Boese, and David R. Young. 2006. ORD/WED/PCEB

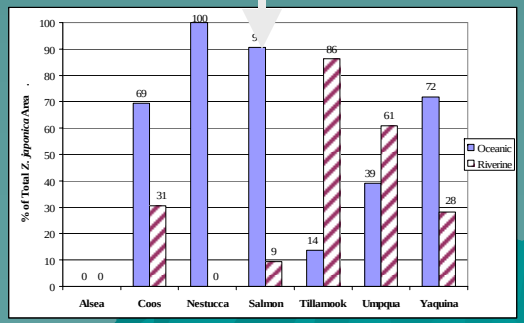
Seven PNW estuaries analyzed for nutrient sources and within-estuarine distribution of benthic resources



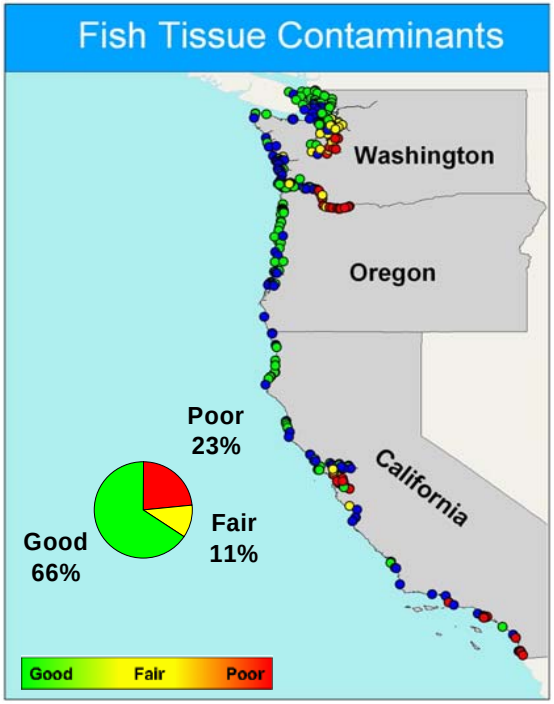
Probabilistic and aerial surveys of SAV & other benthic resources

Delineation of segments dominated by oceanic vs. riverine nutrients

Overlay nutrient sources on benthic resources to evaluate vulnerability to riverine-derived nutrients by estuary class

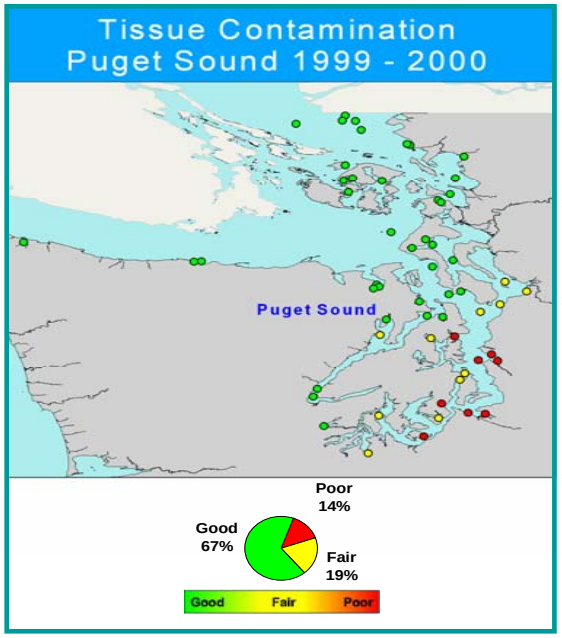


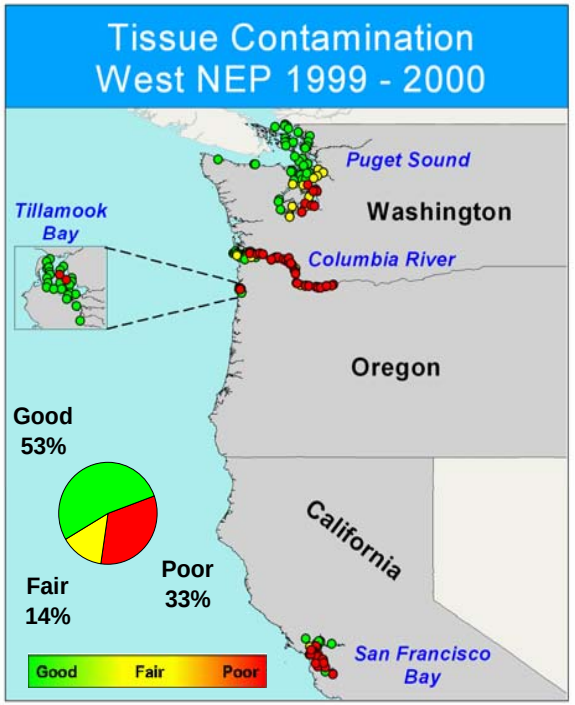
NCA - West:
Assessments for Multiple Clients at Multiple Scales



Western Regional Assessment
NCCR2

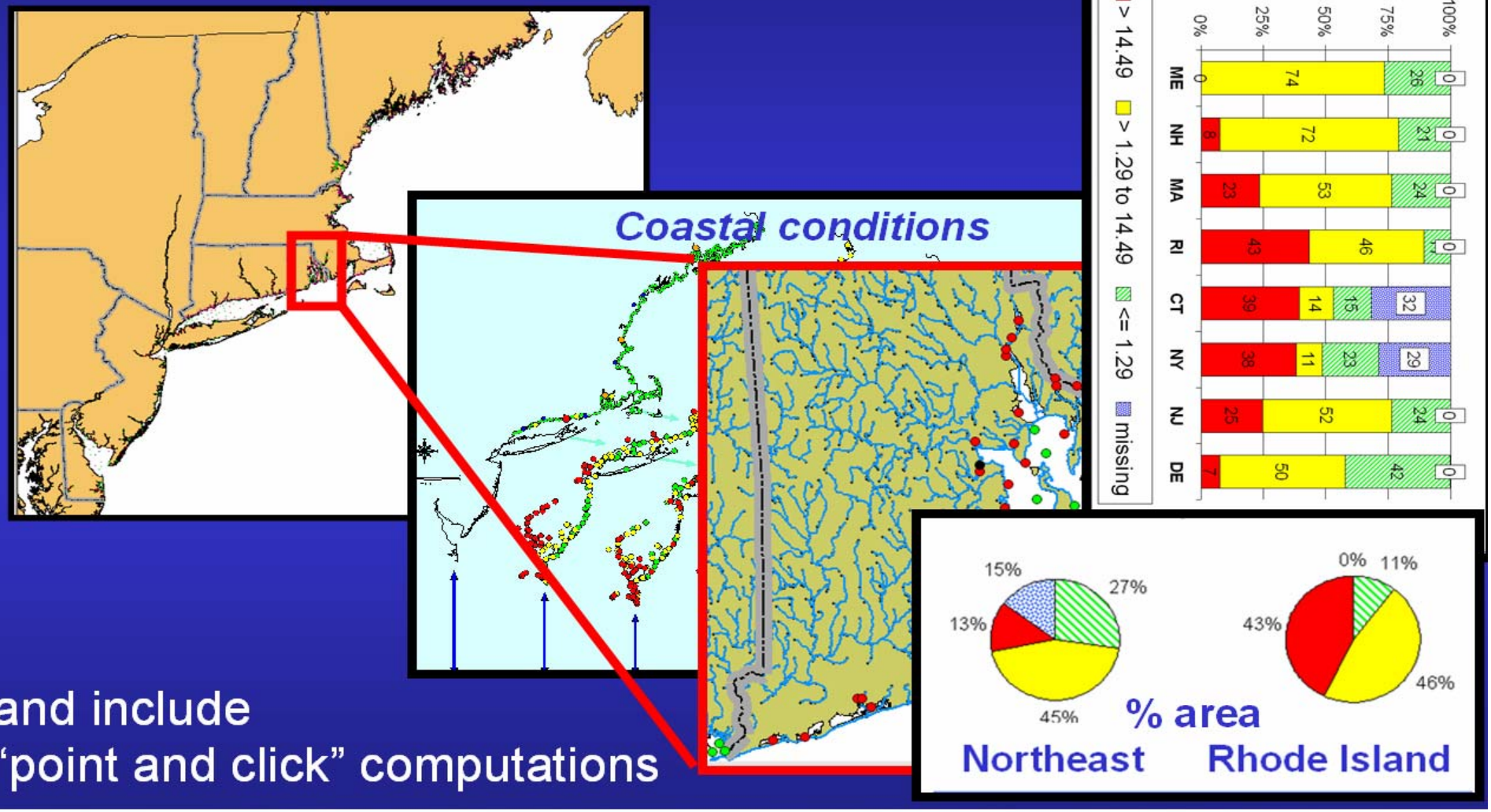
Puget Sound
National Estuary Program





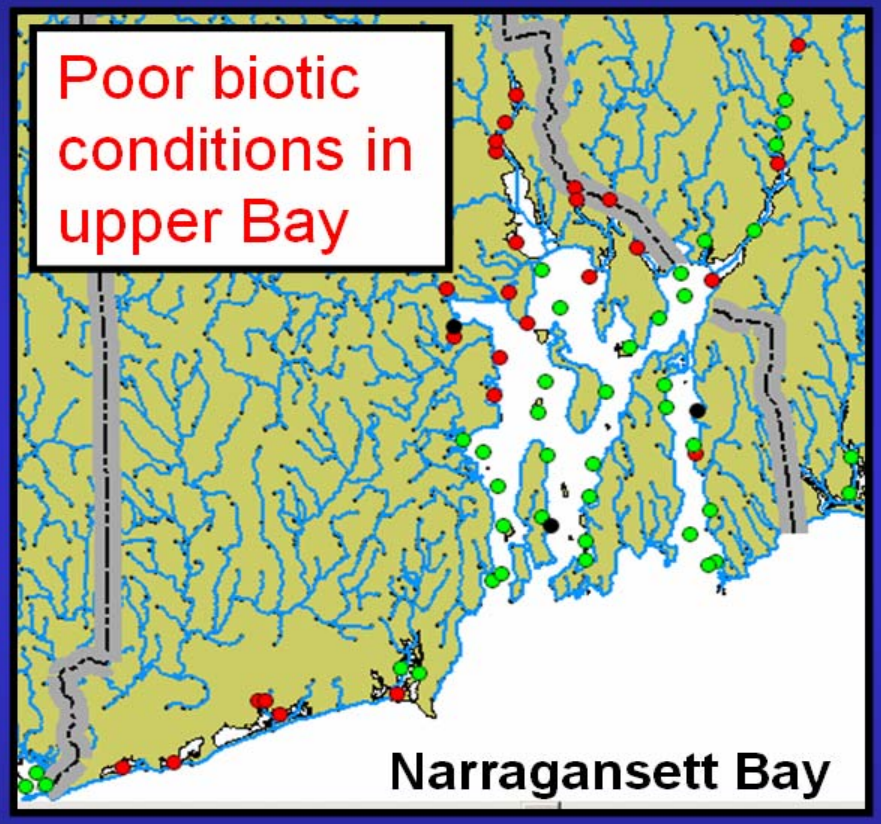
National Estuary Program
Regional Assessment

Our "Northeast Coastal Condition Report: 2000-2001" will illustrate baseline conditions.



and include
"point and click" computations

Spatial variations can be visualized



A large number of variables can be included and queried in GIS project - attribute tables

Index

	SPIONID	TUBIFIC
9	210	113
9		
9		
7		

	SHANNON	GLEASON
33	0.8218	4.4162
-999	-999	-999
20	0.7856	3.1705
1	0	0.1606
8	0.7456	2.1543

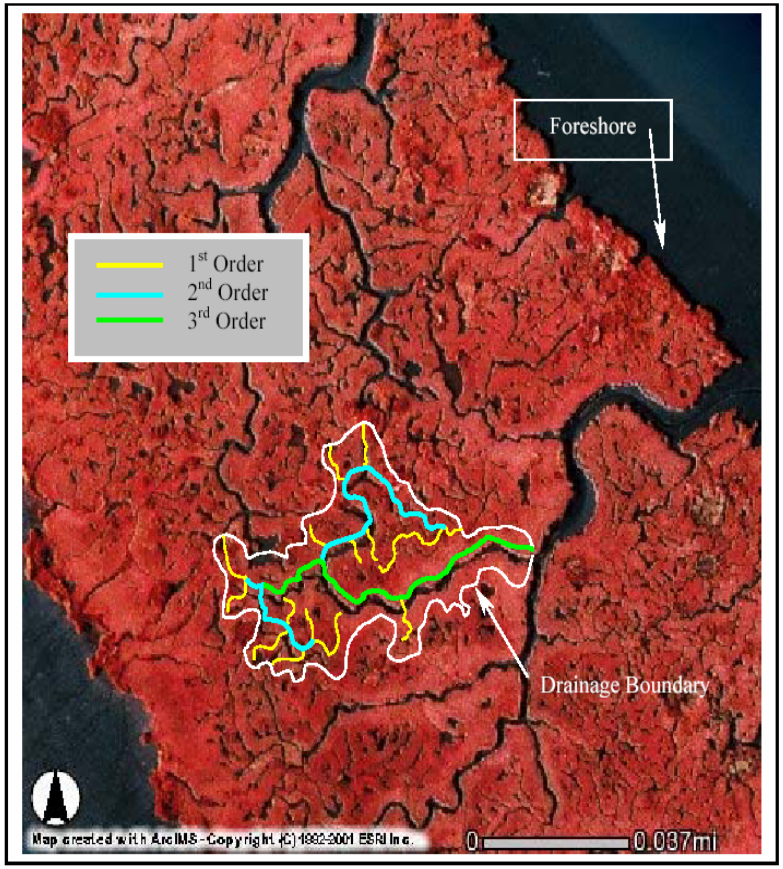
GIS: Virginian Province Benthic Index (NCA 2000-2001)

NCA - West: Breaking New Ground
2002 Intertidal Wetlands Survey

Hovercraft in Willapa Bay, WA

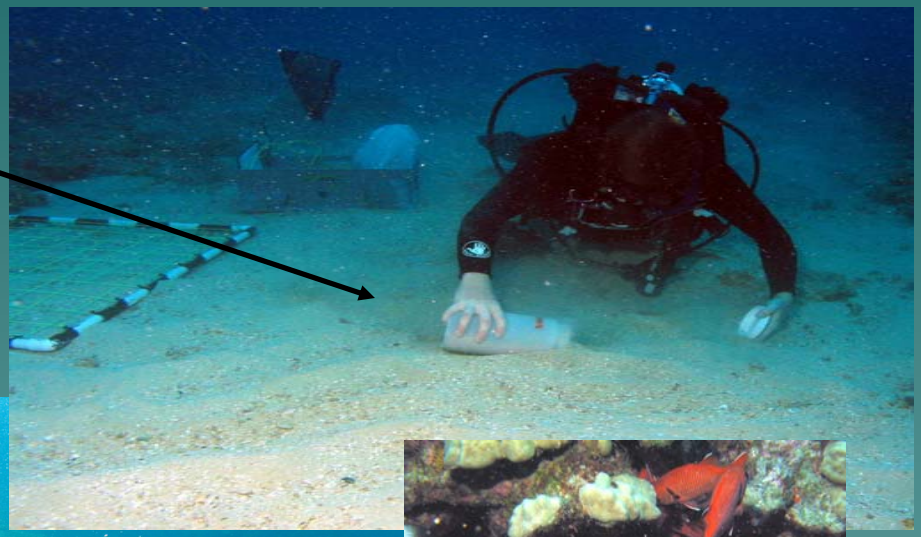
Wetlands Assessment in OR and CA

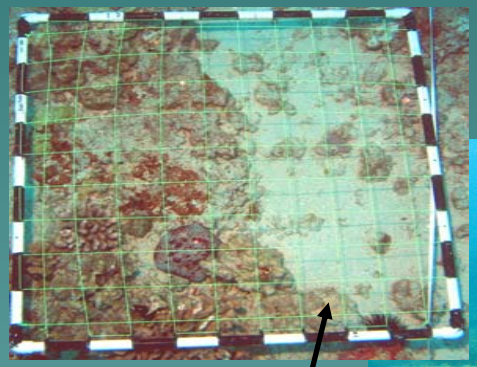
Landscape Scale Condition Indicators San Francisco Bay

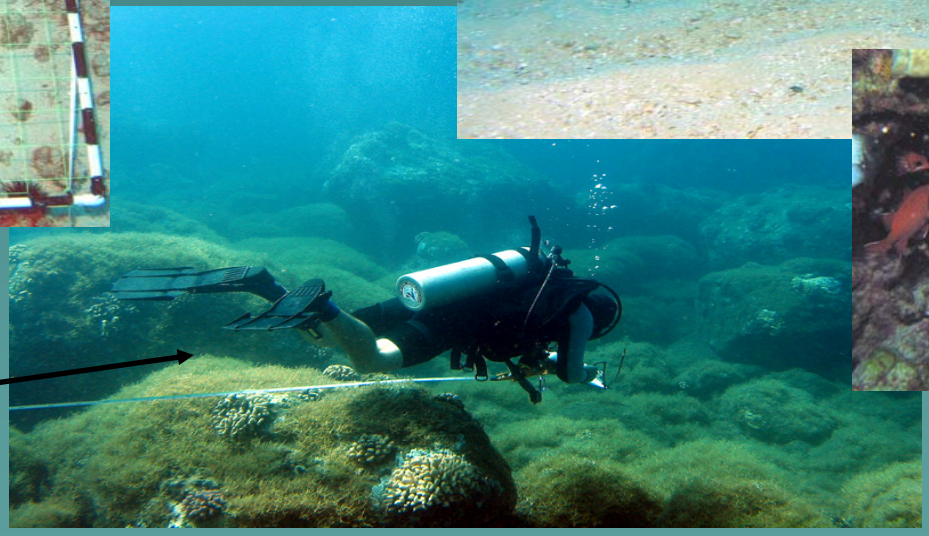


NCA - West: Breaking New Ground
Field Work - Hawaii 2002

Utilizing diver collection for sediment samples

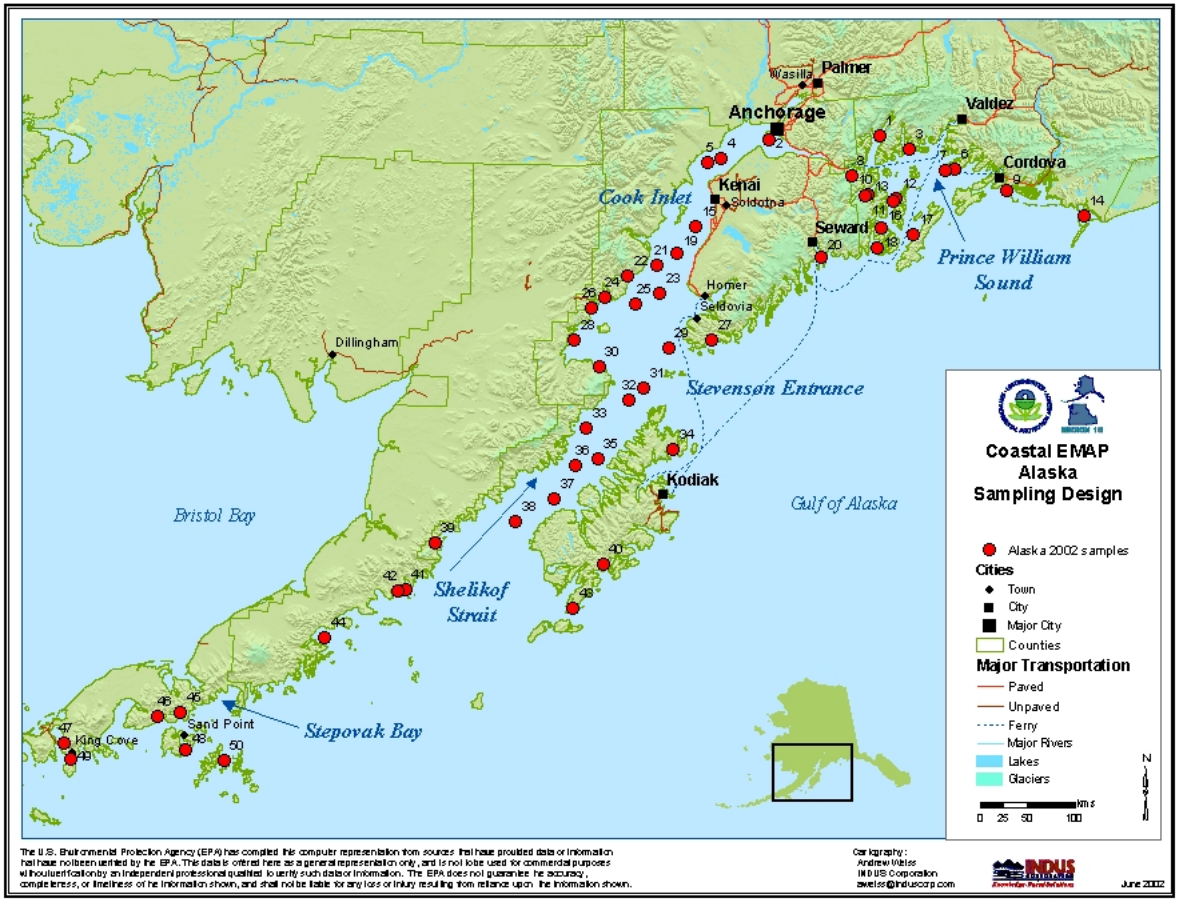




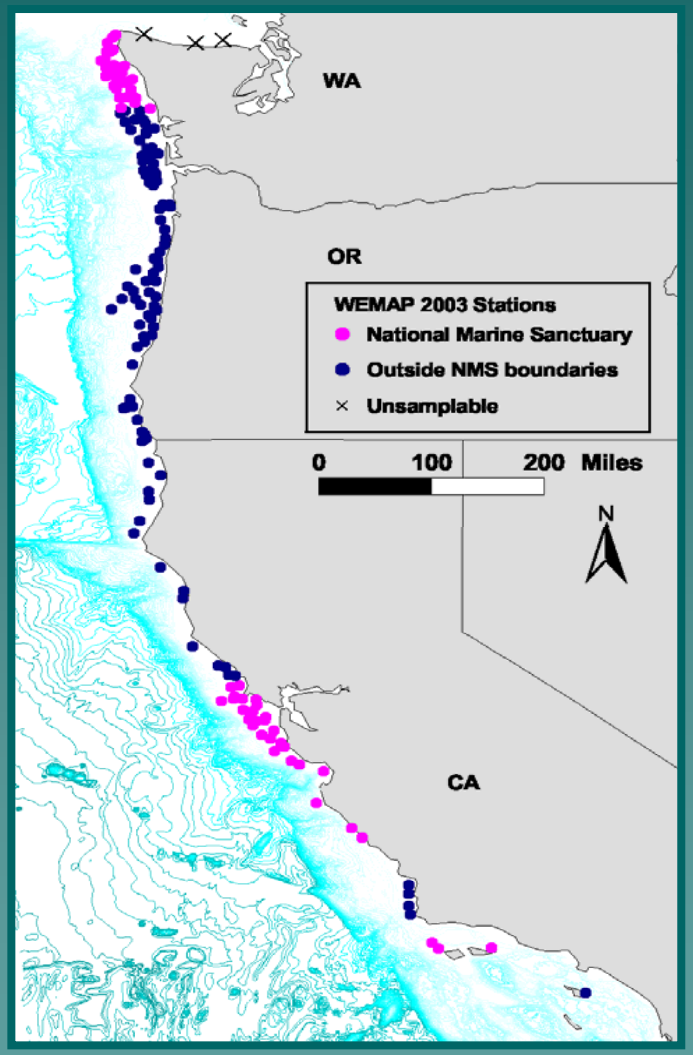


Hard substrate community sampling via quadrat methods.

NCA - WEST: Breaking New Ground
2002 Pilot Study, South Central Alaska



NCA - West: Breaking New Ground:
West Coast Shelf (30-120 m): 2003

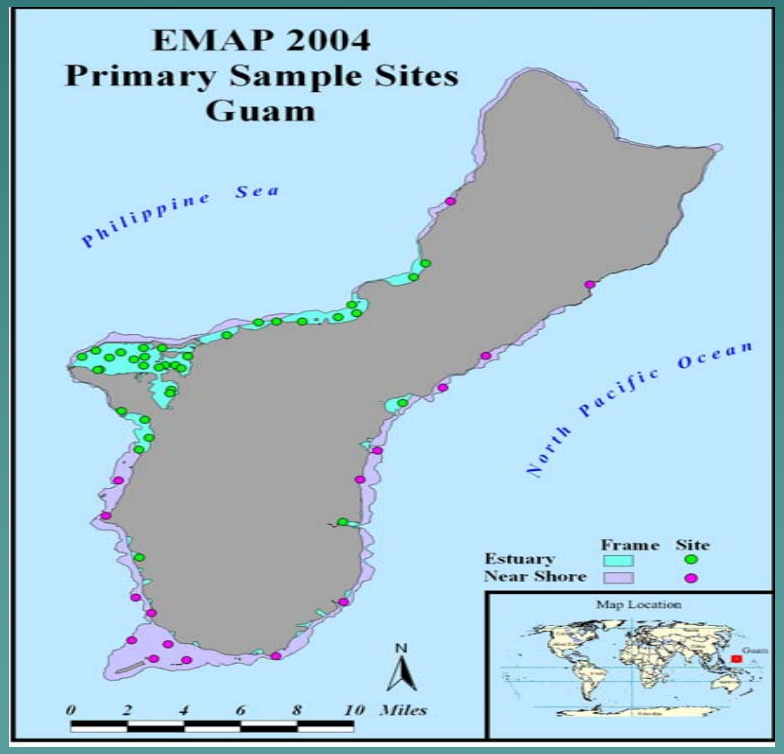


UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

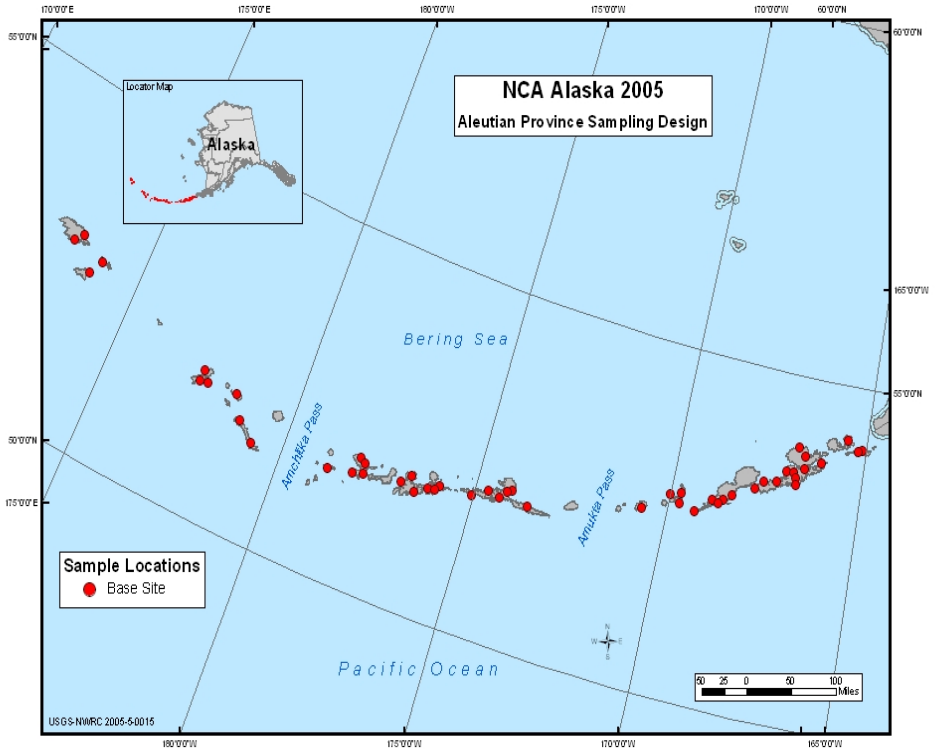
NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

Breaking New Ground in Coastal Assessment

Guam 2004 Sampling Plan



Aleutians 2005-6 Sampling Plan



International Transfer

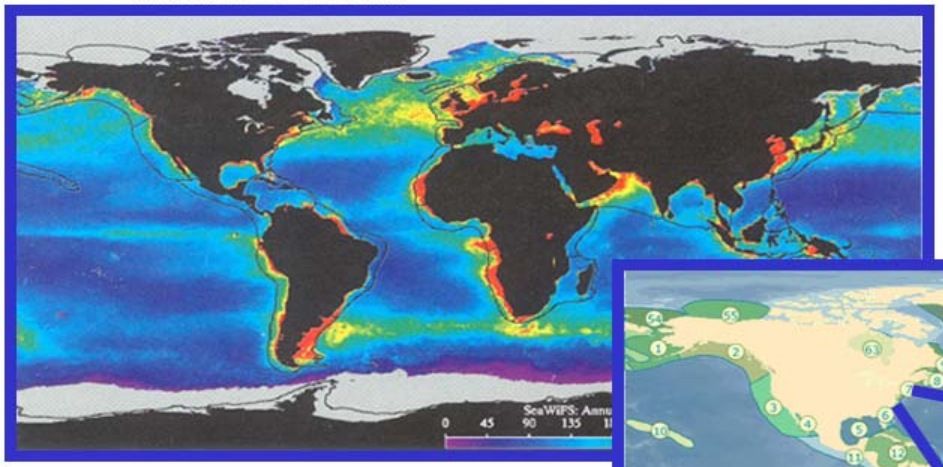
- Interacting with 80 countries through the Large Marine Ecosystem Program sponsored by GEF, WB, UNEP, UNDP UNIDO, and IUCN

RESEARCH & DEVELOPMENT

Building a scientific foundation for sound environmental decisions

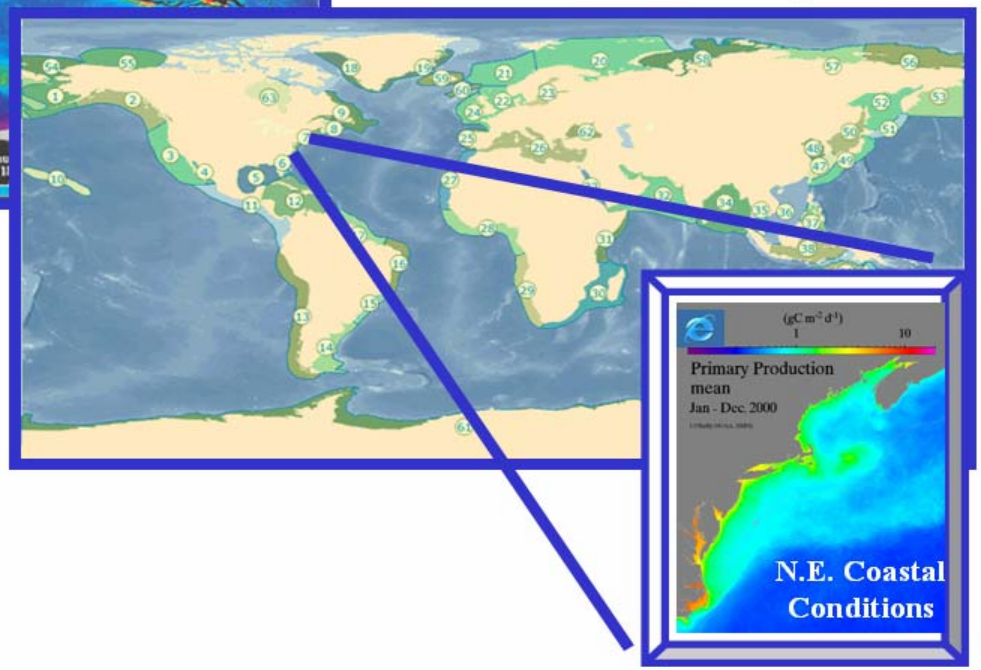
Large Marine Ecosystems of the World

Primary Productivity in the Ocean



The Color-inhanced image (provided by Rutgers University) depicts a shaded gradient of primary productivity from a high of 450g/Cm2 in red to <45g/Cm2 in purple.

UN Atlas of the Ocean: Interactive Map



International Applications

- Baltic Sea
- Benguela Current
- Guinea Current
- Yellow Sea
- Mediterranean Sea
- Black Sea
- Caribbean Sea
- Gulf of Mexico – Talk by Gold