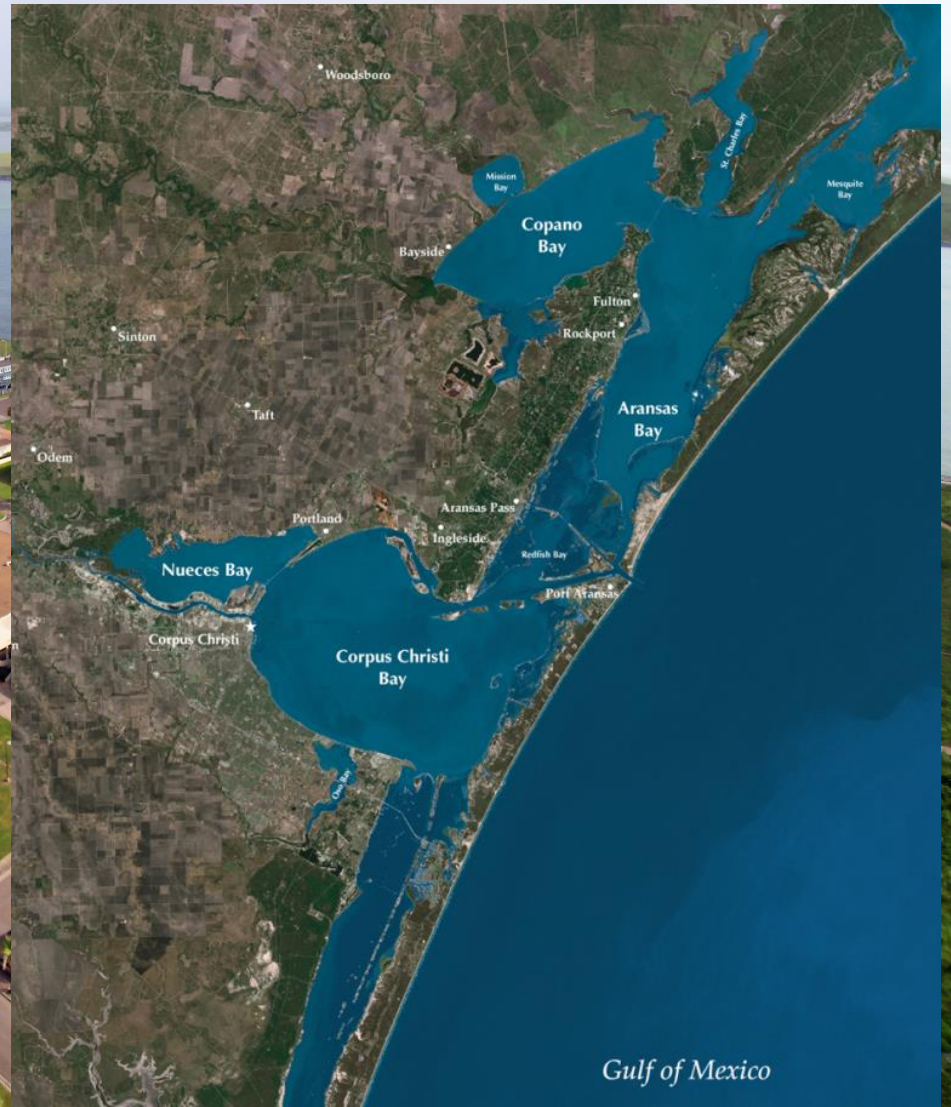






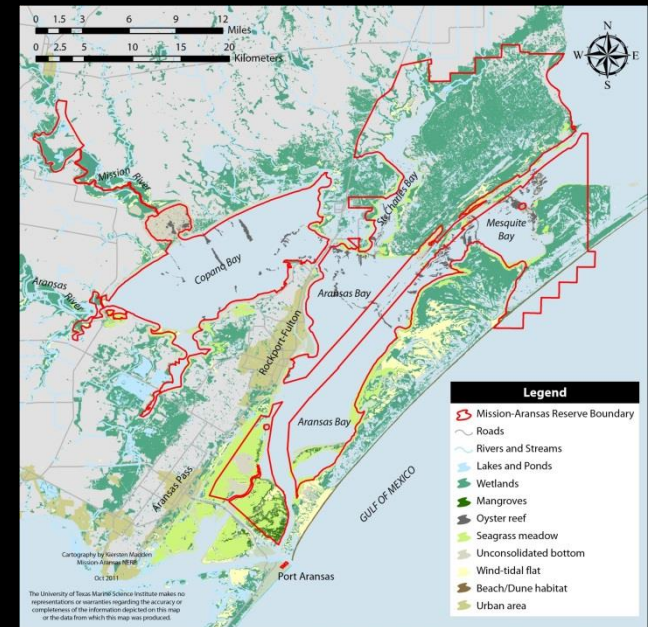
# MARINE SCIENCE INSTITUTE



72 Acres – Location, Location, Location

# NATIONAL ESTUARINE RESEARCH RESERVE

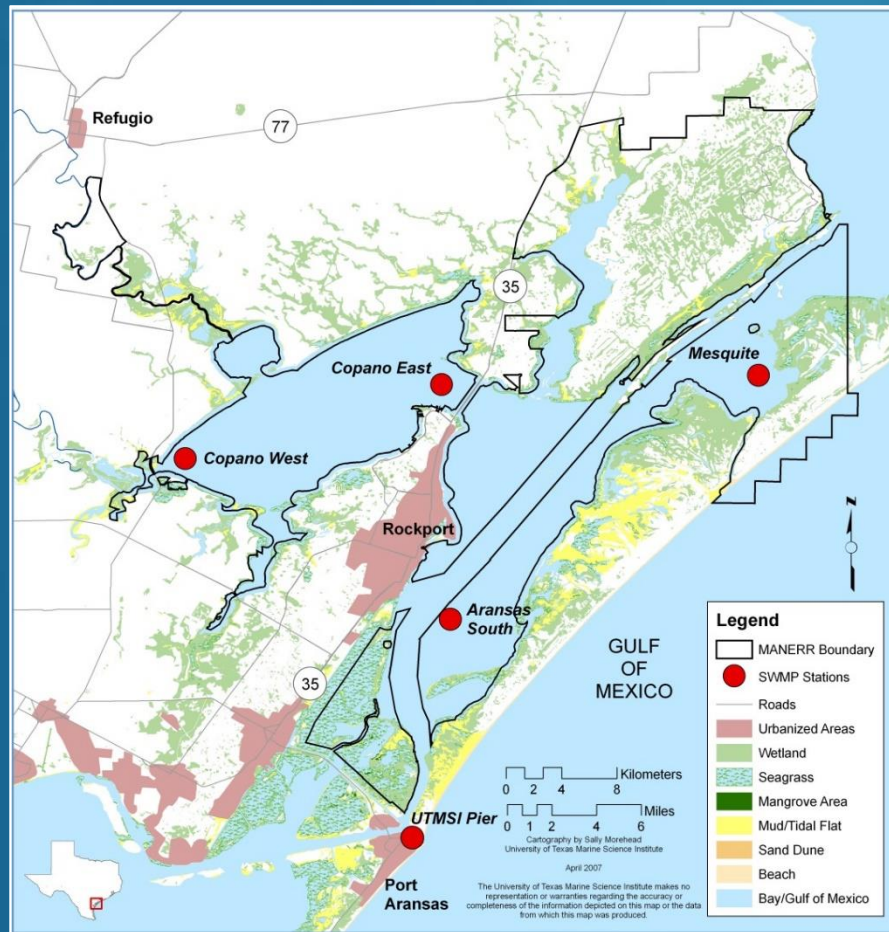
*Conducting long-term research to find solutions to crucial issues facing America's coasts*





# Mission-Aransas NERR Research

System-Wide Monitoring Program (SWMP)  
9 years of water quality, nutrient data, 5 stations  
NERR-IOOS integration; NAML



Real time Weather and Water  
Data available online  
[utmsi.utexas.edu](http://utmsi.utexas.edu)



# SWMP - ABOTIC

## SYSTEM WIDE PROTOCOLS

*Same equipment and protocols = comparable data*

- Same equipment aids in tech training
- Water depth, temperature, salinity, pH, turbidity, oxygen and chlorophyll
- Collected every 15 minutes
- Data is telemetered by satellite/radio and recorded internally



# SWMP – ABOTIC

## BIOLOGICAL AND CHEMICAL MONITORING

*Same equipment and protocols = comparable data*

- Biological and chemical data
- Inorganic nutrients (nitrate/nitrite, ammonium, phosphate, silicate) and extracted chlorophyll monthly
- 1 station collect @ 2-hour intervals  
for nutrients and chlorophyll over a 24  
hours period, per month – estimate fluxes  
of nutrients and algal biomass



# SYSTEM WIDE MONITORING PROGRAM (SWMP) – VEGETATION MONITORING





# SWMP – VEGETATION SYSTEM WIDE PROTOCOLS

*Same equipment and protocols  
= comparable data*

- Annually during peak biomass
- Transects with 1m<sup>2</sup> quadrats
- Abundance, % cover, composition,
  - shoot/stem densities, & canopy height
- Groundwater salinity for marsh
- Voucher specimens



# SYSTEM WIDE MONITORING PROGRAM (SWMP) – HABITAT MAPPING

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- **Map** land cover and land use in Reserve and watersheds
- Model elevation and tidal datums in Reserve and elevation in adjacent watersheds

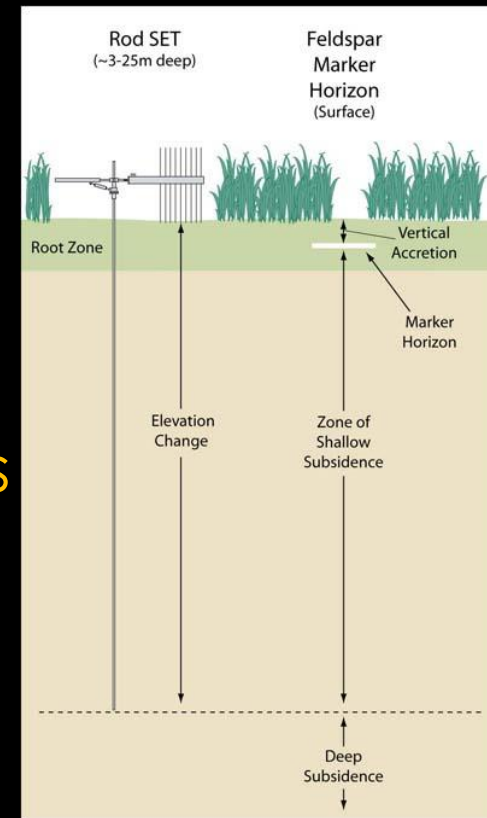
*Map, model, and disseminate information on habitat trends and associated linkages to anthropogenic- and climatic-stressors.*

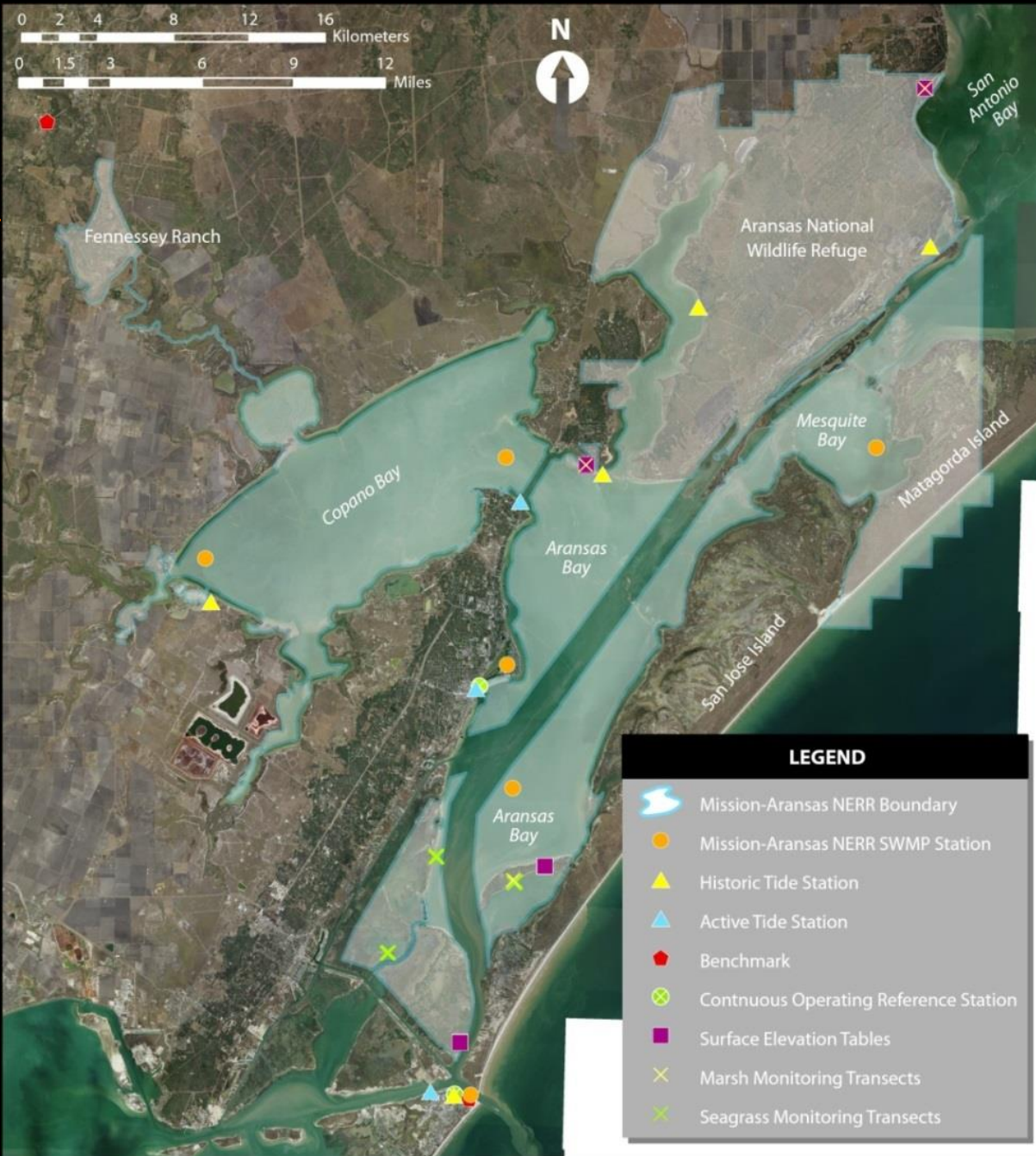
# SWMP – SENTINEL SITE

## SEA LEVEL CHANGE

### Elevation/Vertical control

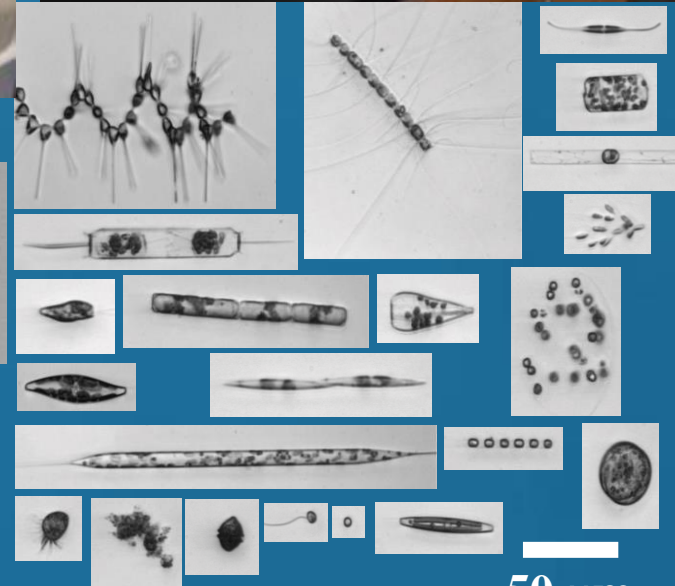
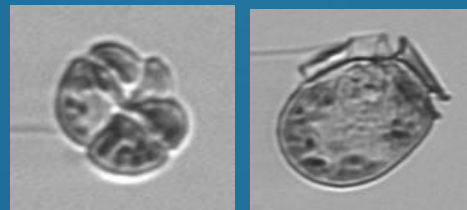
- vertical bench marks with verified heights
- long-term tide stations
- knowledge of local tidal datums
- Continuous Operating Reference Stations
- Surface Elevation Tables (SETs)
- Marker horizons





# HARMFUL ALGAL BLOOM MONITORING

- Imaging FloCytobot – Lisa Campbell, TAMU
- Deployed on UTMSI pier
- Local support by MANERR personnel
- FlowCAM – grab samples from SWMP stations
- Detected first reported toxic bloom of *Dinophysis* in Feb. 2008 – lead to closure of oyster beds before any human illness reported
- *Karenia* blooms



Continuous monitoring using Imaging FloCytobot (left) deployed on UTMSI pier,

50  $\mu$ m

# TOWARD A BROADER COASTAL MONITORING NETWORK

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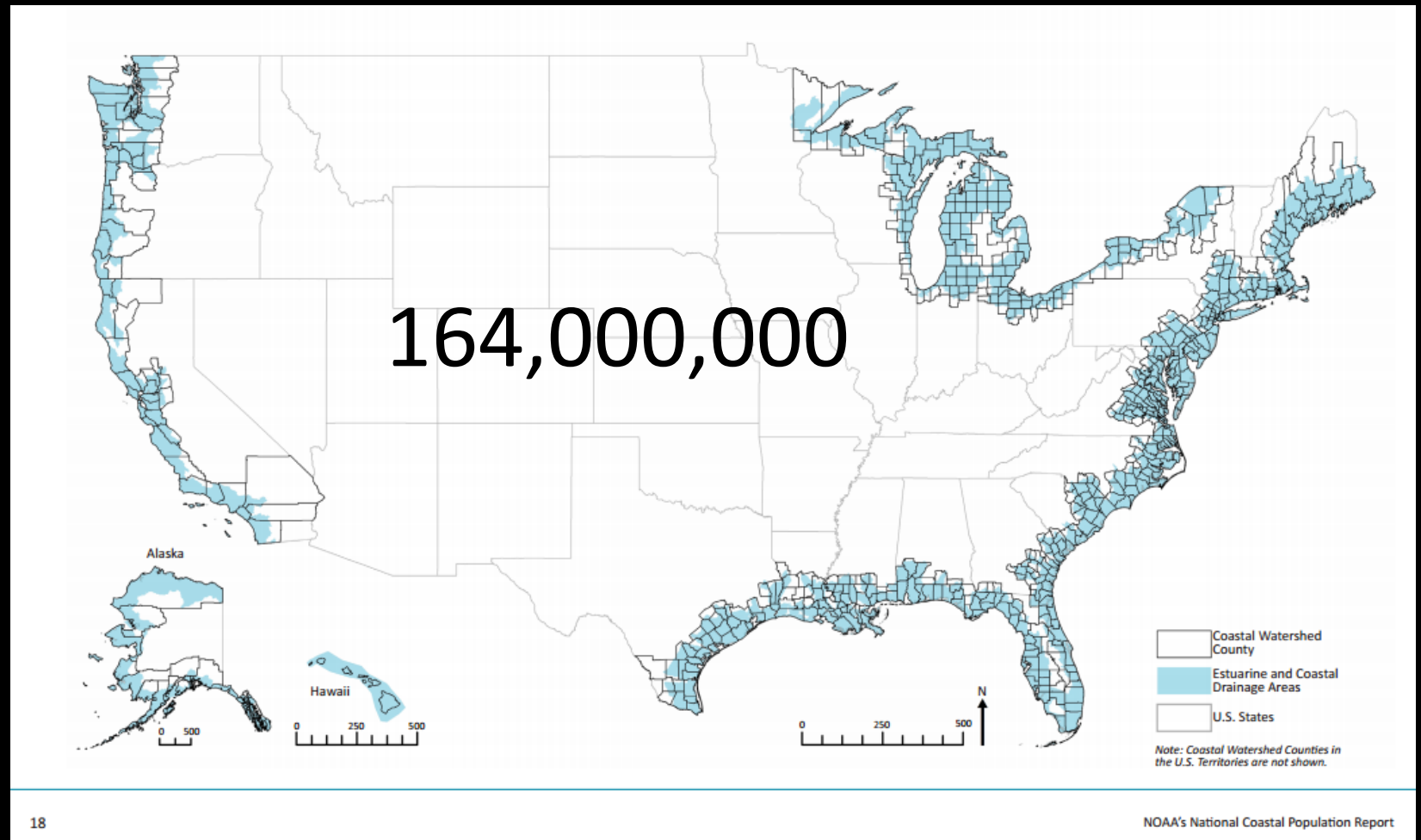
## NERRS Approach

- Standardized abiotic monitoring 4 sites
- Standardized protocols for vegetation monitoring
- Sentinel Site Application Modules (SSAM)
- Toolbox approach for biological monitoring; development of standard protocols
- Suggested budget for abiotic monitoring" \$120K/yr

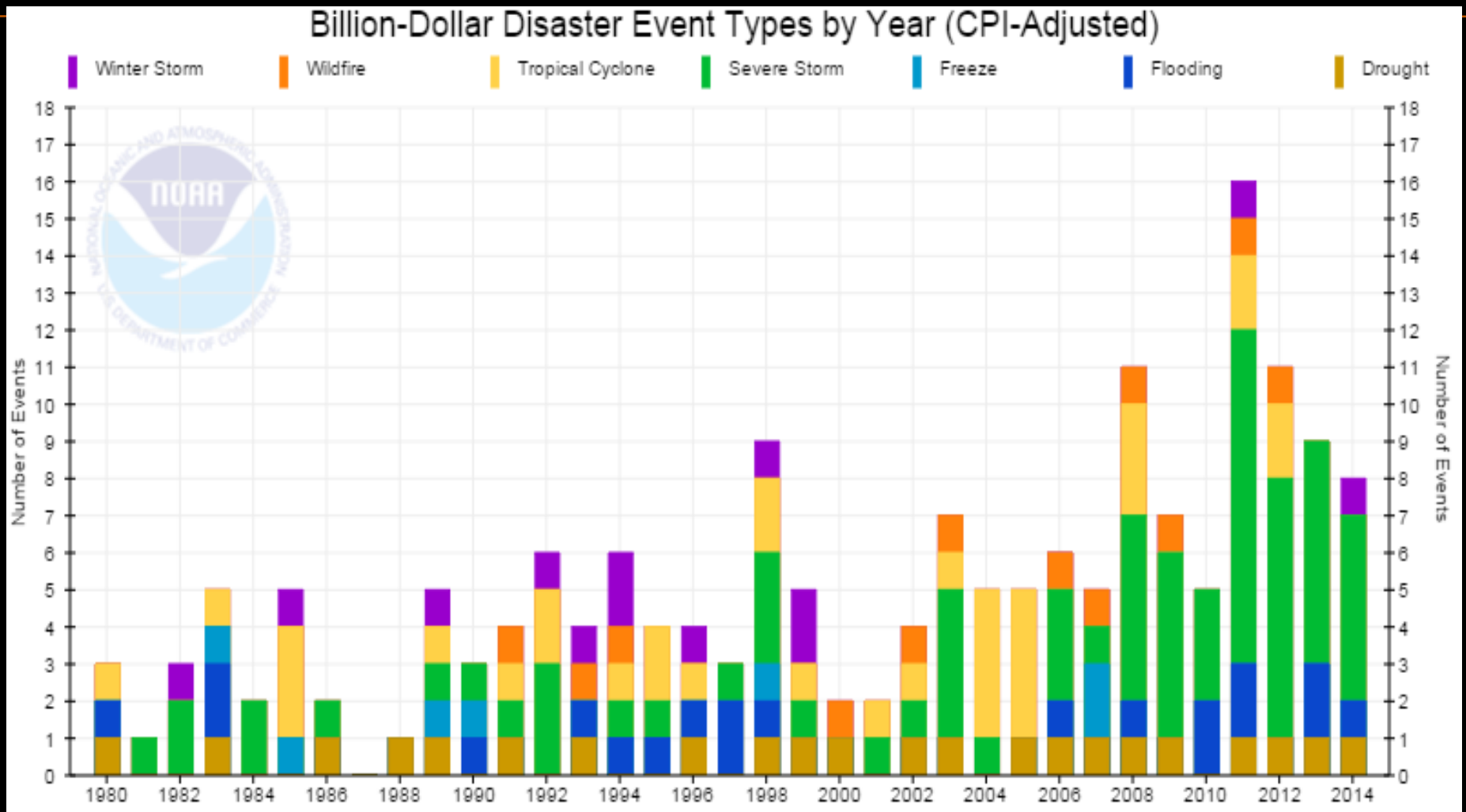
## IOOS/NAML/others

- Abiotic need not be as rigorously standardized
- Instrument calibration is key
- QA/QC standards and data repository with metadata important
- Goal for standardized protocols for biological monitoring and metadata standards

# ABOUT HALF OF US POPULATION LIVES IN COASTAL WATERSHED COUNTIES



# GENERAL INCREASE IN WEATHER AND CLIMATE RELATED DISASTERS



<http://www.ncdc.noaa.gov/billions/time-series>

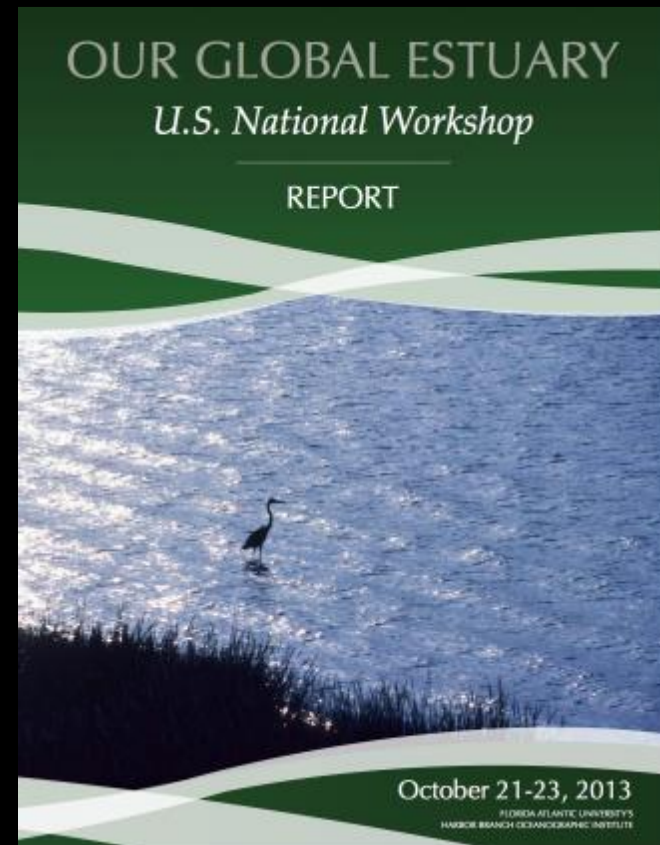




Courtesy: GOOS

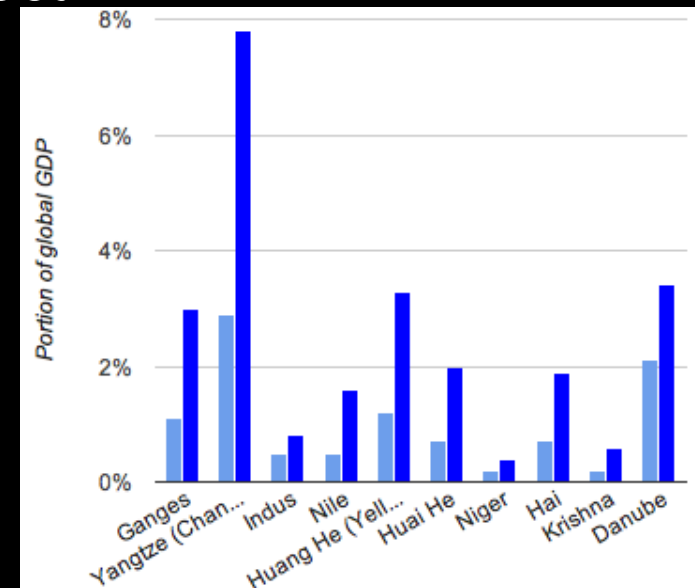
# Our Global Estuary

- [António M. Baptista](#), Oregon Health & Science University
- [Edward Buskey](#), The University of Texas at Austin
- [Megan Davis](#), Harbor Branch Oceanographic Institute
- [Margaret Leinen](#), Scripps Institution of Oceanography
- [Vembu Subramanian](#), SECOORA
- [Yvette Spitz](#), Oregon State University



# BROAD RATIONALE

- **Estuaries are essential interfacial ecosystems**
- Buffer the ocean from land stresses
- Are distinctive nurseries and migration corridors
- Are major hubs of economic development
- Portion of global GDP increasing rapidly in most populated river/estuary systems
- Are unique resources to their communities, including in many cases their Indigenous peoples
- ...
- **Estuaries are sensitive to change**
- Climate change
- Subsidence
- Increased land development
- ...



# 2013 U.S. NATIONAL WORKSHOP: OUTCOMES

**Our Global Estuary**, created around points of consensus that boil down to these four key ideas:

Estuaries are important individually, essential as a collective

Estuaries are undergoing increasing stresses, smart local action on the collective of estuaries is needed for global sustainability

We must develop the ability to quickly and effectively transfer lessons learned across estuaries

Estuarine **classification systems** and **observation & prediction systems** are key to knowledge transfer, capacity building and stakeholder engagement

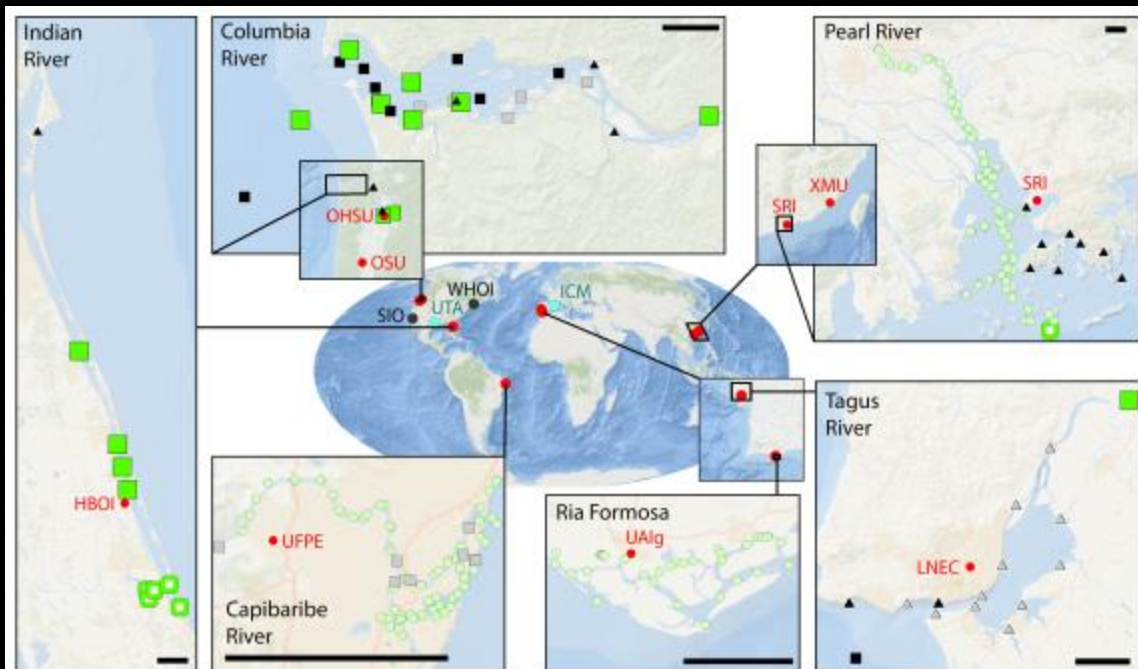


- 50 invited participants, mostly across the U.S.
- Expertise: estuarine and coastal observatory science, technology, data management, and models; fisheries, biogeochemistry, and oceanography; resource management and policy; socio-economics; environmental law; tribal culture; and education.

# MOVING FORWARD: OUR *VIRTUAL* GLOBAL ESTUARY

## Vision

- Progressively create an *in silico* global estuary, leveraging & improving existing observations
- Tiered evolution: *Tier 1* estuaries (tentatively, below), unlimited *Tier 2* and *Tier 3* estuaries
- Initial partners: 12 institutions from 5 countries
- Strong Education & Indigenous components



World ocean background layer: Sources: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors.

## Target Outcomes

Understanding of the **global** significance and susceptibility of estuaries

Quantification of the buffering capacity and **safe operating space** of estuaries

Conceptual & **modeling framework** to study estuaries worldwide

**Worldwide capacity- building** in estuarine science

# THE SMITHSONIAN'S MARINEGEO

Email: [MarineGEO@si.edu](mailto:MarineGEO@si.edu)  
Twitter: [@SmithsonianMarineGEO](https://twitter.com/SmithsonianMarineGEO)





# WHAT IS MARINEGEO?

## MarineGEO niche IS:

- Focused on biodiversity and ecosystem function
- Coastal, shallow, benthic
- Habitat-based
- Standardized sets of observations and experiments
- Long-term and interdisciplinary
- Coordinated across a global network of partnerships
- New and growing

## IS NOT:

- Physical and chemical oceanography
- Open, pelagic ocean
- Remote-sensing only
- Short-term
- Local or regional only

# MARINEGEO: A GROWING GLOBAL NETWORK





SALT MARSH VEGETATION



MANGROVES



ROCKY INTERTIDAL



SEAGRASSES



# MARINEGEO CORE RESEARCH

## ENVIRONMENTAL FORCING FACTORS

- Temperature
- Conductivity/Salinity
- Dissolved oxygen
- Turbidity
- Pressure
- Fluorescence
- Nitrogen concentration
- Precipitation

## BIODIVERSITY INVENTORY

- Habitat mapping
- Infauna
- Epifauna
- Macrophytes
- Nekton

## BIODIVERSITY QUANTIFICATION

- Infauna
- Epifauna
- Macrophytes
- Nekton
- Sessile organisms
- Structural complexity
- Disease

## ECOSYSTEM PROCESSES

- Primary production
- Recruitment
- Decomposition
- Herbivory
- Predation



CORAL REEFS



OYSTER REEFS



KELP FORESTS



SOFT SEDIMENTS



# SUMMARY

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- NERRS/SWMP: National system with standardized water quality, vegetation, habitat mapping, sentinel sites for coastal change, resiliency; network of 28 sites, up to 20 years of existing data; standardized QA/QC; Centralized Data Management Office; Integration with IOOS
- OGE: National meeting; plans for international meeting; research in formative stages, seeking additional funding NSF-PIRE; classification of estuary types based on physics; develop a series of circulation models; supplement/tune models with local measurements
- MarineGEO: Focus on biodiversity; environmental monitoring, ecosystem processes
- NAML....



[utmsi.utexas.edu](http://utmsi.utexas.edu)  
[missionaransas.org](http://missionaransas.org)  
[dropps.utmsi.utexas.edu](http://dropps.utmsi.utexas.edu)

*Discovery Starts Here*