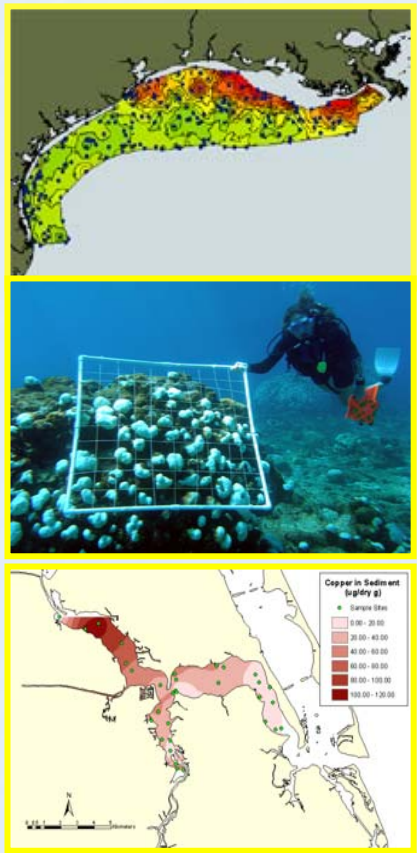
Air Quality and Water Quality Monitoring in NOAA

Jawed Hameedi

Center for Coastal Monitoring and Assessment

NOAA, NOS, NCCOS

Silver Spring, MD



NWQMC Meeting

Reston, VA

December 10, 2008

Legislative mandates:
derived from more than a dozen specific statutes

Strategy

Exercise NOAA's full range of capabilities (research, monitoring, assessment, technology transfer, education, and outreach) and focus those efforts on:

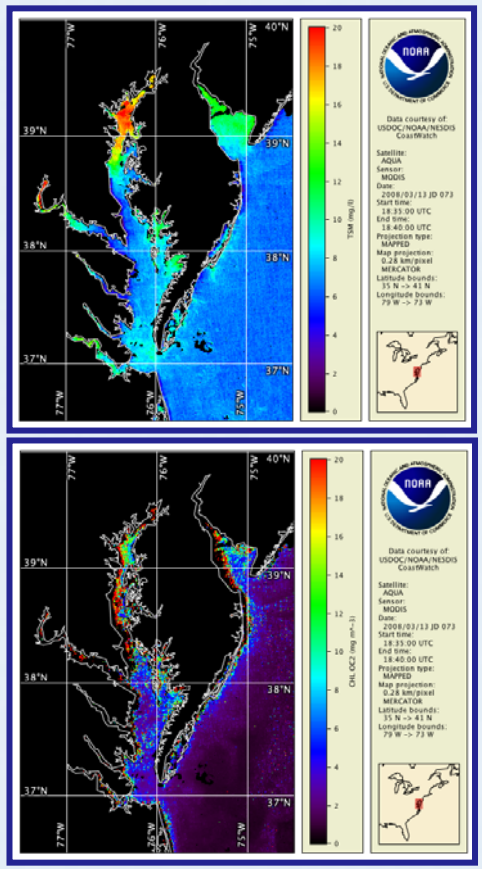
- Providing greater understanding of coastal ecosystems and the goods and services they provide for sustaining the Nation's economy;
- Designing and implementing management solutions that are comprehensive, integrated, and geographically-focused over a variety of scales; and
- Synthesizing and communicating information about coastal environmental issues to coastal decision-makers and the public

Water Quality Data Needs

Establishing connections between water [and air] quality and undesirable ecosystem conditions or outcomes (e.g., nuisance or harmful algal blooms, eutrophication, fish diseases and deformities, hypoxic conditions, and loss of species and biodiversity)

Water Quality Data Needs – contd.

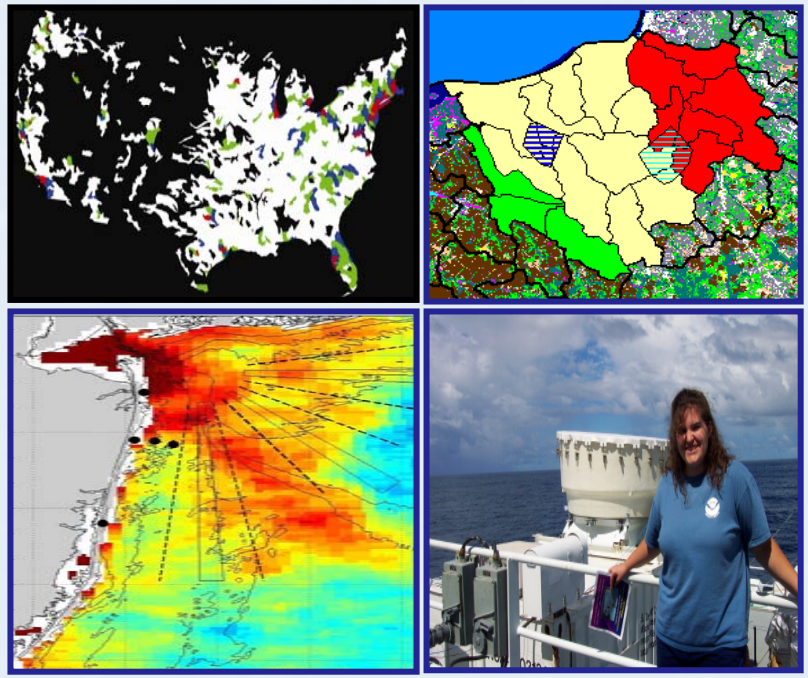
Understanding the role of physical processes (including episodic events, decadal changes, and global warming) on coastal and Great Lakes ecosystems.



Loading from a Runoff Event in Chesapeake Bay, March 2008
(High-Resolution Ocean Color Satellite Data)
http://coastwatch.noaa.gov/

Water Quality Data Needs – contd.

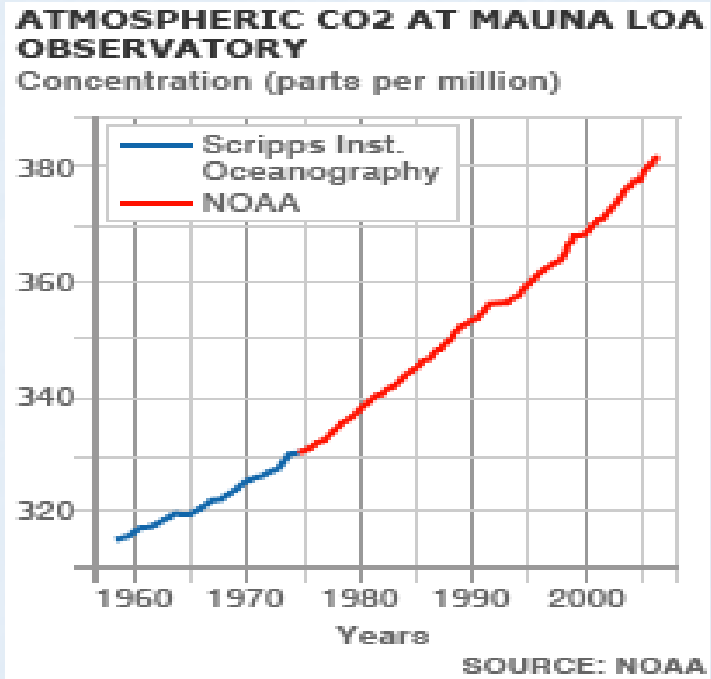
- Fostering collaboration between NOAA, universities, and states
- Enhancing environmental literacy (through education, outreach and training)

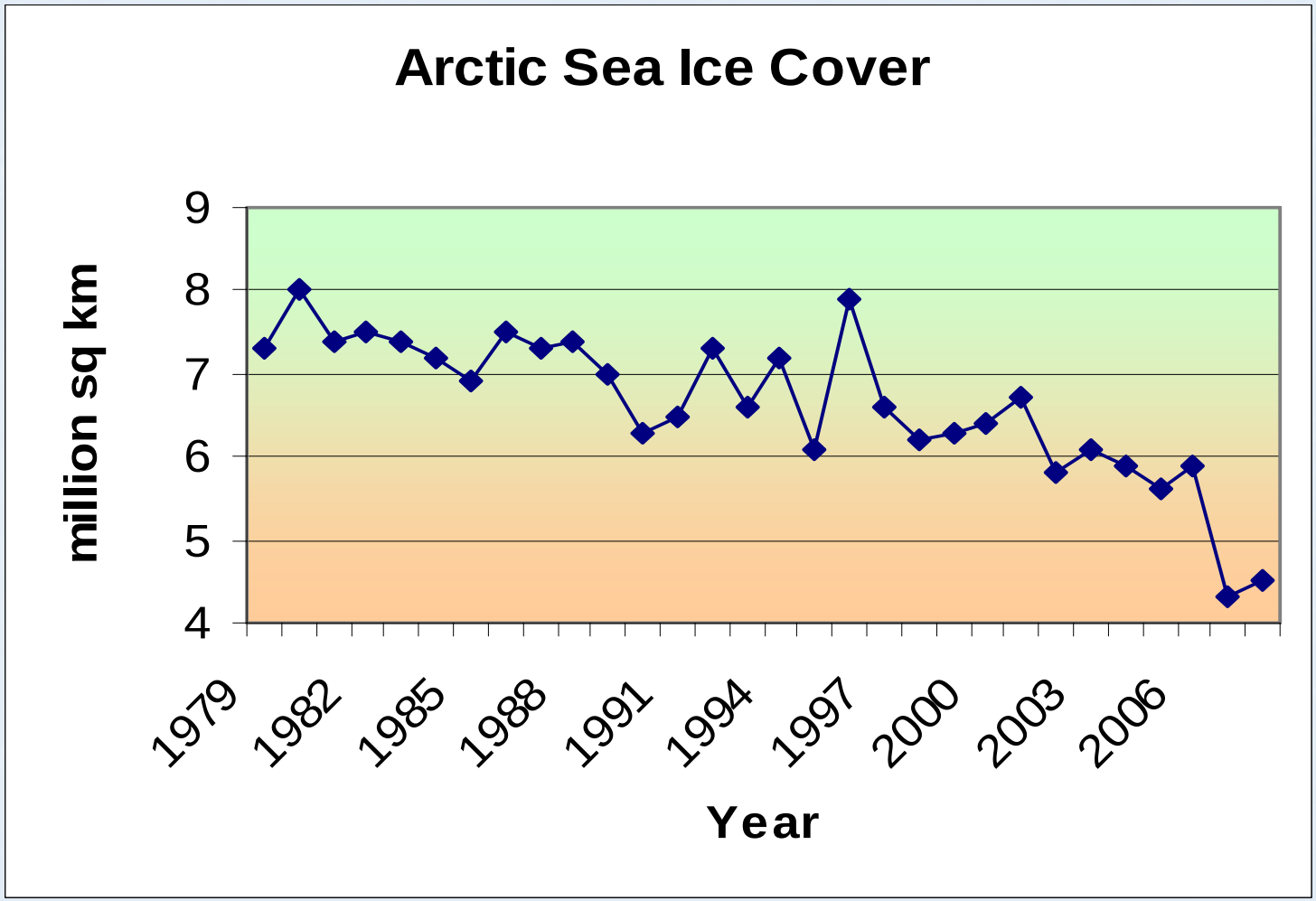


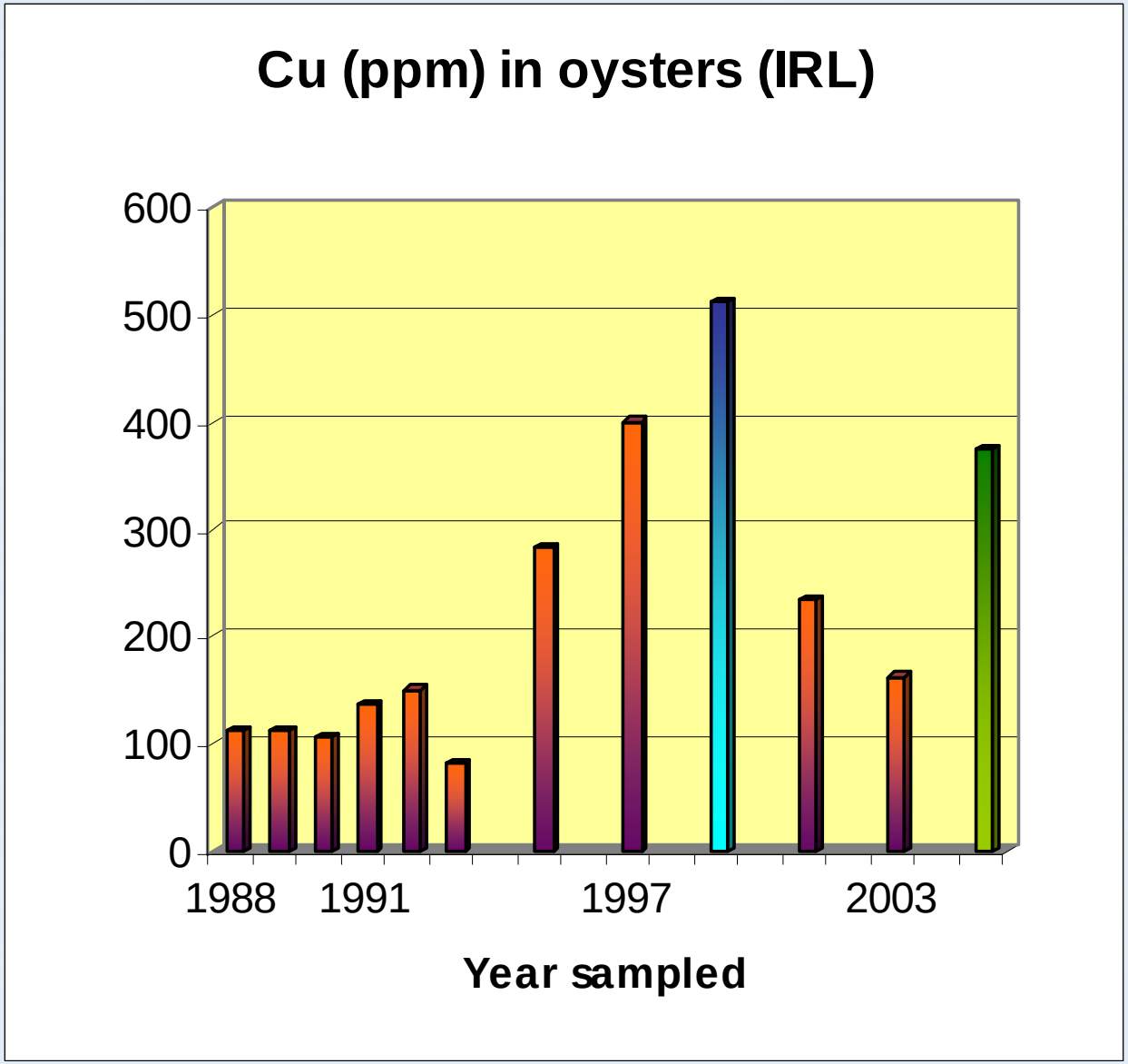
Impervious surface area; ISAT; Rutgers COOL; Teachers at Sea

Environmental Monitoring

- Environmental monitoring results make strong and lasting impression – both perceptibly and metrologically; such data can develop or alter public policies
- It can answer specific, straight-forward questions with consistent, high quality data
- Keeling Curve




Arctic Sea Ice Cover
million sq km
9
8
7
6
5
4
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Year

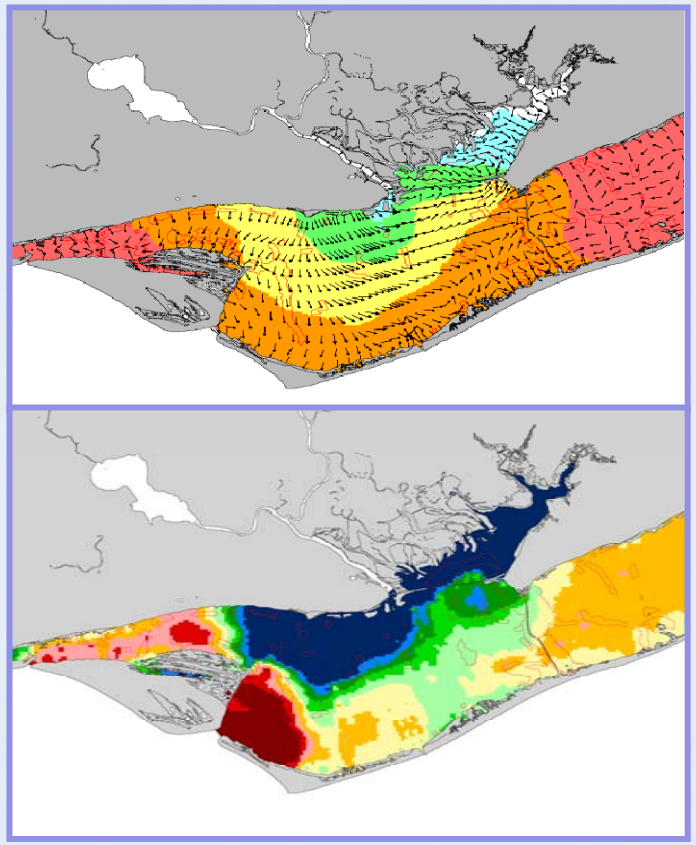

Cu (ppm) in oysters (IRL)
600
500
400
300
200
100
0
1988
1991
1997
2003
Year sampled

In the end, we can't rely on observations alone; need to know causes and consequences of change

- *"Policy-relevant evaluative research"*
  - *Factually correct, reproducible data*
  - *Accurate representation of technical issues; multi-dimensional questions cannot be solved by one-dimensional data*
  - *Balanced analysis and interpretation; exceptions are important*
  - *Pass the muster – peer review*

Also, at the most basic level we want to say something about the future: Forecasting

- Forecasting impacts on oyster mortality under reduced freshwater availability
- Integration of a suite of hydrodynamic and biological models
- Simulations under normal, flood, drought and future (Year 2050) flow conditions
- Collaborative work: NOAA, ACOE, State of Florida

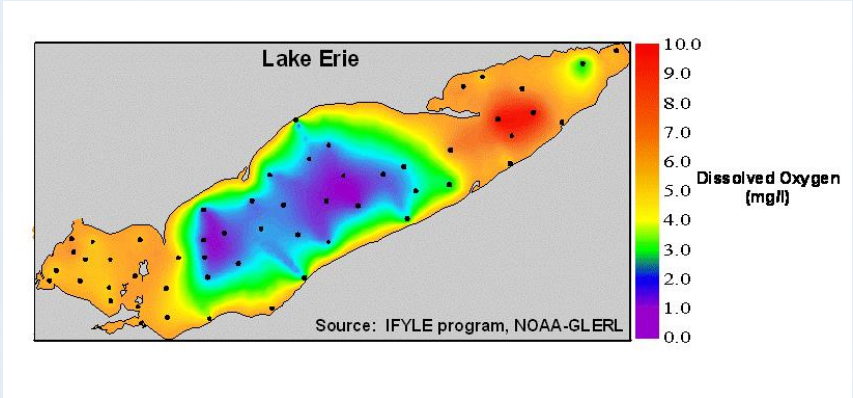


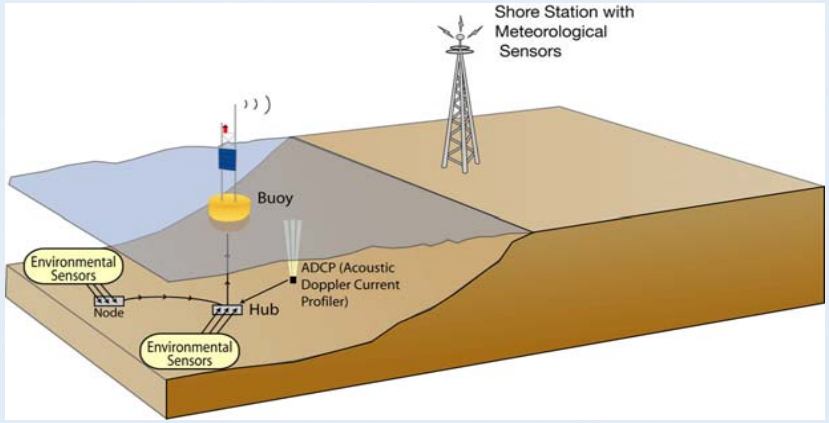
Forecasting onset of hypoxic conditions – Lake Erie

Early warning system for Cleveland Water District to adjust water intake, storage and processing due to low-oxygen water

- Lower temperature
- Lower pH
- Possible manganese precipitation

Monitoring by Real Time Coastal Observation Network (ReCON) with automated, multiple sensor data





Copper is on the increase in many coastal bays and estuaries

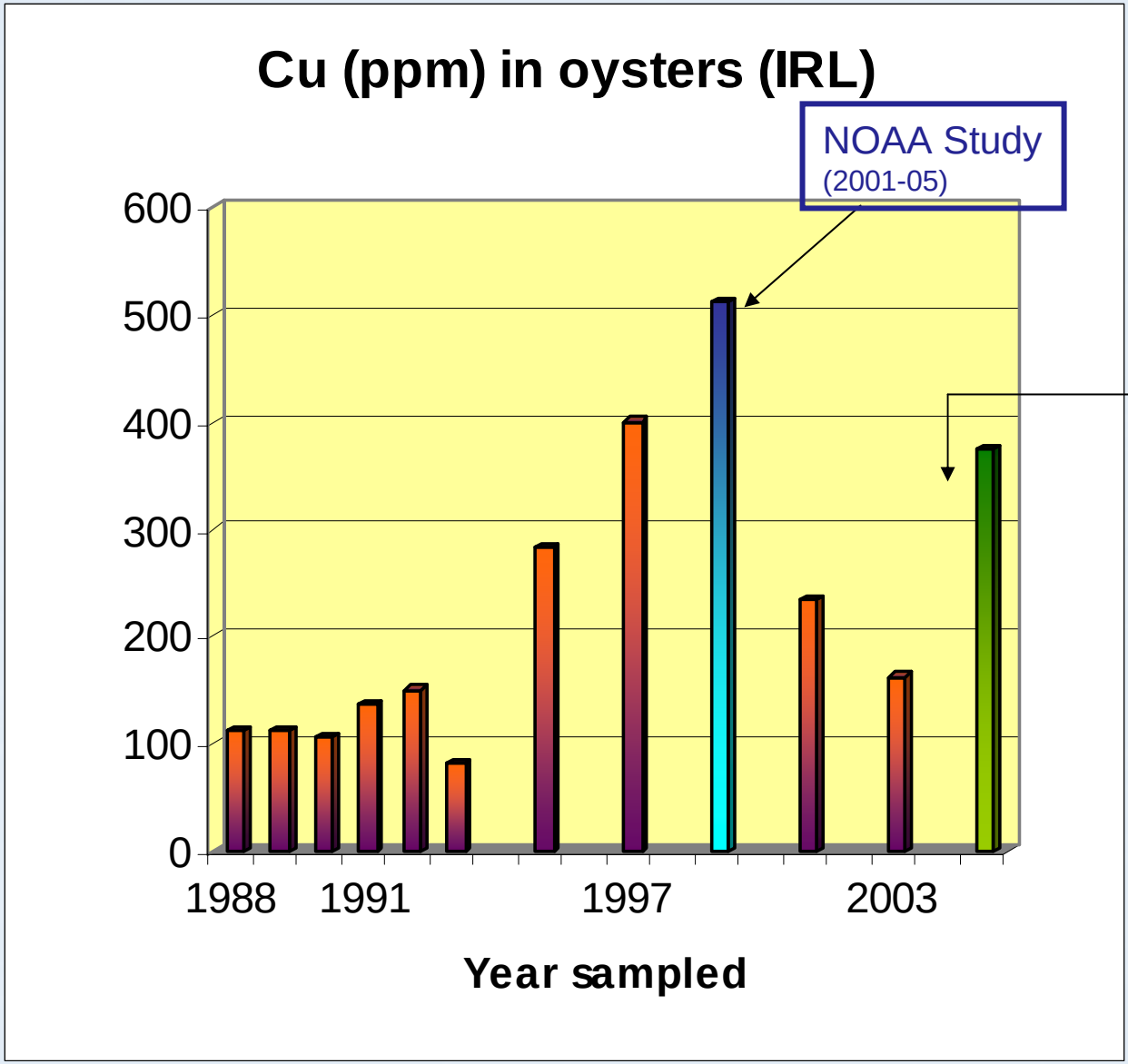
- Upper Bay/HRE
- Jamaica Bay/HRE
- Boston Harbor
- Narragansett Bay
- Naples Bay, FL
- St. Lucie Estuary, FL
- San Diego Bay, CA
- Newport Bay, CA

- Water criteria (EPA 2006)
  - 3.1 ppb (CCC)
  - 4.8 ppb (CMC)
- Sediment guidelines
  - ER-L: 34 ppm
  - ER-M: 270 ppm
  - Consensus (1): 30 ppm
  - Consensus (2): 100 ppm
  - UK EAC: 5 to 50 ppm

  (Ecotoxicological Assessment Criteria)

SLE: Identified Copper as a Contaminant of Concern

- Multiple lines of evidence
  - Ambient levels in sediments exceed ERL and TEL levels (34 and 19 mg/kg) – consensus "level of concern:" 100 mg/kg
  - Tissue residues in oysters high relative to the 85th percentile of nationwide MW data
  - EC 50 values – Cu spiked assays (LC_{50} = 125 mg/kg; LOEC = 31 mg/kg)
  - Probability of toxicity – based on logistics regression (nationwide data; Field, et al., 2002) – for 100 mg/kg Cu, p=0.52
  - Biomarker responses
- Primary source – copper used as fungicide (citrus and some vegetable crops)
- Developed and transferred a hydrodynamic+copper distribution model, possibly for use in TMDL calculations


Cu (ppm) in oysters (IRL)
NOAA Study
(2001-05)
2004
Hurricanes:
Charley,
Frances,
Ivan, and
Jeanne
600
500
400
300
200
100
0
1988
1991
1997
2003
Year sampled

Copper Data from San Diego Bay: Total concentration exceeding 4 μg/L

(Zirino, 1998; Buck and Bruland, 2005)

- Free Cu (Cu(II)aq): 0.00025 μg/L
- Free copper + inorganically complexed: 0.0025 μg/L
- Dissolved, organically complexed: 1.59 μg/L (38%)
- Colloidal, largely organic: 2.2 μg/L (52%)
- Particulate: 0.4 μg/L (10%)

Epilogue

- Snippets of NOAA's WQ-related activities
  - Monitoring
  - Research and assessments
  - Modeling and forecasting
  - Education and outreach
- More specific and topical presentations to follow

Copper Sources in Estuaries

- Marine anti-fouling paint
- Vehicle brake pads
- Copper-based pesticides and fungicides
- Soil erosion
- Air deposition
- Copper algaecides
- Industrial use
- Vehicle fluid leaks
- Copper roofs and gutters

NERRS System-Wide Monitoring Program (SWMP)

27 Weather and 108 Water Quality Monitoring Stations:

Sentinel Sites for Monitoring Climate Change

Water Quality

temperature
conductivity
salinity
DO (mg/L)
DO (%)
depth
chlorophyll a
turbidity

Weather

air temperature
pressure
relative humidity
precipitation
wind speed
wind direction
photosynthetically active radiation
total incoming radiation

NOAA spends approximately $3.6M per year on data collection and management at NERRS sites