US EPA ARCHIVE DOCUMENT

# ORD's Environmental Monitoring and Assessment Program

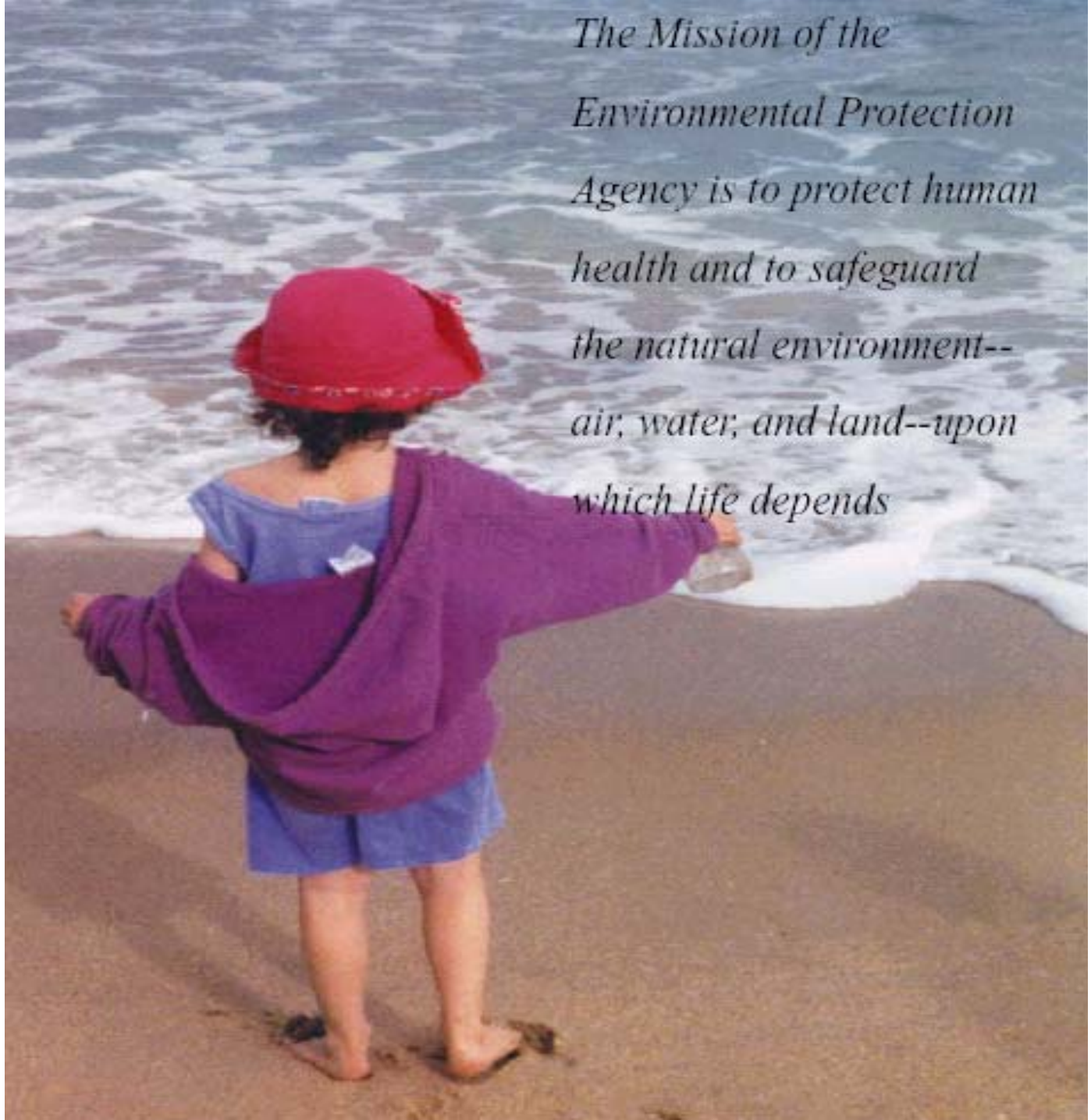
**Sound Science for Measuring Ecological Condition**

- **Background**
- **Progress to date**
- **Future Directions**

Office of Research and Development

EMAP

EPA


The Mission of the
Environmental Protection
Agency is to protect human
health and to safeguard
the natural environment--
air, water, and land--upon
which life depends

# Agency Needs Condition Monitoring

- **Status**
  - EPA Administrator William Ruckelshaus (early 1980s) – ***"What do you mean you don't know how many acid lakes there are?"***

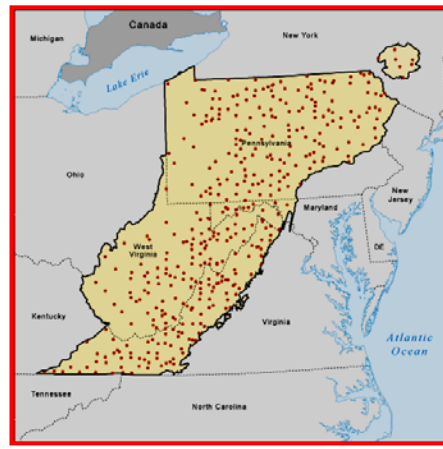
- **Trends**
  - EPA Administrator William Reilly (1989) – "***Good News - Based on my years in the environmental movement, I think the Agency does an exemplary job of protecting the nation's public health and quality of the environment.***
    ***Bad News - I can't prove it."***

# Key Agency Questions

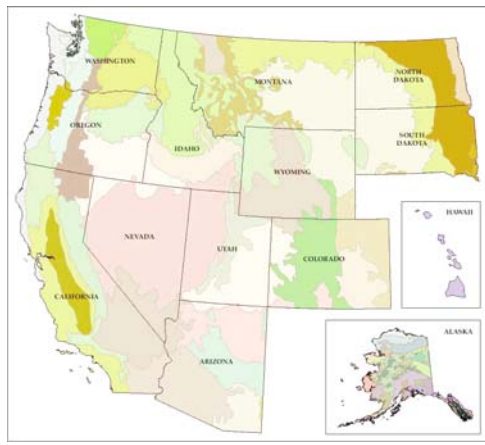
- What are the current conditions of our ecosystems?
  - State of the Environment Report
- Where is the condition improving or declining?
- What stresses are associated with declines?
- Are our management programs and policies working (GPRA)?

# GOALS of ORD's EMAP

- Develop the scientific basis for consistent, unbiased, cost-effective measurement of the condition of the Nation's aquatic ecosystems
  - Status (State of the Environment Report)
  - Trends (GPRA)

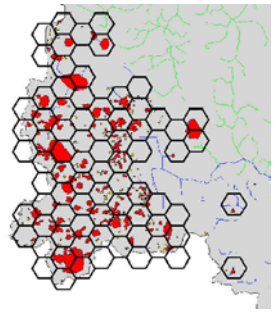



- Build state capacity for monitoring condition and transfer our technology
- Make data generally available to all stakeholders (STORET)



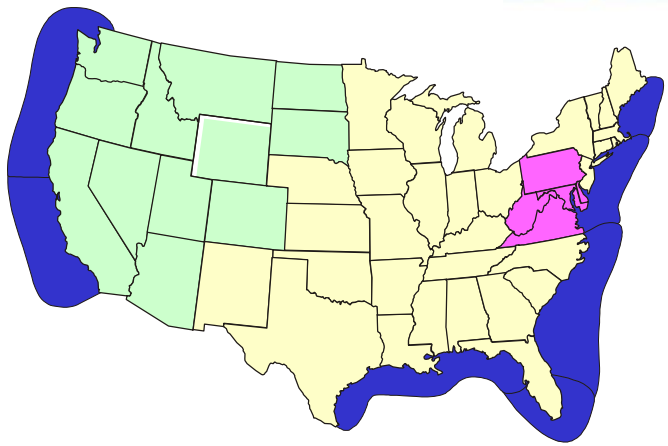
# Key Elements of EMAP's Approach

- Statistical Design - Scientifically defensible, unbiased sampling



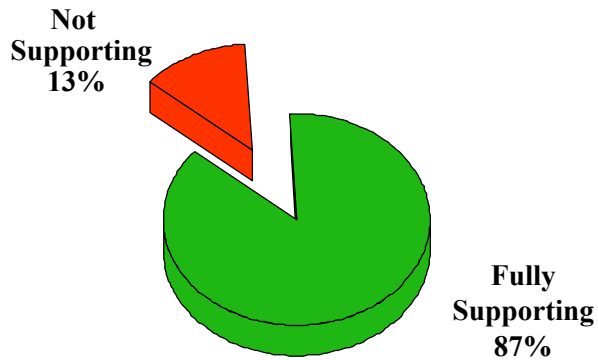
- Biological Indicators – Meaningful, direct measures of the biological condition

- Current Partnerships
  - 33 States
  - NOAA
  - USGS



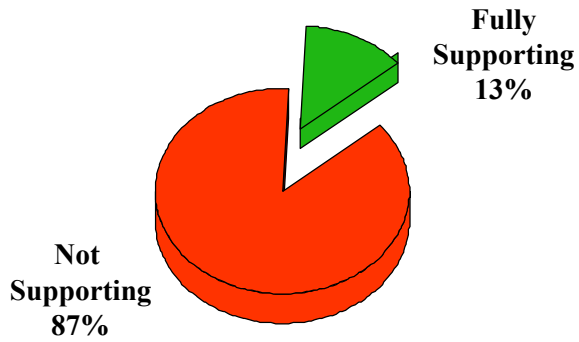
# Importance of EMAP Design

## Condition of a State's streams using different designs

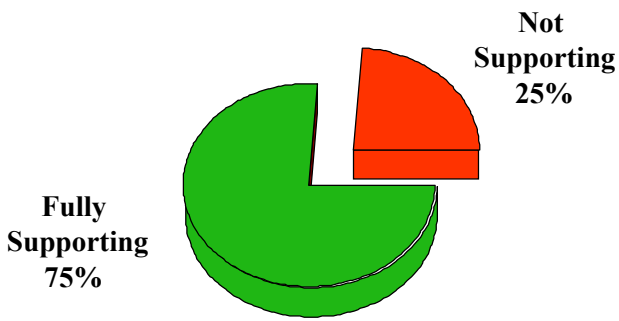



Traditional Targeted Monitoring

**STATE A**

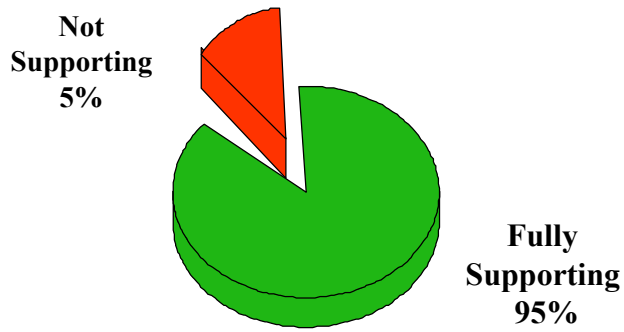



Probability Survey




Traditional Targeted Monitoring

**STATE B**




Probability Survey

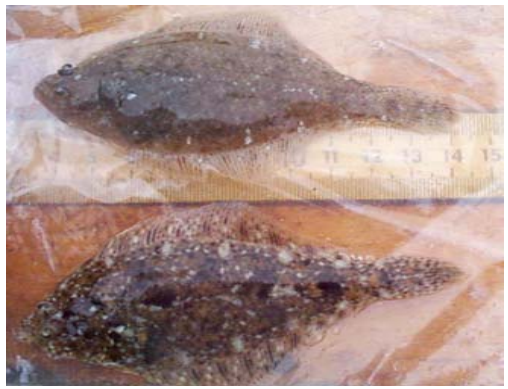
# EMAP Uses Biological Indicators

- Biological Indicators – Integrate the effects of stressors and are a direct measure of the biology

# EMAP Core Indicators

## Estuarine Biological Indicators

- Benthic community assemblage
- Fish community assemblage
- Fish pathologies
- Fish tissue residues
- Submerged vegetation



## Stream Biological Indicators

- Fish assemblage
- Benthic invertebrate assemblage
- Periphyton assemblage
- Riparian vegetation

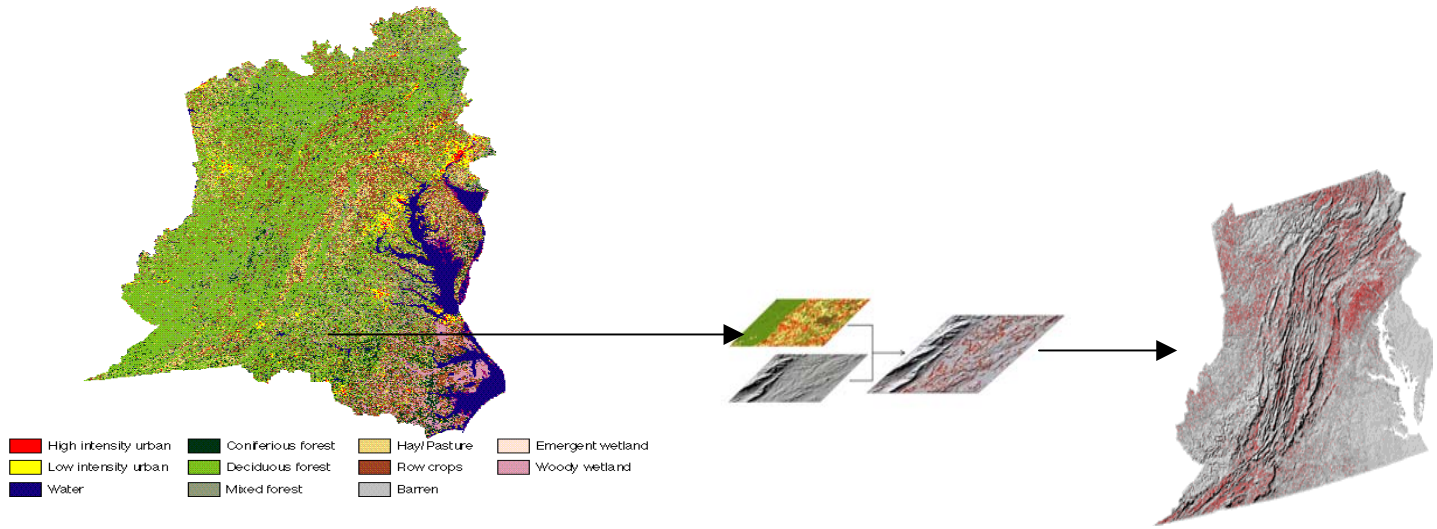
## Stressors

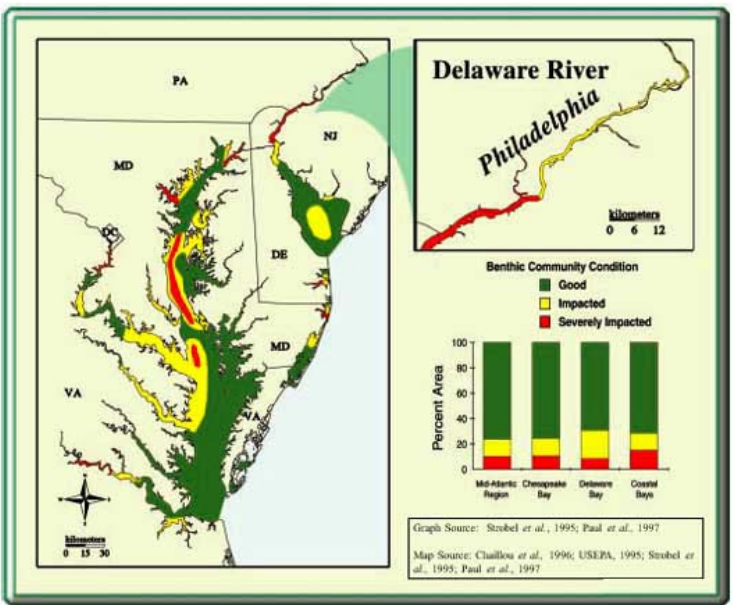
- DO
- Salinity
- Temperature
- Depth
- pH
- Nutrients
- Sediments
- Toxics

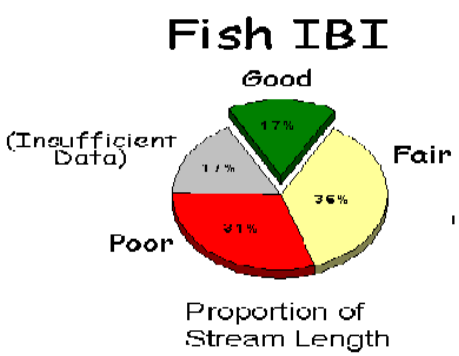
# EMAP Accomplishments

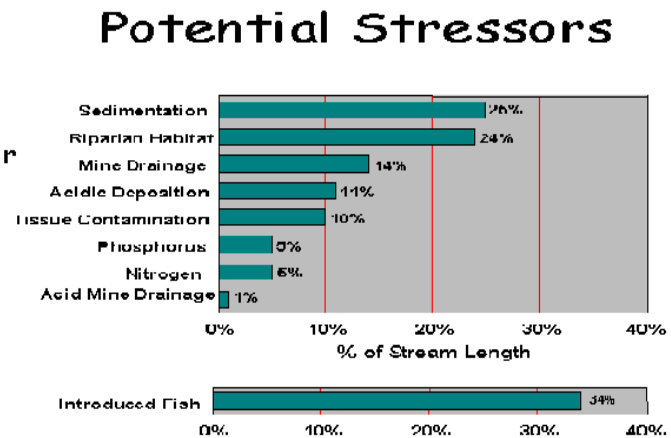
- Mid-Atlantic Integrated Assessment
  - An Ecological Assessment of the United States Mid-Atlantic Region: A Landscape Atlas (EPA 600/R-97/130)
  - Condition of the Mid-Atlantic Estuaries (EPA 600-R-98-147)
  - Mid-Atlantic Highlands Streams Assessment (EPA 903/R-00/015)

# EMAP Accomplishments in MAIA



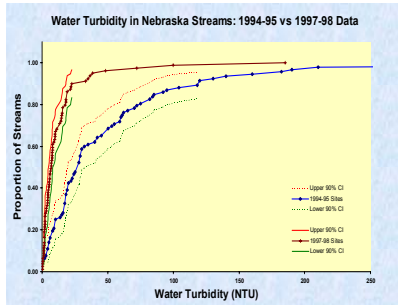



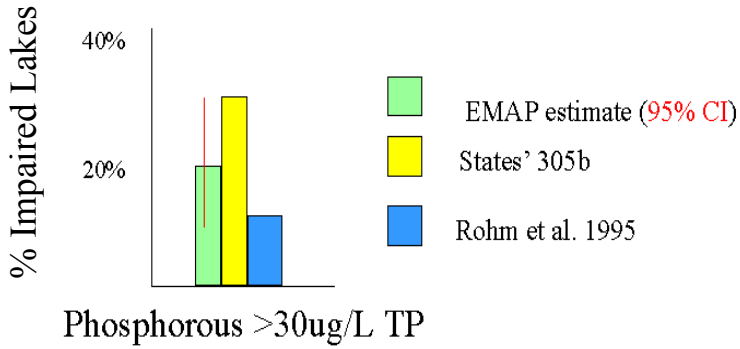



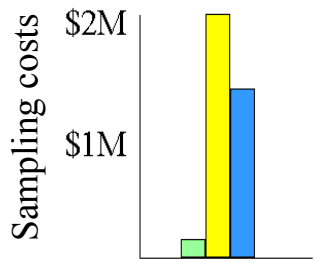
# EMAP Accomplishments (Con't)

- Only means of detecting significant change in condition at a state or national level

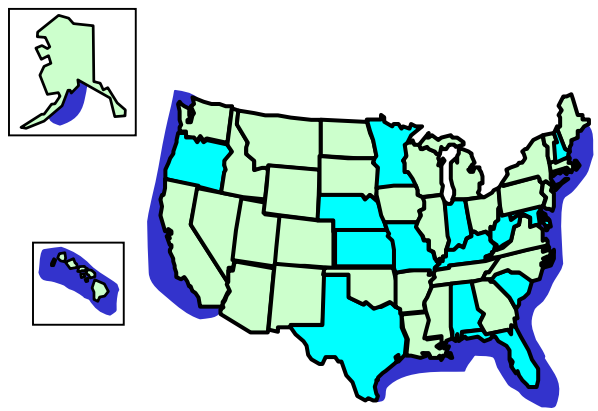



- Cost-effective monitoring for States




- 20 States have already adopted our approach



# EMAP Awarded EPA's Silver Medal

- "For scientific contributions and leadership in developing the science and tools for monitoring and assessing the status and trends of the condition of our environment"

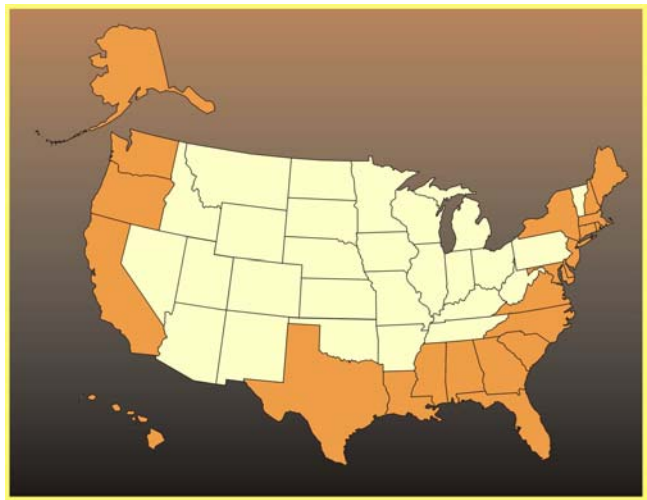
Roger Blair
Tom DeMoss
Dan Heggem
Bruce Jones
Bill Kepner
Harold Kibby
Rick Kutz
(Rick Linthurst)
Michael McDonald
Jay Messer
Daniel McKenzie
Douglas Norton
Anthony Olsen
John Paul
Steven Paulsen
Denise Shaw
John Stoddard
Kevin Summers
(Gilman Veith)

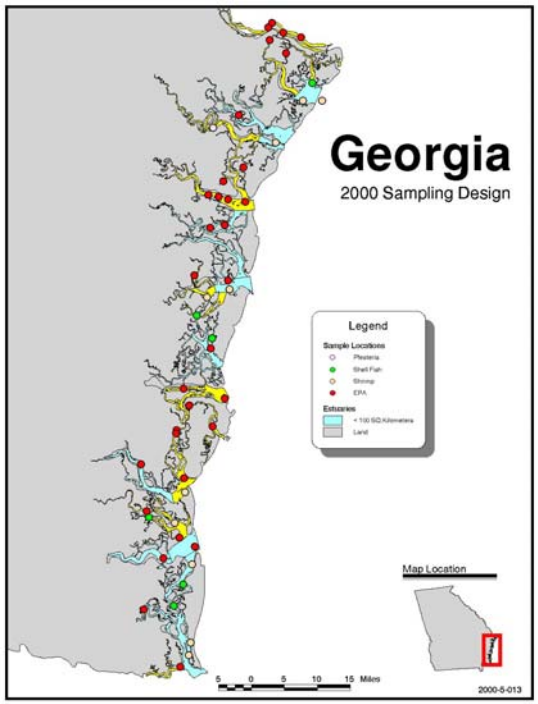
# Current EMAP Efforts

- National Coastal Assessment – First statistically-based determination of the health of any national aquatic resource
- Western Pilot – Develop baselines for streams and estuaries in western states
- STAR Grants – University-based research on focused topics

# EMAP's National Coastal Assessment

- Coastal States monitoring all the nation's estuarine waters with core EMAP design and indicators

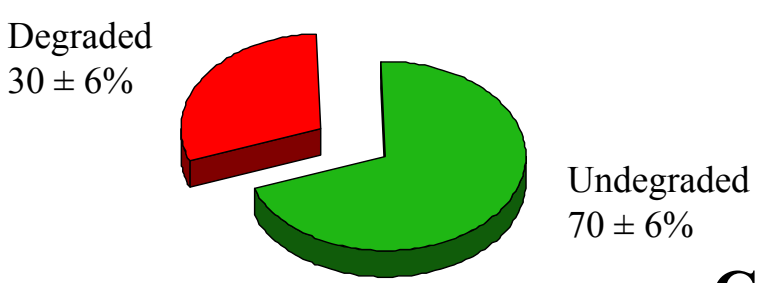




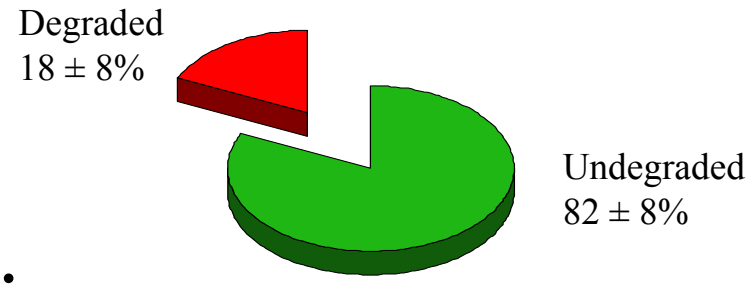

# Estuarine Stressor Comparison

## Benthic invertebrate condition

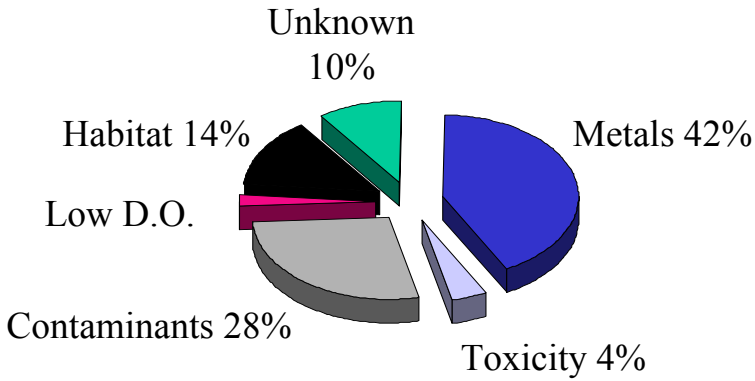
### Louisianian Province

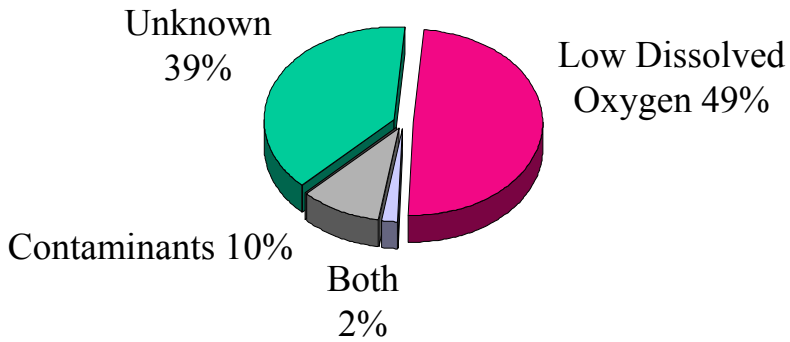



### Virginian Province




**Condition**

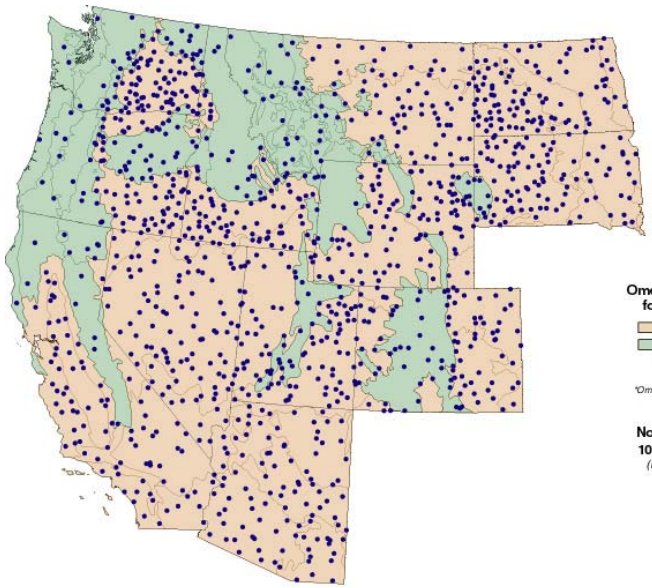


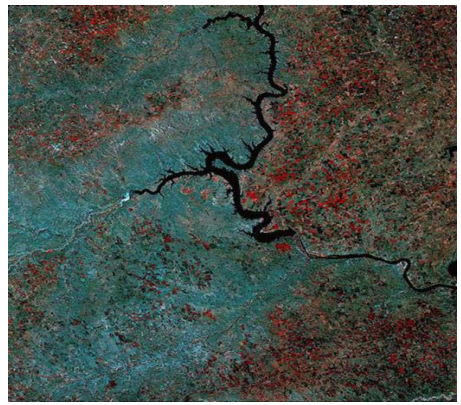




**Stressors Associated with Degraded Condition**

# National Stream Condition

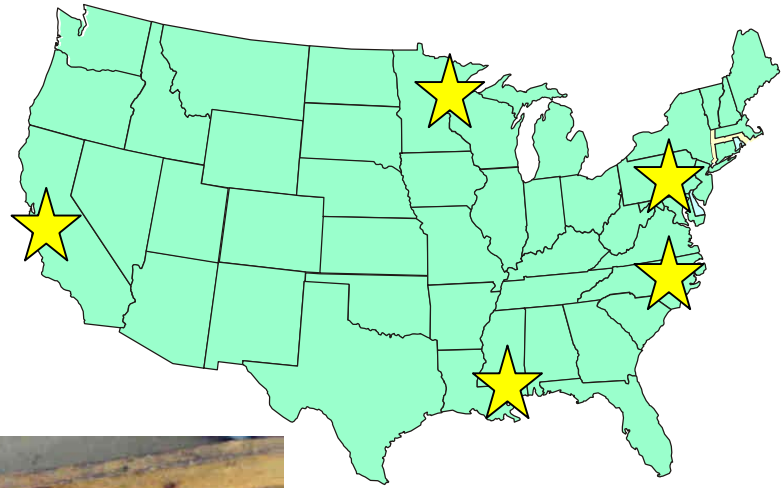
- Reducing scientific uncertainties
  - Western Pilot

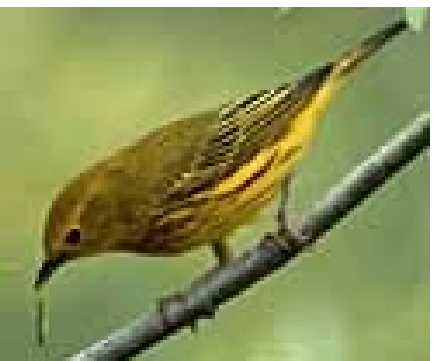


# Academic Research Partnerships

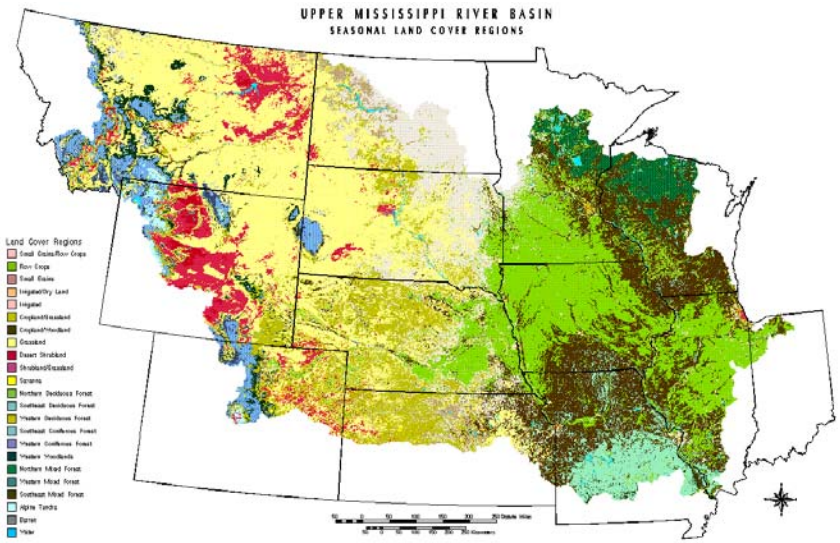
- EMAP is integrated with academic scientists through ORD's STAR Grants Program
  - Design
  - Ecological Indicators

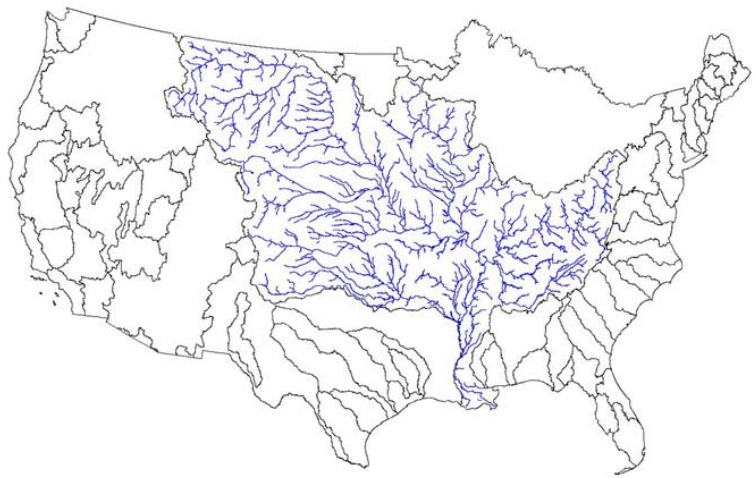




# Future Directions for EMAP

- Develop the scientific basis for assessing the condition of large and Great Rivers
  - Link streams to rivers to estuaries
  - Add condition of large Great Rivers to State of the Environment Report



# ORD's Sound Science for Condition

- Consistent, state-conducted approach for national monitoring of streams and estuaries is available
- Statistical detection of changes and trends in ecological condition is possible in support of GPRA
- Assistance to States for 305(b) designs is available
- The science for determining condition of the large/Great Rivers is being developed