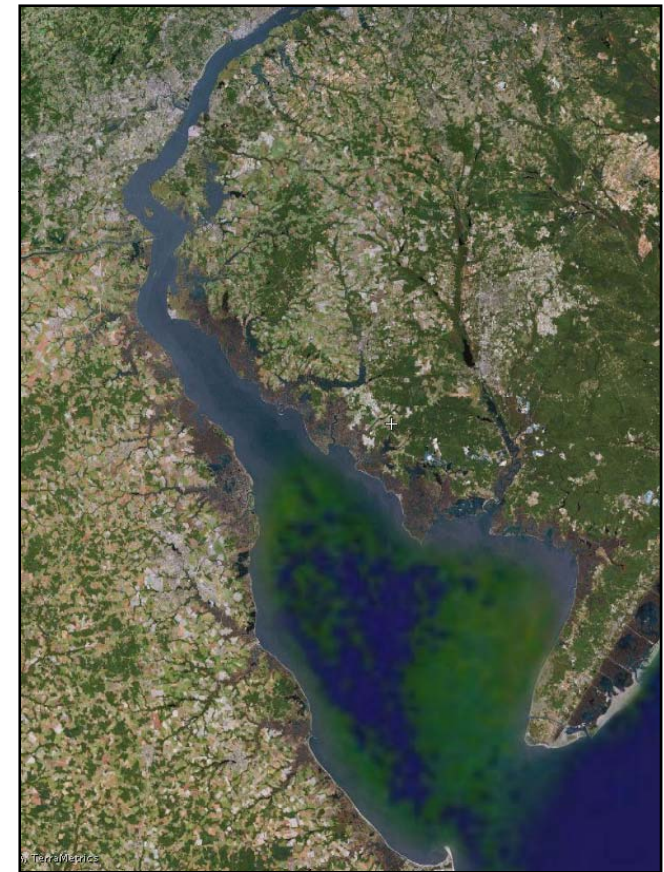


# A Watershed-Scale Tool for Assessing Ecological Conditions in the Delaware Estuary

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**URS**

# Overview

- Background on Delaware River Study
- Review of Relative Risk Model (RRM) approach and ecological database
- Summary of potential user applications and future plans

# “Delaware River Study”

## Objective:

- To evaluate relative ecological risks among multiple habitats, stressors, and their sources in the Delaware Estuary

## Key Components:

- Review of literature to characterize current and historic ecological conditions
- Development of conceptual models for regional risk assessment and calculation of relative ecological risks using RRM approach
- Construction of ecological database integrating quantitative information for habitats and stressors
- Development of RRM in ArcGIS® model builder platform to allow increased functionality for future model applications

2005-2007

2008-2009

# Stressors and Habitats

## Stressors

Water volume  
Suspended solids  
Sedimentation  
Habitat loss/degradation  
Water temperature  
Barriers to fish access  
Dissolved oxygen  
Nutrients  
Chemical toxicants  
Reduction of local stocks  
Invasive species  
Pathogens (*oyster disease*)



Photos courtesy of J. Jacobini, Delaware DF&W

## Ecological Habitats

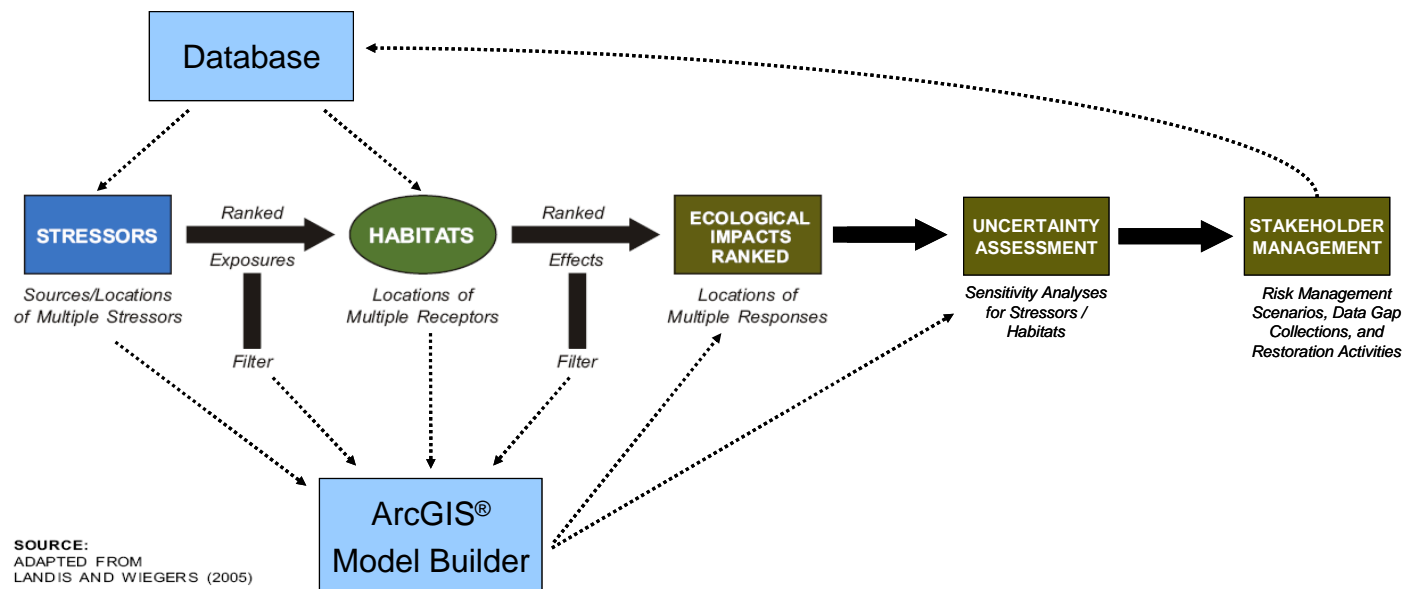
Open water  
Benthic substrates  
Intertidal mudflats and sandbars  
Wetlands  
Immediately adjacent uplands



Photo courtesy of [www.delawareestuary.org](http://www.delawareestuary.org)

# Relative Risk Model

- Uses rank based approach for stressors and habitats to assess relative ecological risks
- Integrates ecological database and RRM in the ArcGIS® model builder application



# Ecological Database

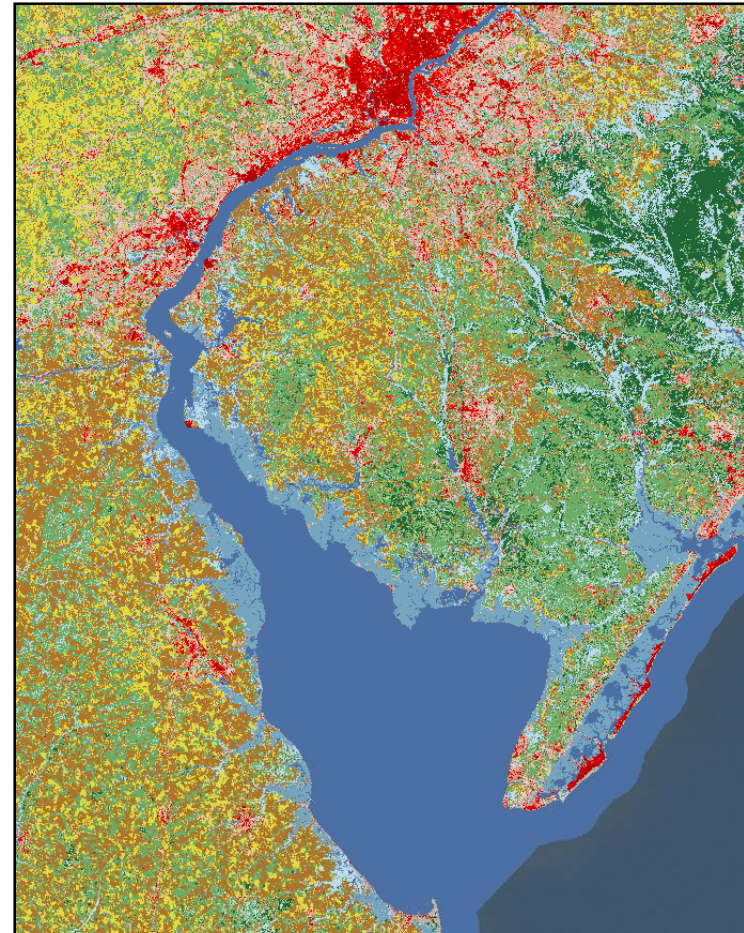
- Includes data from a variety of public sources (mainly 1997 to 2007)
- Links two information systems including ArcGIS® geospatial and Microsoft Access databases

| Data Type           | Description                              | Records in Database |
|---------------------|--|---------------------|
| Chemical data       | PCBs, metals, pesticides, PAHs, & others | >600,000            |
| Physiochemical data | DO, salinity, temperature, discharge     | >730,000            |
| Water Use Inventory | Total & consumptive water use            | >12,000             |
| Biological data     | Ecological parameters & fish stocks      | >40,000             |

# Physical Information

## **Database Contents:**

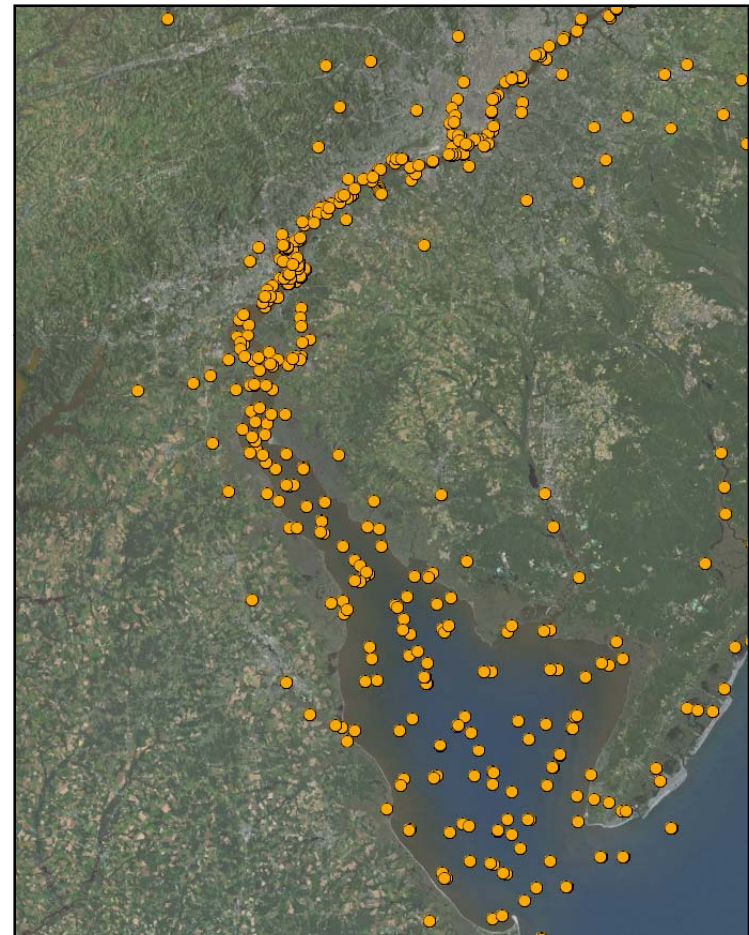
- DNREC Benthic Mapping Program
- DRBC Water Use Inventory
- USGS National Land Cover Datasets 1992 & 2001
- NOAA Environmental Sensitivity Index
- USGS National Water Information System



# Chemical Information

## **Database Contents:**

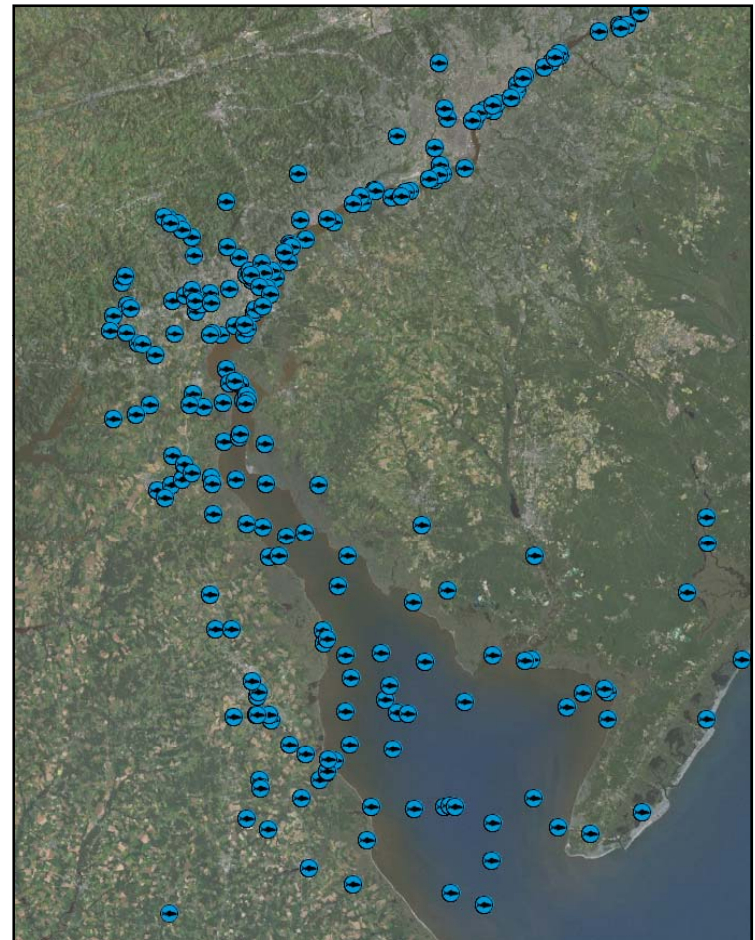
- DRBC Boat Run Program & Fish Tissue Monitoring
- DRBC PCB Monitoring
- NOAA NS&T Program
- DNREC Toxics in Biota Program
- USEPA NCA
- Univ. of Del. Cruise Database



# Biological Information

## Database Contents:

- DNREC Striped Bass Spawning Stock Survey
- DNREC Coastal Finfish Assessment
- DNREC Atlantic Sturgeon Survey and Telemetry Studies
- DNREC Natural Oyster Ground Survey
- NJDEP Young-of-Year Survey
- NJDEP Trawl Program

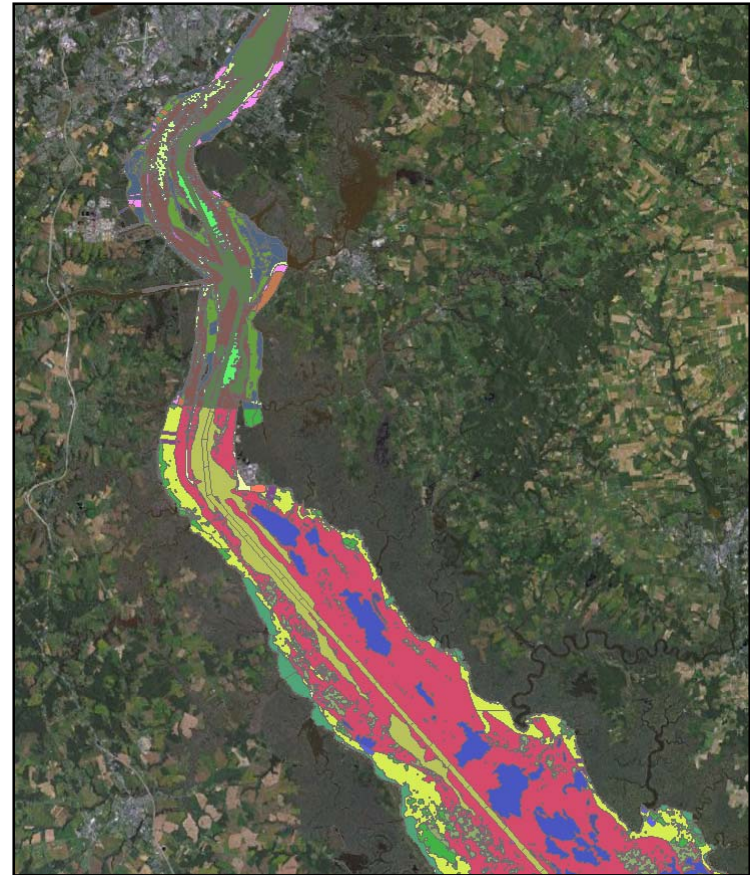


# Potential End User Applications

- ArcGIS® based RRM is valuable tool because it provides:
  - Centralized source of information on habitats, fish stocks, and chemical and physiochemical parameters
  - Comprehensive tool to evaluate and compare viability of potential management options
  - More automated updates of underlying information and model runs

# Example Application: *Benthic Habitats*

- Integrated multiple sources of habitat information
- Conducted field evaluations in areas lacking information
- Assigned relative rankings based on habitat attributes and ecological functions
  - Salinity regime
  - Water depth
  - Shoreline condition
  - Substrate type



# Example Application: *Managed Fisheries Matrix*

- Identifies key species based on fishery independent and dependent information
- Provides relative rankings for fish stocks based on:
  - Ecological, commercial fishery, and recreational fishery values
  - Threatened and endangered standing
  - Stock status



*Photos courtesy of J. Jacobini, Delaware DF&W*

# Future Plans

- Expand assessment area to include watershed units in the Estuary
- Incorporate new stressor and habitat information, such as PDE's Delaware Estuary Benthic Inventory
- Collaborate with stakeholders to provide ArcGIS® based RRM to managers throughout the Estuary

# Acknowledgements



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