CENTER FOR COASTAL MONITORING AND ASSESSMENT

science for coastal communities

Integrating Chemical and Biological Data in Coastal Ecosystems: Lessons Learned from the National Status and Trends Program

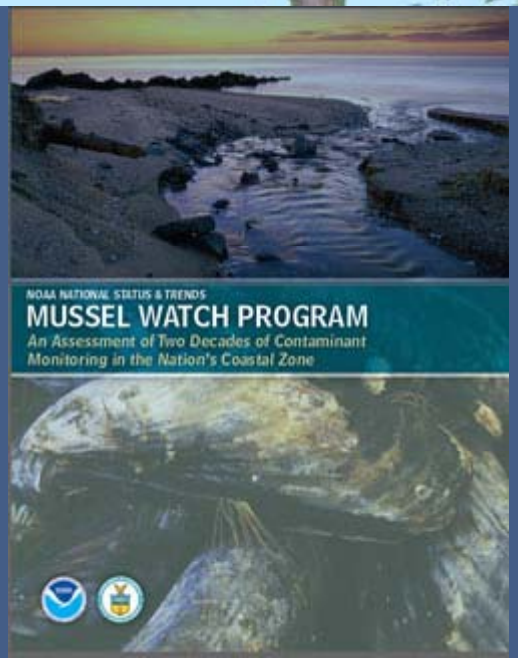
Dr. David Whitall

National Centers for Coastal Ocean Science
Center for Coastal Monitoring and Assessment
National Status and Trends Program

http://ccma.nos.noaa.gov/

What is the National Status & Trends Program?

- Resides within NOAA's National Ocean Service (National Centers for Coastal Ocean Science)
- National program to assess the occurrence (presence and magnitude) and temporal trends in pollution in the Nation's coastal waters, including effects on biology
- Program includes a national monitoring program (Mussel Watch), large scale national/regional synthesis assessments (e.g. National Estuarine Eutrophication Assessment) and system specific pollution assessments (e.g. pollution in Guanica Bay, Puerto Rico)



What is the National Status & Trends Program?

- The vast majority of the data we generate is chemistry data, but we do collect biological information (bivalve histopathology, water column pathogens, benthic infauna)
- Plus, we collaborate with other scientists collecting biological data, and utilize existing biological data sets

Challenges/Considerations

There are inherent challenges in integrating biological and chemical data, including:

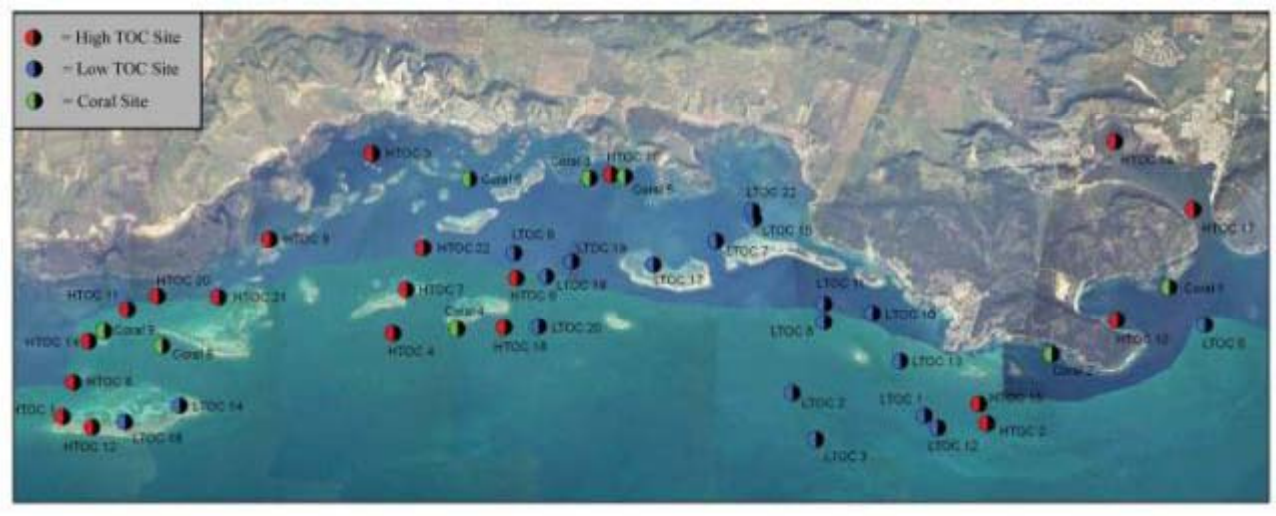
- *What happens when data don't coincide spatially?*
- *How do you quantitatively express multiple measures of stress and effect?*
- *What happens when biology affects chemistry?*
- *Challenges of database management with very different data characteristics between chemical and biological data*

When data don't coincide spatially

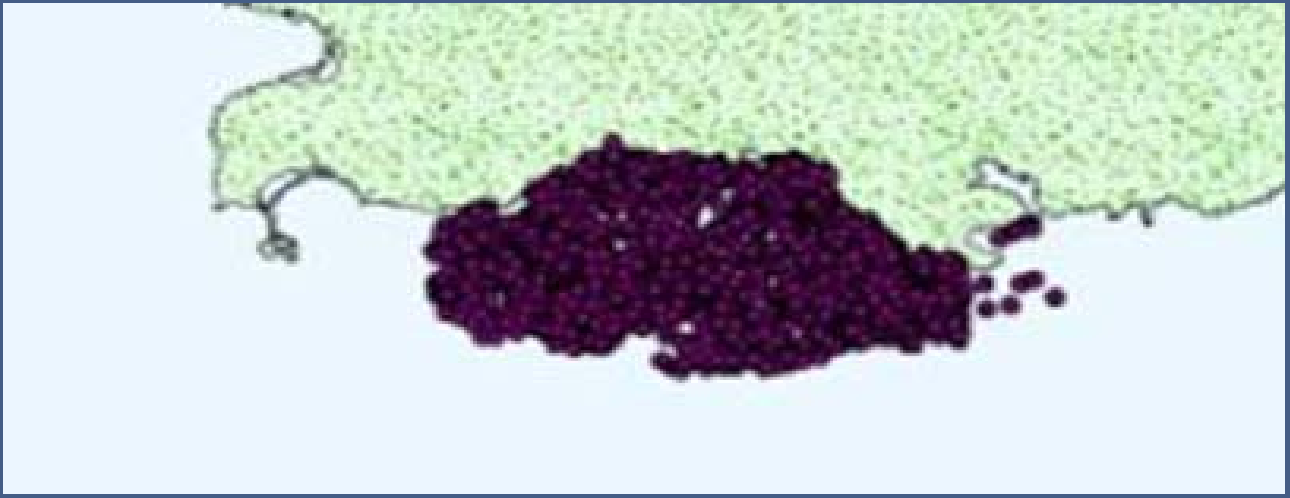
- There are many reasons why biological and chemical data might not overlap spatially
  - Data synthesized from multiple efforts
  - Sampling matrices don't overlap
- This can be partially overcome with spatial/statistical techniques

When data don't coincide spatially

Example: Contaminants in coral reef ecosystems in southwest Puerto Rico



Contaminant sampling sites (43 sites in 2005)

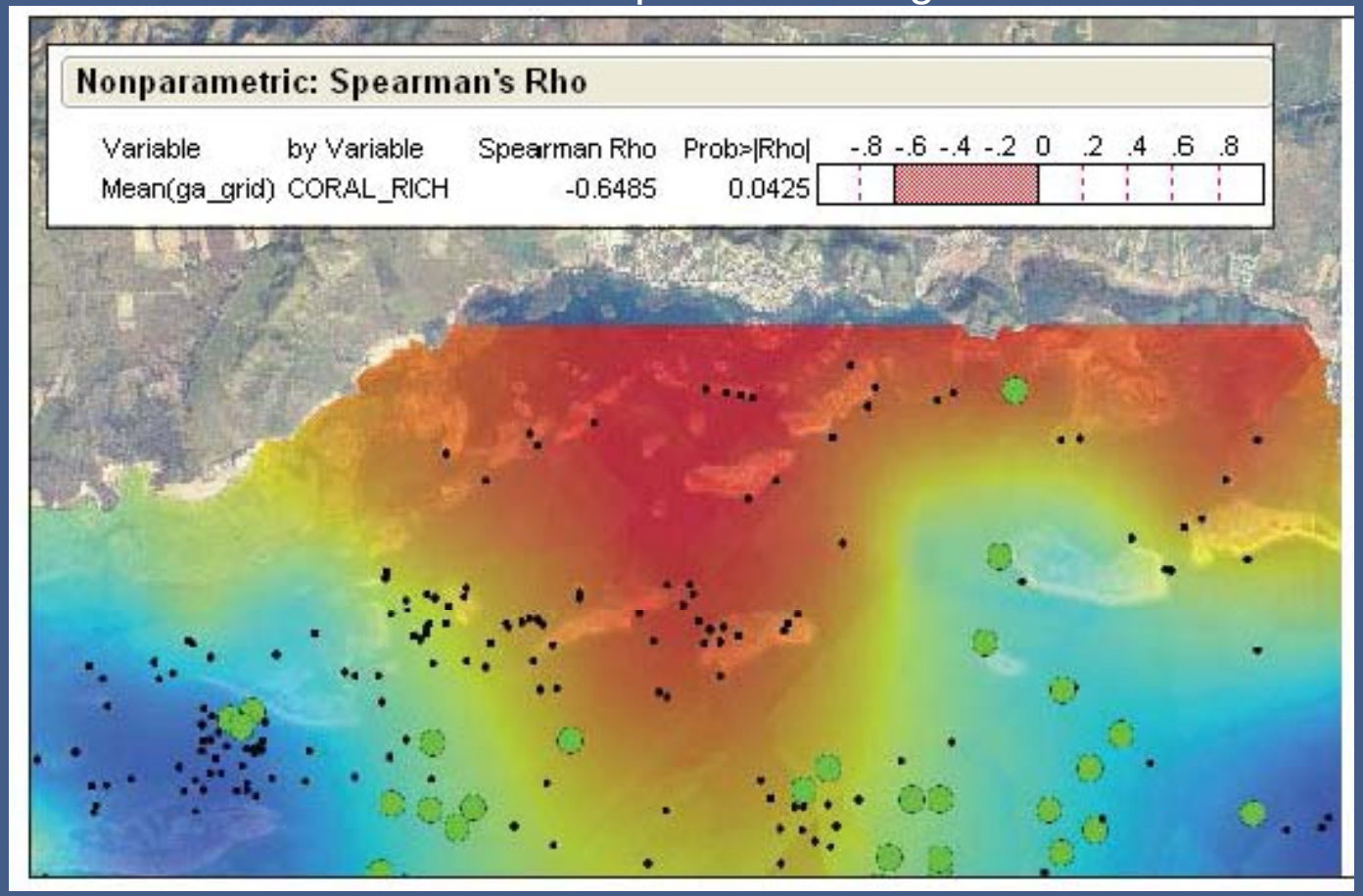


Biological sample (>1600 sites from 2000 to 2009)

When data don't coincide spatially

Example: Contaminants in coral reef ecosystems in southwest Puerto Rico

Solution: Spatial modeling (kriging) of contaminant data; then correlation of model output with biological data



PAH sediment concentrations (modeled) vs coral species richness. Green dots indicate top 25%. Significant negative correlation between PAHs and species richness.

Quantifying multiple measures of stress and effect

Sediment Quality Triad

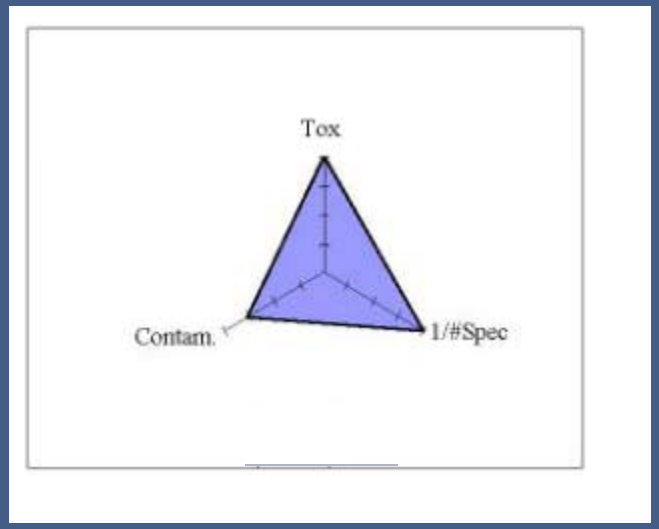
1. Sediment chemistry

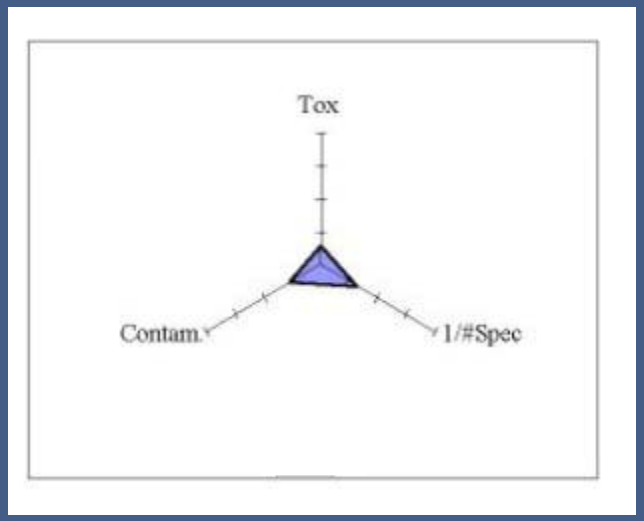
2. Sediment toxicity
   - amphipod mortality
   - sea urchin fertilization impairment
   - cytochrome P450 Human Reporter Gene

3. Benthic Infaunal Community

Quantifying multiple measures of stress and effect

Sediment Quality Triad – Use of Triaxial plots





The larger the area of the triangle, the more impacted the site is

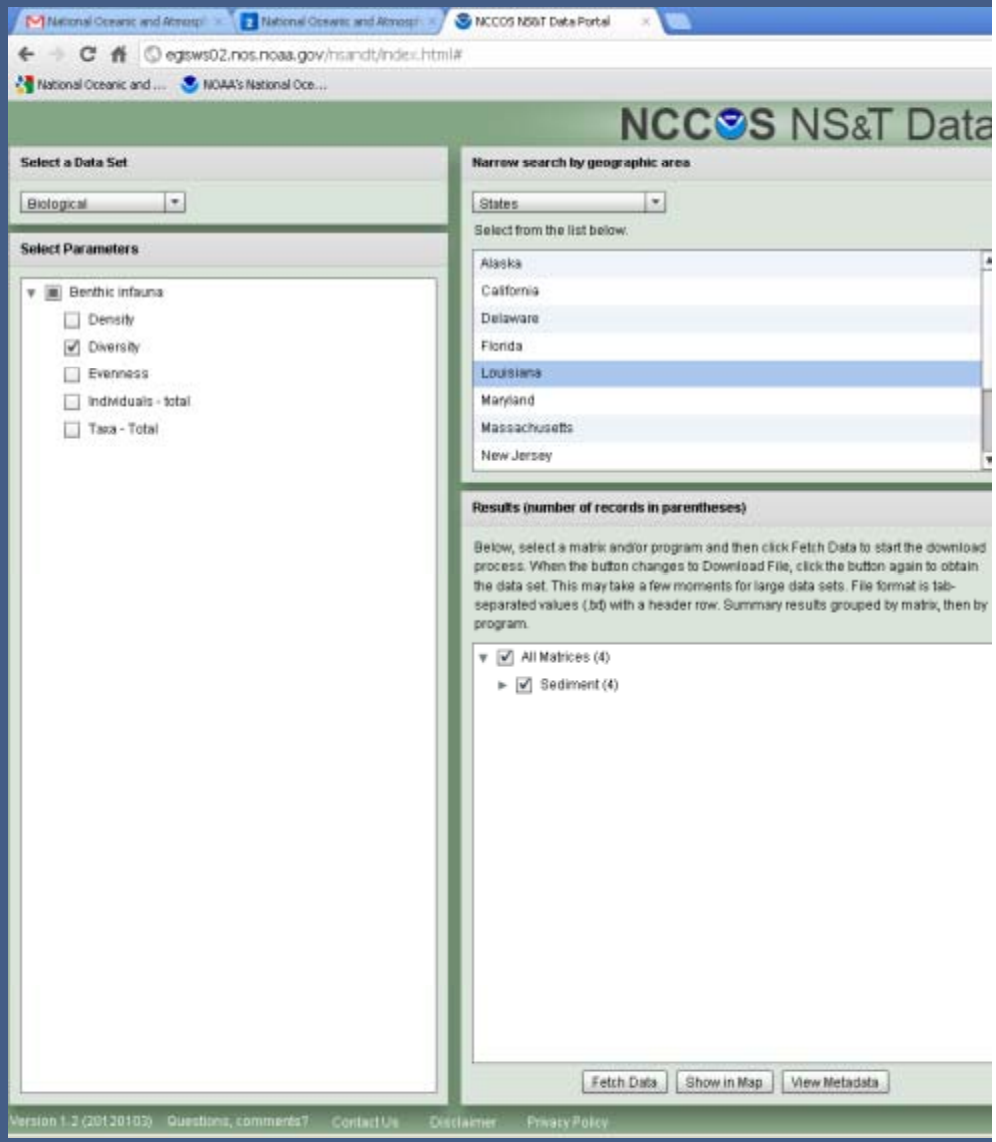
When Biology affects Chemistry

Usually we think of chemistry affecting biology, but we have to be aware of when biology actually affects our chemistry data

Example: gonadal index in bivalves

Database challenges

- Benefits to serving chemical and biological data all in one place
- However, this can create challenges for database architecture
- Importance of having database expertise combined with understanding of scientific parameters



Questions?

Dave.Whitall@noaa.gov