MORE PRECISE ASSESSMENT OF BENTHIC CONDITIONS IN DELAWARE BAY

Henry A. Walker[1], Jeff Hollister[1], Bart Wilson[2], Robert Scarborough[2], David Carter [2], Danielle Kreeger[3], Krista Laudenbauch-Nelson[3], Amie Howell[4] and Charles Strobel[1]

[1] U.S. Environmental Protection Agency (USEPA), ORD, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division, Narragansett, RI 02882

[2] Delaware Department of Natural Resources and Environmental Control, DSWC, Delaware Coastal Programs,
89 Kings Highway, Dover, DE 19901

[3]Partnership for the Delaware Estuary, One Riverwalk Plaza. 110 South Poplar Street, Suite 202, Wilmington, DE 19801

[4] U.S. EPA Region III, Office of State and Watershed Partnerships, 1650 Arch St. (3WP10). Philadelphia, PA 19103

MORE PRECISE ASSESSMENT OF BENTHIC CONDITIONS IN DELAWARE BAY

Talk Outline:

- (1) National Coastal Assessment – Measurements
- (2) Delaware Bay Estuary Benthic Community Assessment and Mapping Project
- Very brief summary NCA results from 2000-2001 Baseline
- PCBs in Delaware River fish
  - Trends in body burdens (info from Delaware DNREC)
  - Some PCB Sources based on NCA data
- Plans to combine information from (1) & (2)

Combining probability survey data with acoustic habitat maps for more precise assessment of benthic conditions in Delaware Bay

Watershed Characteristics

- One of the longest un-dammed rivers in the U.S.
- Tributaries within NY, PA, DE, and NJ
- 15 Million people use the water for drinking
- Worlds largest freshwater port complex
- One of the Nation's largest oil/container ports
- Valued: Finfish, Shellfish, Horseshoe Crabs (largest breeding population)
- Internationally Migrating Shore Birds
- Use of the estuary for tertiary treatment (removal of nitrogen)

NCA / Assessment Endpoints

- Water column condition
- Sediment conditions
- Benthic community measures
- Contaminants in Fish

NCA: Measurement Endpoints

- Numerous

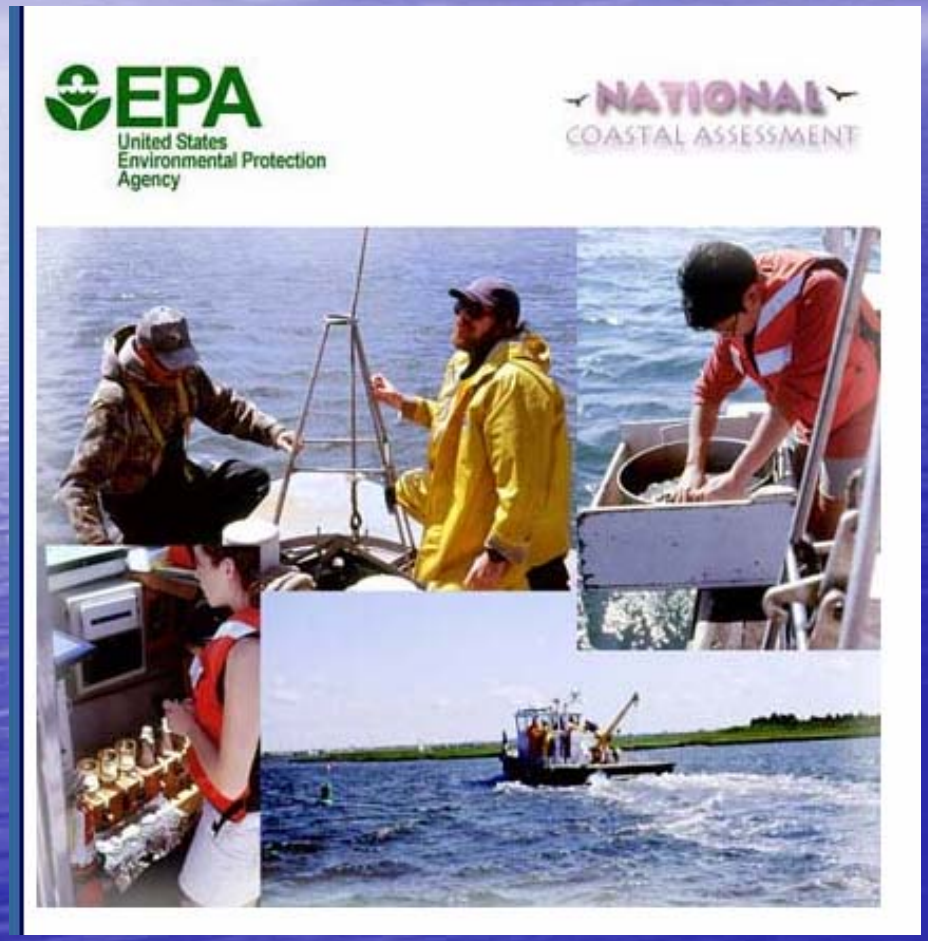
NCA Indices:

- Water Quality
- Sediment Quality
- Benthic Index
- Fish Tissue Contaminants

Assessments of Condition

Management Decisions

Different techniques for assessing benthic conditions.



- Sediment samples at random locations
  (blind sampling / by design)
- Advantages:
  - Comparable method for unbiased cross-system comparisons
  - Look at sediment triad : sediment chemistry, benthic biology and sediment toxicity.

A different approach is being used by the Delaware Estuary Benthic Community Characterization and Mapping Project

Bart Wilson[1], Robert Scarborough[1], David Carter [1], Danielle Kreeger[2], Krista Laudenbauch-Nelson[2], Amie Howell[3]

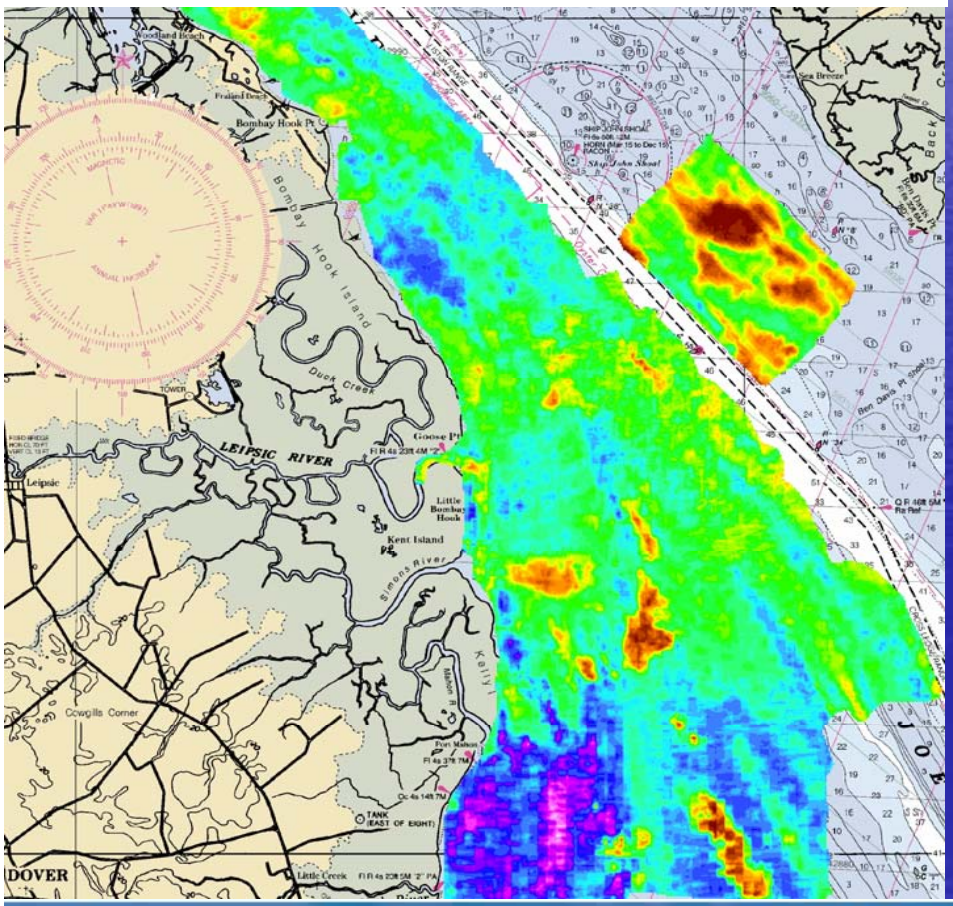
[1] Delaware Department of Natural Resources and Environmental Control, DSWC, Delaware Coastal Programs, 89 Kings Highway, Dover, DE 19901

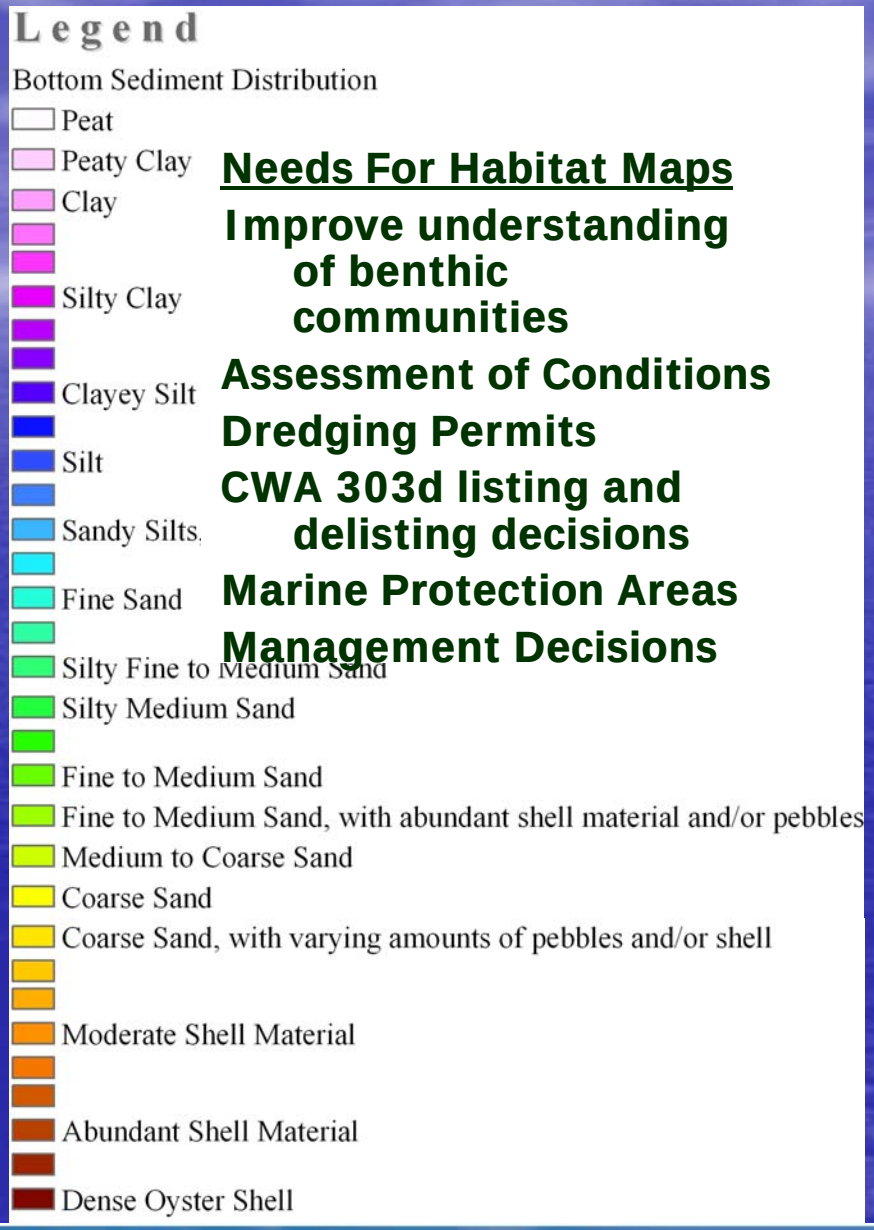
[2] Partnership for the Delaware Estuary, One Riverwalk Plaza. 110 South Poplar Street, Suite 202, Wilmington, DE 19801

[3] U.S. EPA Region III, Office of State and Watershed Partnerships, 1650 Arch St. (3WP10). Philadelphia, PA 19103

One goal is to map benthic habitat types

Information useful for management efforts to restore oyster reefs (e.g. market value exceeds $1.5 million annually), and identify and protect many other valued benthic habitat features



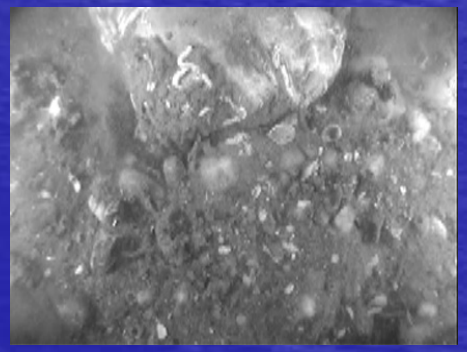


Needs For Habitat Maps

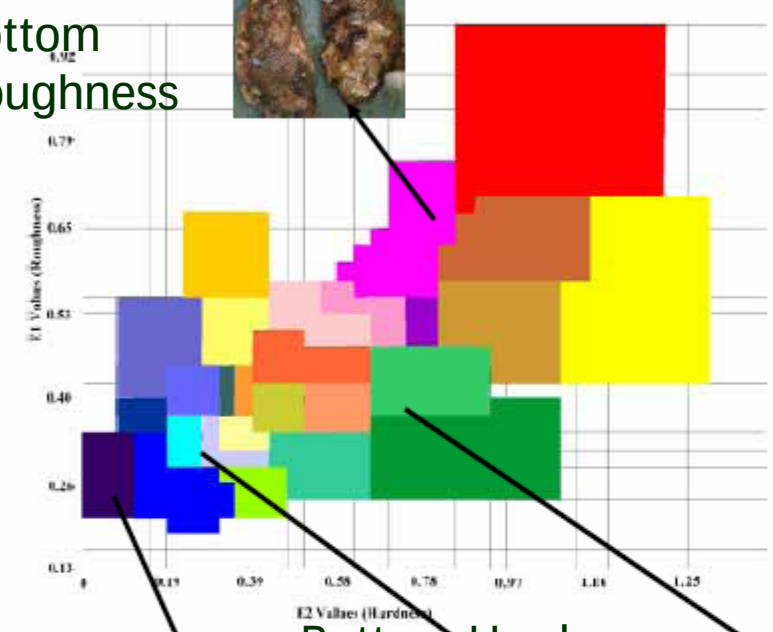
- **Improve understanding of benthic communities**
- **Assessment of Conditions**
- **Dredging Permits**
- **CWA 303d listing and delisting decisions**
- **Marine Protection Areas**
- **Management Decisions**

Using acoustic technology to collect bathymetric and sediment classification data

- RoxAnn Seabed Classification
- Chirp Sub-bottom Profiler
- Multibeam bathymetry system
- Field verification (sediment and biology)

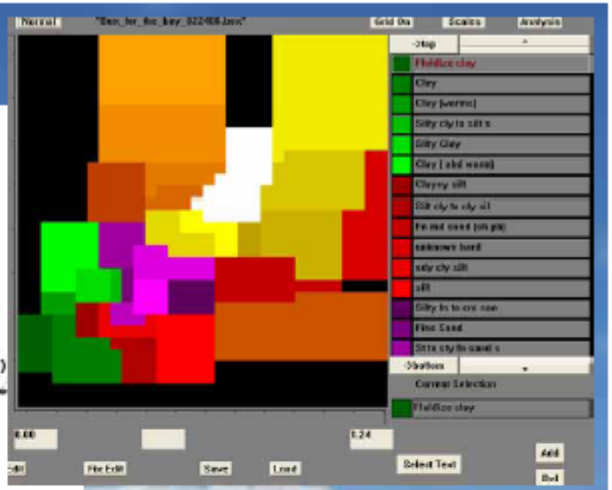


Bottom Roughness



Bottom Hardness

- Fluidized clay
- Clay
- Clay (with random worm tubes)
- Clay (with abundant worm tubes)
- Clayey silt
- Silty clay (with random shells fragments)
- Silty clay to Clayey silty sand
- Firm Silty clay to Clayey silt
- Silt
- Sandy clayey silt
- Dense Sandy silt (with moderate shell material)
- Silt to Silty fine sand (with moderate shell mate
- Fine sand
- Silty fine to medium sand
- Silty medium sand
- Silty fine to coarse sand
- Fine to medium sand
- Medium to coarse sand (with coarse pebbles)
- Fine to medium sand (with moderate amount of shell material and pebbles)
- Course sand (with random pebbles)
- Very Coarse sand
- Medium sand (with moderate to abundant pebbles); or Dense Shell Material (Oyster) with Matrix
- Sandy granule pebbles (with a coarse sand matrix); or Abundant Shell Material (Oyster Shell) with matrix
- Gravel (mix of pebbles and cobbles; with coarse sand matrix); or Dense Shell Material (Oysters)
- Gravel (dense mix of pebbles and cobbles); or Outcropping of Compacted Pre-Holocene Sediments
- Gravel (dense mix of pebbles and cobbles); or Outcropping of Compacted Pre-Holocene Sediments

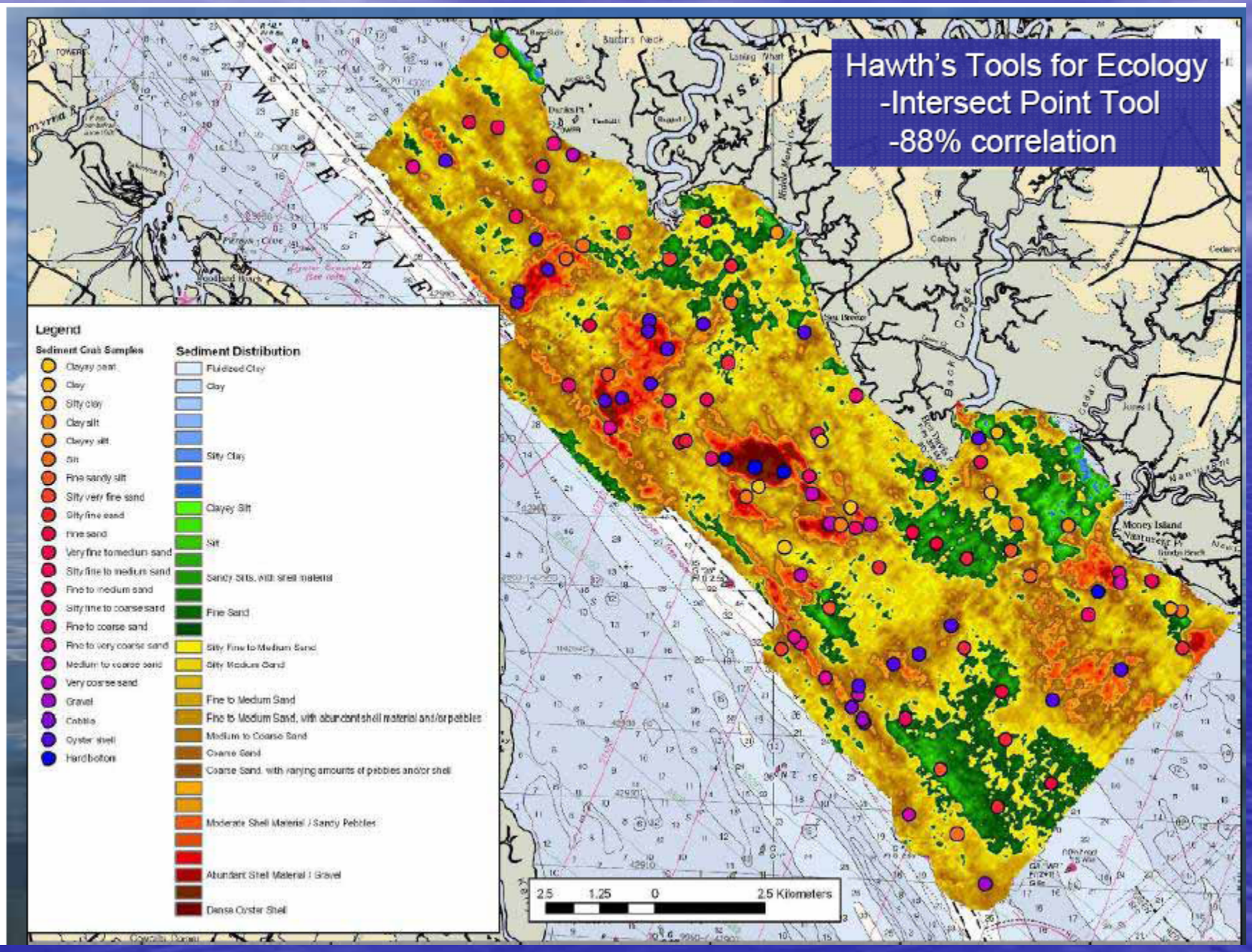


91% Correlation on Hardness and Roughness values of grab samples

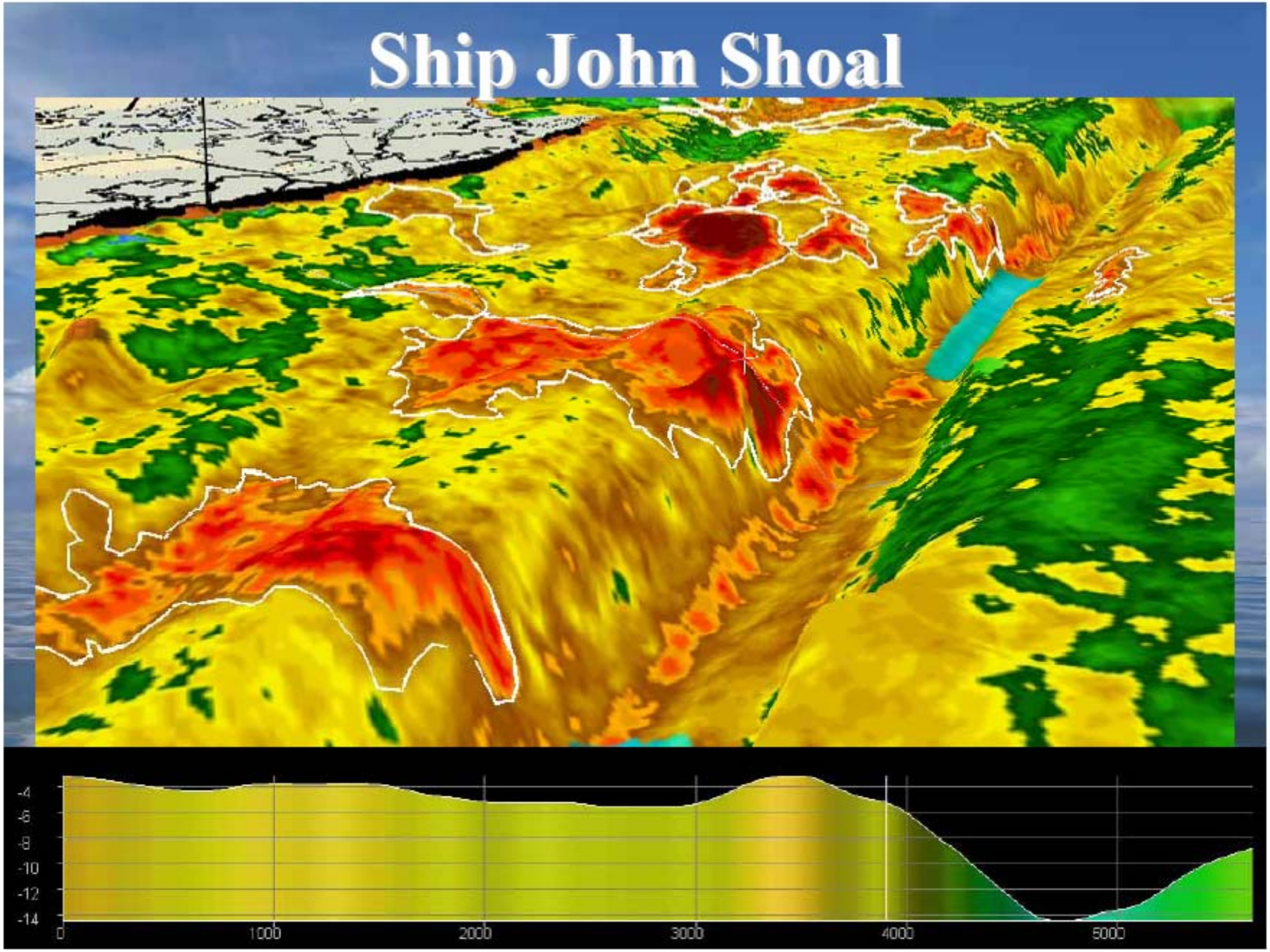
database - Notepad

File Edit Format View Help

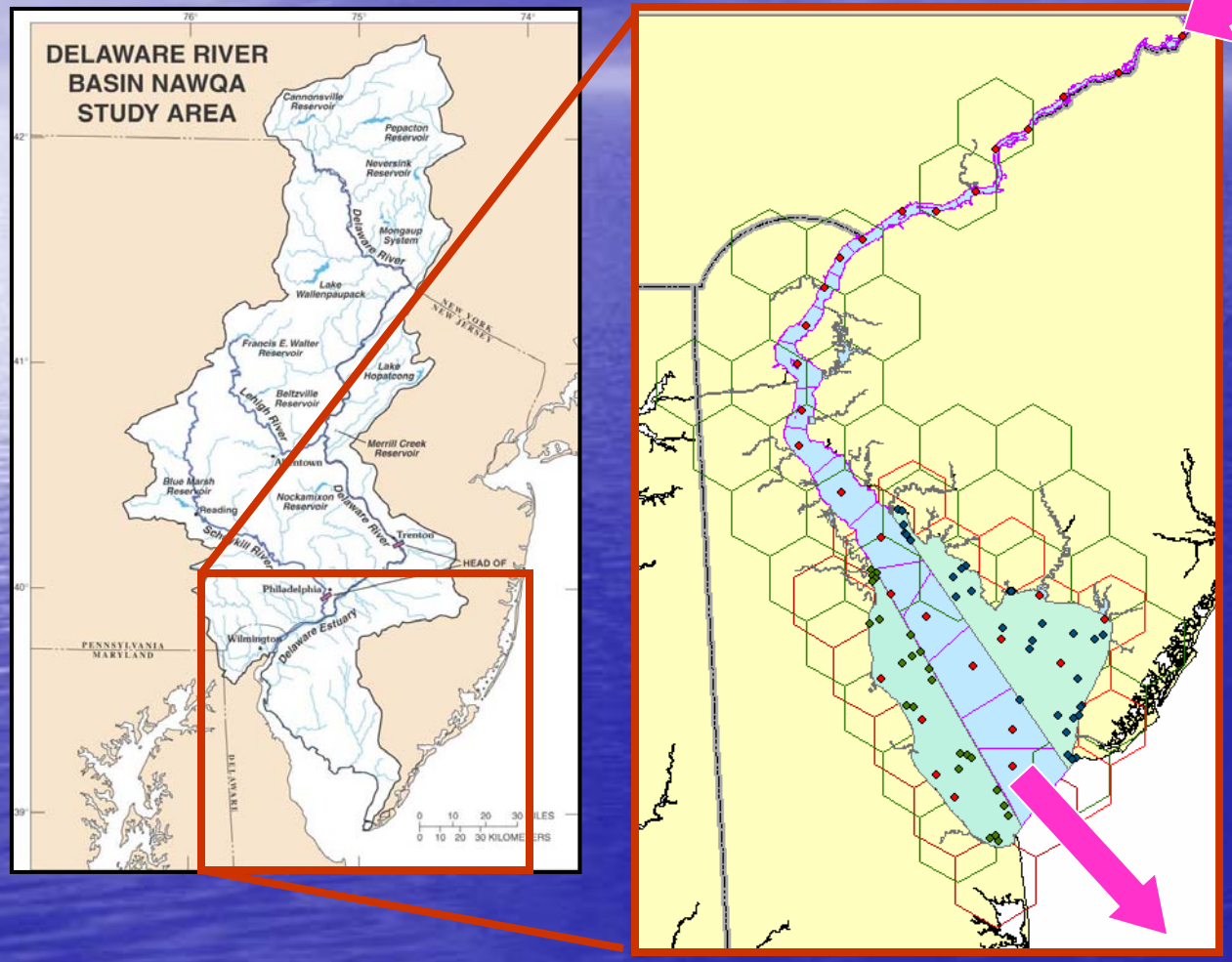
9	39.4566086	-75.5661083	-9.06	0.250	1.27
9	39.4566050	-75.5661016	-9.15	0.244	1.22
19	39.4566033	-75.5662966	-9.15	0.226	1.13
19	39.4565983	-75.5662916	-9.15	0.222	1.12
19	39.4565956	-75.5662849	-9.06	0.218	1.15
9	39.4565933	-75.5662800	-9.06	0.217	1.26
19	39.4565916	-75.5662766	-9.15	0.194	1.02
20	39.4565883	-75.5662716	-9.06	0.370	0.94
19	39.4565849	-75.5662666	-9.15	0.251	1.12
19	39.4565816	-75.5662633	-9.06	0.248	1.03
19	39.4565800	-75.5662600	-9.15	0.255	1.09
9	39.4565766	-75.5662566	-9.15	0.256	1.44
19	39.4565750	-75.5662533	-9.15	0.227	1.09
9	39.4565700	-75.5662500	-9.15	0.255	1.19
19	39.4565683	-75.5662466	-9.06	0.262	1.13
19	39.4565650	-75.5662410	-9.06	0.243	1.07
19	39.4565616	-75.5662433	-9.15	0.245	1.04
9	39.4565600	-75.5662399	-9.15	0.260	1.19
19	39.4565350	-75.5662383	-9.15	0.267	1.15


Hawth's Tools for Ecology
-Intersect Point Tool
-88% correlation
Legend
Sediment Grab Samples
Clayey peat
Clay
Silty clay
Clayey silt
Clayey silt
Silt
Fine sandy silt
Silty very fine sand
Silty fine sand
Fine sand
Very fine to medium sand
Silty fine to medium sand
Fine to medium sand
Silty fine to coarse sand
Fine to coarse sand
Fine to very coarse sand
Medium to coarse sand
Very coarse sand
Gravel
Cobble
Oyster shell
Hardbottom
Sediment Distribution
Fluidized Clay
Clay
Silty Clay
Clayey Silt
Silt
Sandy Silts, with shell material
Fine Sand
Silty Fine to Medium Sand
Silty Medium Sand
Fine to Medium Sand
Fine to Medium Sand, with abundant shell material and/or pebbles
Medium to Coarse Sand
Coarse Sand
Coarse Sand, with varying amounts of pebbles and/or shell
Moderate Shell Material / Sandy Pebbles
Abundant Shell Material / Gravel
Dense Oyster Shell
2.5 1.25 0 2.5 Kilometers

Ship John Shoal



Some of the basics related to the probability survey design.



Boat Run Stations

Sampling design for 2000-2001 includes:

(1) Boat Run stations,

(2) Delaware Bay, and

(3) Minor tributaries

Additional Info from earlier EMAP Virginia Province, MAIA, and subsequent NCA surveys thru 2006.

National Estuary Program Coastal Condition Report Assessment for the Delaware River Estuary (data from 2000, 2001)

About 60 % of the fish have contaminant concentrations based on whole fish analysis that exceed FDA consumption advisories, primarily due to PCB & DDT

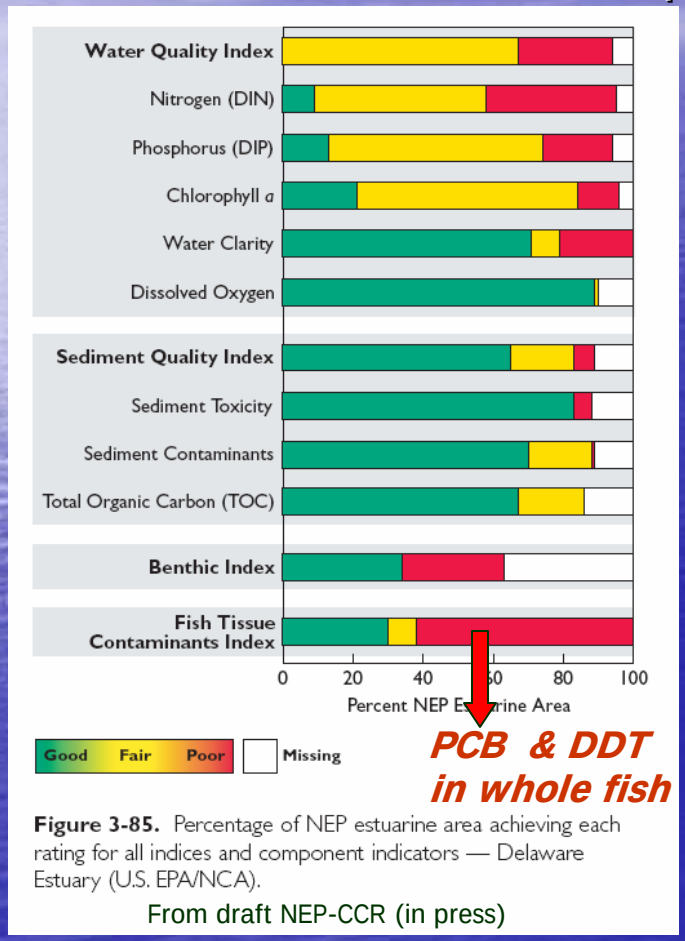
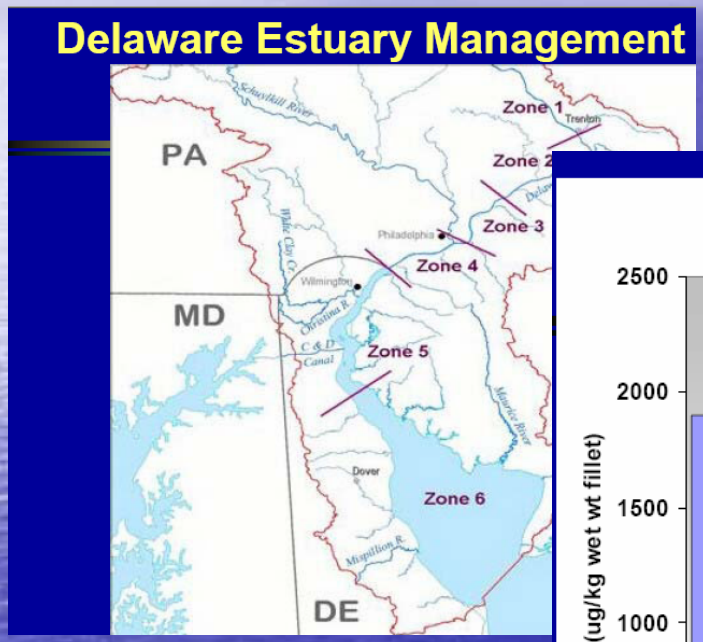


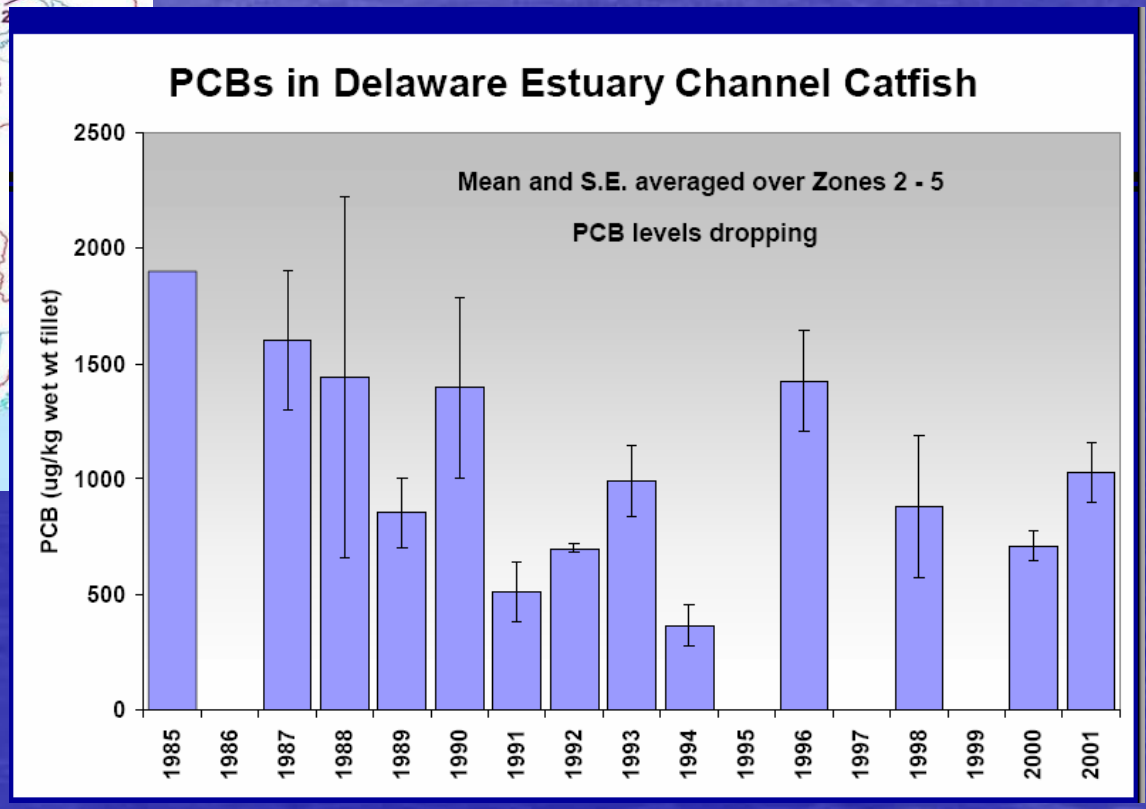
Figure 3-85. Percentage of NEP estuarine area achieving each rating for all indices and component indicators — Delaware Estuary (U.S. EPA/NCA).

From draft NEP-CCR (in press)

- Species Caught in Bottom Trawls associated with bottom feeding:
  - Channel Catfish
  - White Perch
  - Weakfish
  - Blue Crab
  - Summer Flounder
- Can high concentratios of PCBs and DDT be detected in NCA sediment samples?
- Are there other contaminant signatures at these sites?

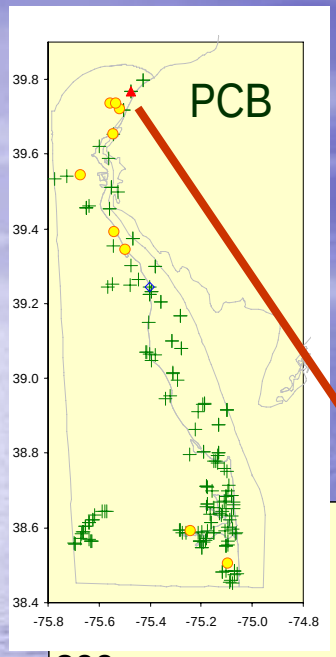
PCB Levels have fallen for a number of species , but rate of decline is slowing.





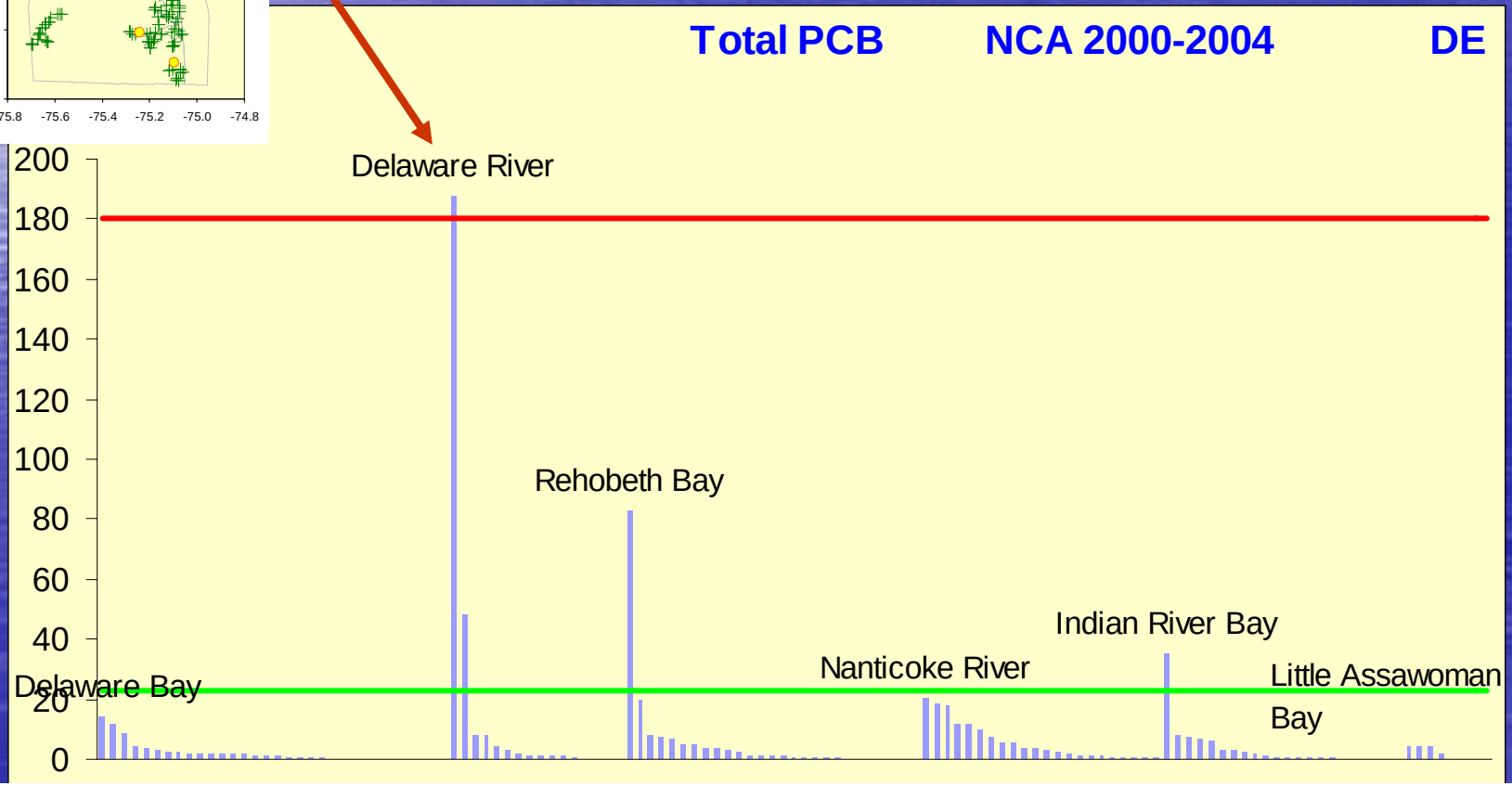
From Rick Greene, Delaware DNREC April 5, 2007

DE00-0047 Delaware River 2000 Long -75.47 Lat 39.767

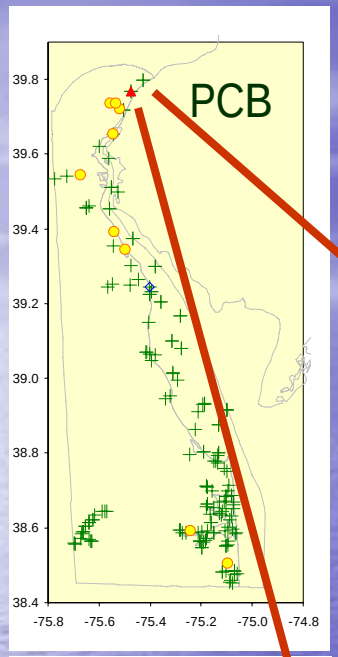


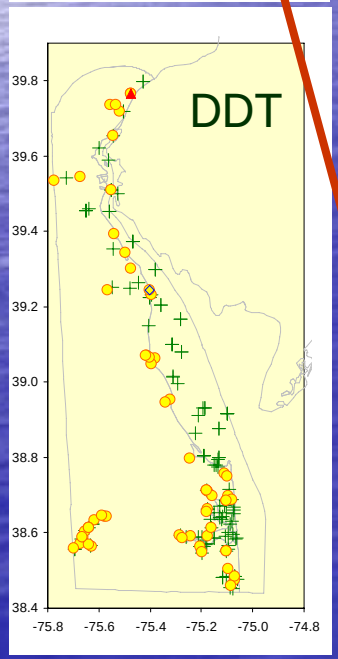
A significant source of PCBs at the AMTRAK Former Refueling Facility, and a remedial investigation study in in process.

The other source is the DuPont Edge Moor TiO2 plant with a unique byproduct (IUPAC 209 deca-PCB)



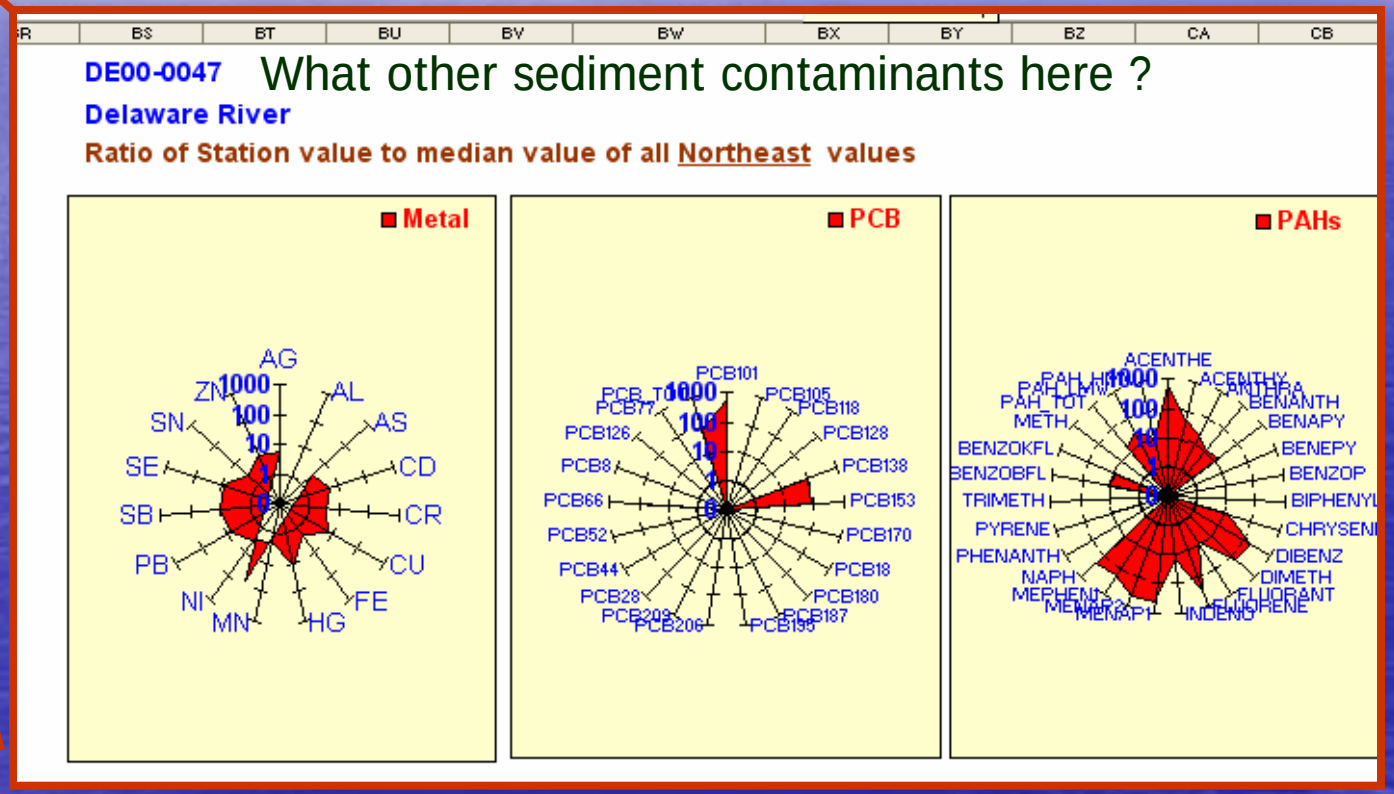
DE00-0047 Delaware River 2000 Long -75.47 Lat 39.767





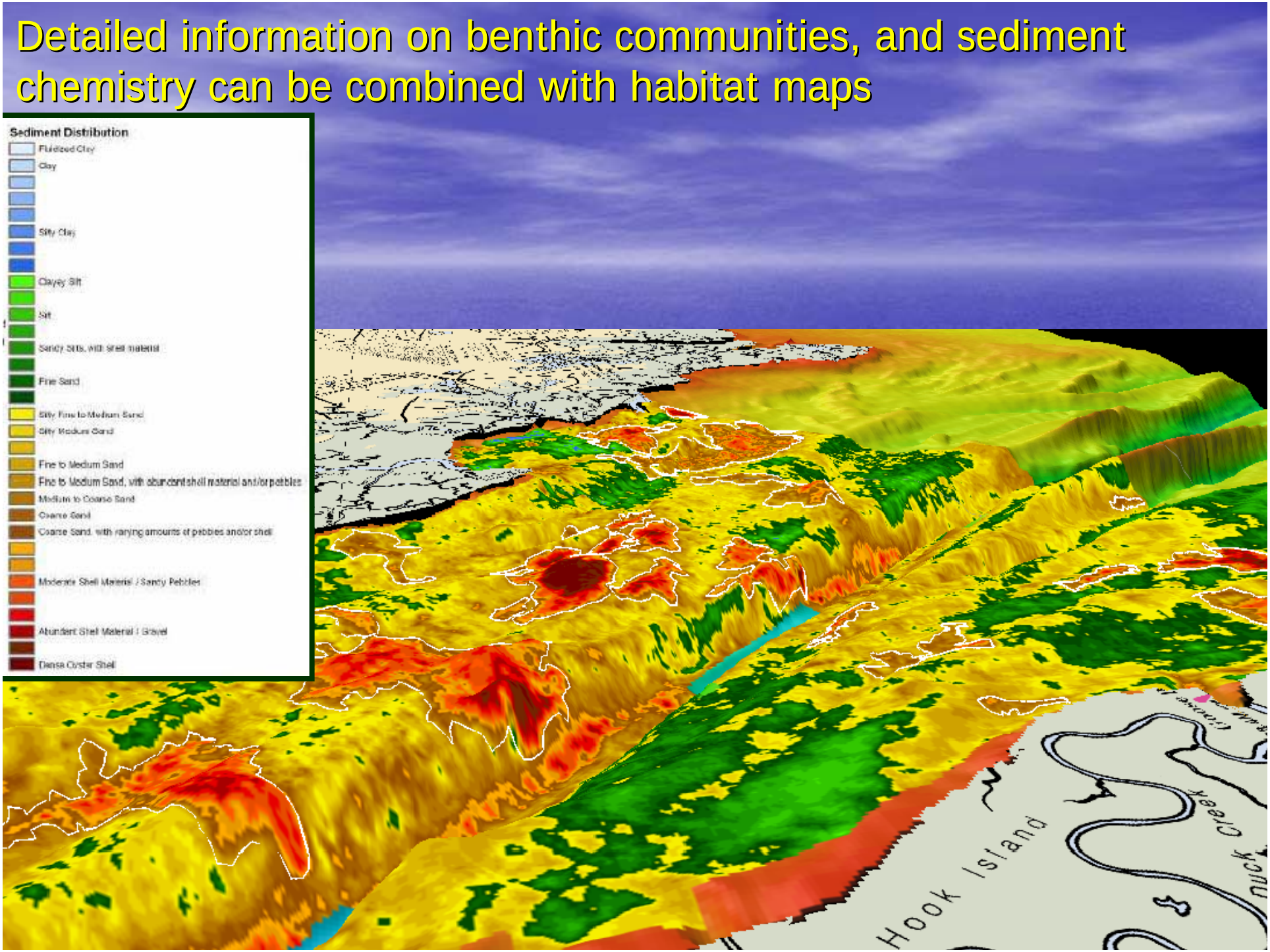
A significant source of PCBs at the AMTRAK Former Refuling Facility, and a remedial investigation study in in process.

The other source is the DuPont Edge Moor TiO2 plant (IUPAC 209 deca-PCB) found some of the NCA fish samples.

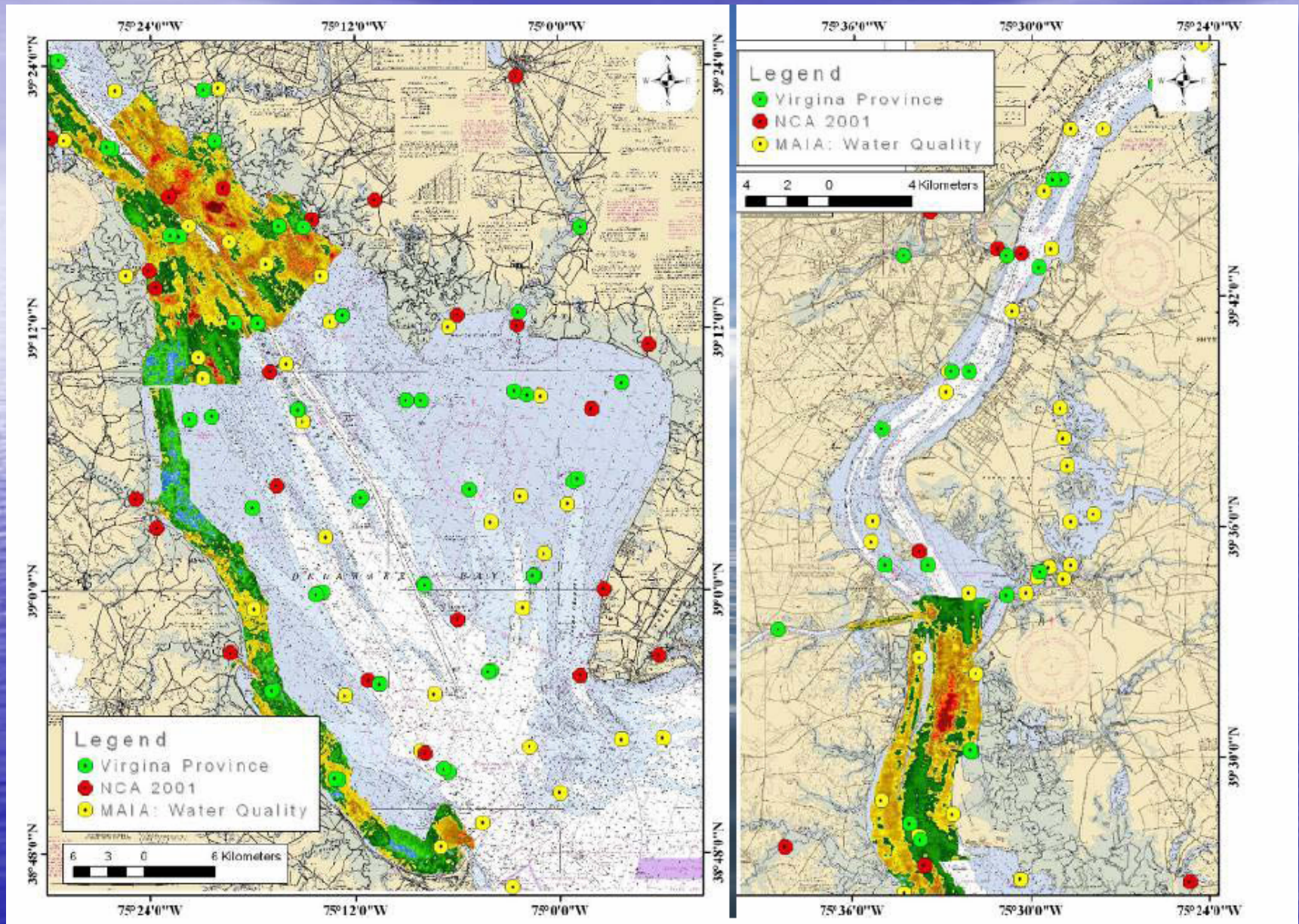


However, 209 – deca-PCB does show up in some NCA samples of channel catfish and white perch

Detailed information on benthic communities, and sediment chemistry can be combined with habitat maps



Re-analysis of information on benthic conditions from probability surveys and habitat maps. Additional sampling in 2008.



Conclusions:

- (1) Probability based sampling can help provide estimates of overall condition
  - % area statistics, diagnostics
- (2) Detailed benthic habitat maps for natural resource management
- Information from both approaches can be combined (forensics / diagnostics), in support of a variety of management decisions

We will be doing more work, including additional field sampling in the summer of 2008 (EPA Region 3 – RARE Project).