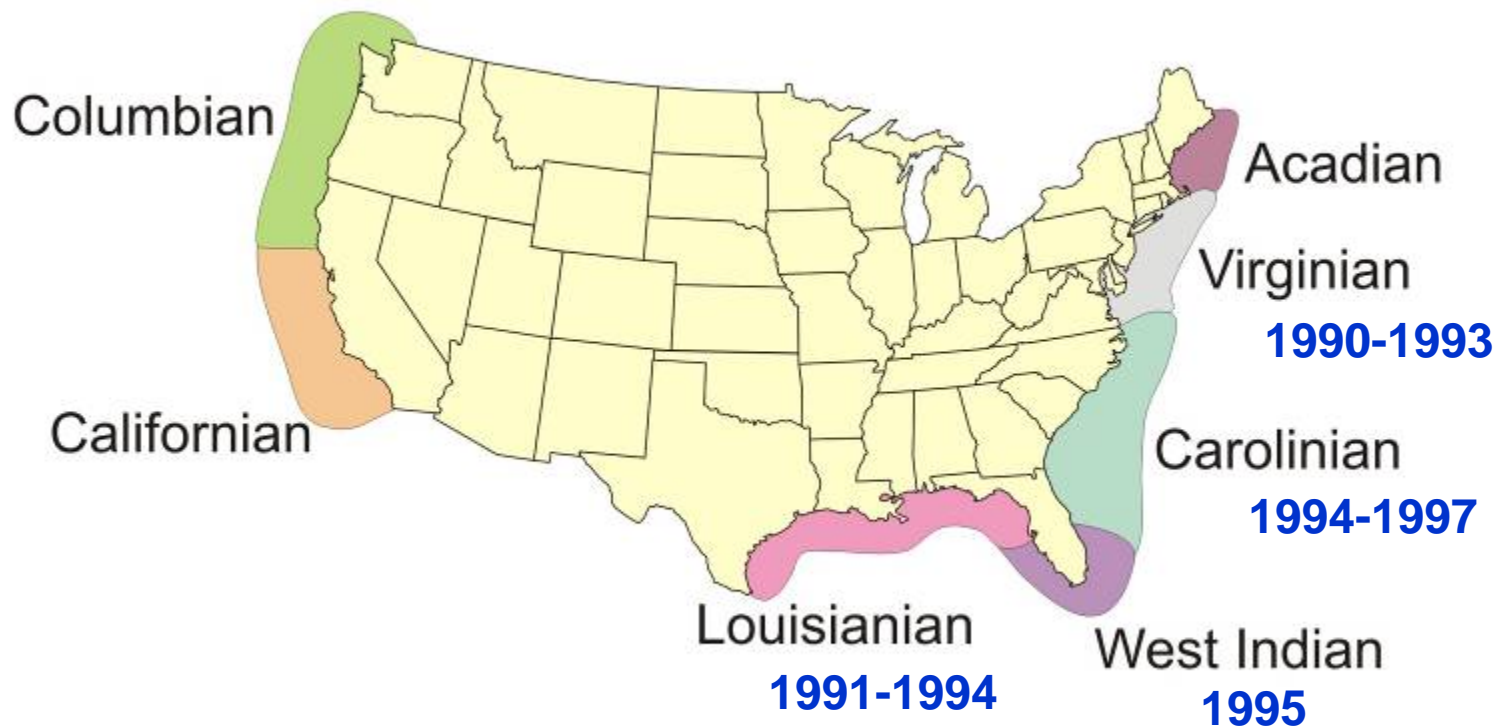




15 Years of Monitoring Estuaries: What have we learned?

Virginia Engle
US EPA
EMAP 2007 Symposium
April 10-11, 2007

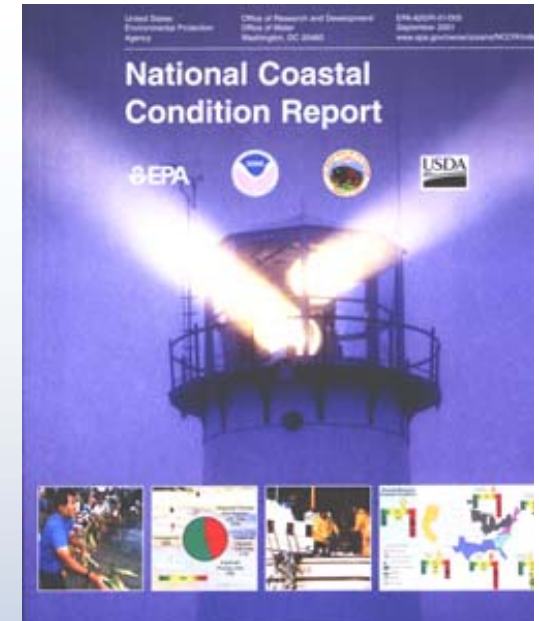
EMAP-Estuaries



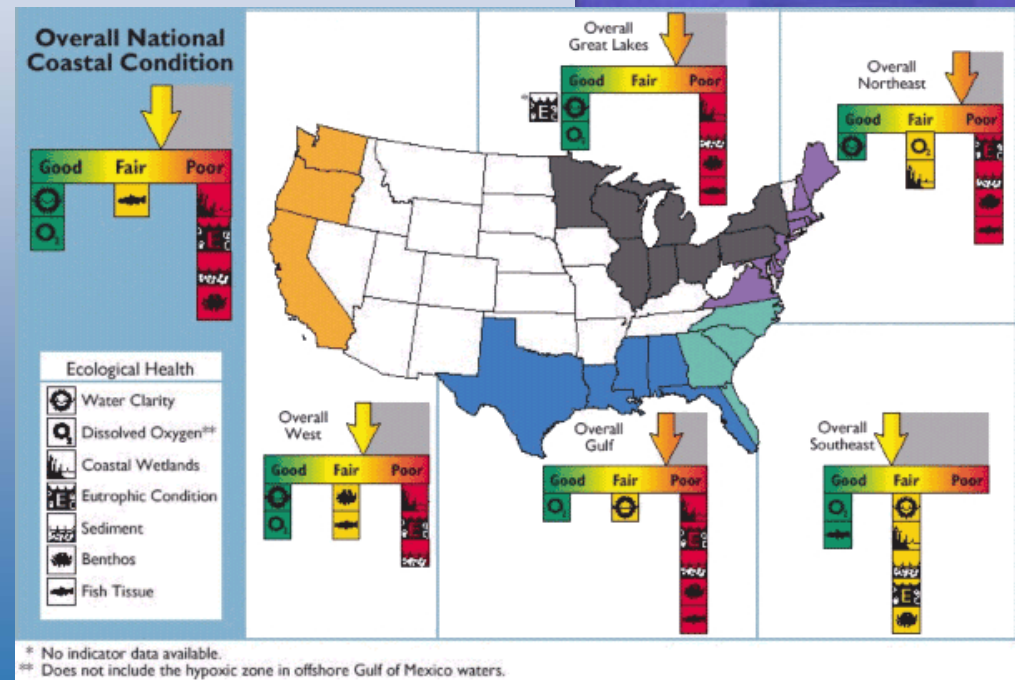
Back then...

- Survey designs
 - Biogeographic province
 - Stratified – large & small estuaries, tidal rivers
- Indicators
 - Habitat – temperature, salinity, pH, secchi, silt-clay, TOC, AVS
 - Response – benthos, fish, pathology, debris, water clarity, tissue contaminants
 - Exposure – DO, sediment toxicity, sediment contaminants

1st NCCR



- 70% of conterminous U.S. estuarine area represented
- EMAP-Estuaries data from 1990-1997
- Overall condition was fair (score=2.4)
- 56% in good condition
- 44% impaired for human or aquatic life use
- SE rated best overall;
- Gulf rated worst.



What did we learn?

- Need to build partnerships with coastal states
- Need to add nutrients & chlorophyll measures to assess water quality
- Need flexible survey designs to meet multiple objectives



Coastal 2000 → NCA

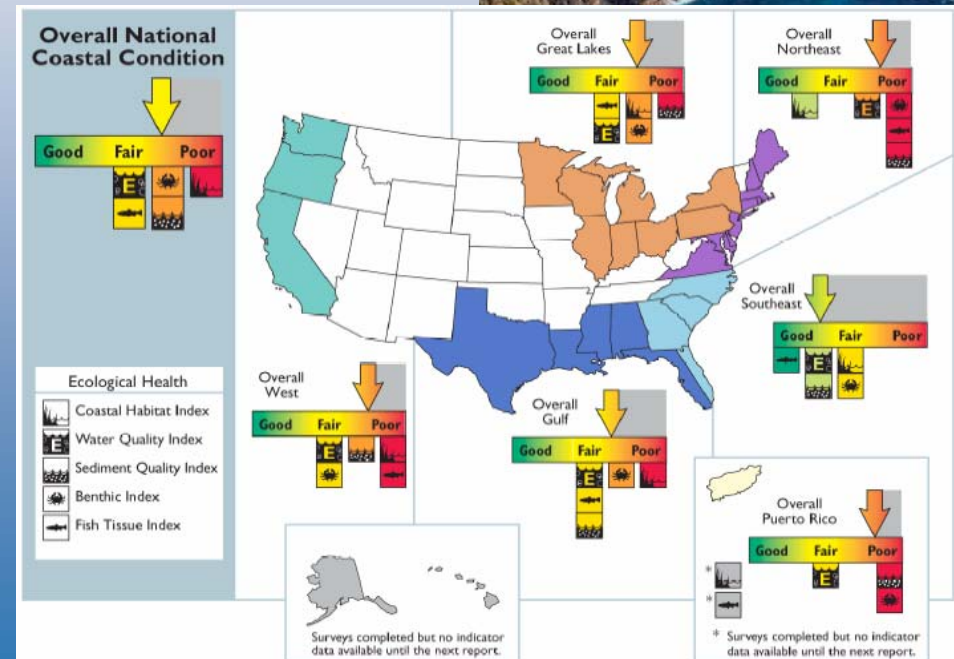
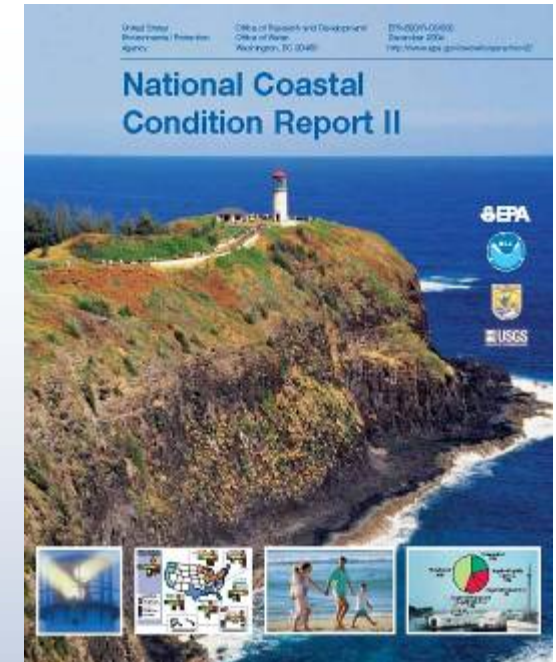
Sampling Stations - National (1997-2000)



- Survey designs
 - Stratified by State
 - USGS Frame – US estuaries
 - Included some existing state monitoring stations
 - Added NE and West Coasts and Puerto Rico

NCCRII

- 100% of conterminous US estuarine area represented
- NCA (+ MAIA) data from 1997-2000
- Overall condition was fair (score=2.3)
- 21% in good condition
- 44% in fair condition
- 35% impaired for human or aquatic life use
- SE rated best overall; Puerto Rico rated worst.



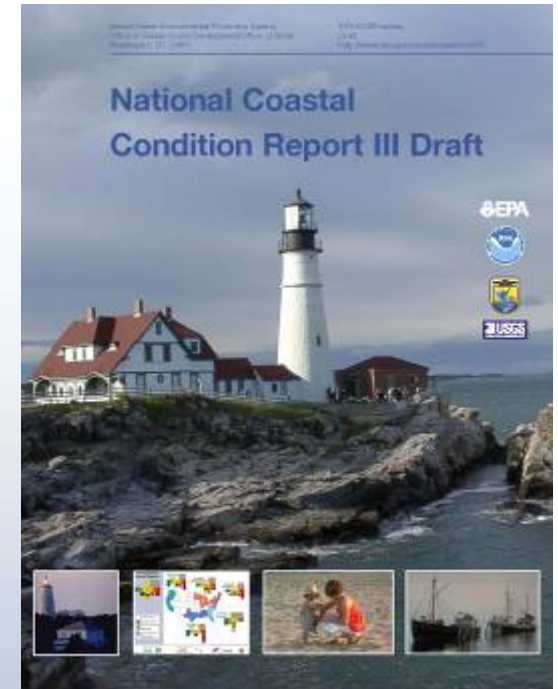
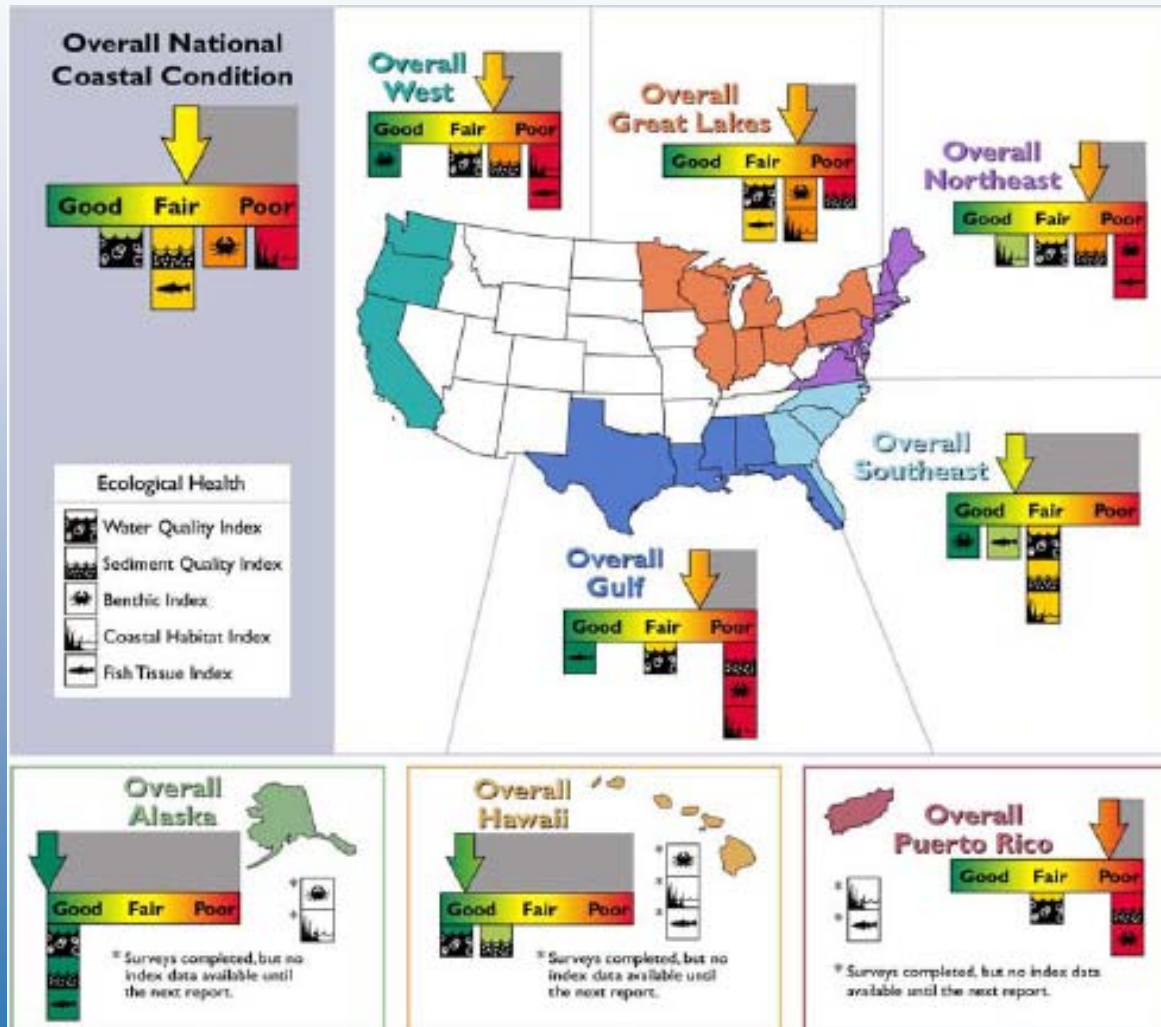
NCCR vs NCCR2

- NCCR Indicators
 - Water Clarity
 - Dissolved Oxygen
 - Coastal Wetlands
 - Eutrophic Condition
 - Sediment
 - Benthos
 - Fish Tissue

- NCCR2 Indicators
 - Water Quality Index
 - Sediment Quality Index
 - Benthic Index
 - Coastal Habitat Index
 - Fish Tissue Index

	NE	SE	Gulf	West	GL	PR	US
NCCR	1.8	3.6	1.8	2.0	1.4	--	2.0
NCCR2	1.8	3.8	2.4	2.0	2.2	1.7	2.3

Draft NCCRIII



- NCA 2001-2002
- Added AK & HI
- Assessed trends
- Overall condition was fair (2.8)
- AK rated best; PR rated worst.

Assessing Trends

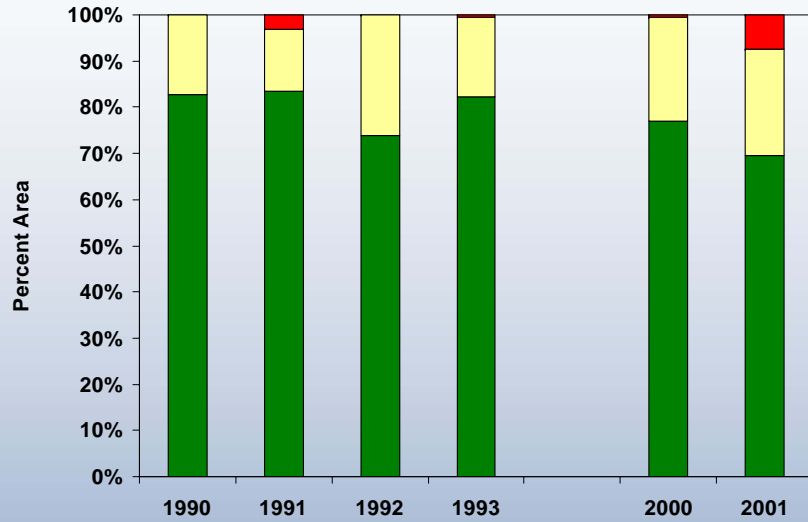
- Challenges
 - Estuarine resource surveyed has changed over time
 - Indicators and scoring methods have changed over time
- But if we...
 - assume that the condition of all estuaries has a similar distribution to the condition of those surveyed and,
 - adjust the indicators and scores to ensure comparability over time then...
- We can assess temporal change in the condition of estuaries by region and for the US.

Regional Trends

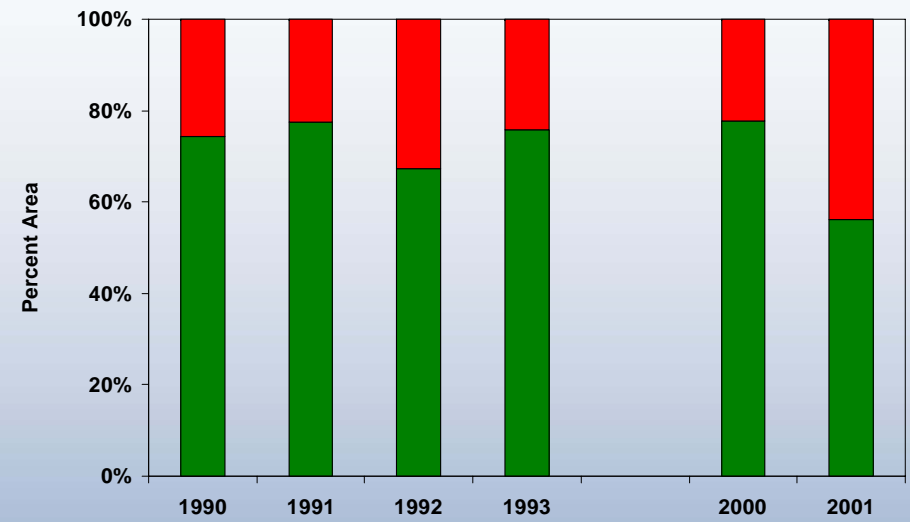
- EMAP-Estuaries province data compared to NCA data
 - boundaries adjusted to match
- Indicators in common
 - DO, water clarity
 - Benthic Index
 - Sediment TOC, toxicity, contaminants
- Analysis
 - CDFs by year
 - Comparison of 2 time periods (e.g., 1990-1993 vs 2000-2001 for NE)
- Comparison of Scores from NCCR, NCCR II, NCCR III

NE Trends

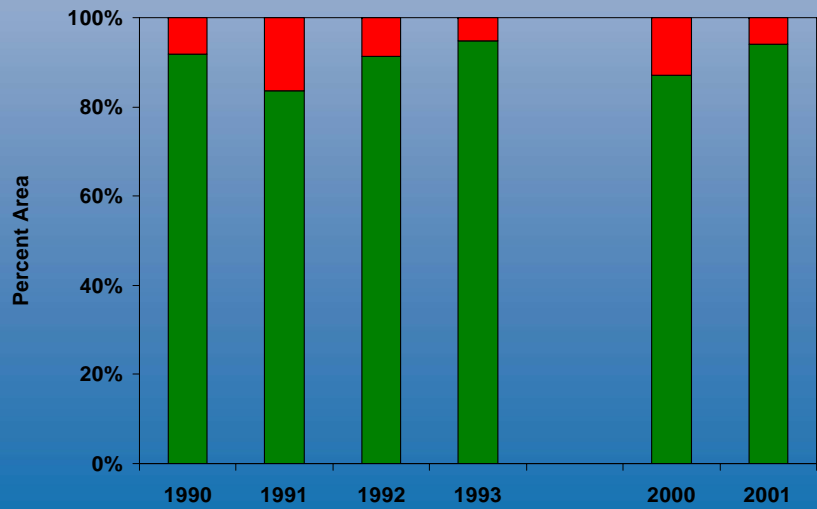
Dissolved Oxygen



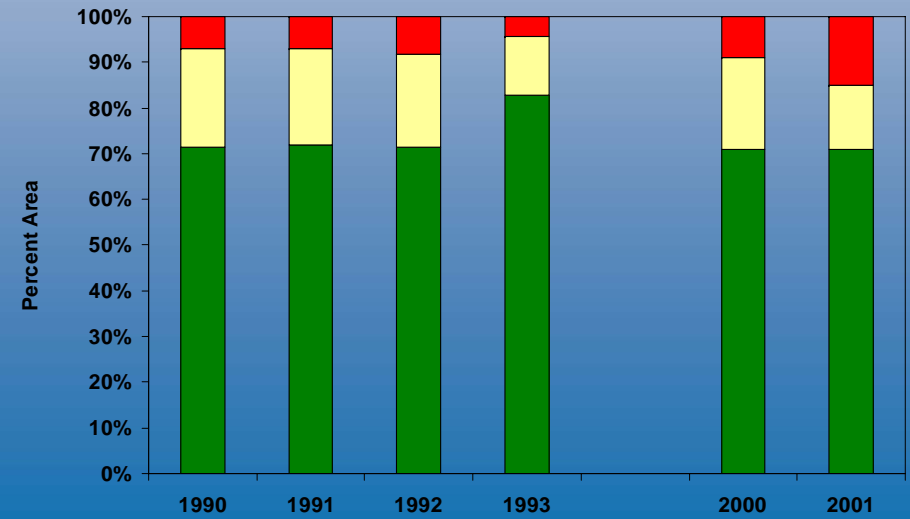
Benthic Index



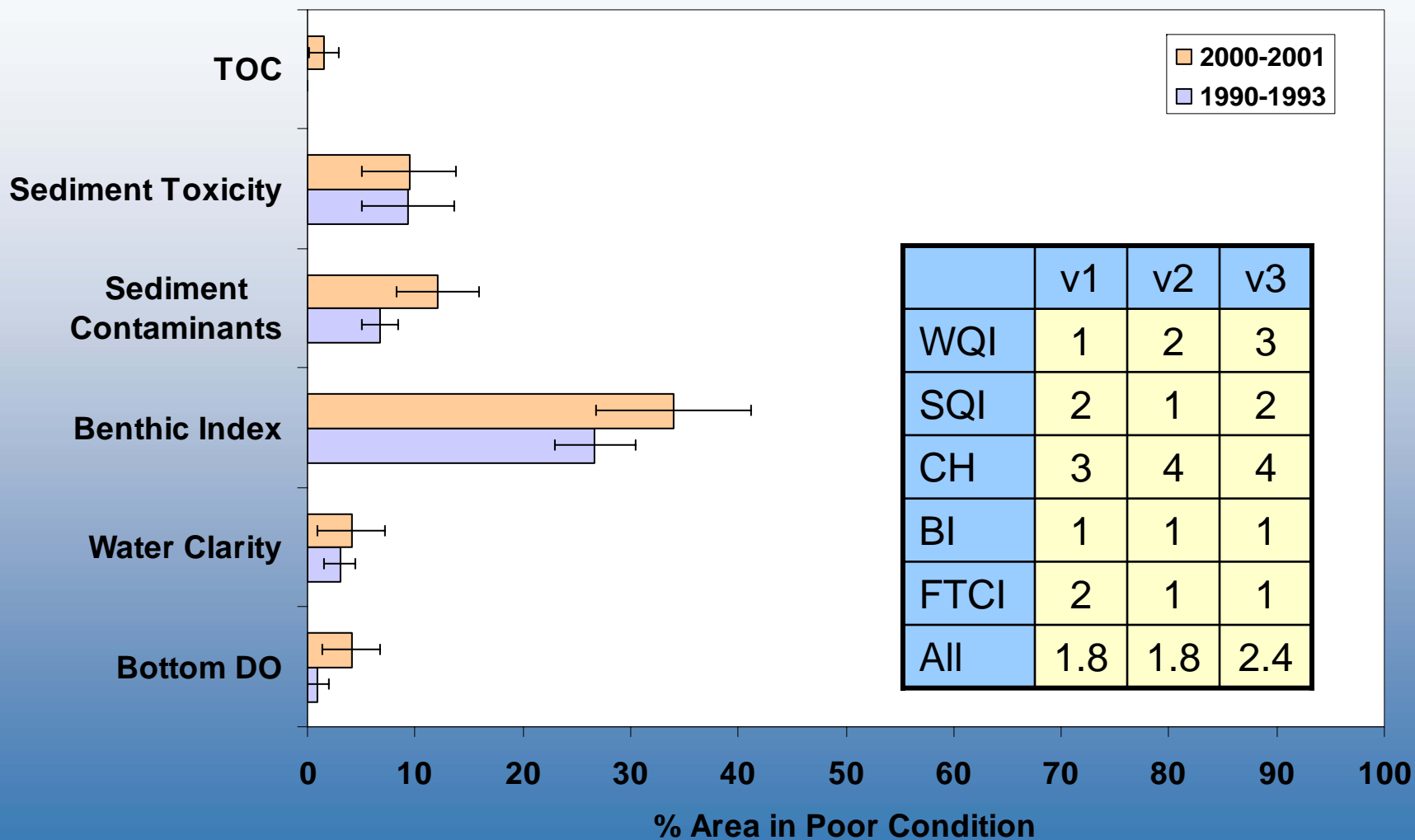
Sediment Toxicity



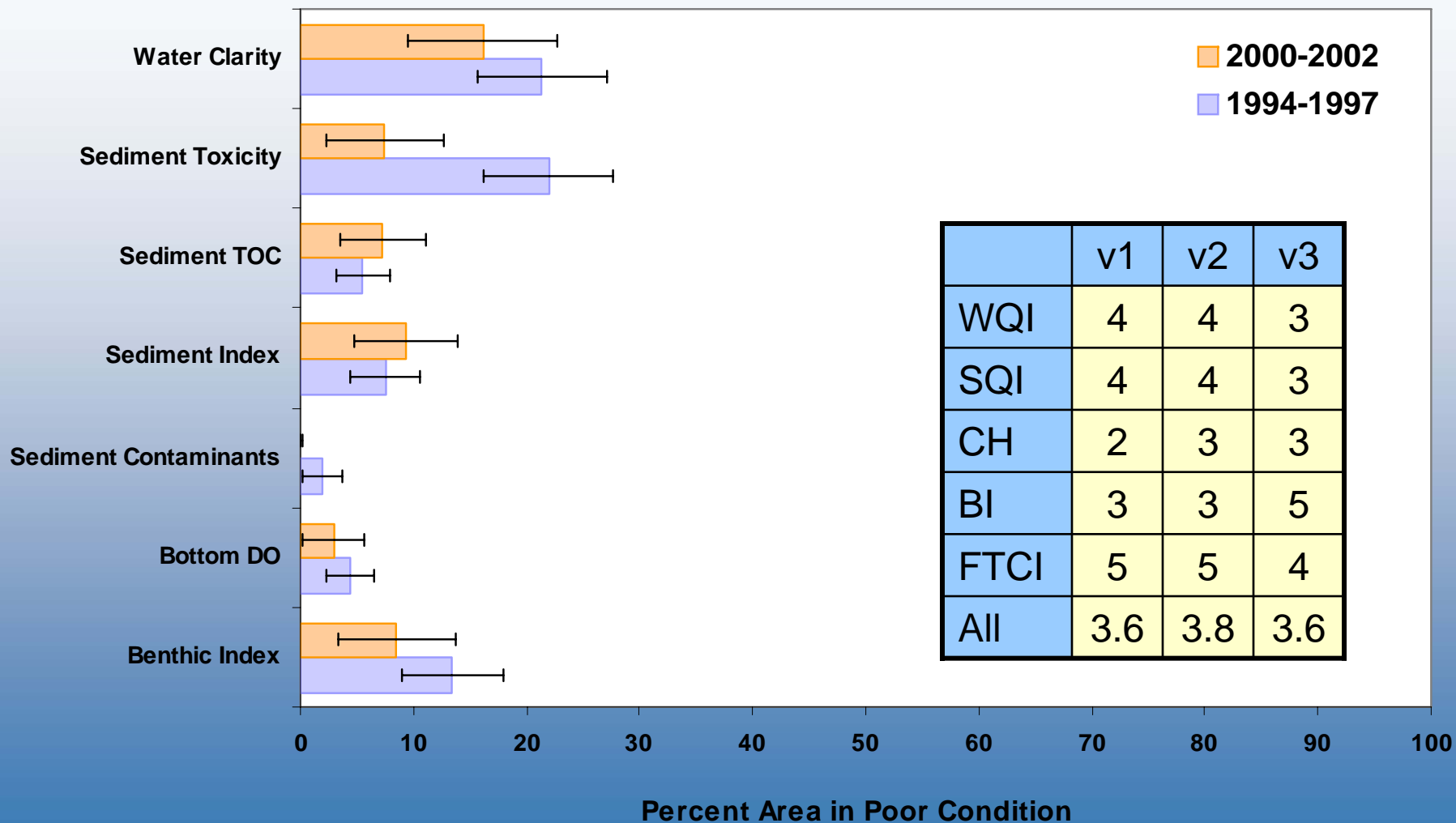
Sediment Contaminants



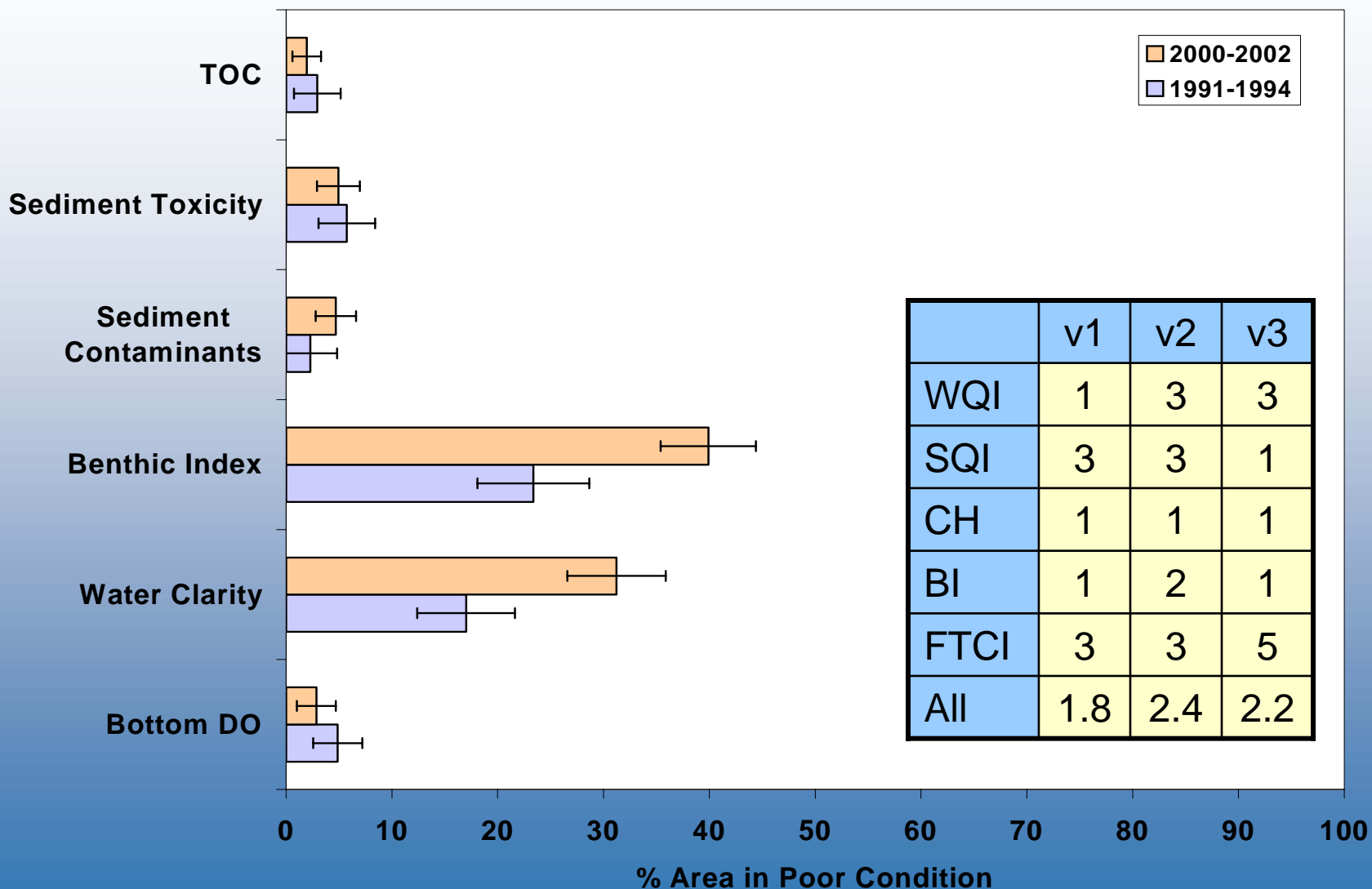
NE Trends



SE Trends



Gulf of Mexico Trends



	v1	v2	v3
WQI	1	3	3
SQI	3	3	1
CH	1	1	1
BI	1	2	1
FTCI	3	3	5
All	1.8	2.4	2.2

Other Regions

- West Coast
 - Original pilot not designed to assess trends
 - NCCR III – trends reported for Puget Sound, San Francisco Bay, & Southern California Bight
- AK & HI
 - No historical EMAP data available
- Great Lakes
 - Not NCA – GLP uses different methods but some similar indicators
 - Can't calculate spatial estimates of condition but can compute scores
- Puerto Rico
 - No new data available to assess trends

Score Comparisons

West Coast

	v1	v2	v3
WQI	1	3	3
SQI	2	2	2
CH	1	1	1
BI	3	3	5
FTCI	3	1	1
All	2.0	2.0	2.4

Great Lakes

	v1	v2	v3
WQI	1	3	3
SQI	1	1	1
CH	1	2	2
BI	1	2	2
FTCI	3	3	3
All	1.4	2.2	2.2

AK

	v3
WQI	5
SQI	5
CH	-
BI	-
FTCI	5
All	5.0

HI

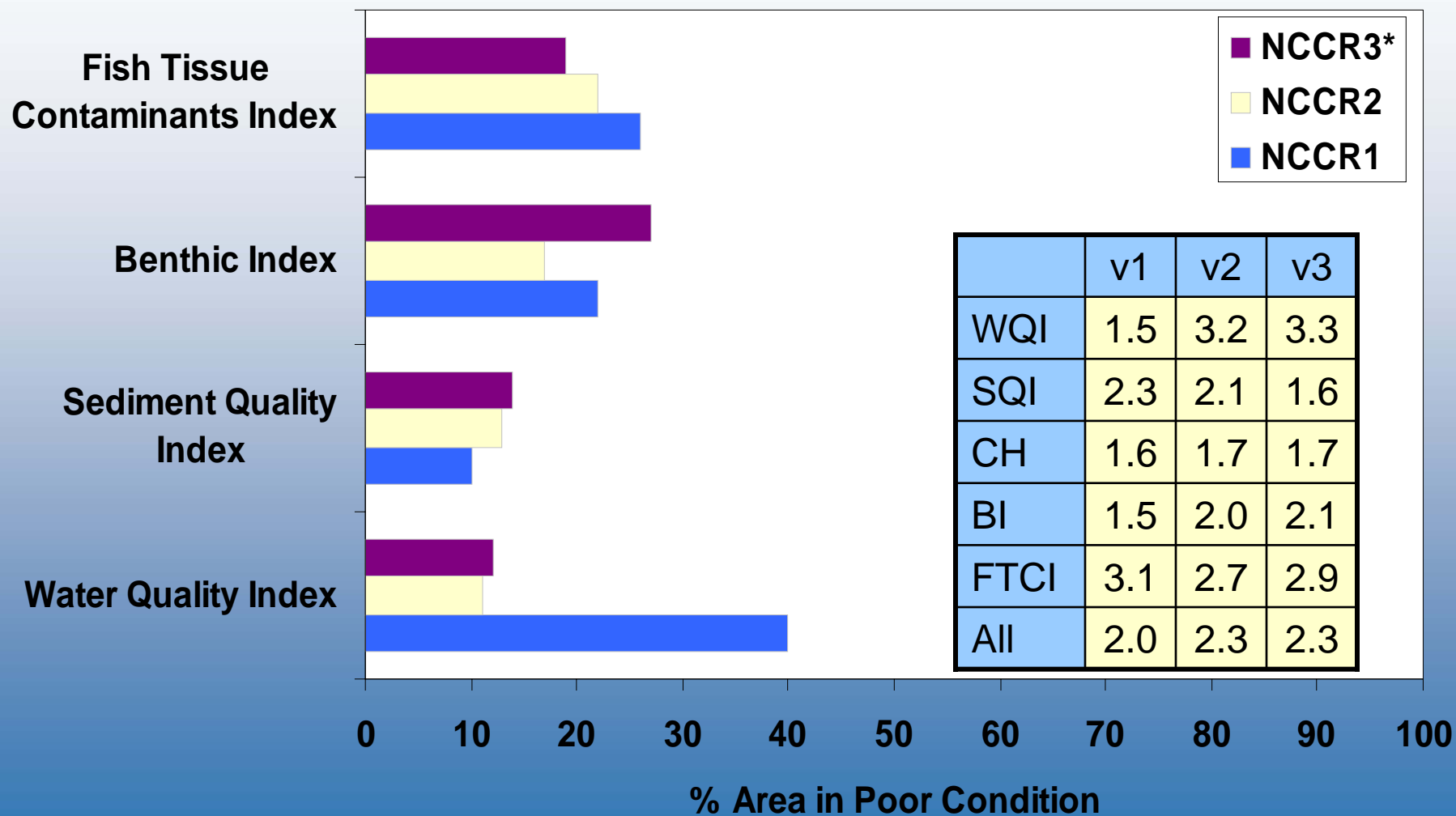
	v3
WQI	5
SQI	4
CH	-
BI	-
FTCI	-
All	4.5

Puerto Rico

	v2	v3
WQI	3	3
SQI	1	1
CH	-	-
BI	1	1
FTCI	-	-
All	1.7	1.7

US Trends

(excluding AK & HI)



What have we learned?

	NE	SE	Gulf	West	PR	AK, HI	US
WQI	↑	↓	↑	↑	■	■	↑
SQI	■	↓	↓	■	■	■	■
CH	↑	↑	■	■			■
BI	■	↑	■	↑	■		↑
FTCI	↓	↓	↑	↓		■	■
Overall	↑	■	■	↑	■	■	↑

What have we really learned?

- Consistency & comparability is key
- When all else fails, be creative
- Successful partnerships require negotiation & compromise
 - EPA gets what we need
 - States get what they need
- Surveys of condition are great for status & trends but do not answer all questions



What's next?

- NCCRIV
 - Draft completed 2009
 - NCA 2003-2006 + Trends
- EPA Office of Water
 - Surveys of the Nation's Waters
 - Coastal 2010 - 1000 sites in US
 - Comparable to NCA
 - Conducted by States with §106 \$\$
 - Report in 2012



