State-Scale Statistically-Valid Surveys
NARS and State Programs
Concordance and Discord

Presented by David Chestnut
Current Components of the SC Ambient Monitoring Network design

- **Statistically-Valid Survey**
  - Big Picture state-scale survey of resource condition
  - Snapshot in time

- **Fixed Monitoring Network**
  - Site Specific focus
  - Consistent statewide coverage year after year
  - Long-term trends at sites
Probability-Based Component

- Great deal of pressure from EPA for state-scale statistically-valid survey of water condition (probability-based monitoring)
  - SC state-scale effort began 2000
  - Line-item in SC §106 grant work plan since FY06
  - In 2008 EPA required certification of state-scale statistically-valid survey implementation
    • Intent was to make it a §106 grant requirement
    • With funding contingent on it
  - 2009 Integrated Reporting memo
SC National & NARS Survey Participation

- EPA ORD & EMAP
  - National Coastal Condition Condition Report I
  - Coastal 2000
- SC already had their program in place prior to the NARS surveys
- 2006 Wadeable Streams
- 2010 Coastal
- 2011 Wetlands
SC Probability-Based Component

- **Probability Sites**
  - Sampled monthly for 1 year

- **Make comprehensive statements about statewide WQ conditions (§305(b) use support)**
  - Unbiased random sample of water resources (statistical survey, like a phone survey or exit poll, snapshot in time)
  - Represents entire resource (“All Waters”)
  - Known confidence of condition estimates

- **Sample previously unsampled locations**
  - Identify new §303(d) candidates
Organizational Constraints

- In SC monitoring staff are distributed in multiple field offices.
- These Regional staff collect almost all the water samples.
- Staff resources and time are limited.
- So to add a state-scale statistically valid survey component, the data should contribute to other program needs beyond §305(b).
Original Intent

- Reliable state-scale condition estimates for §305(b)
- Monitoring of probability-sites should conform with the Department’s §303(d) assessment methodology
- So individual sites could be assessed for potential inclusion on the §303(d) list of impaired waters
- And data could be used for permits and modeling
In order to do that, **sufficient data** must be collected at **each** Probability Site to apply SCDHEC's §303(d) Assessment Methodology

- Monthly sampling for 1 year at all probability sites
- Same parameter suite as our fixed monitoring sites
- This is a little different approach than NARS and most other states with state-scale statistically-valid designs
South Carolina Questions

- What are the state-scale conditions for the water resource for each waterbody type (§305(b), all waters)?
  - Aquatic Life Use
  - Recreational Use
- What are the main causes of impairment (determined by size or % of resource impacted)?
- Do the individual sites meet State Standards (§303(d) list)?
Statistical Magic

- It requires around 50 to 60 sites to make a population statement 90% ± 10% confidence
- We sample 30 sites per year in each waterbody type
- So we could make a statewide statement every 2 years
- §305(b) cycle
Resource Types Assessed Using Probability-Based Approach

- Streams
- Lakes
- Estuaries
SC Targeted Categories for Probability-Based Sites

- **Streams**
- 30 sites per year
- Perennial only
- Sampled monthly
- Unequal weights
  - 8 first order streams
  - 10 second & third order streams
  - 12 fourth order & greater streams
2008-09 NARS National Flowing Waters

- 1 sampling event, Index period April/May - Sept.
- Wadeable & non-wadeable
- Included “intermittent” streams
- Status of urban flowing waters
- Changes in wadeable since 2004
  - Includes some 2004 site revisits
SC Targeted Categories for Probability-Based Sites

- Significant Lakes with Unrestricted Public Access:
  - 17 Major Lakes ($\geq 850$ acres)
  - 15 Minor Lakes (40 to 850 acres)

- 30 sites per year
- Sampled monthly
- Unequal weights
  - 20 in Major lakes
  - 10 in Minor lakes
2012 NARS Lakes

- 1 sampling event
- Focus is the deepest area (centroid) of the lake (2007)
  - So estimates are in numbers of lakes, not lake area
  - (got some give on this for 2012, added a littoral site, but still won’t provide accurate estimates of total lake area)
2012 NARS Lakes

- Some 2007 site revisits
  - New lakes added in 2012 sample frame
- All freshwater lakes, ponds, and reservoirs greater than 1 hectare (~2.5 acres)
- Unequal weights based on 5 size classes
  - 1 - 4, 4-10, 10-20, 20-50, >50 ha
Sample Frame and Site Location

Issues

SC specifically lets sites fall where they may within the entire lake area
- All habitats are fair game
- The estimates are for total lake area
- All waters, not number of waters

Criticism from public over fixed sites locations, nobody swims in the middle of the lake

Subset of the significant lakes accessible to all SC citizens vs. small, private ponds
Targeted Categories for Probability-Based Sites

- **Estuaries**
- 30 sites per year
- Sampled monthly
  - Two distinct strata:
    - 15 Open water (> 100 m wide)
    - 15 Tide Creeks (< 100 m wide)
2010 NARS National Coastal Condition Assessment

- Head-of-salt to confluence w/ocean
- For SC, Delaware Bay, Chesapeake Bay, & Puget Sound, NCCA sample frame replaced by organization provided GIS layers
- Unequal weight categories within individual major estuaries created based on area to ensure that sites were selected in the smaller polygons
This One Really Worked for SC!

- Estuary design developed with Tony Olsen’s help around 1999
- EPA (Tony Olsen) aware of and understands the State program
  - The SC sample frame was used for the area of the draw
  - So we could use a sub-set of our monthly sites to replace the NARS sites
- SCDHEC could field a trained crew from the central office, so sample collection didn’t impact the Regional staff (much)
- We already have partnerships in place with SCDNR and NOAA
Side Benefits of NARS to States

- **Tech Transfer**
  - In SC, we can now do our own draw of sites for all three resource types to suit our design and needs.
  - And compute the final statistics!
- **NARS draws now include enough additional sites for States to incorporate a state-scale survey**
Why NARS design may not work for States

- Different sample frame
- Different population of interest
- Different timing
  - Rotating basin vs. statewide
  - Draw may not be available in time for a State to incorporate a state-scale implementation
    - Time for adequate repeat visits
    - Time to address different index periods
Concerns With NARS Indicators

- Some have no standards, so the data don't fit State needs
- Supplemental & Research indicators - ditto
- Methods don't agree with State programs, so State's don't trust the results
  - We know our State better and have developed appropriate approaches
- Cutpoints applied nationally may not make sense in some areas, or may differ from State standards
Concerns With Limited Data

- A single visit usually doesn’t supply enough data to conform with State §303(d) assessment and listing methods.
Resources & Logistics

- In some states monitoring staff are distributed in multiple field offices
  - So not enough specialized equipment for each office to implement NARS indicators
  - Not enough training for each office
- Different waterbody type each year requires re-training every year
  - Loss of experience and interest in implementing “research methods” into state program
Resources & Logistics

- Staff resources already dwindling and low
  - So it’s often a choice between meeting State program needs or collecting data that may not satisfy reporting needs
Resources & Logistics

- During reconnaissance the land owner says OK, but when you show up to sample they’ve changed their mind
- Sample processing time after collection (e.g. filtering)
- Finding an express shipping office that’s open at the end of the day
Resources & Logistics

- And the paperwork.....
  - In the field
  - Before shipping
  - When the data are submitted

- And QA people constantly calling....
  - To ask where the data are
  - When will it be done
  - Where’s all the associated QA records
When It Can Work

- EPA aware of **and understands** the State program
  - And both State and national questions can be addressed by the State design
That’s All Folks!

Any Questions? Discussion?
MAP Design Subcommittee Recommendations

- The national survey design for an aquatic resource should be developed from state designs
  - State designs will either be a generic design for 50 sites
  - Or a state specific design requested by the state
  - State specific designs will need to meet some criteria consistent with national questions
MAP Design Subcommittee Recommendations

- Current NARS strategy of rotating surveys through the aquatic resource types should be retained until a detailed plan for monitoring all aquatic resources every year is available.
  - The strategy would need to address policy/funding, operational and scientific issues.
MAP Design Subcommittee
Recommendations

- National or state assessments could be based on up to five years of data
  - For example, a national lake assessment for 2012 could be based on state data from 2008-2012