

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



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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 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% \pm 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

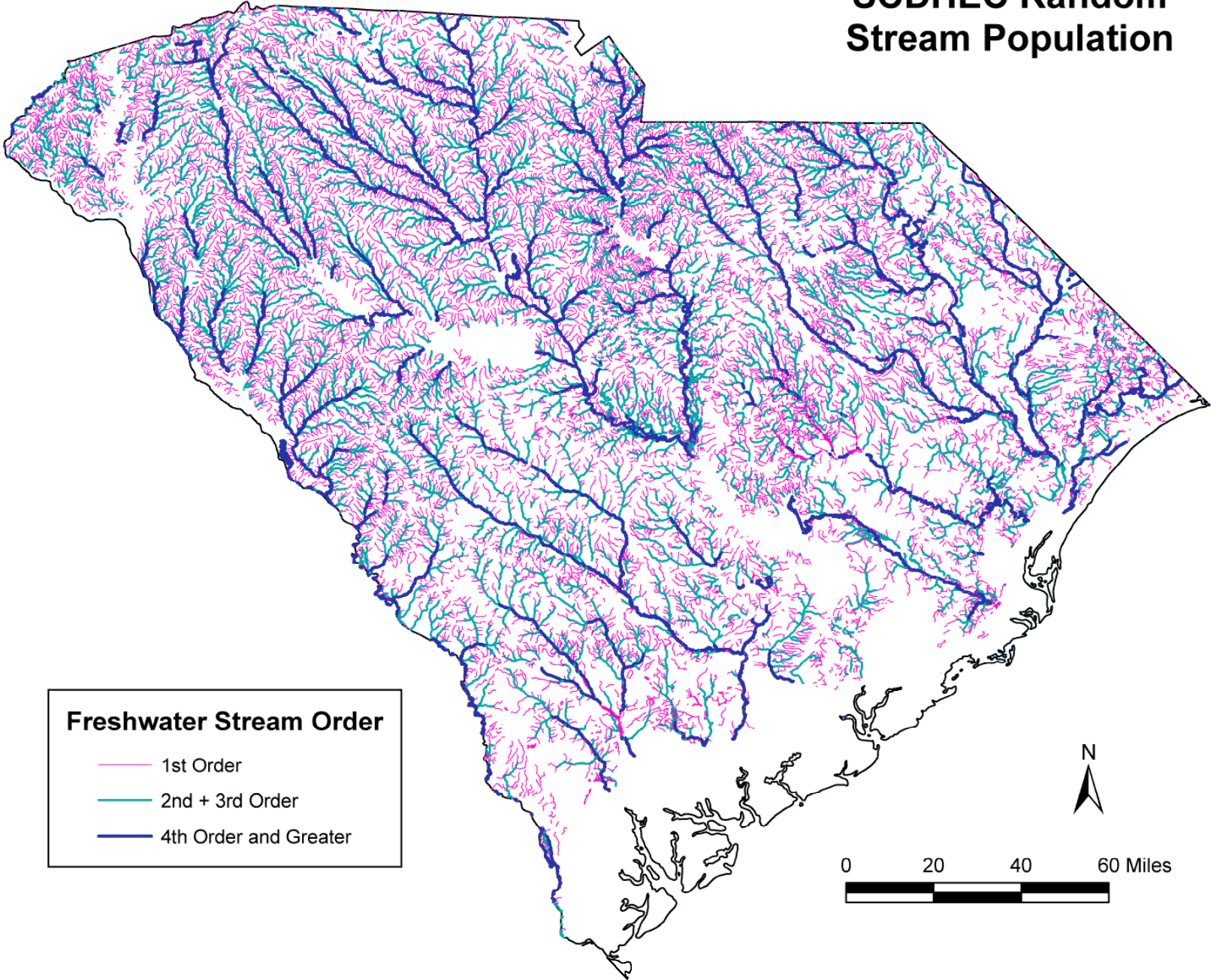
❖ Sampled monthly

❖ Unequal weights

- 8 first order streams
- 10 second & third order streams
- 12 fourth order & greater streams



SCDHEC Random Stream Population



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 (≥ 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

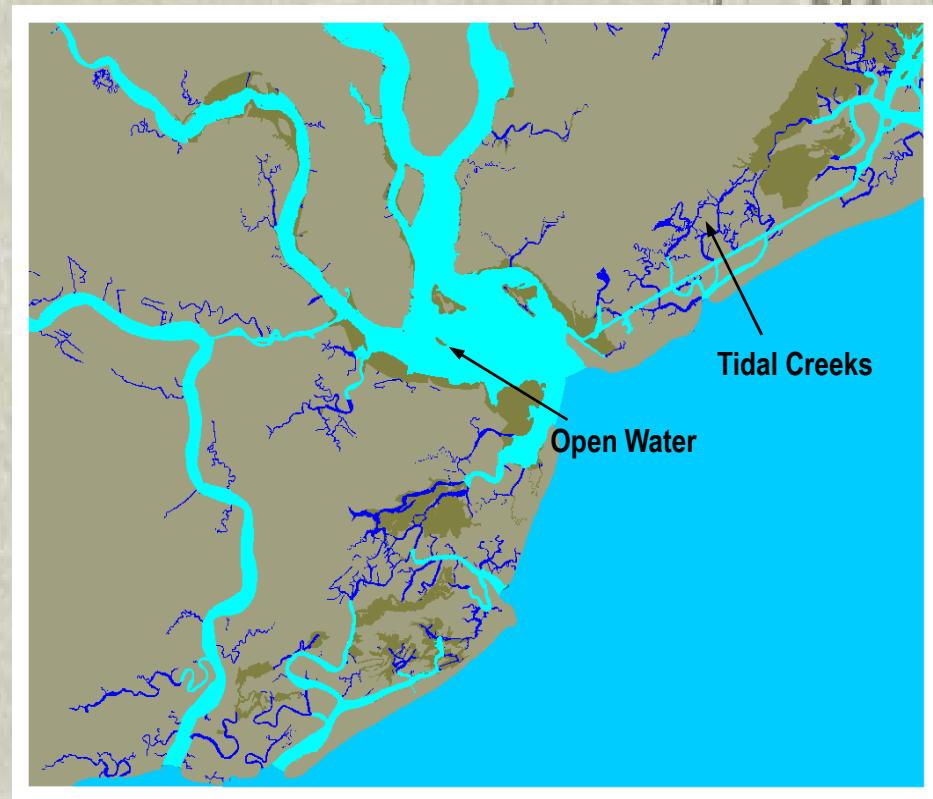
❖ 30 sites per year

❖ 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