



Using the Coastal Salinity Index for Monitoring Drought in the Carolinas

Paul Conrads

USGS - South Atlantic Water Science Center, Columbia, SC

Lauren Rouen

Carolinas Integrated Sciences and Assessments



U.S. Department of the Interior
U.S. Geological Survey



Presentation Outline

- Coastal Drought
- Coastal Salinity Index
- Where are we?
- Next Steps
- Linkages with environmental response variables

Imagine Drought Along the Coast



The Impact of Drought on Coastal Ecosystems in the Carolinas

Executive Summary January 2012

Steve Gilbert, US Fish & Wildlife Service and National Oceanic and Atmospheric Administration (retired)
Kirsten Lacksbrom, University of South Carolina, Department of Geography, Carolinas Integrated Sciences & Assessments
Dan Tufford, Ph.D., University of South Carolina, Department of Biological Sciences, Carolinas Integrated Sciences & Assessments

cisa
carolinas integrated sciences & assessments

U.S. Department of the Interior
U.S. Geological Survey

Drought and coastal ecosystems

- Drought is a significant stressor to coastal ecosystems,
- but... ecological information has not been systematically integrated into drought monitoring and response,
- and... drought information is not well-integrated into coastal resource management.

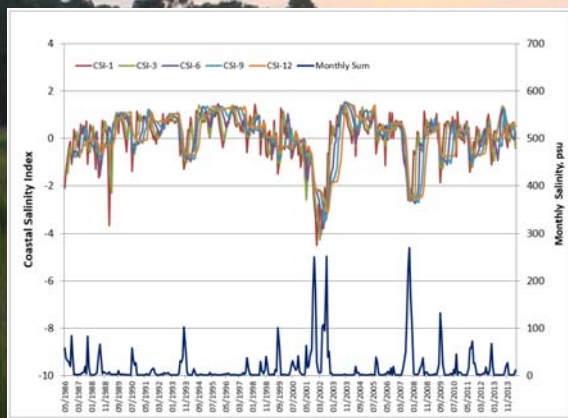


Coastal Salinity Index (CSI)

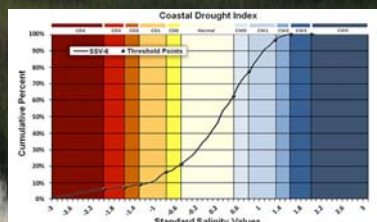
- Approach similar to Standardized Precipitation Index (SPI)
- Computed for multiple time periods
 - 1-month, 6-month, 9-month, 12-month, 24-month
 - Evaluate short- and long-term conditions
- Index for drought (saline) and wet (freshwater) conditions
- Real-time computation
- Challenges
 - Limited number of long-term sites

U.S. Department of the Interior
U.S. Geological Survey

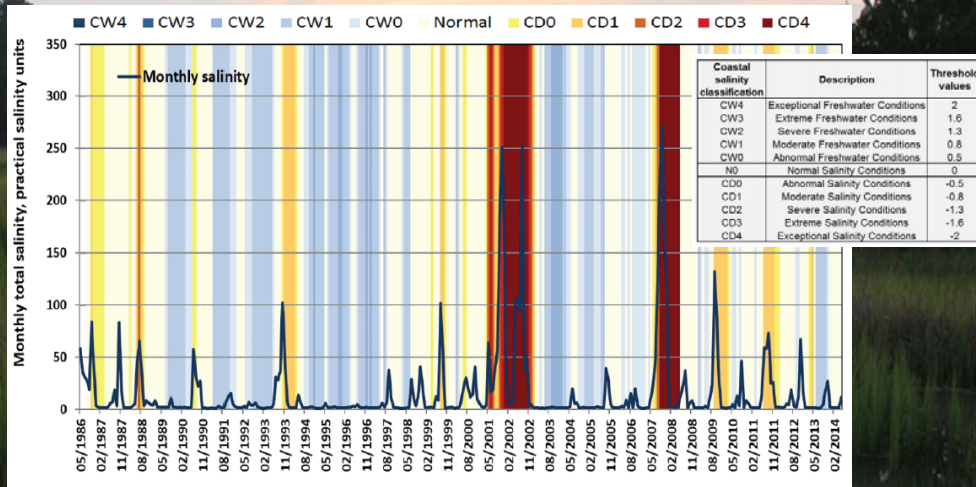
Coastal Salinity Index (CSI) for Waccamaw River



| Coastal salinity classification | Description | Threshold values |
|---------------------------------|-----------------------------------|------------------|
| CW4 | Exceptional Freshwater Conditions | 2 |
| CW3 | Extreme Freshwater Conditions | 1.6 |
| CW2 | Severe Freshwater Conditions | 1.3 |
| CW1 | Moderate Freshwater Conditions | 0.8 |
| CW0 | Abnormal Freshwater Conditions | 0.5 |
| N0 | Normal Salinity Conditions | 0 |
| CD0 | Abnormal Salinity Conditions | -0.5 |
| CD1 | Moderate Salinity Conditions | -0.8 |
| CD2 | Severe Salinity Conditions | -1.3 |
| CD3 | Extreme Salinity Conditions | -1.6 |
| CD4 | Exceptional Salinity Conditions | -2 |

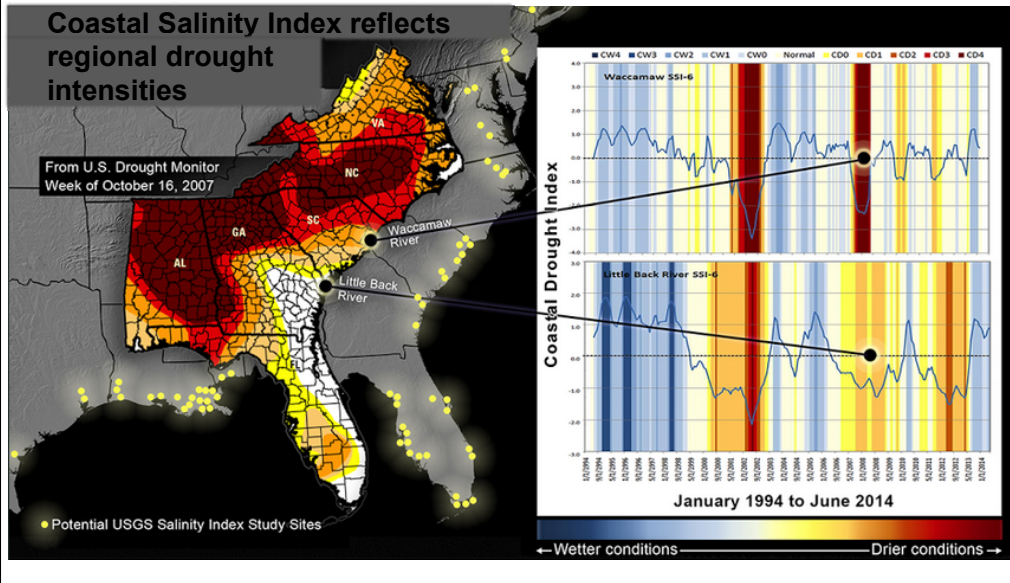


6-Month CSI with Color Ramps



Comparison with Drought Monitor maps

Uniqueness of coastal drought due to variability of salinity conditions



Where are we?

Computed the CSI at 17 sites
2 in South Carolina; 15 in South Florida

Approach published in BAMS (<http://dx.doi.org/10.1175/BAMS-D-15-00171.1>)

Some work on linking the CSI to response variables

Started a CSI Working Group for the Carolinas

NIDIS funding “Next Steps”

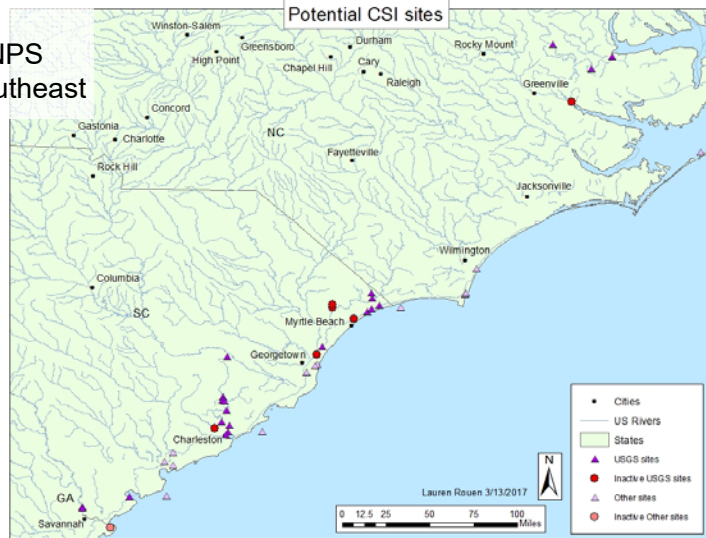


CSI Next Steps

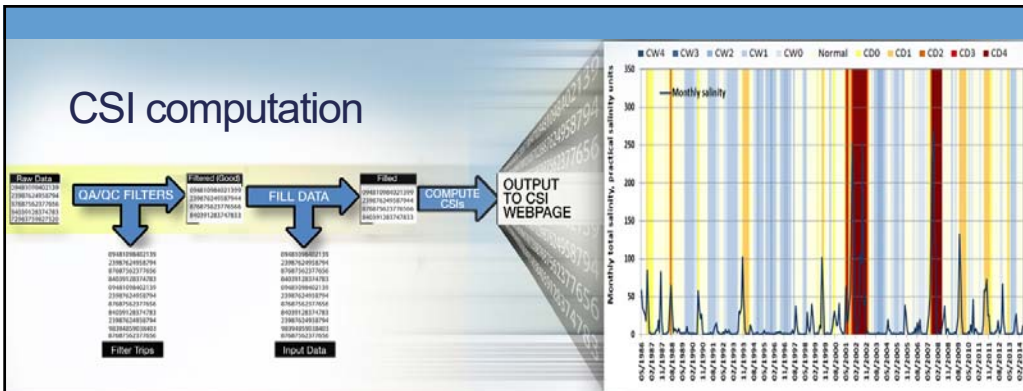
- **Compute CSI at other locations**
- **Develop a software package for CSI computation**
- **Elicit working group guidance and input**
- **Make computation of the CSI operational**
- Analyze CSI with respect to coastal environmental response variables
- Assess use and application of CSI with resource managers

Compute CSI for additional locations

Identify and prioritize potential USGS, NERRS, and USNPS stations in the Southeast



CSI computation



- Need one distributable software package for consistent computation of the CSI
- Development of an R-Package
- Real-time computation

Partner with USGS EDEN Project and the USGS SAWSC

CSI Working Group

- First meeting held in December 2016
- Next meeting coming in April 2017

- Potential partnerships

- Provide guidance

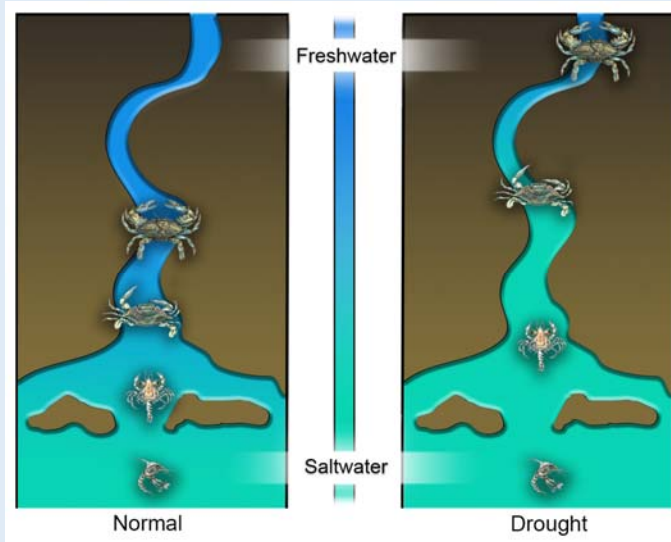


Identifying ecological datasets

- Literature review has identified preliminary categories
 - Plankton
 - Fish
 - Shellfish
 - Crustaceans
 - Marsh grasses (*Spartina alterniflora*, *Juncus roemerianus*)
 - Tree ring chronologies



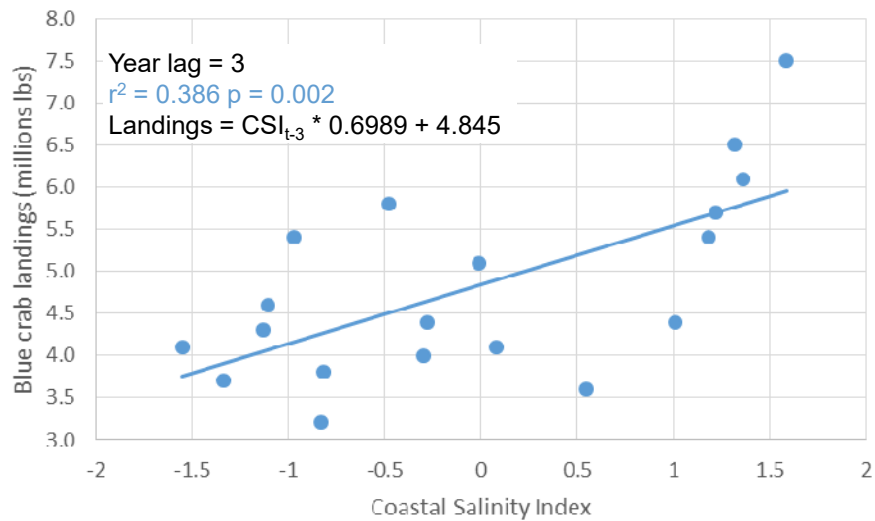
Linkage of CSI with Blue Crabs



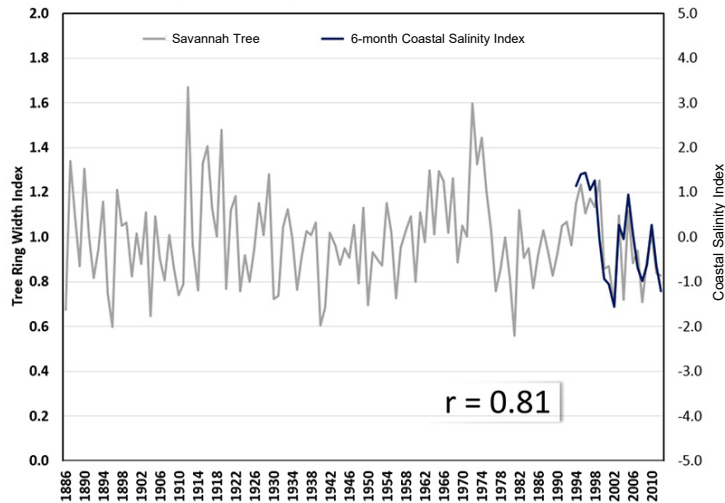
Reference

Childress, M.J., G. Carbone, P. Conrads, J. Lu, D. Tufford. (2016) Using the coastal salinity index and predicted streamflow to forecast SC Blue crab landings. *Proceedings of the 2016 Annual Water Resources Conference*, Orlando, FL.

CSI Can Predict Future Crab Landings



Bald cypress chronology



Reference

Thomas, B.L., Doyle, T.W., Krauss, K.W., 2015, Annual growth patterns of baldcypress (*Taxodium distichum*) along salinity gradients. *Wetlands* 35(4):831-839.

Summary

- CSI – robust index for characterizing short- and long-term coastal drought (saline) and wet conditions (fresh)

Next steps for the CSI:

- CSI Working Group
- Computation of CSI along Gulf and SE Atlantic Coast
- Distributable CSI software package
- Real-time CSI computation and dissemination

More linkages?

- We'd appreciate your suggestions on datasets
- Get in touch:
 - Paul Conrads (USGS): pconrads@usgs.gov
 - Kirsten Lackstrom (CISA): lackstro@mailbox.sc.edu



U.S. Department of the Interior
U.S. Geological Survey

Questions?

U.S. Department of the Interior
U.S. Geological Survey