Using the Coastal Salinity Index and predicted streamflow to forecast SC blue crab landings

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NIDIS
NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM

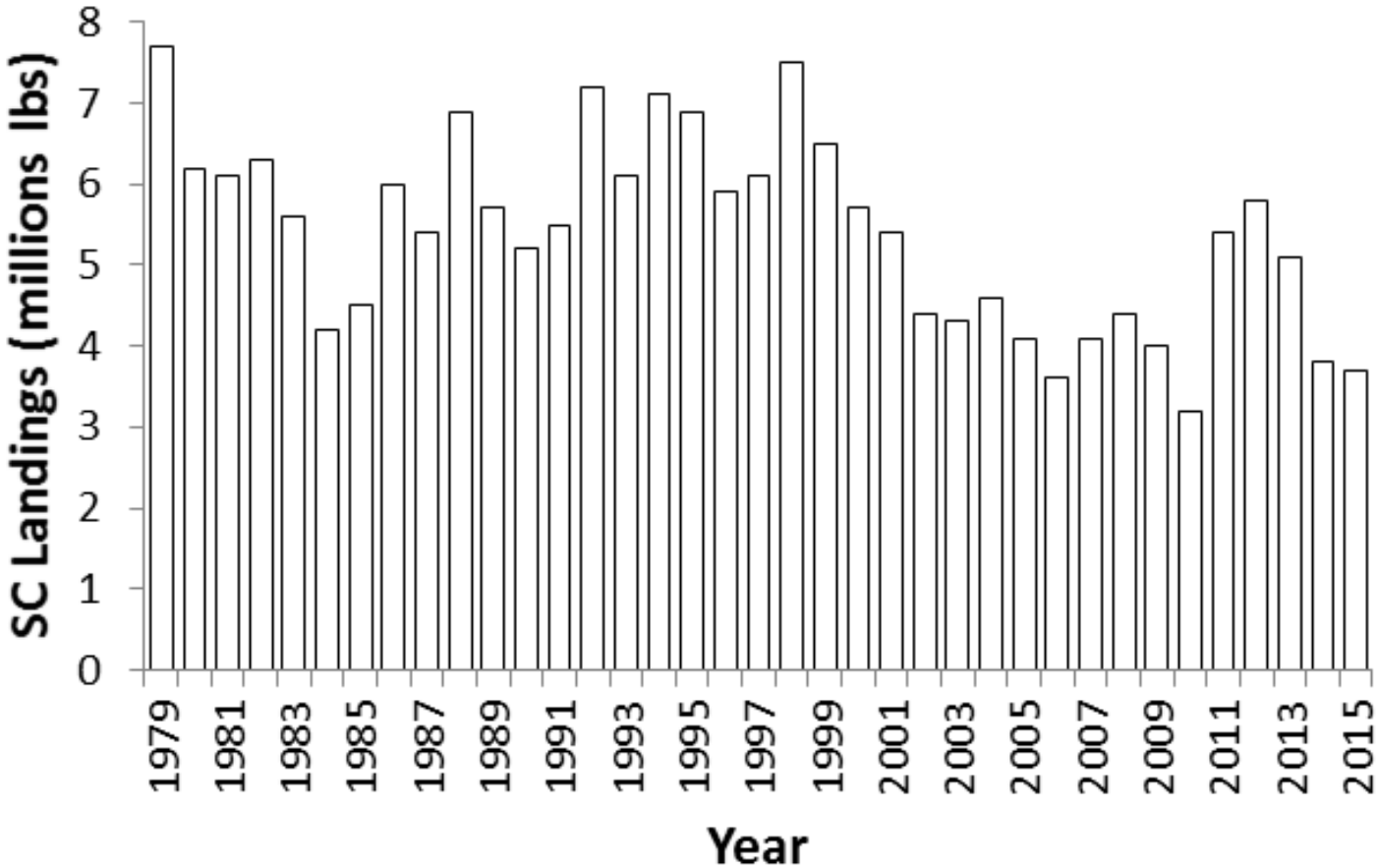
CISA
Carolinas Integrated Sciences and Assessments
A NOAA RISA TEAM

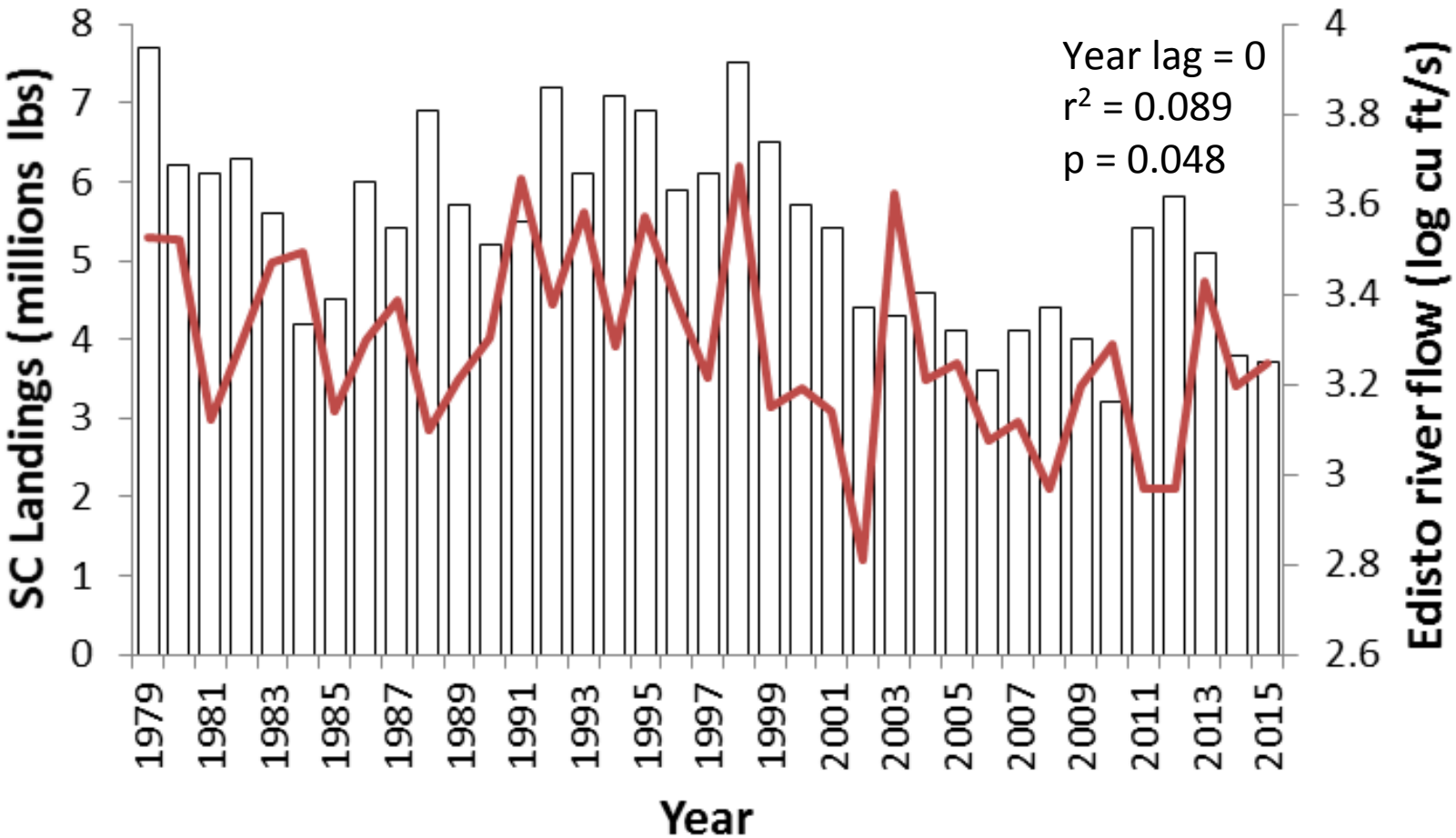
CLEMSON UNIVERSITY
SOUTH CAROLINA
1889

USGS
science for a changing world

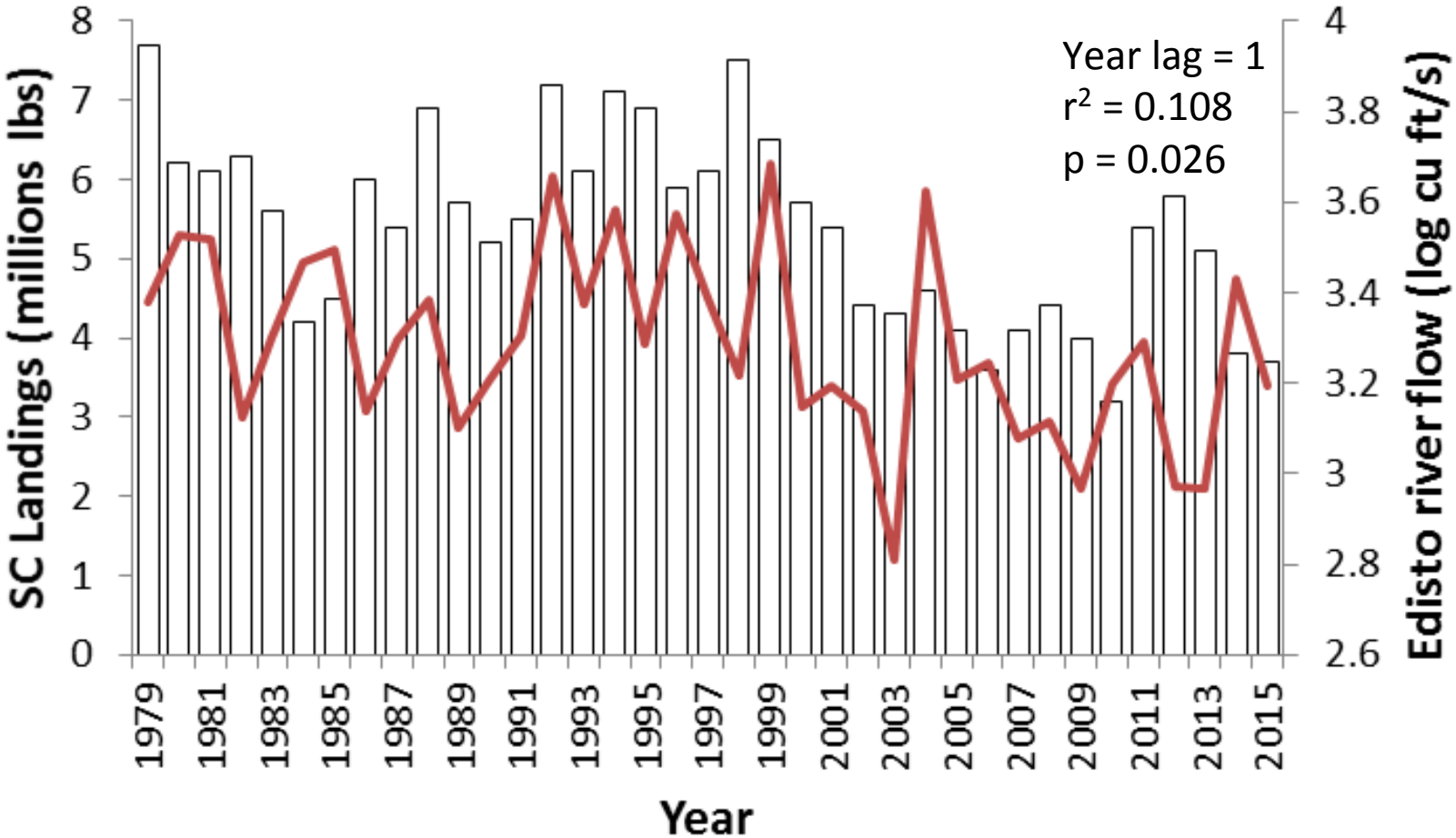
ACE Basin
National Estuarine Research Reserve

Sea Grant
S.C. Sea Grant Consortium


SC Landings (millions lbs)
0
1
2
3
4
5
6
7
8
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
Year



Childress 2010 SCWRC



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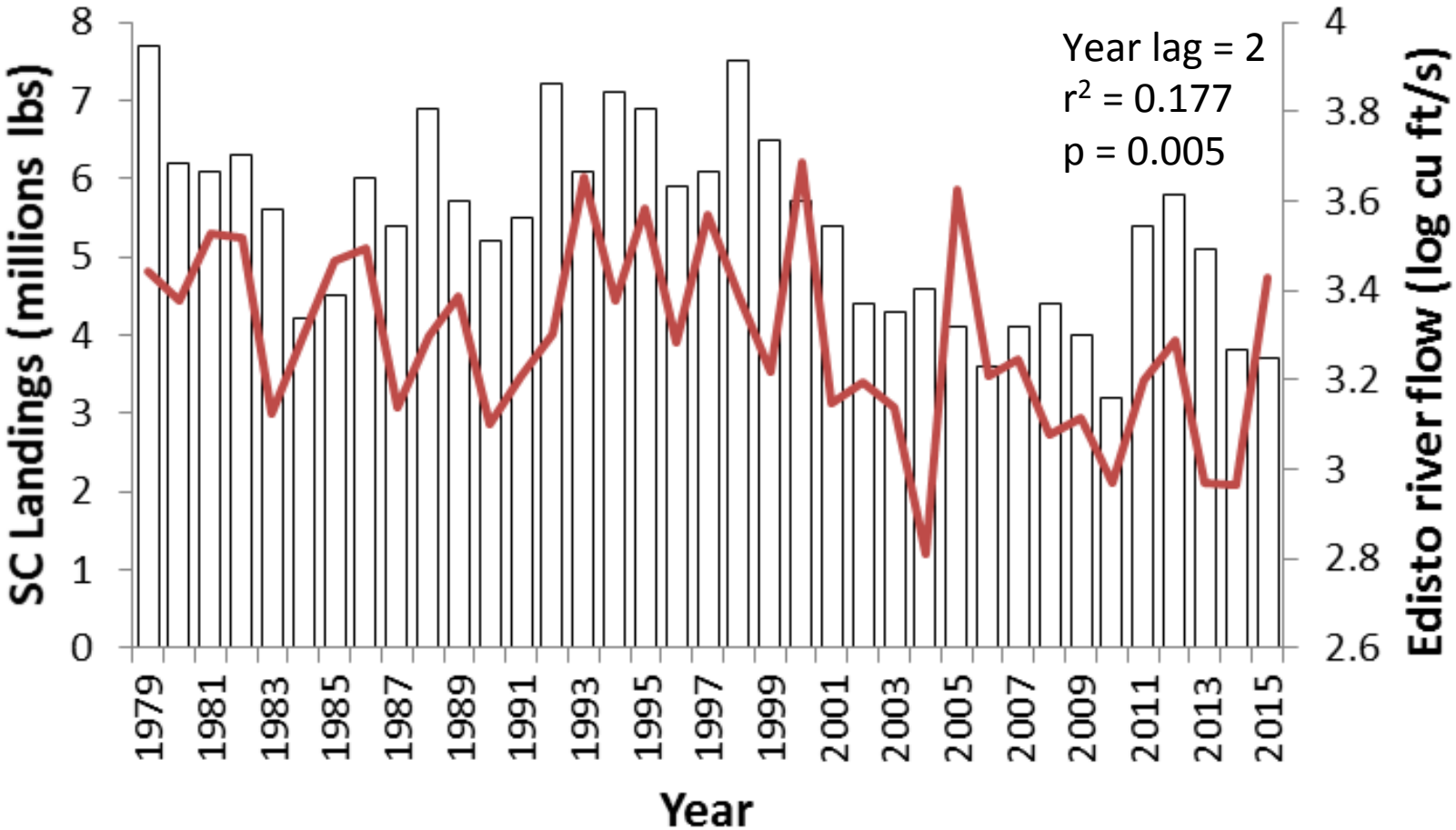

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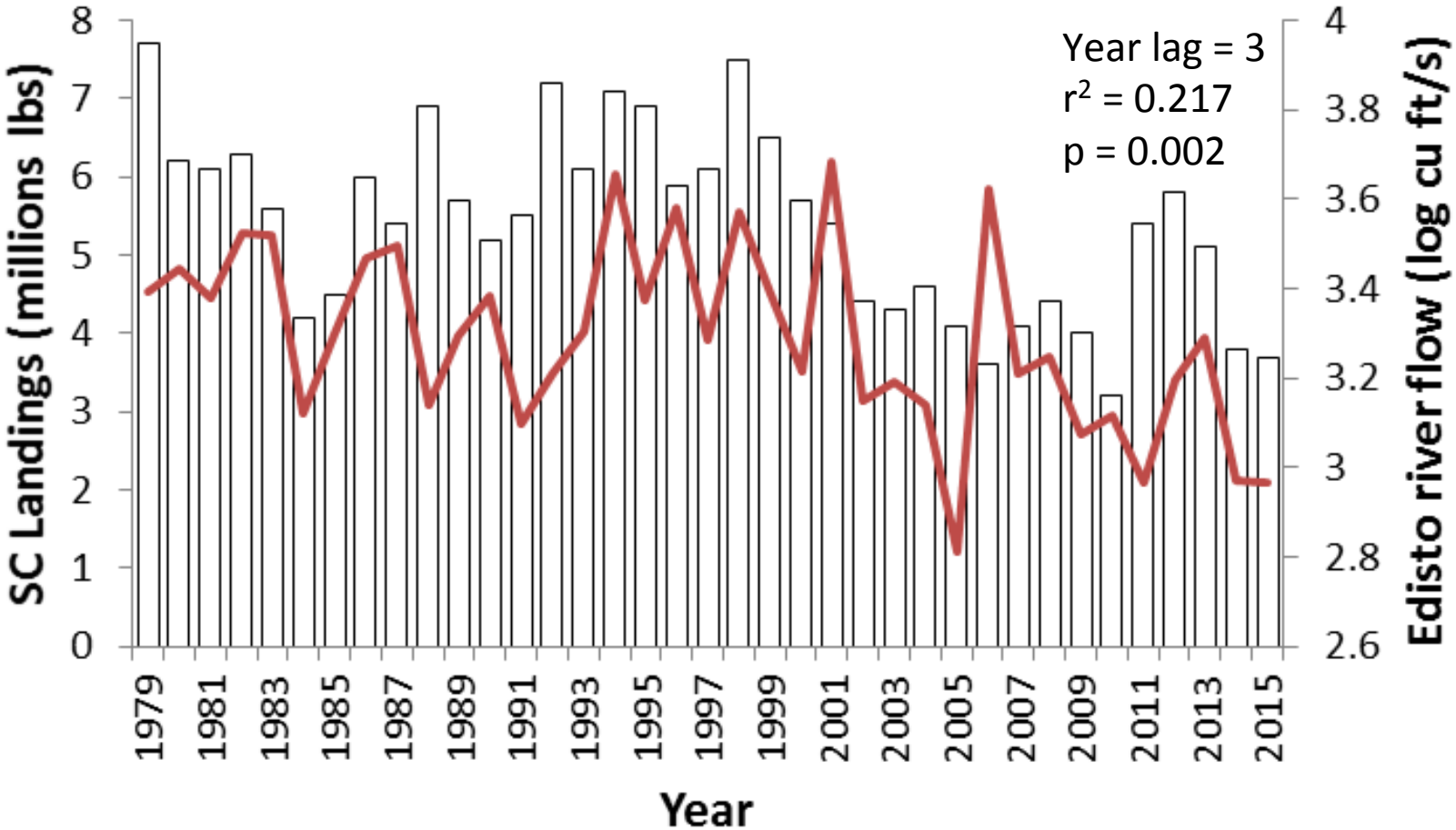

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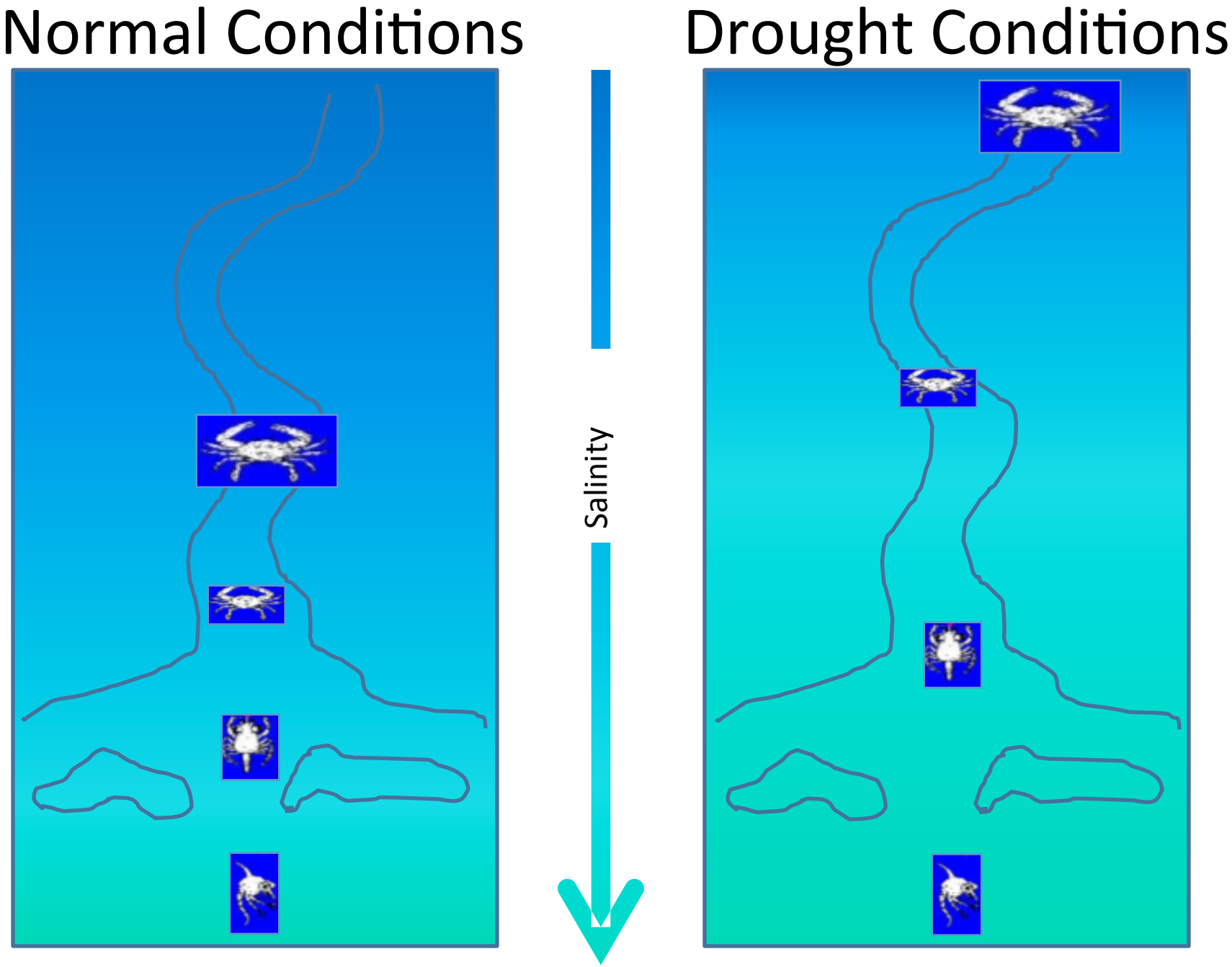
Normal Conditions
Drought Conditions
Salinity

Questions

- How does drought impact blue crabs?
- Can we forecast future droughts?
- Can we use drought forecasts to predict crab landings in South Carolina?
- Can we use the Coastal Salinity Index to forecast US blue crab landings?

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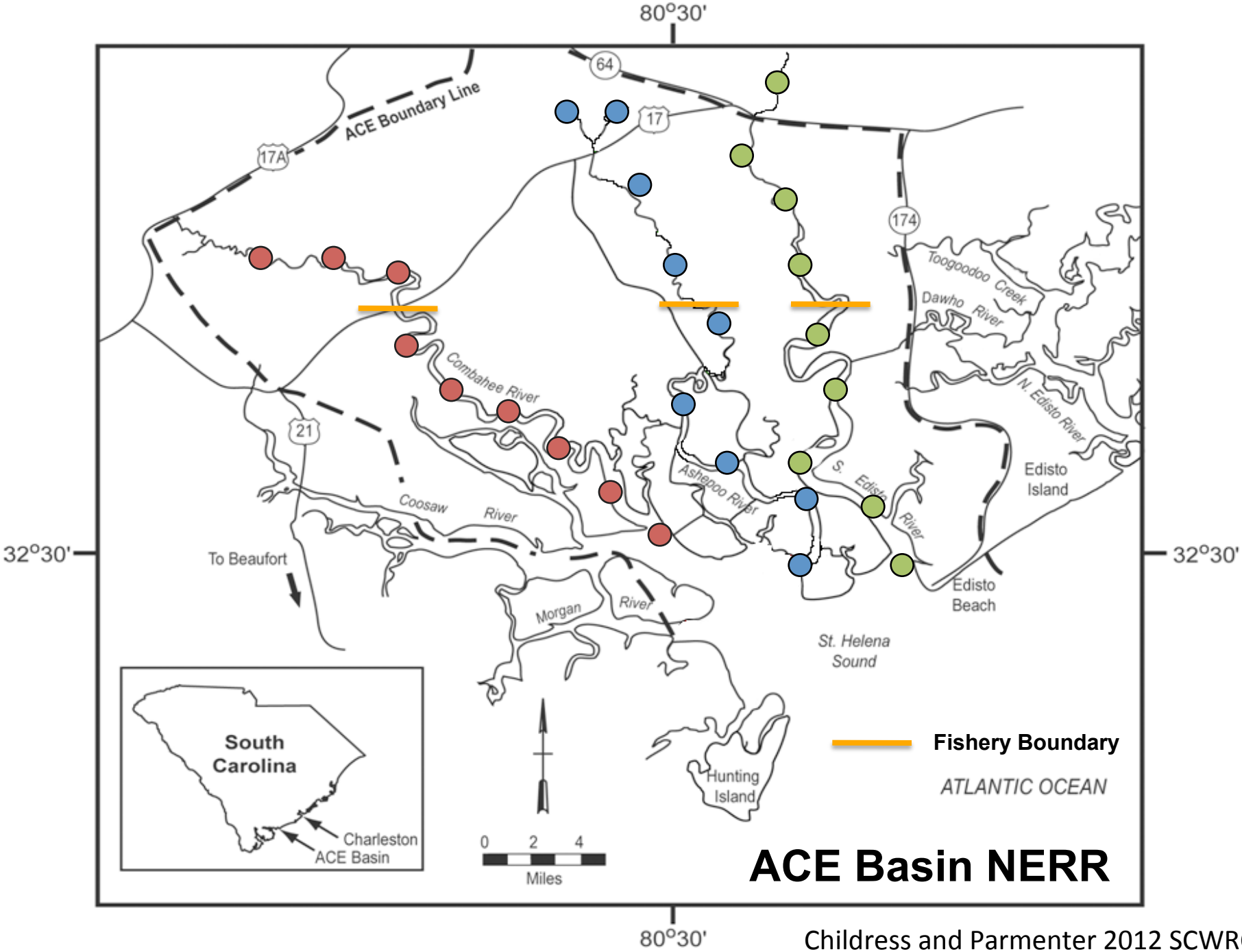


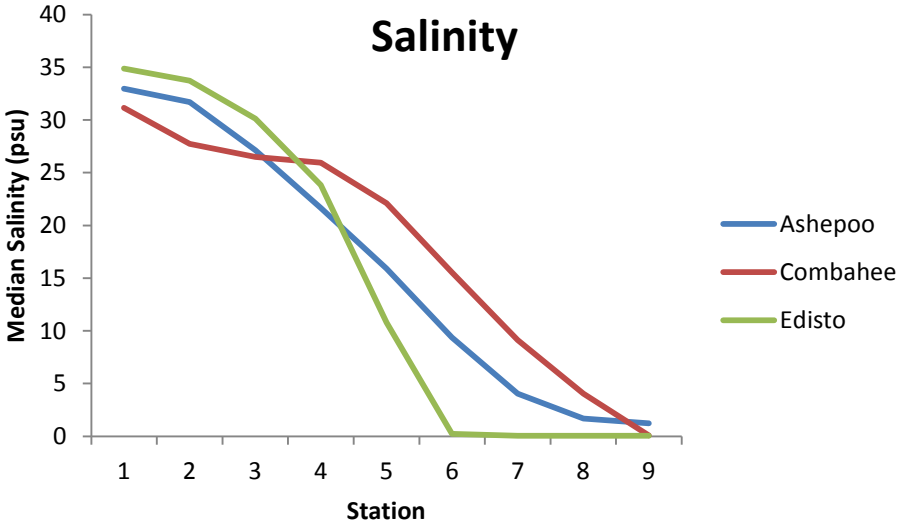
Childress and Parmenter 2012 SCWRC

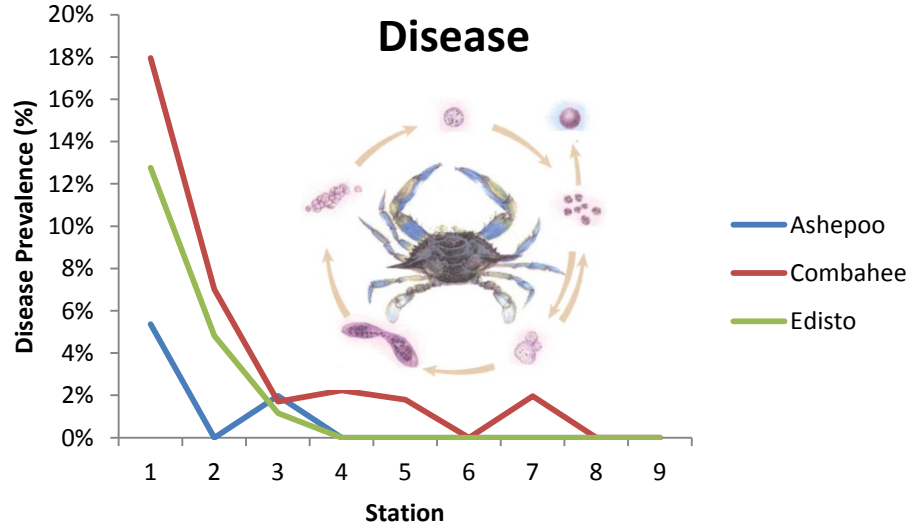
Water Quality

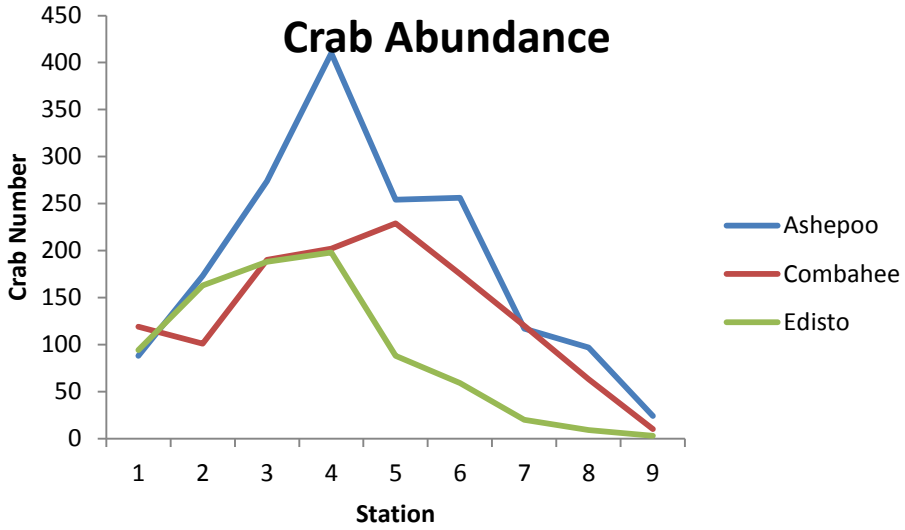
Disease

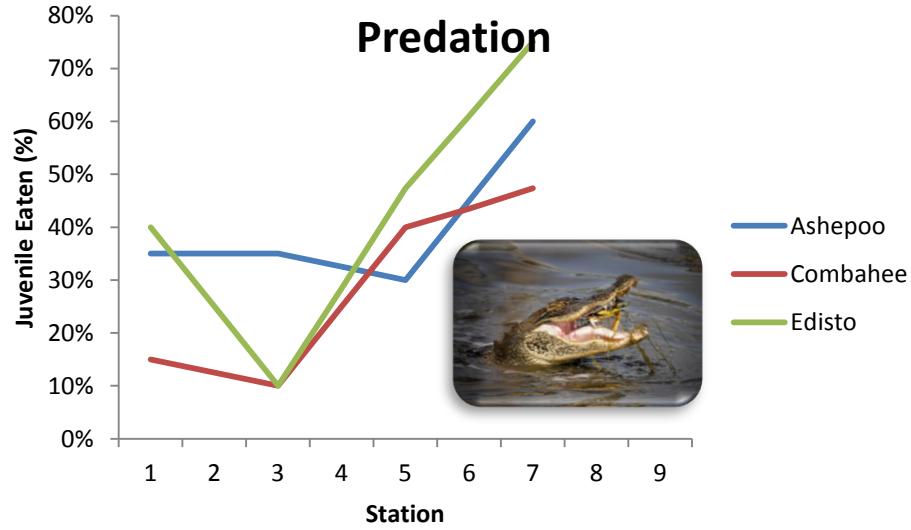
Crab Density

Predation









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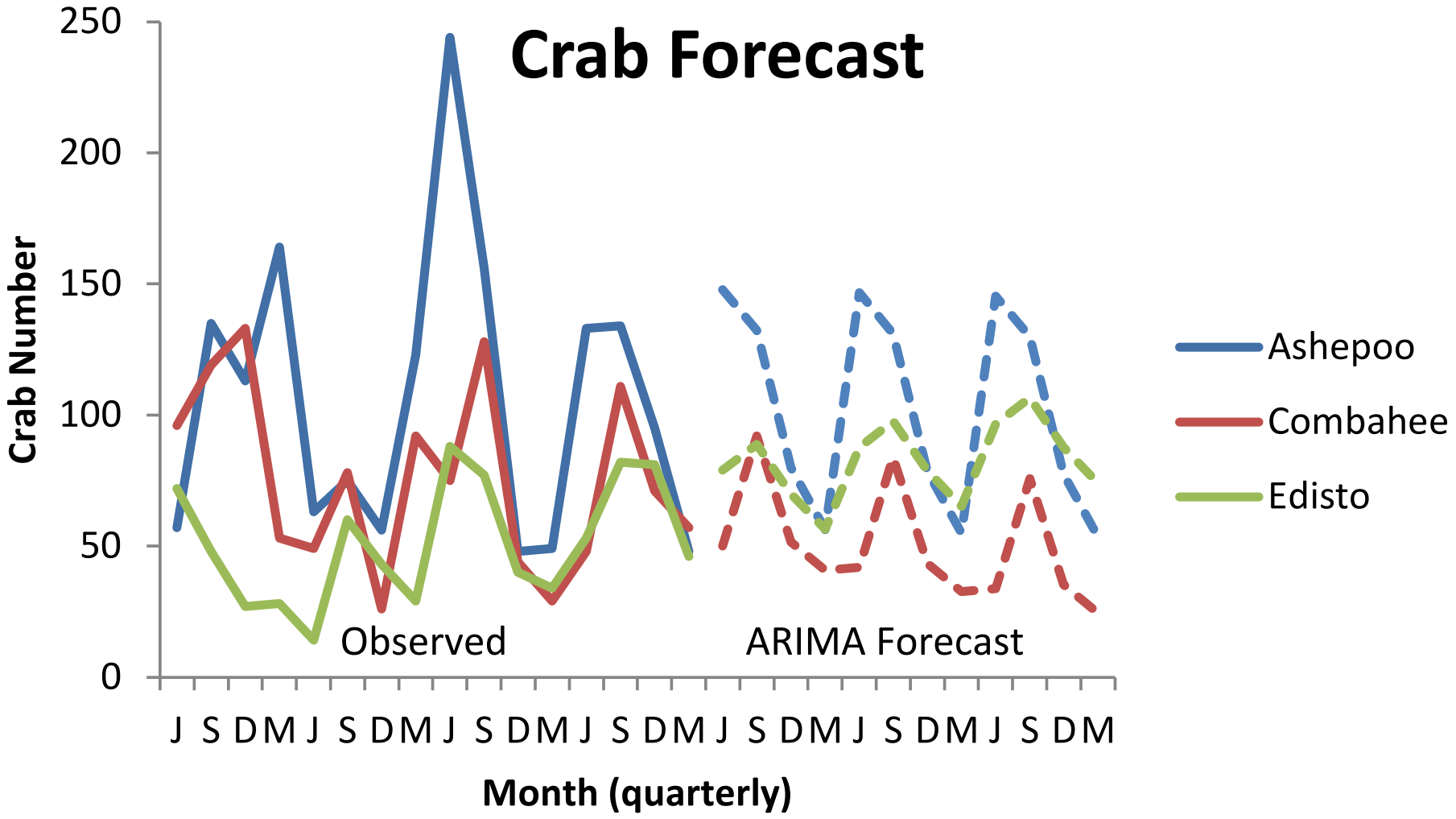

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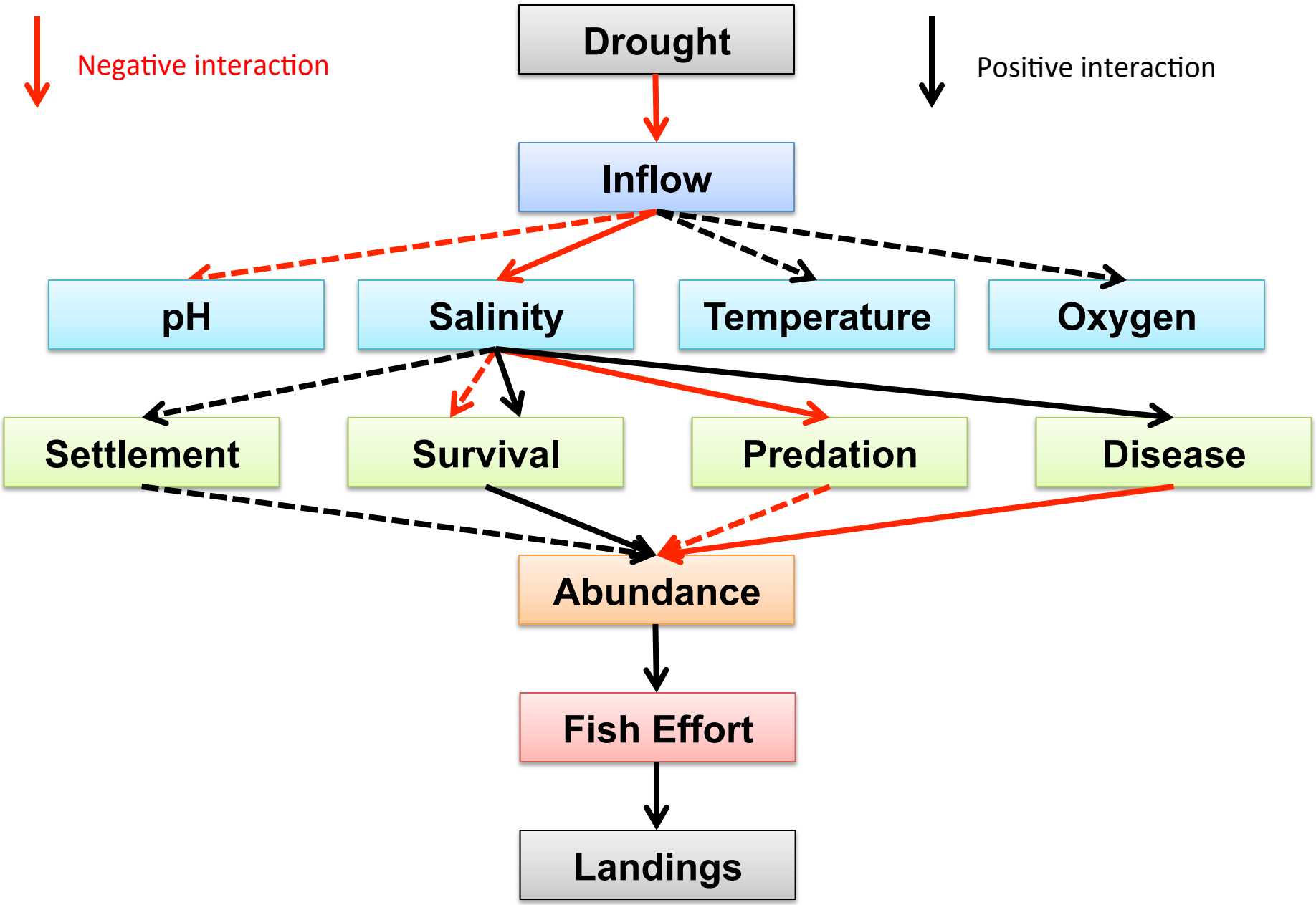
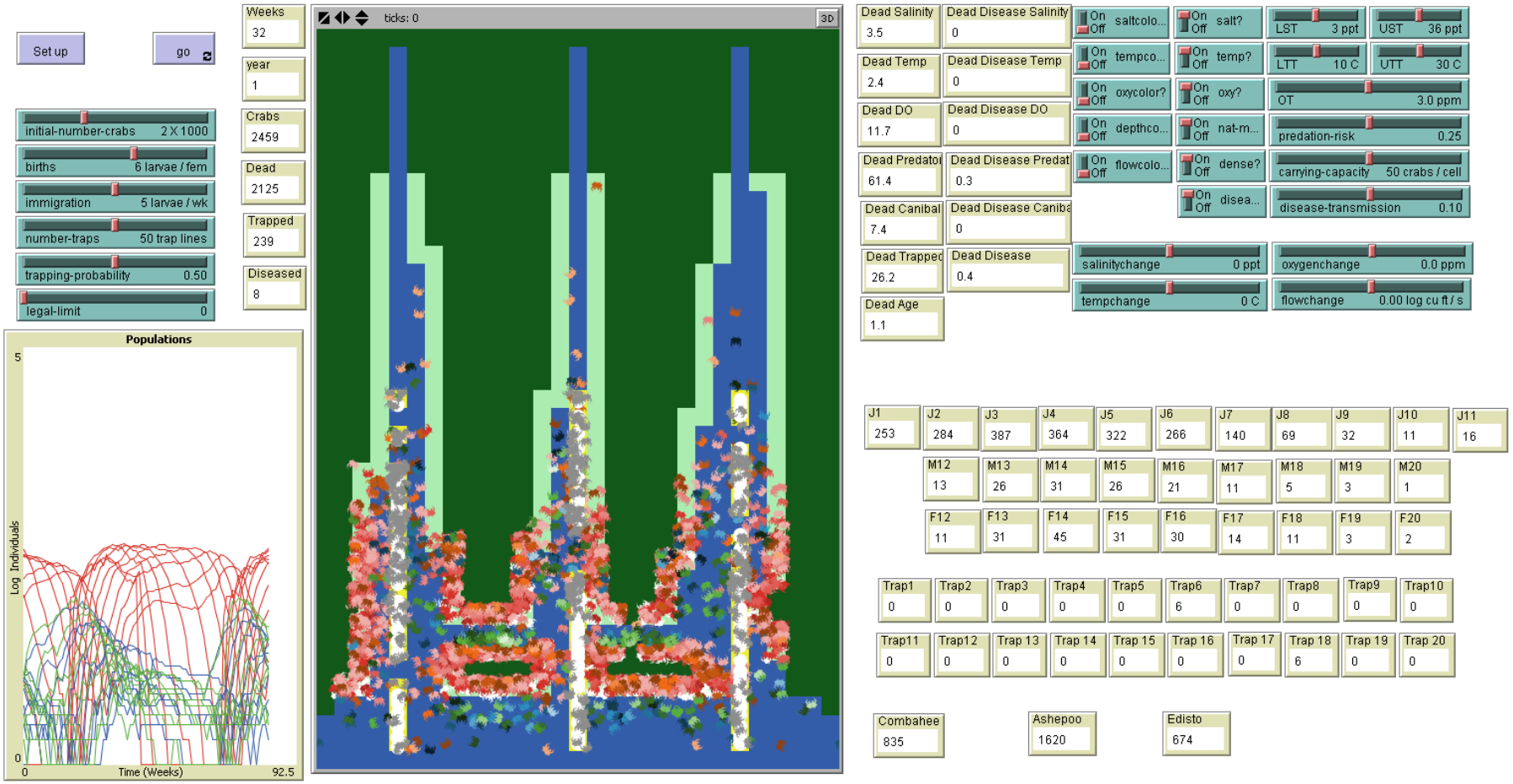


Childress 2014 SCWRC

SCBCRABS Individual Based Model



Childress 2014 SCWRC

Questions

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- Can we use drought forecasts to predict crab landings in South Carolina?
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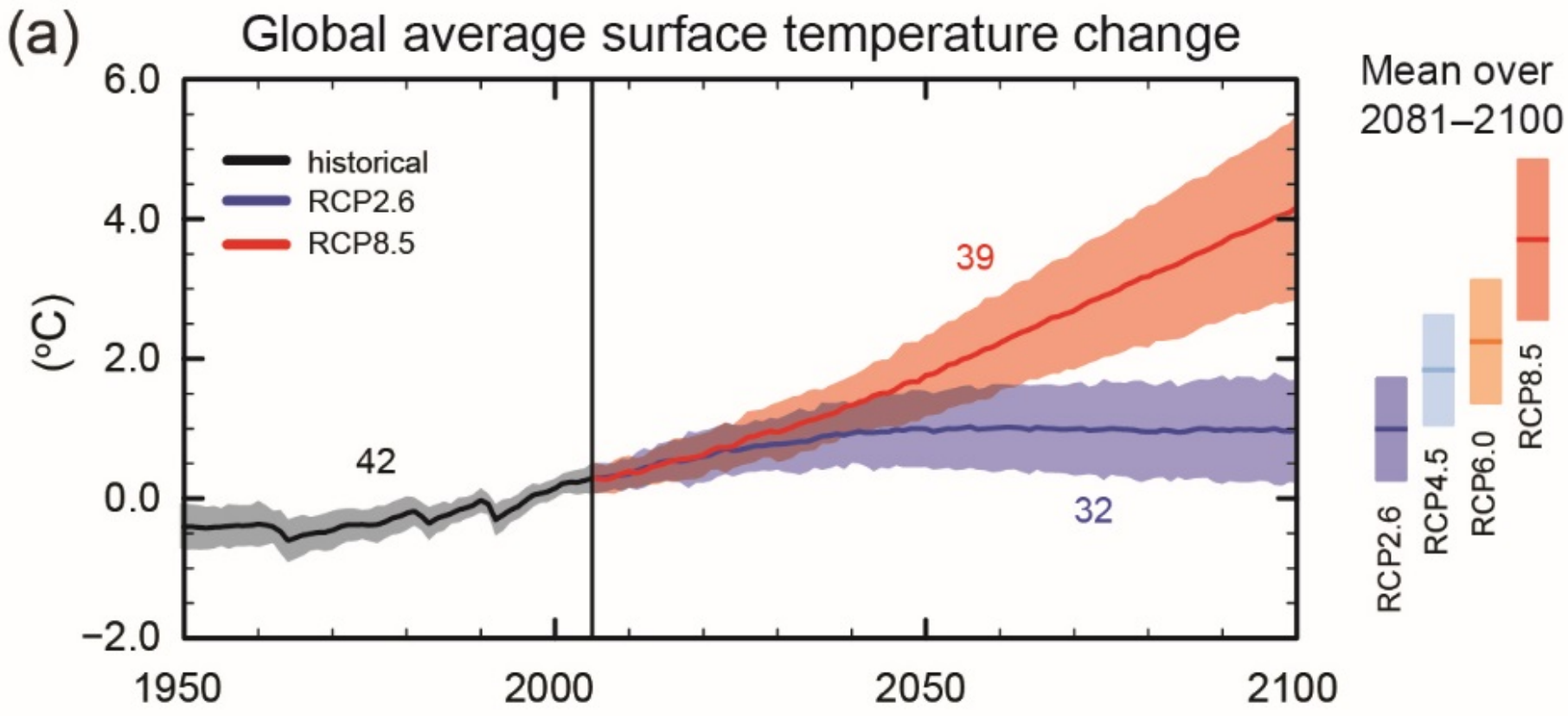
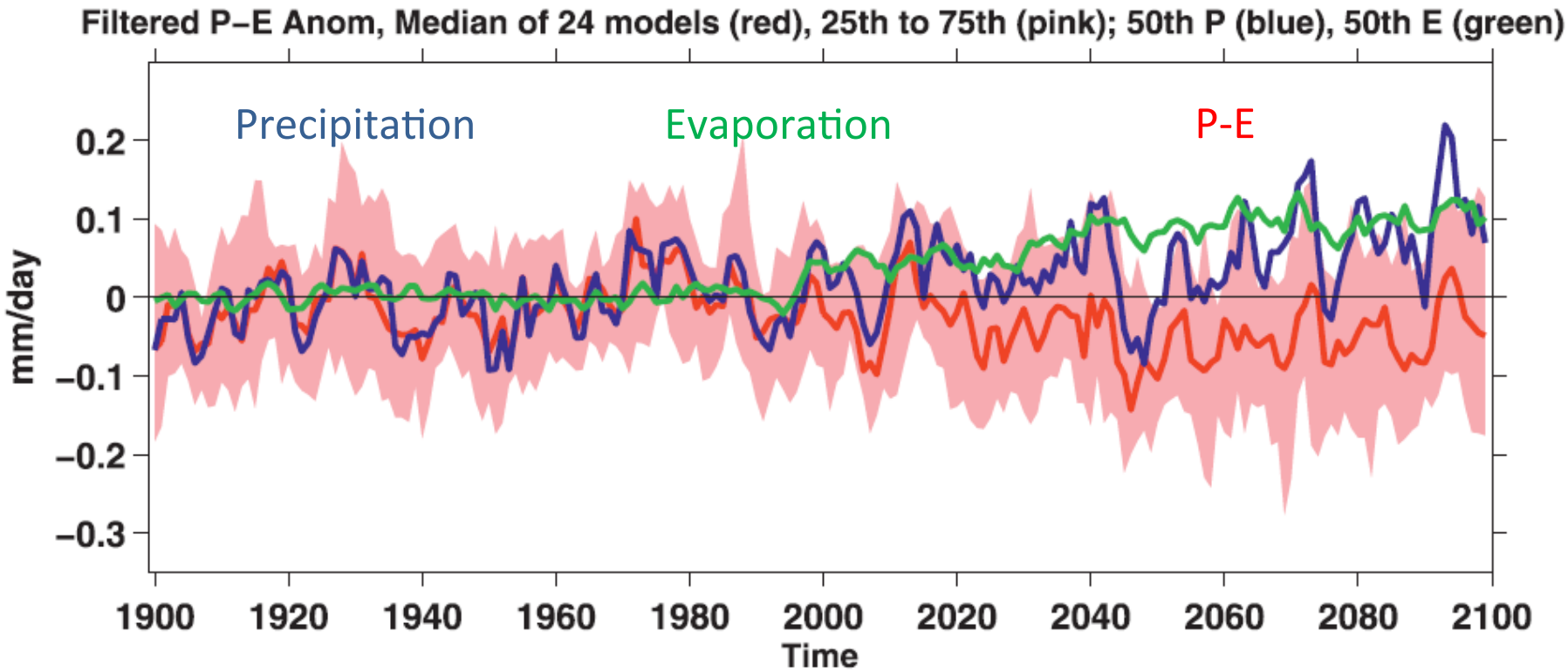
Drought Forecasting



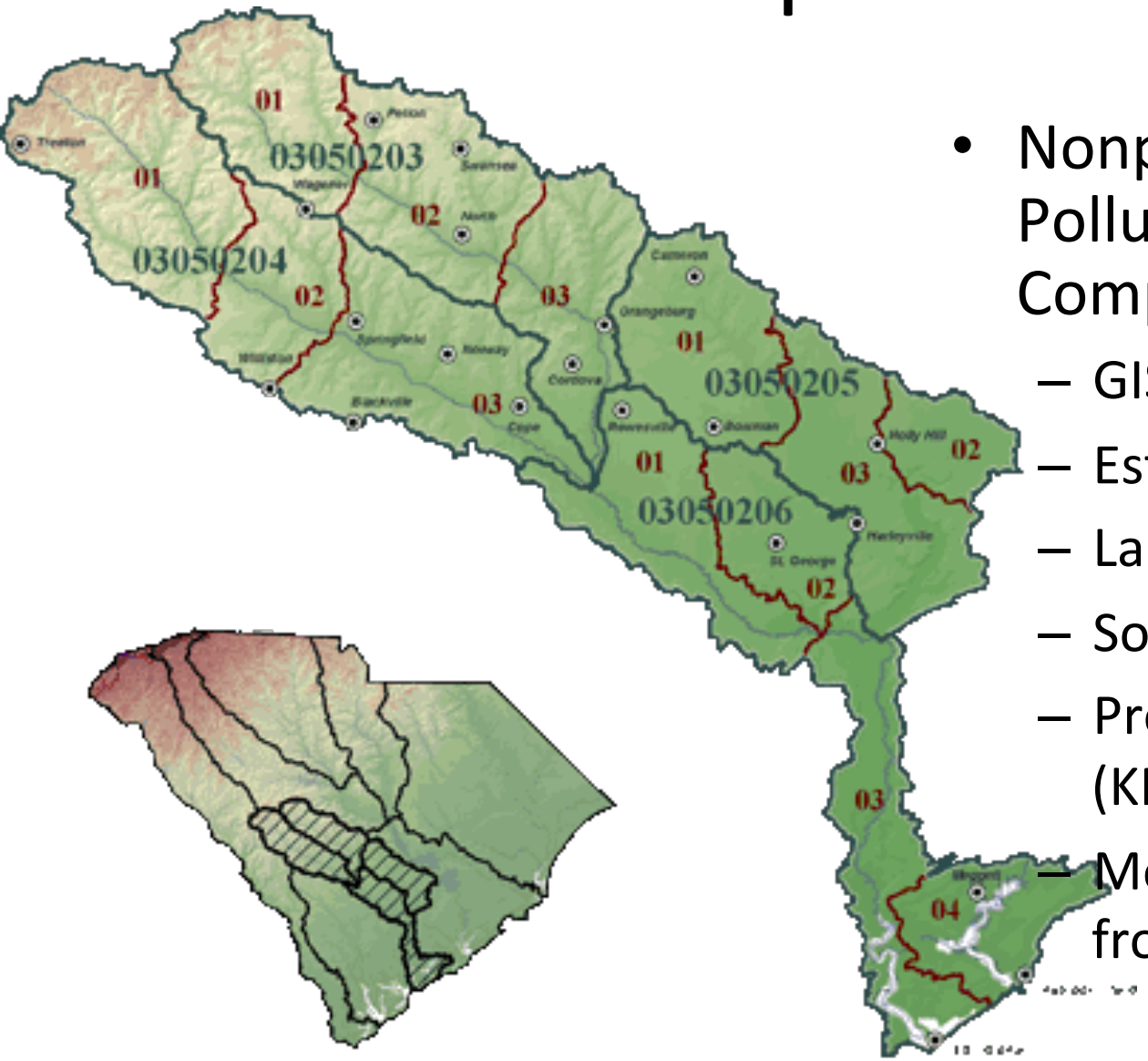
IPCC 2013

Drought Forecasting



Seager et al. 2009 J Climate

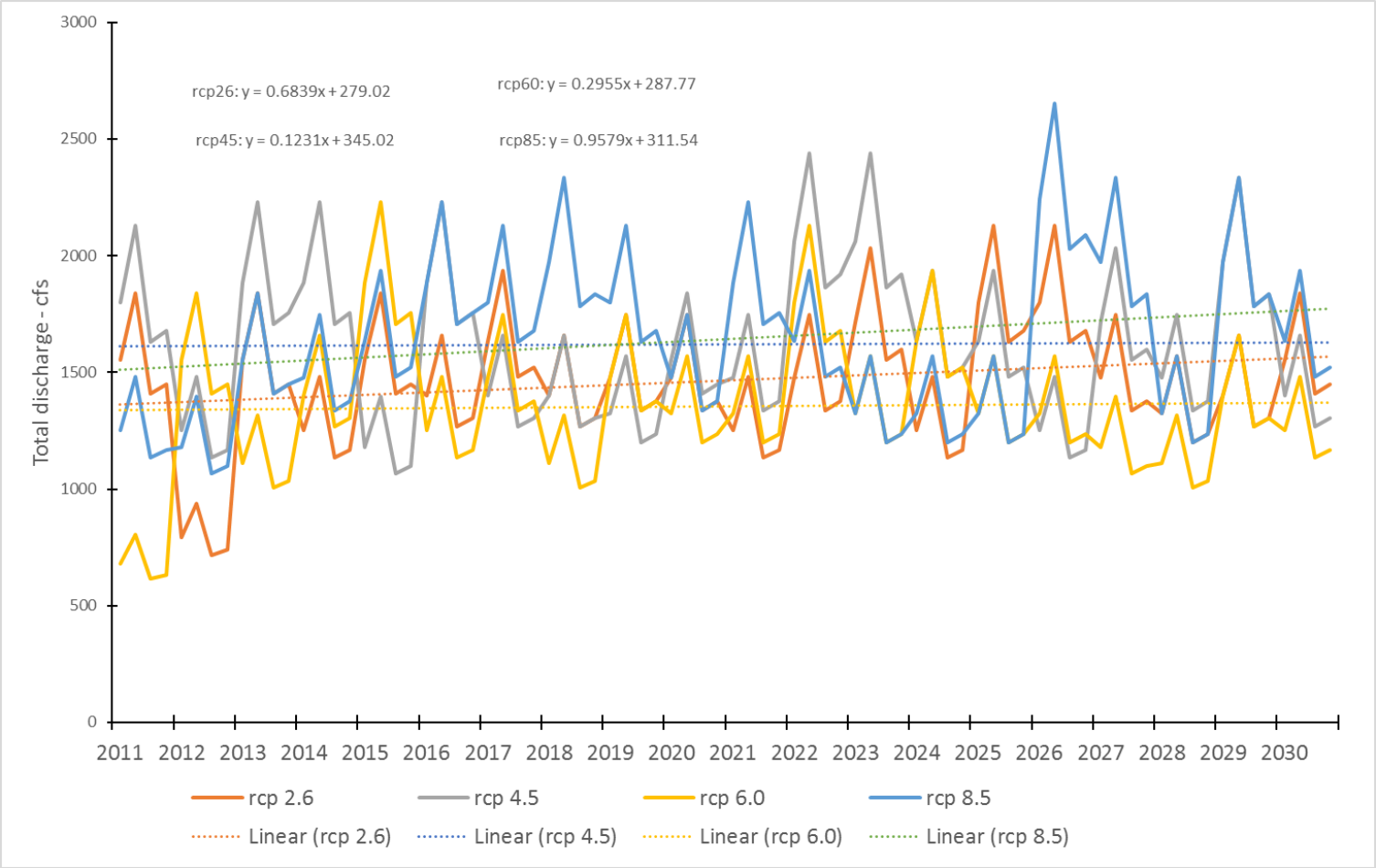
Edisto River OpenNSPECT Model



- Nonpoint Source Pollution and Erosion Comparison Tool
  - GIS-based
  - Estimates surface runoff
  - Land use from C-CAP
  - Soils from NRCS
  - Precipitation from GCMs (KMNI) using CMIP 5
  - Monthly precipitation from 2011-2030

Tufford, Carbone, Lu AWRA 2015

Edisto River OpenNSPECT Model



Tufford, Carbone, Lu AWRA 2015

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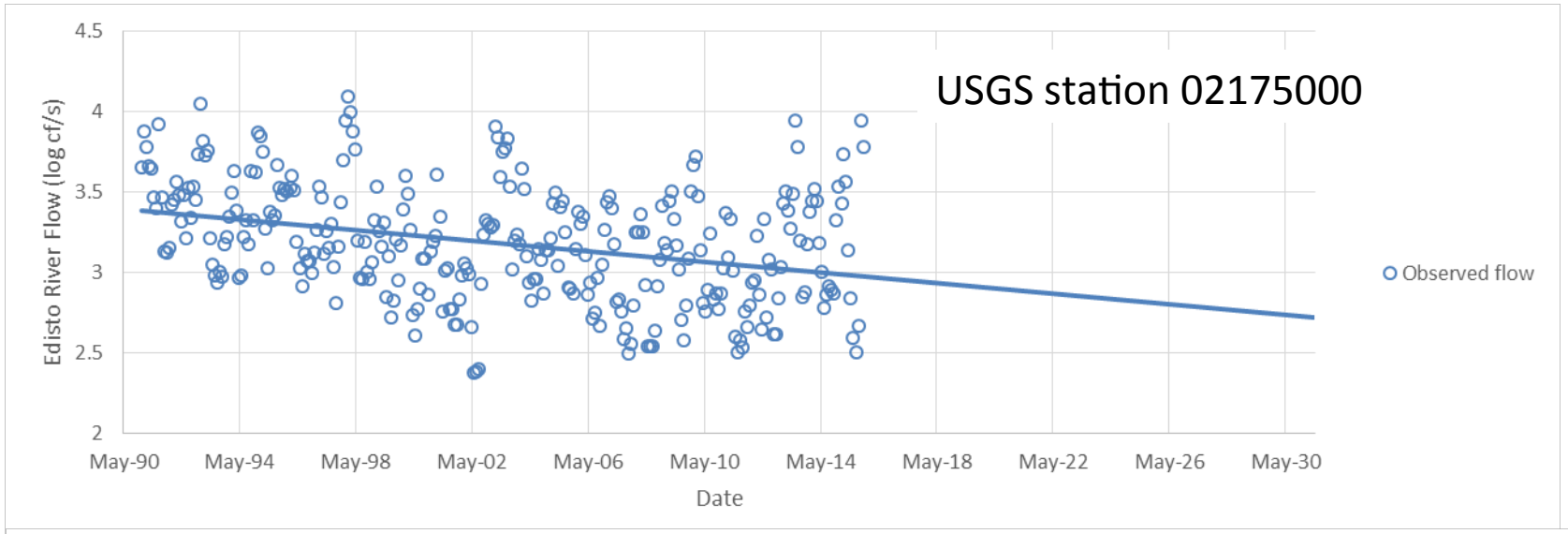
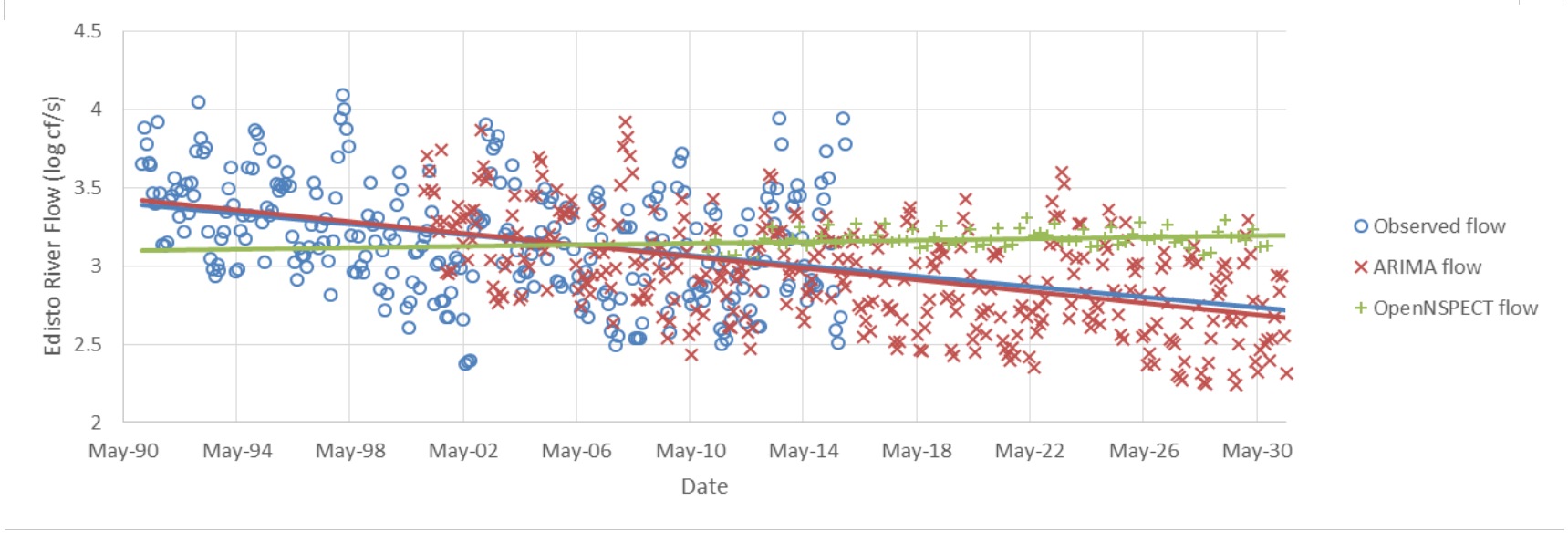
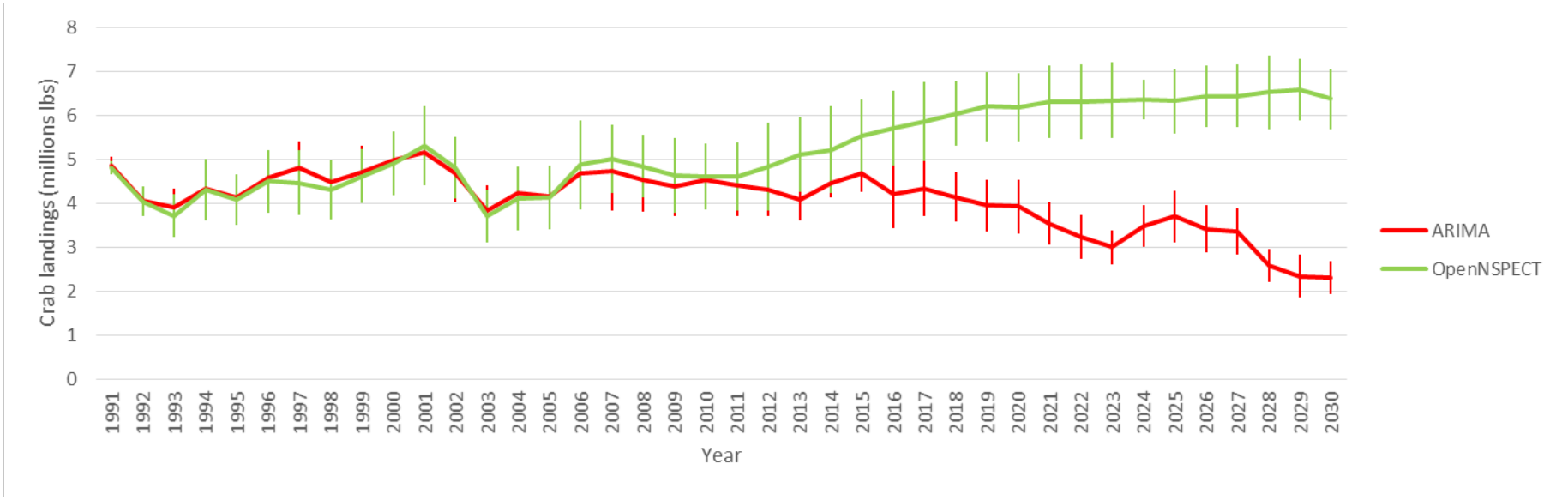
SCBCRABS Flow Input

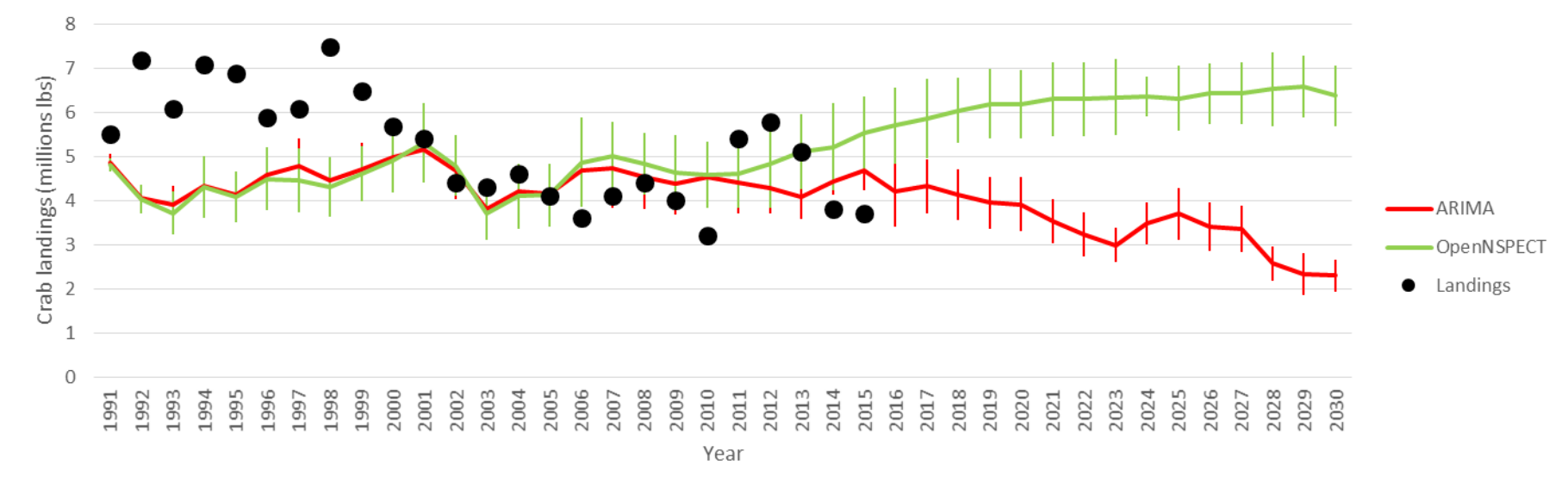




SCBCRABS Landings Output



SCBCRABS Landings Output



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Coastal Salinity Index (CSI)

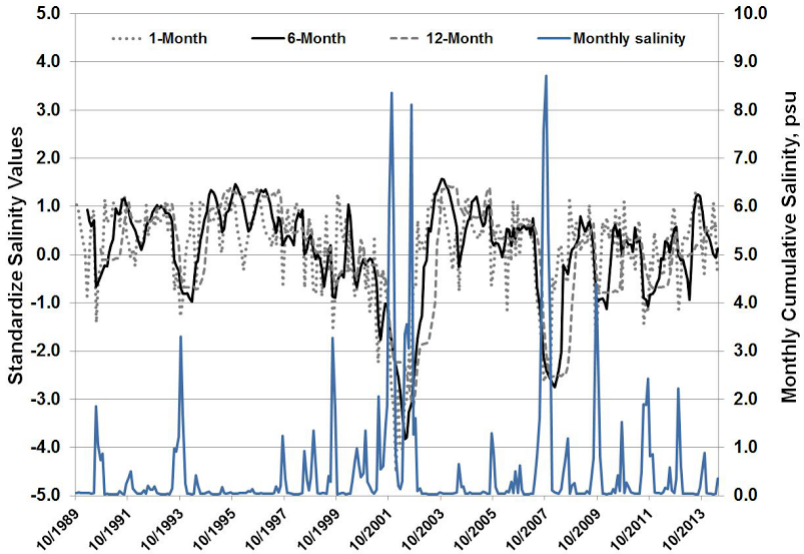


Figure 3. The 1-, 6-, and 12-month standardize salinity values for the Waccamaw River at Hagley Landing, South Carolina.

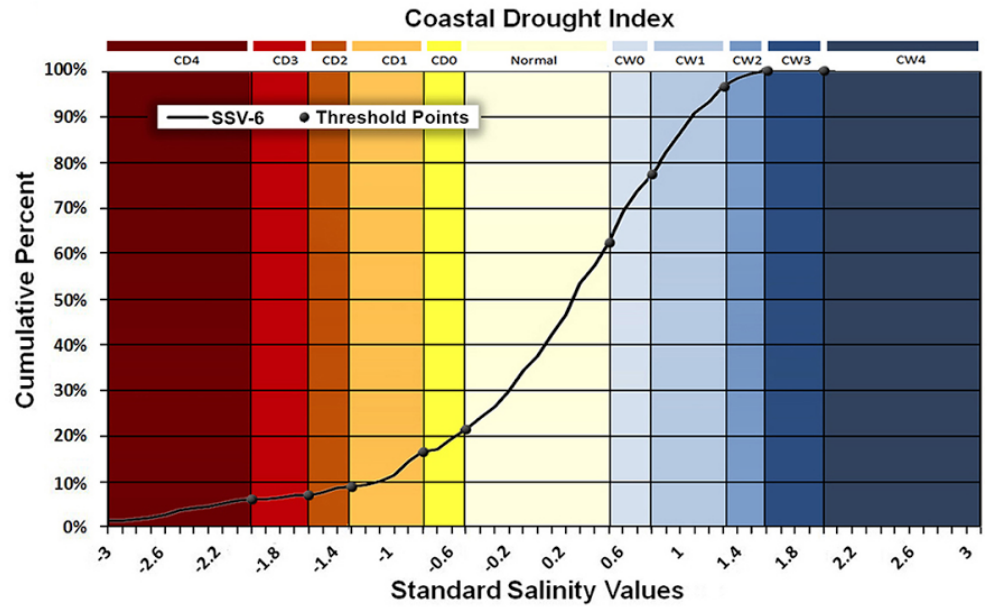


Figure 4. The cumulative frequency curve (left figure) for the 6-month standardize salinity values for the Waccamaw River at Hagley Landing, South Carolina (fig. 3), and the declarations, descriptions, and coastal drought index values (right table).

http://sc.water.usgs.gov/drought/coastal-drought/figures-large/

Conrads USGS SAWSC

Coastal Salinity Index (CSI)

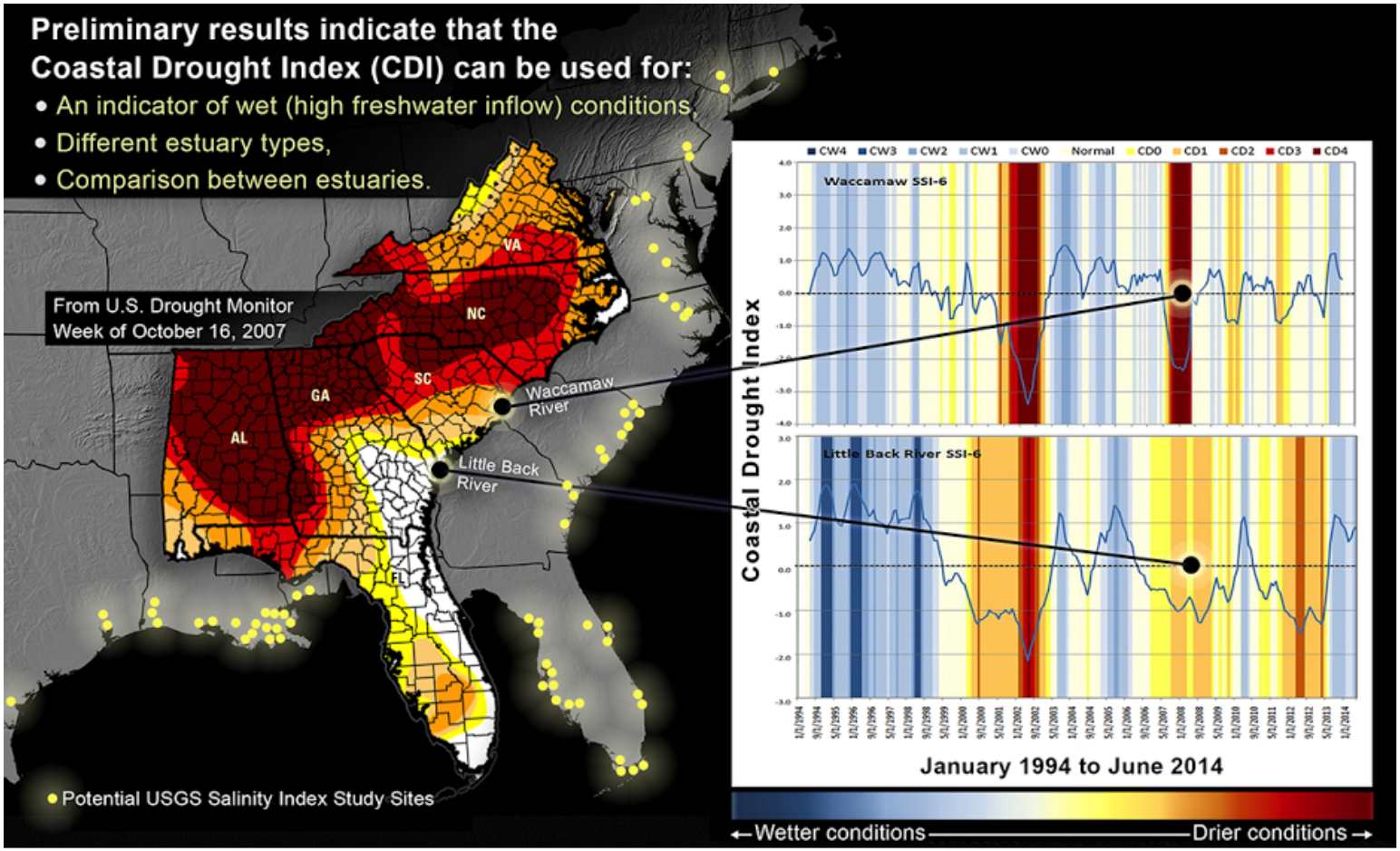
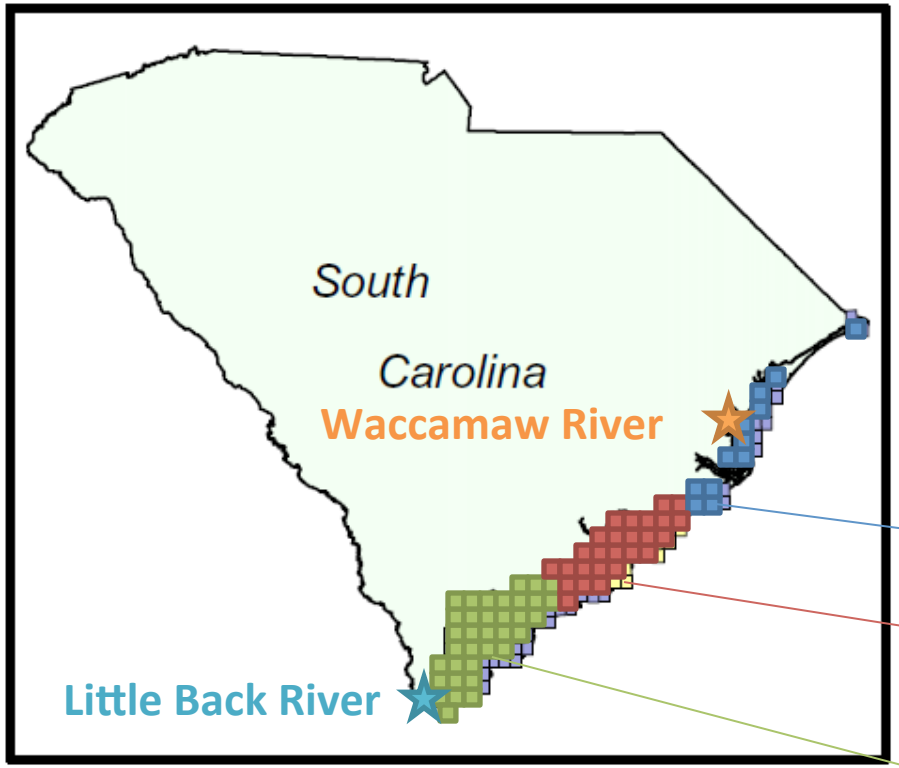


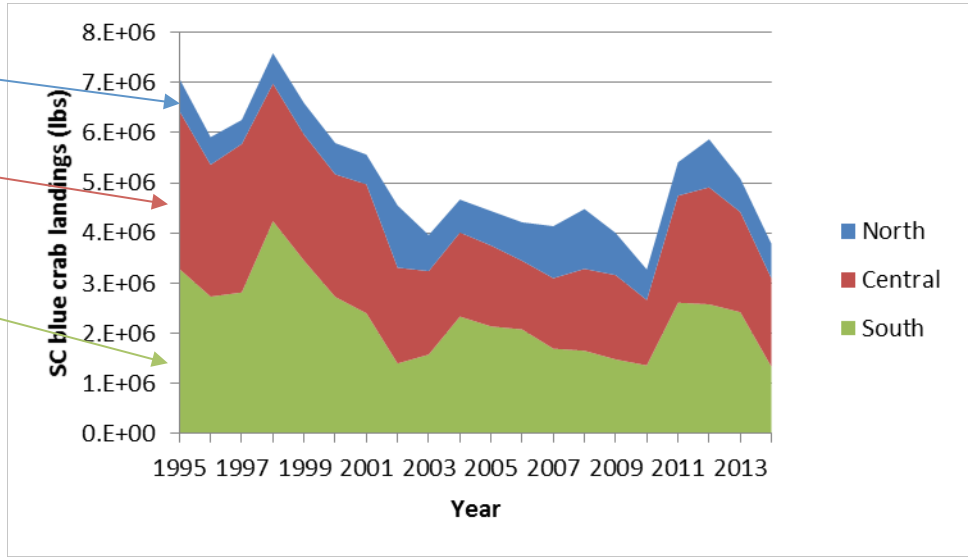
Figure 5. The Coastal Drought Index (CDI) for the Waccamaw River and Little Back River and the U.S. Drought Monitor map for the week of October 16, 2007.

http://sc.water.usgs.gov/drought/coastal-drought/figures-large/Figure5.png

Conrads USGS SAWSC

Coastal Salinity Index (CSI)





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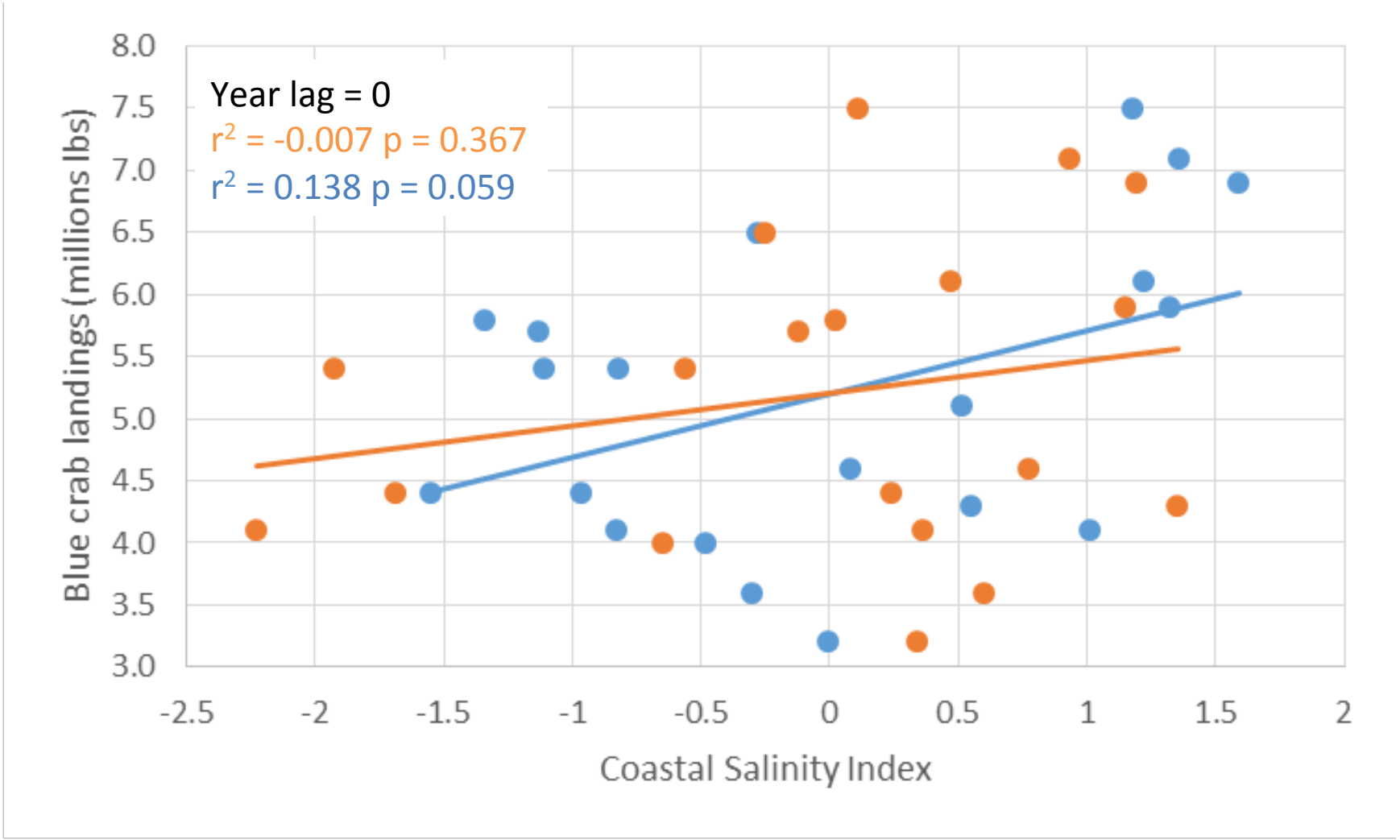

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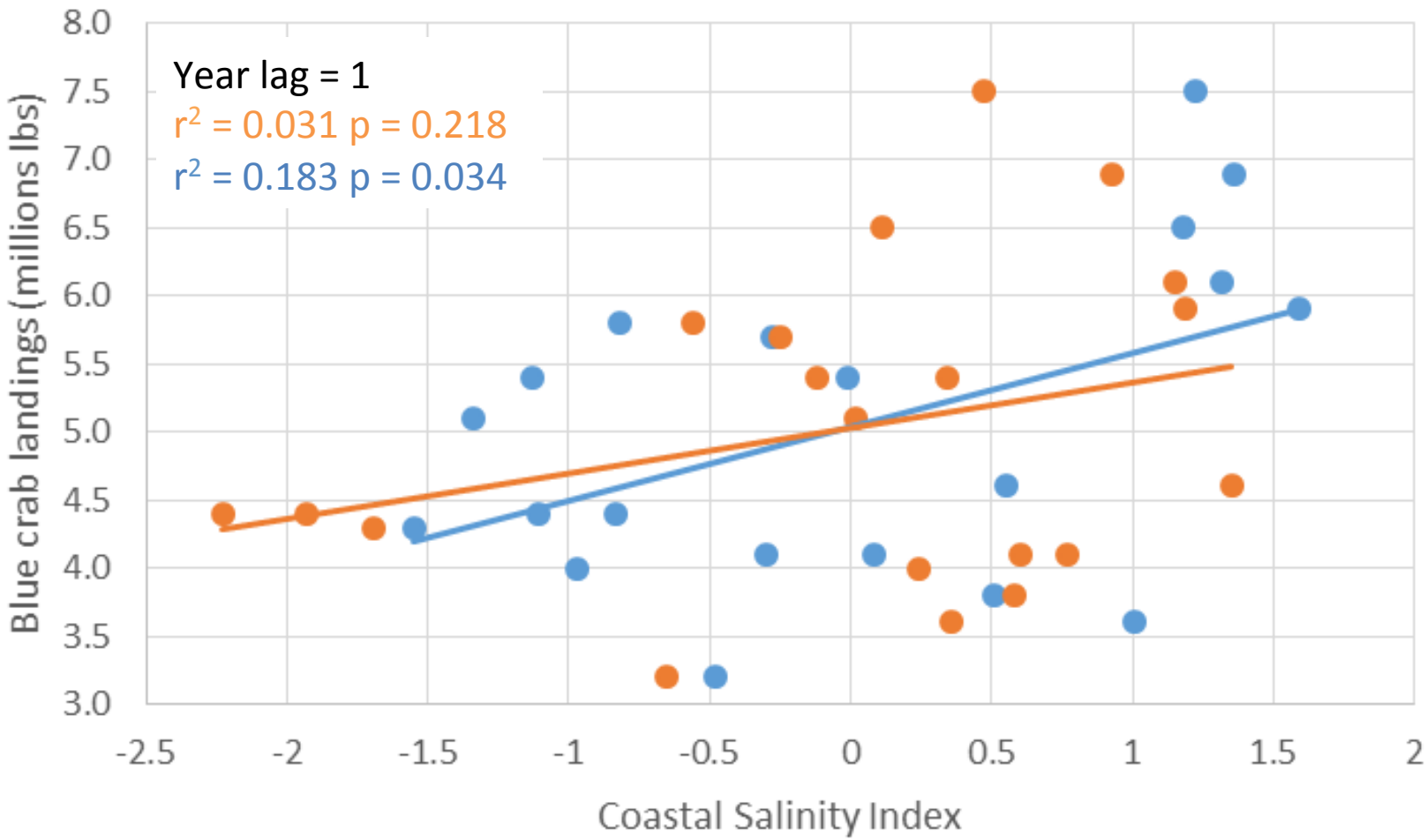

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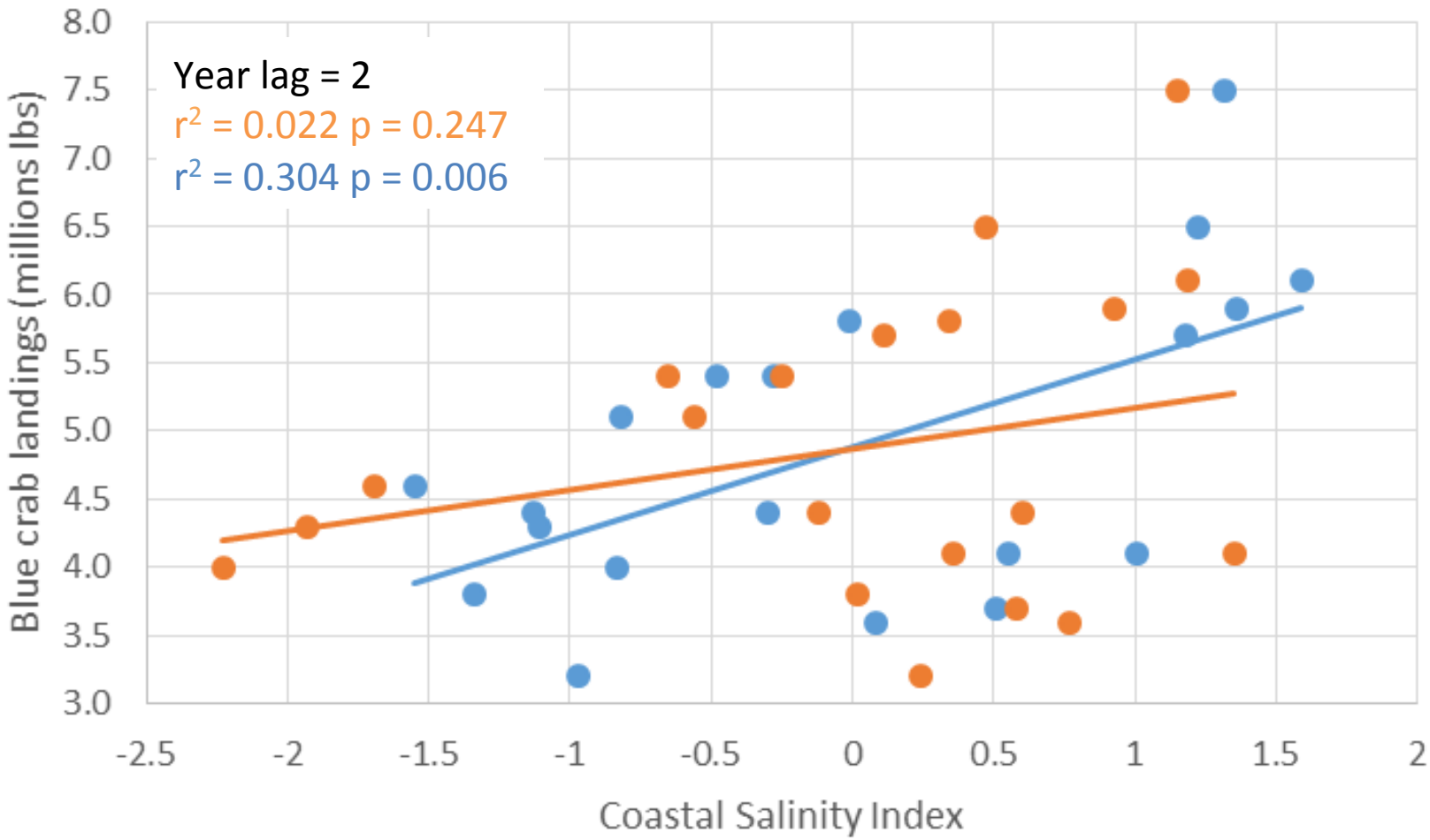

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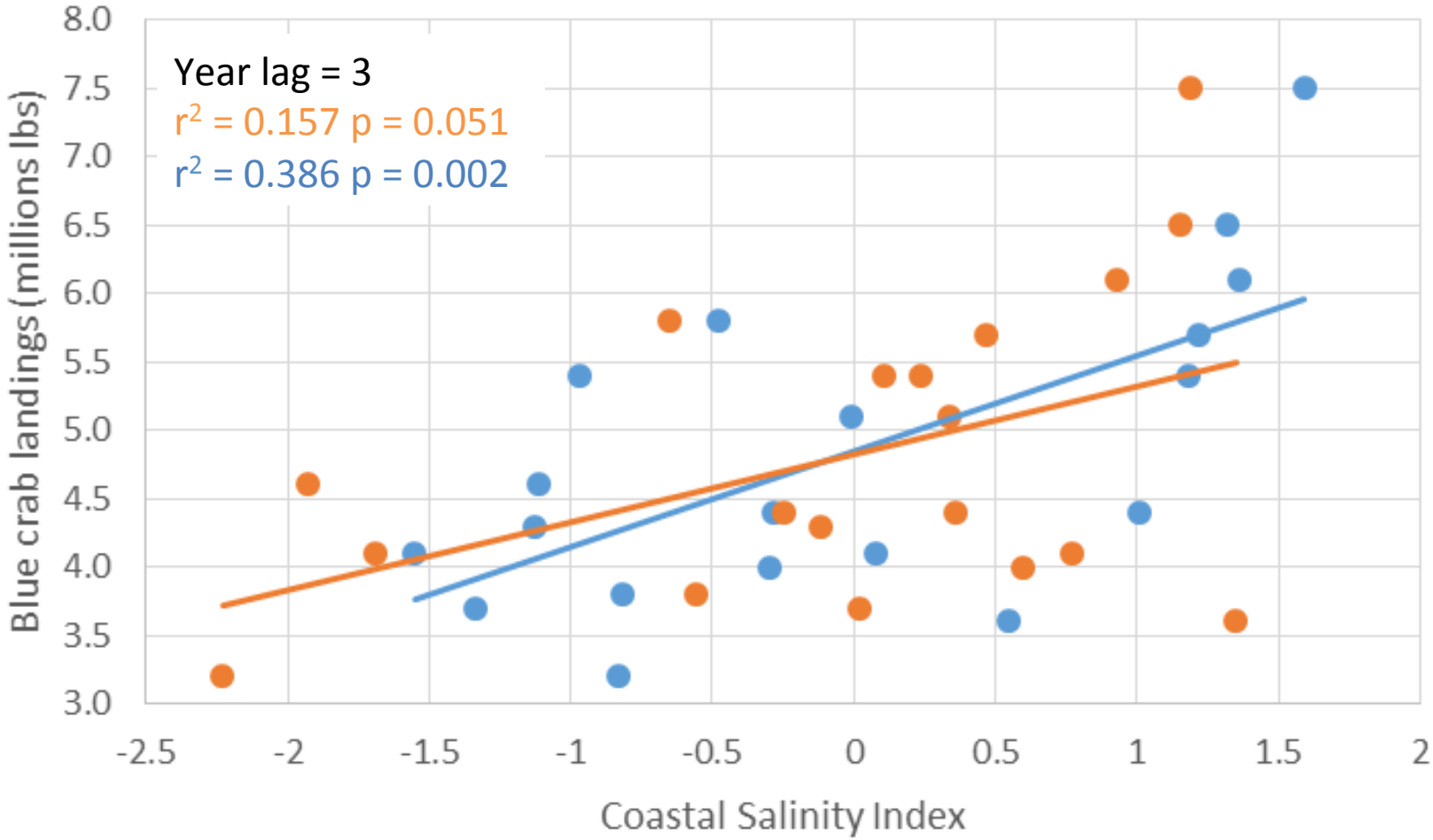
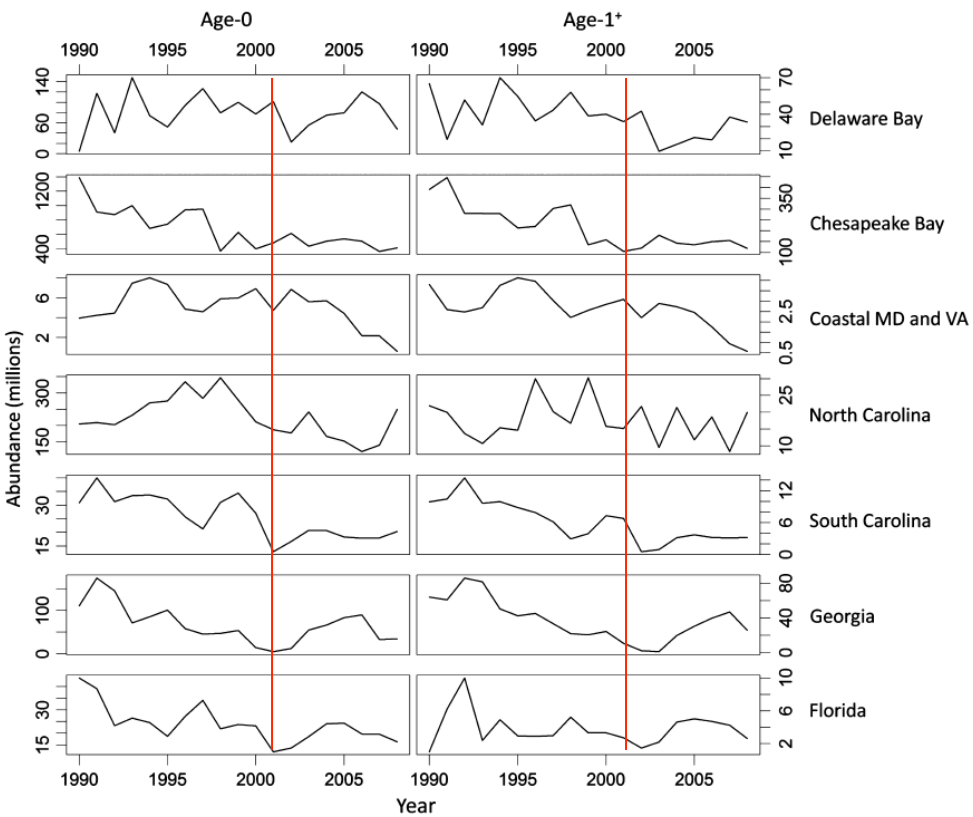


Coastal Salinity Index (CSI)

Landings (million lbs) = 0.6989 * CSI_{t-3} + 4.8451
SC Landings 2016 = 5.25 (4.73-5.72)



Colton et al. 2013 Fisheries & Oceanography

Conclusions

- How does drought impact blue crabs?
  - Increases disease and metabolic costs of migration
- Can we forecast future droughts?
  - Not specifically, but high degree of future occurrence
- Can we use drought forecasts to predict crab landings in South Carolina?
  - Yes, IBM model can forecast landings trends
- Can we use the Coastal Salinity Index to forecast US blue crab landings?
  - Yes, allows for extrapolation to other estuaries

Acknowledgements

- Funding
  - NOAA-UCAR Subaward Z14-15056
  - SC Sea Grant R/CF-10 & R/CF-15
  - NERR Graduate Research Fellowship
  - Clemson Research Incentive Fund
- Collaboration
  - Clemson – M Ptacek
  - ACE Basin NERR – A Segars, J Leffler
  - SC DNR – D Whittaker, L DeLancey, A Fowler
  - CISA – D Tufford, G Carbone, J Lu
  - USGS – P Conrads
- Field assistants
  - K Parmenter
  - K Smith
  - Conservation of Marine Resources Team

Questions?