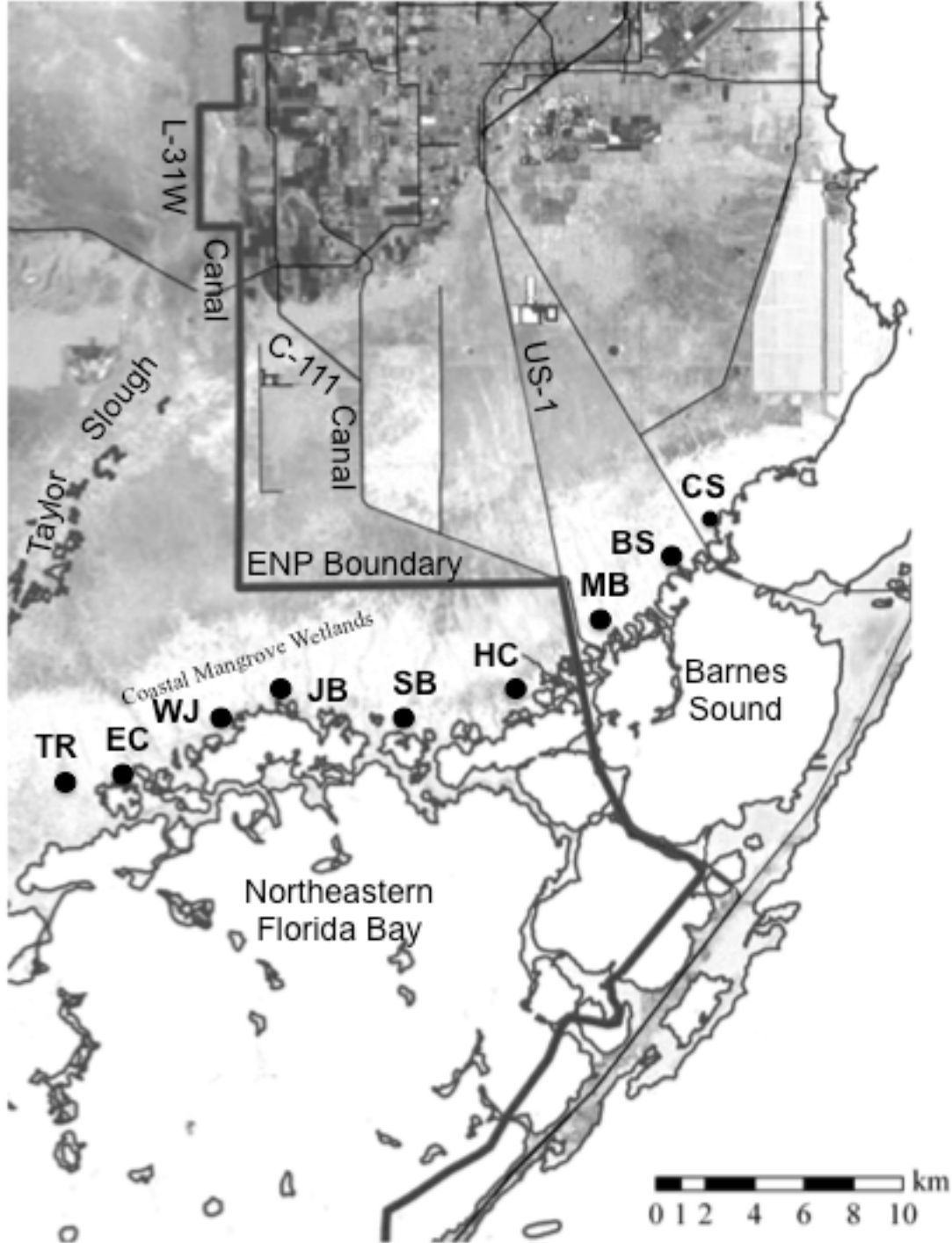
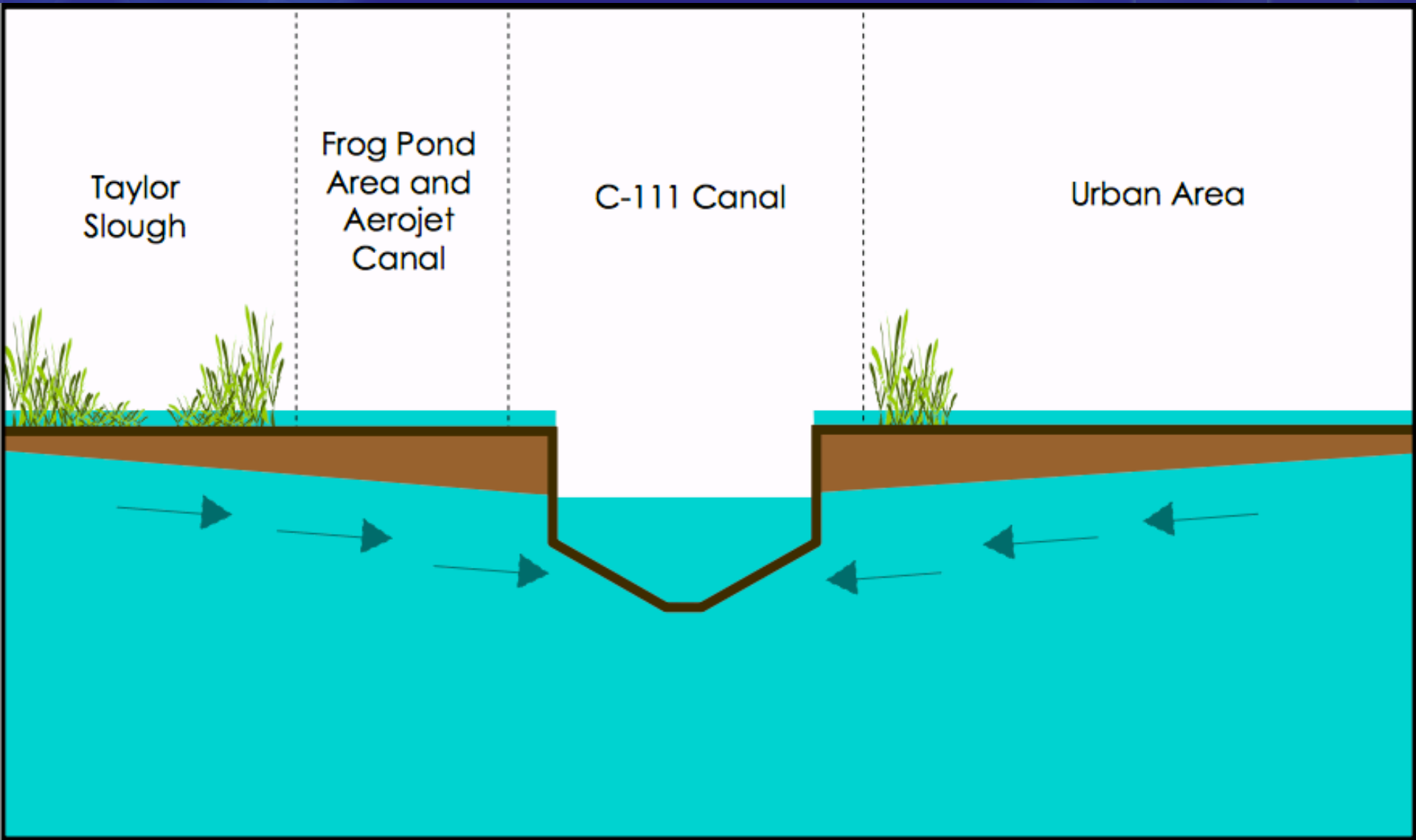


ESTUARINE FISH AND SUBMERGED AQUATIC VEGETATION RESPONSE TO THE C-111 SPREADER CANAL WESTERN PROJECT



Jerome J. Lorenz, Michelle Robinson, Michael Kline and Peter E Frezza
Everglades Science Center, Audubon Florida,
Tavernier FL





Taylor Slough

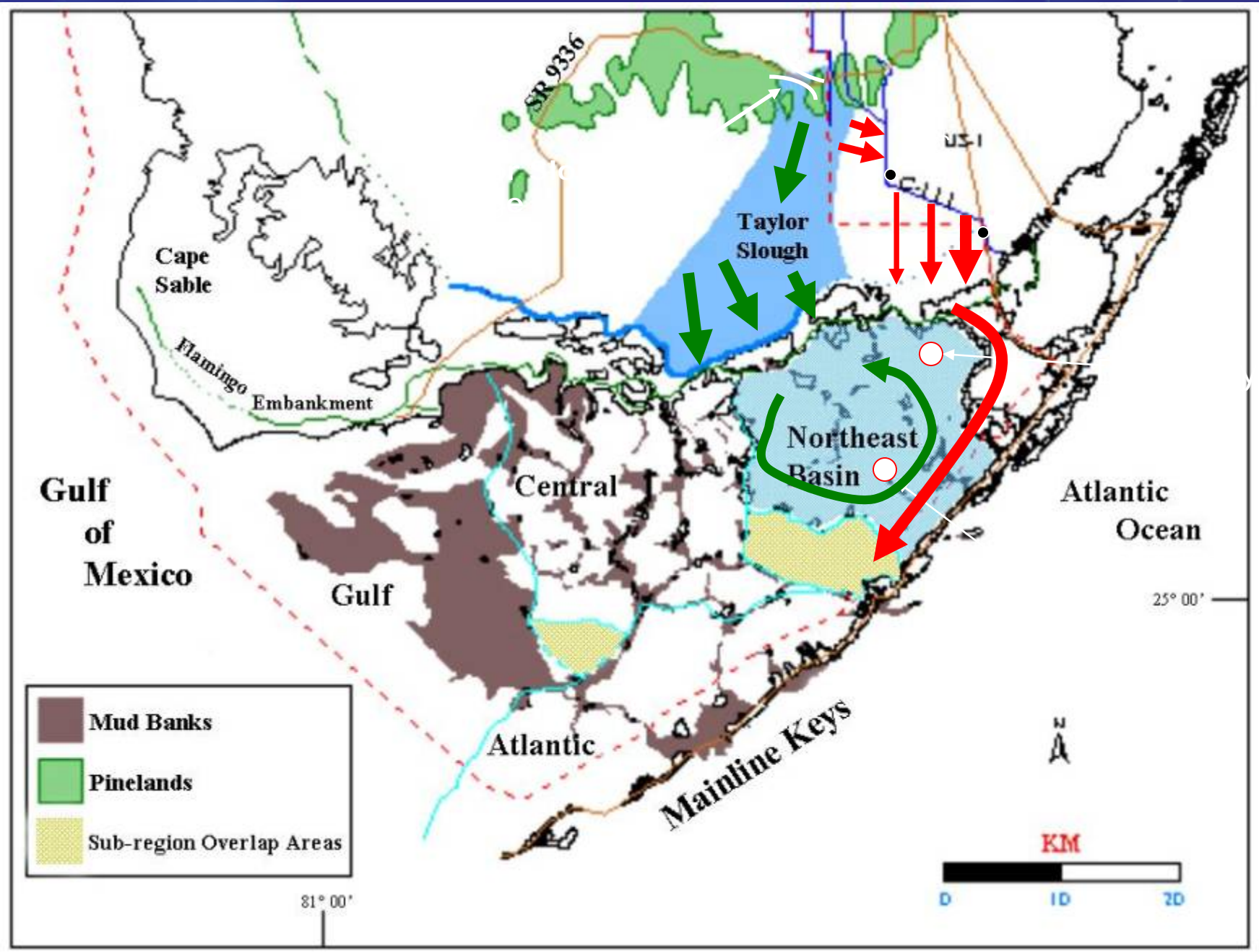
Frog Pond Area and Aerojet Canal

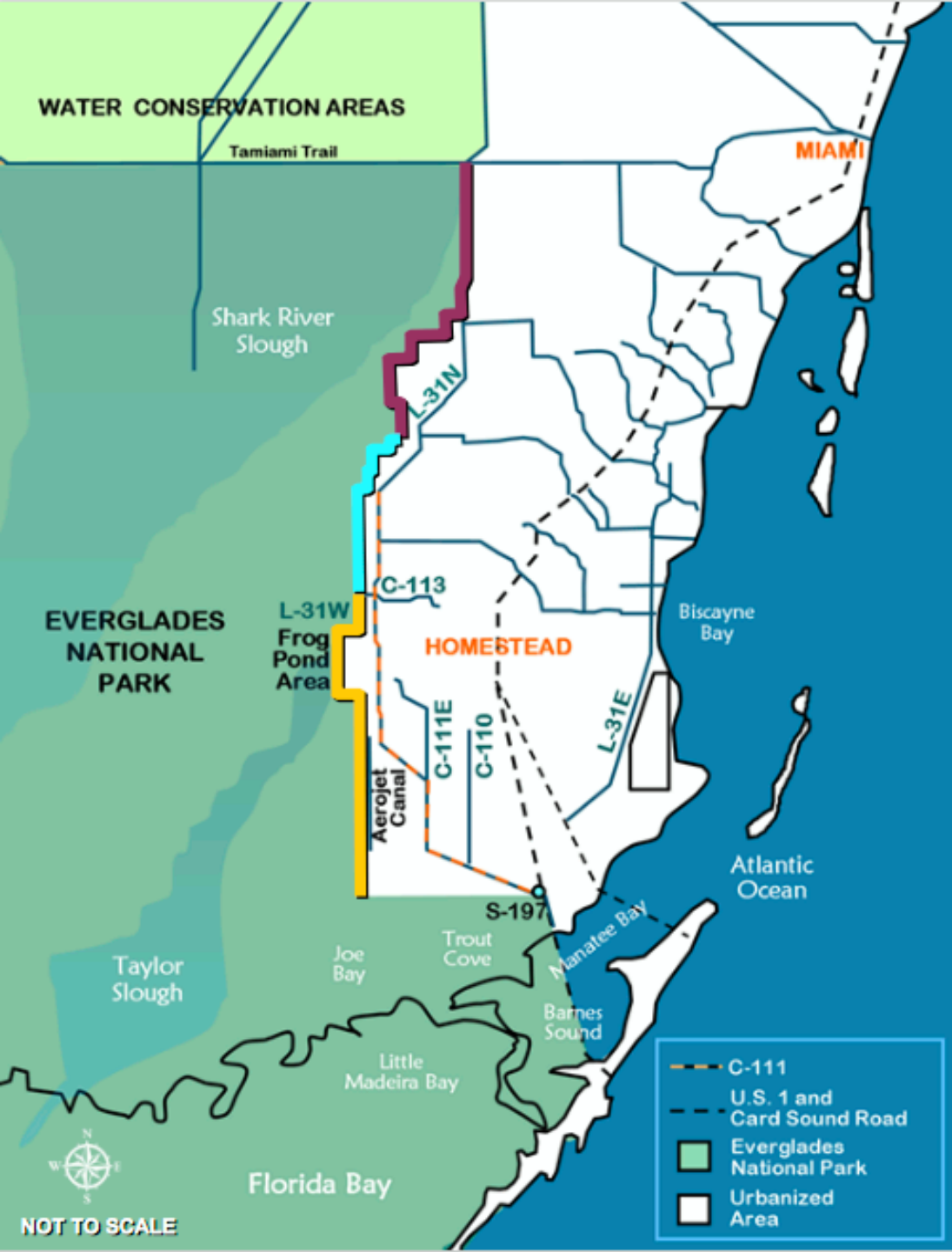
C-111 Canal

Urban Area

•Water seeps out of Taylor Slough into the C-111 Canal







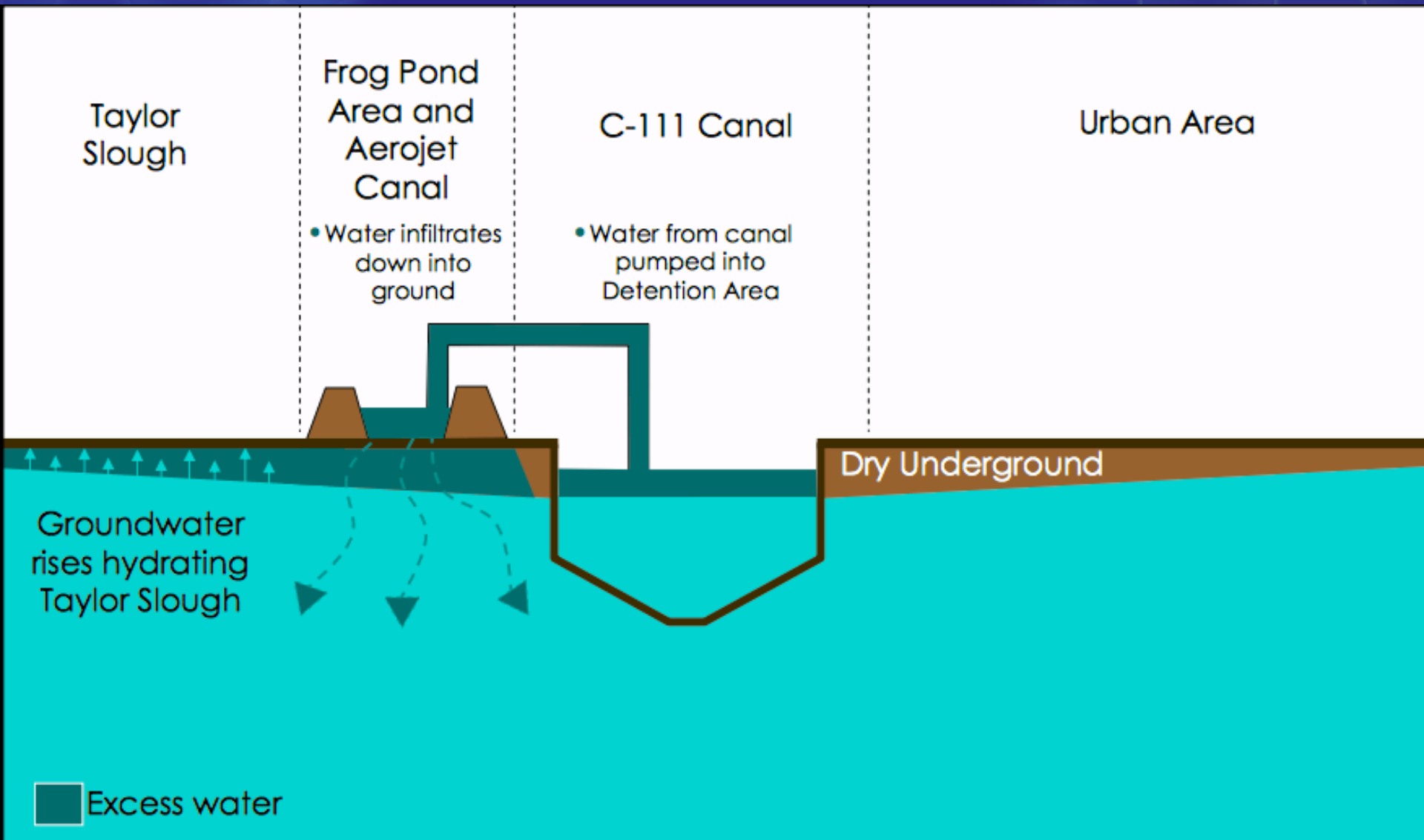
ENP Seepage Reduction Strategy

- Modified Water Deliveries Project (non-CERP)**
 - C-111 South Dade Project (non-CERP)**
 - C-111 Spreader Canal Western Project (CERP)**
- C-111 Spreader Canal Western Project forms the southernmost increment for strategy to keep water in ENP



BUILDING STRONG®

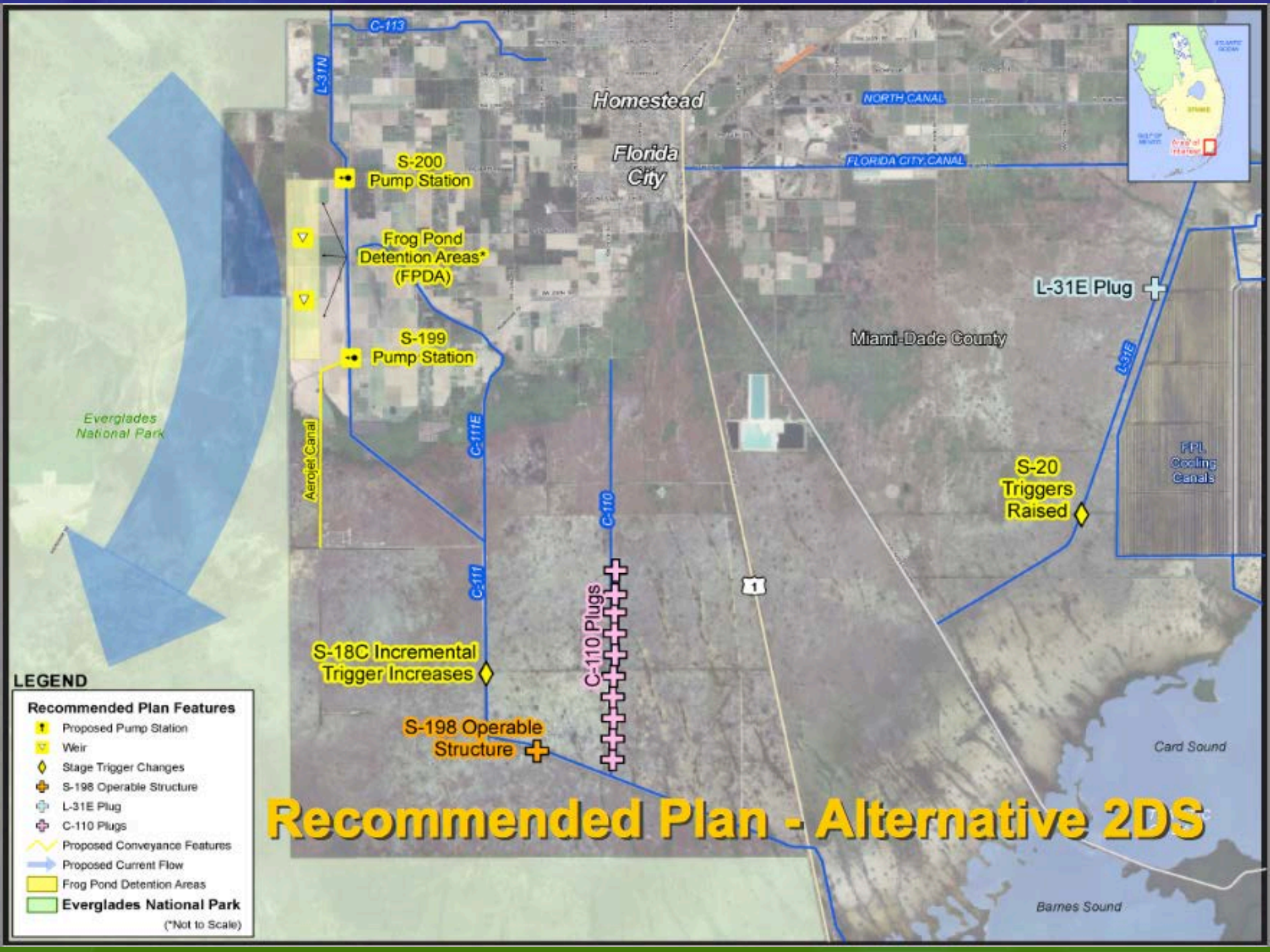
NOT TO SCALE



Hydraulic Ridge Concept

Detention area used to infiltrate water into ground and artificially raise groundwater table





Homestead

Florida City

FLORIDA CITY CANAL

NORTH CANAL

Miami-Dade County

L-31E Plug

FPL Cooling Canals

Everglades National Park

Aerofjet Canal

Frog Pond Detention Areas* (FPDA)

S-200 Pump Station

S-199 Pump Station

S-20 Triggers Raised

S-18C Incremental Trigger Increases

S-198 Operable Structure

C-110 Plugs

Card Sound

Barnes Sound

Recommended Plan - Alternative 2DS

LEGEND

Recommended Plan Features

- Proposed Pump Station
- Weir
- Stage Trigger Changes
- S-198 Operable Structure
- L-31E Plug
- C-110 Plugs
- Proposed Conveyance Features
- Proposed Current Flow
- Frog Pond Detention Areas
- Everglades National Park

(*Not to Scale)

Pre-Project Prediction of the Impacts of the C-111SCWP On Florida Bay Mangrove zone (based on our previous findings)

1. Reduce Salinity
2. Increase Abundance of SAV
3. Increase the Abundance of Freshwater Fish
4. Increased Secondary Production

Taylor Slough Watershed

- (TR) Taylor River
- (EC) East Creek
- (WJB) West Joe Bay

C-111 Watershed

- (JB) Joe Bay
- (SB) Sunday Bay
- (HC) Highway Creek

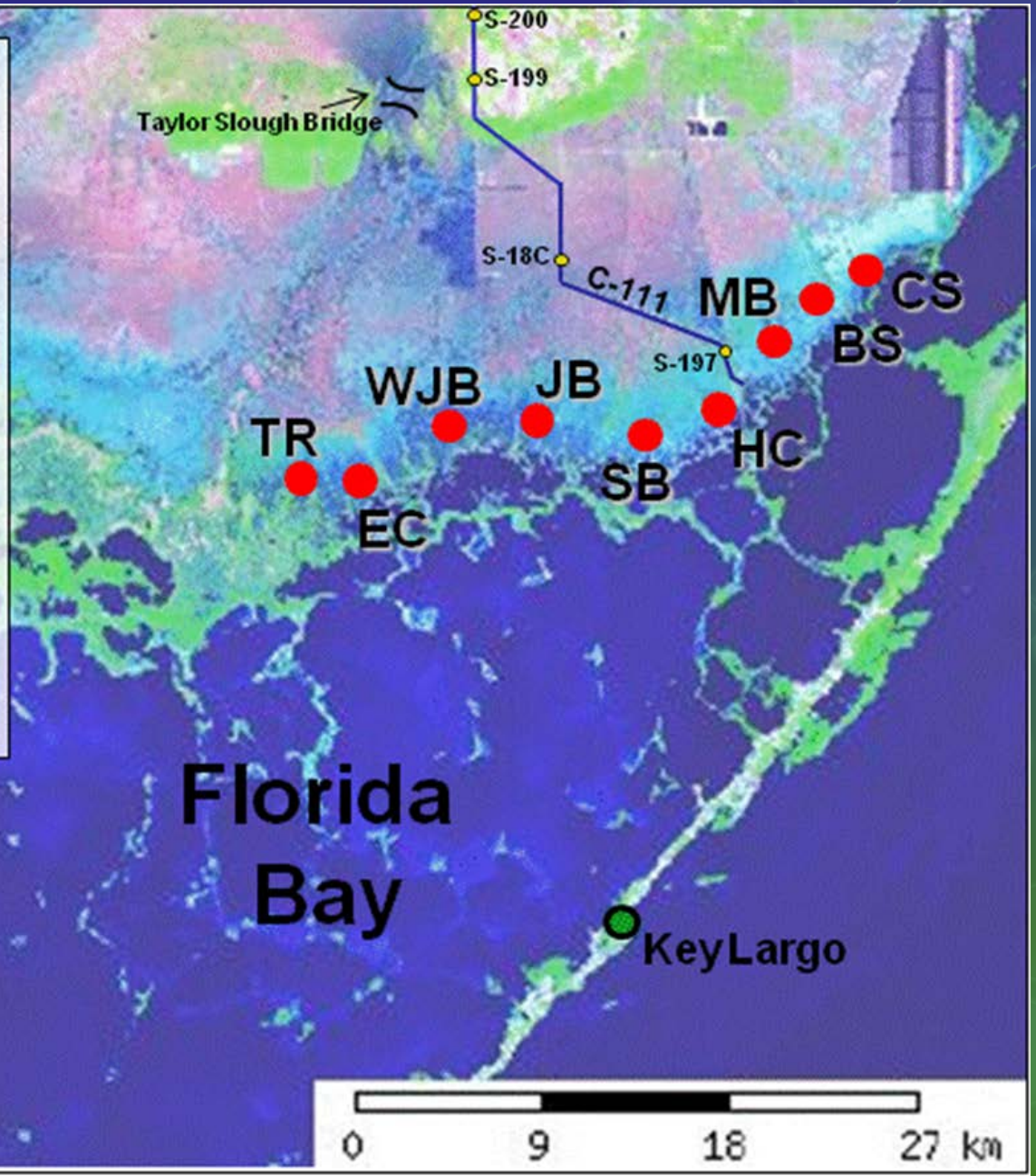
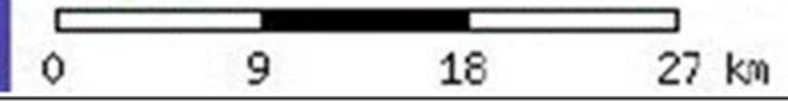
Southern Biscayne Bay Watershed

- (MB) Manatee Bay
- (BS) Barnes Sound
- (CS) Card Sound

Taylor Slough Bridge

Florida Bay

KeyLargo



Parameters Measured

- Hydrology

 - Salinity, Water Level, Rainfall and Temperature

 - Telemetered Hydrostations Measure Hourly

- Submerged Aquatic Vegetation (SAV)

 - Total SAV and Species Coverage

 - Point Intercept Method

 - Bi-Monthly

- Prey Base Fish

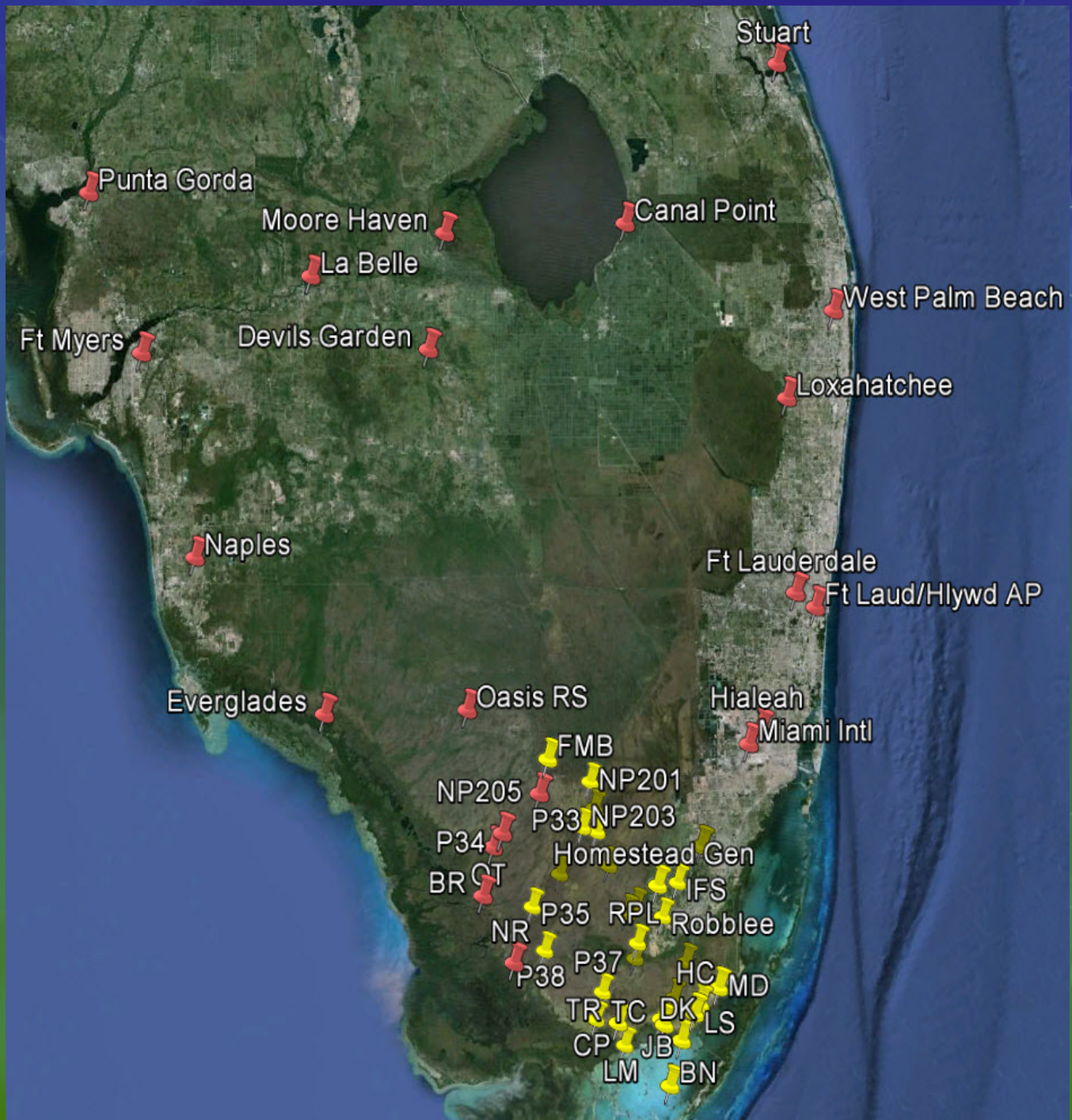
 - Species Composition, Abundance, Standard Length and Biomass

 - 9m² drop trap

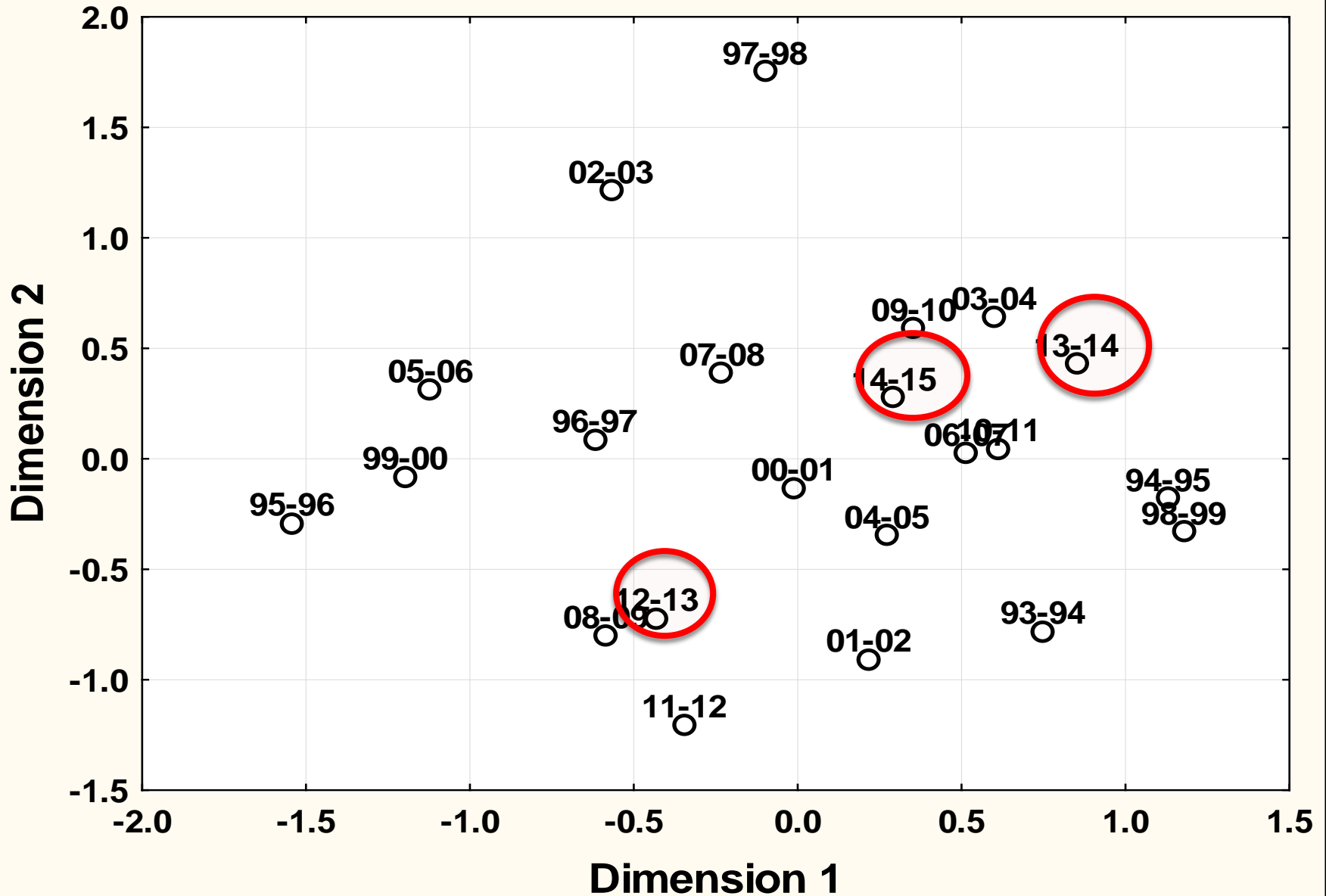
 - Jun, Sep, and monthly Nov-Apr

Analytical Techniques

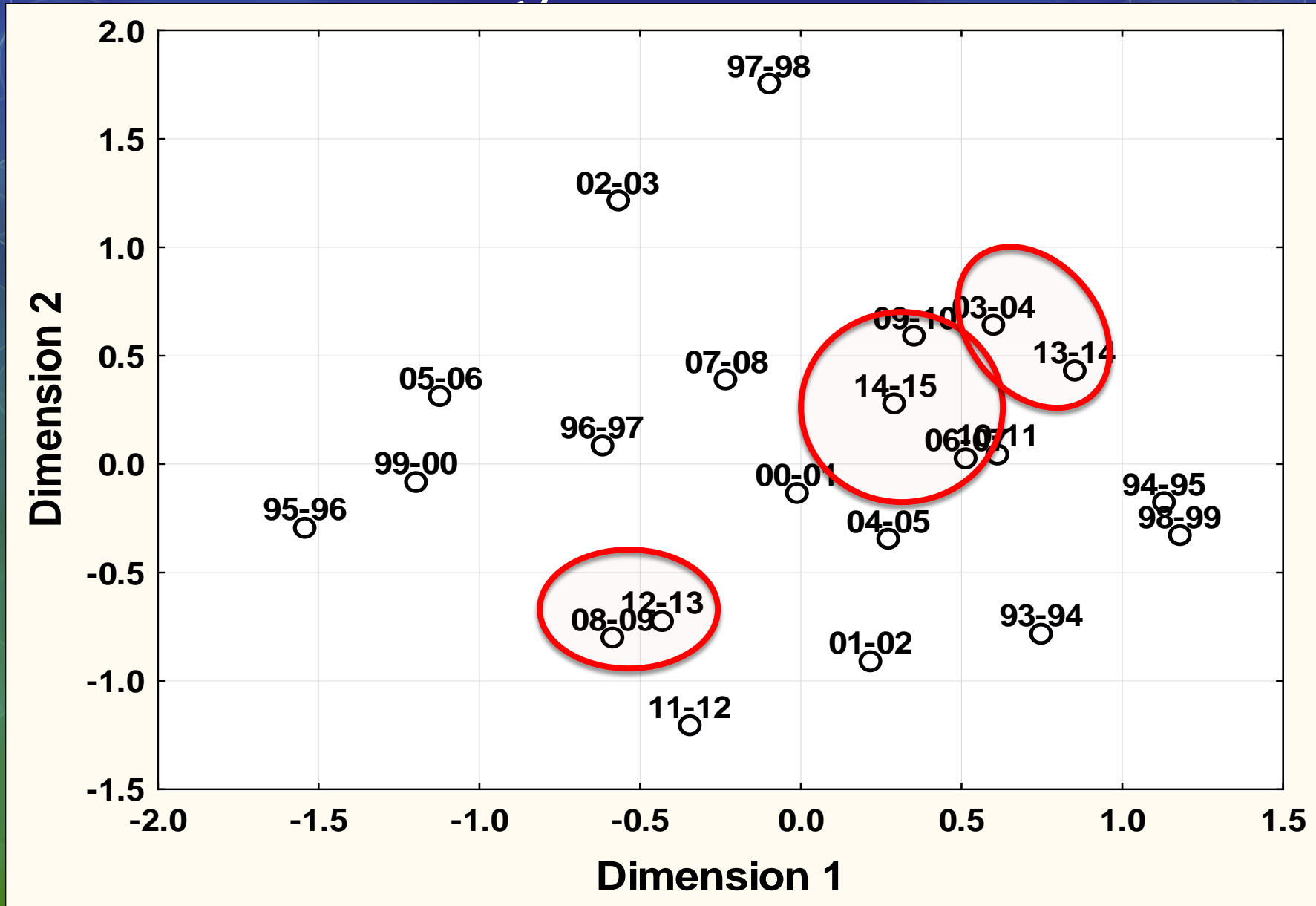
- Hydrologic Year Jun 1 – May 31
 - Based on Rainfall and Water Level
 - Wet Season Jun 1-Nov 30
 - Dry Season Dec 1-May 31
- Each of 3 Years Post Project Analyzed Individually
 - Compared to a Pre-Project Year
 - Based on Similarity in Regional Rainfall
 - Used NMDS to Identify Similar Year
 - OPOR 1996-Present (Start of SAV Sampling)



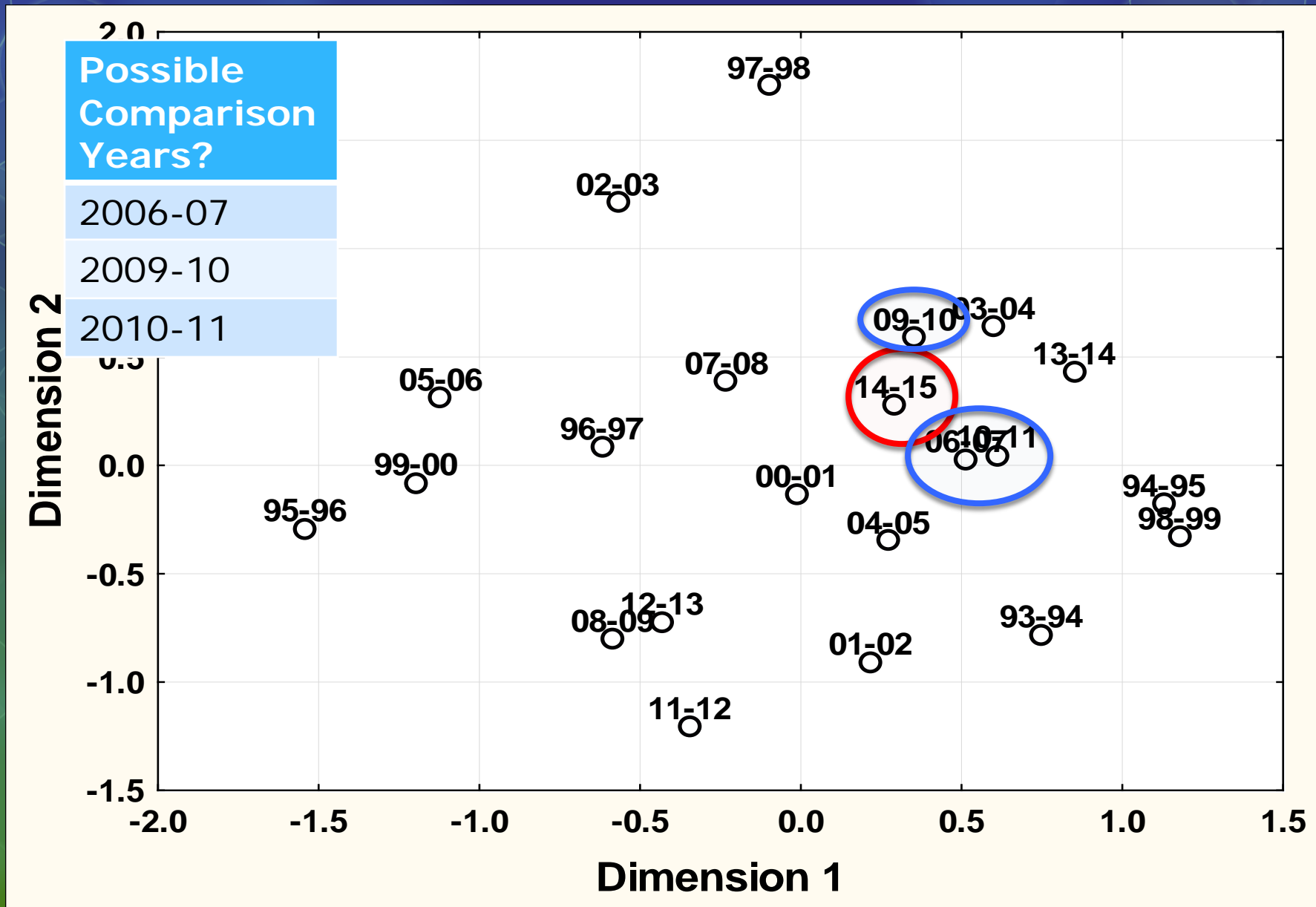
NMDS of Regional Rainfall Patterns Post Project Years



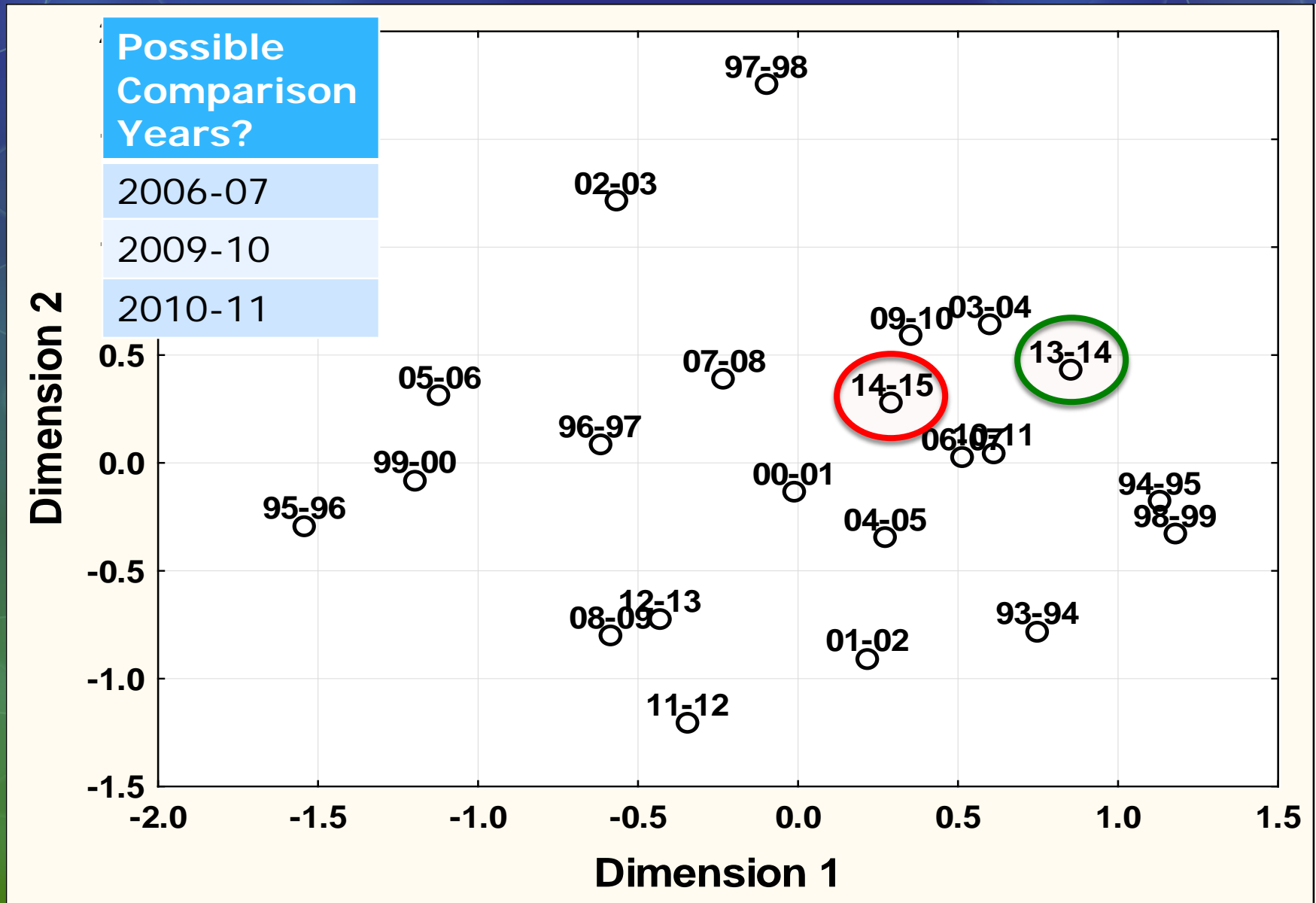
Pre Project Year Selection Based On Regional Rainfall



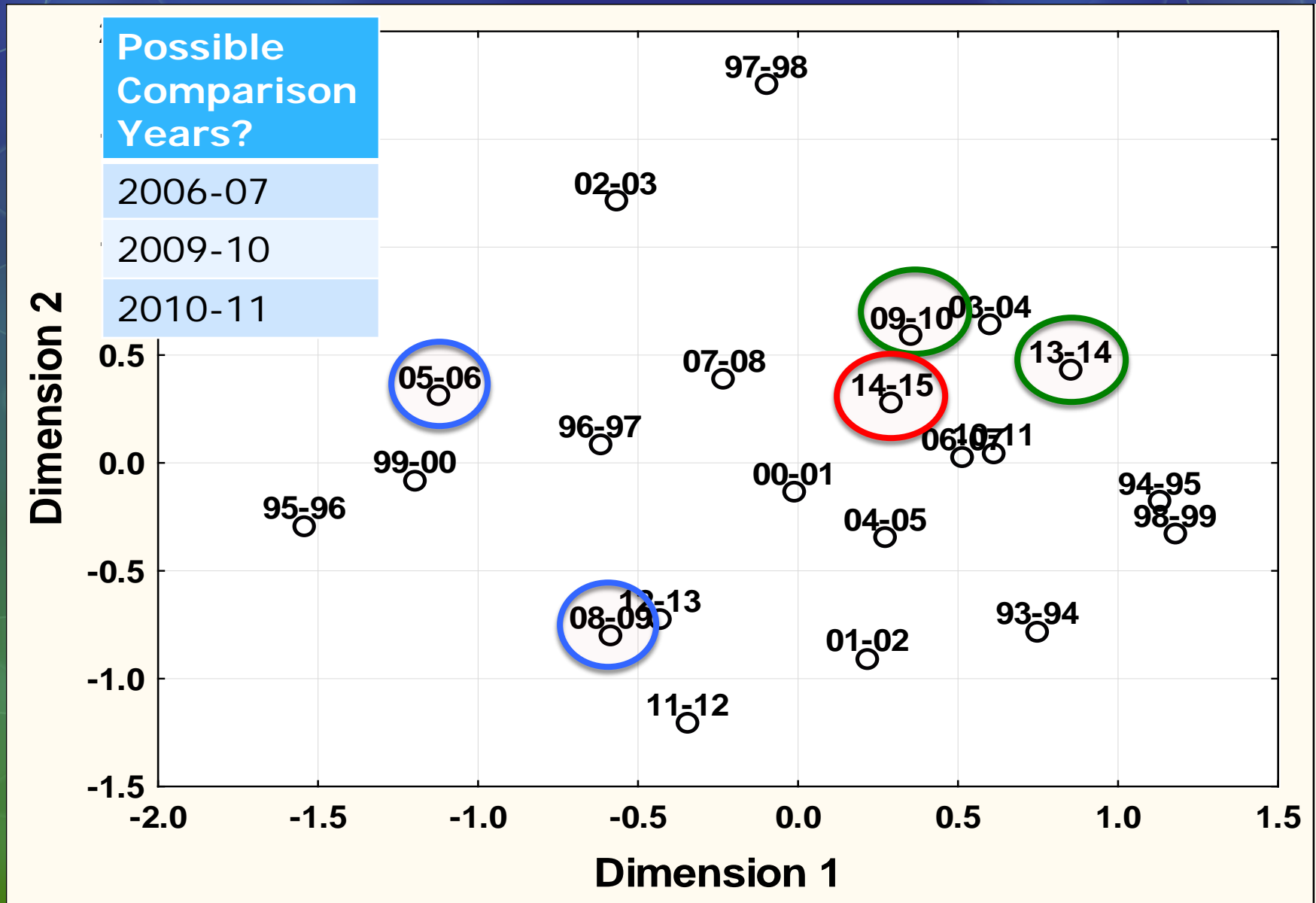
2014-15 Pre Project Year Selection Problematic



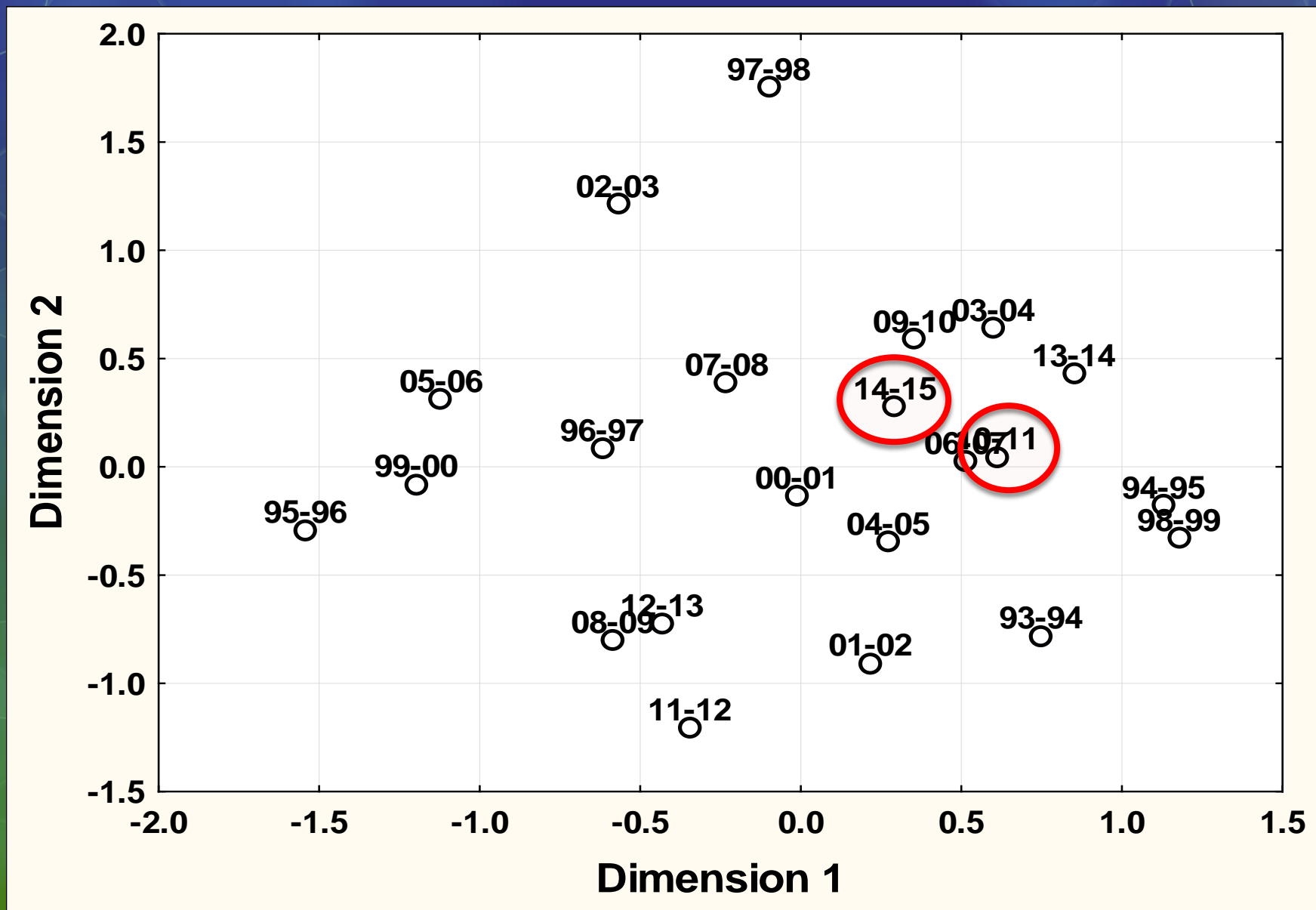
Preceding Year Rainfall Taken Into Account when Selecting a Comparison Year (2014-15 Example)



Preceding Year Rainfall Taken Into Account when Selecting a Comparison Year (2014-15 Example)



2010-11 selected as comparison year for 2014-15 because 2009-10 was similar to 2013-14



Year Pair Comparisons

Post Project

○ 2012-13

○ 2013-14

○ 2014-15

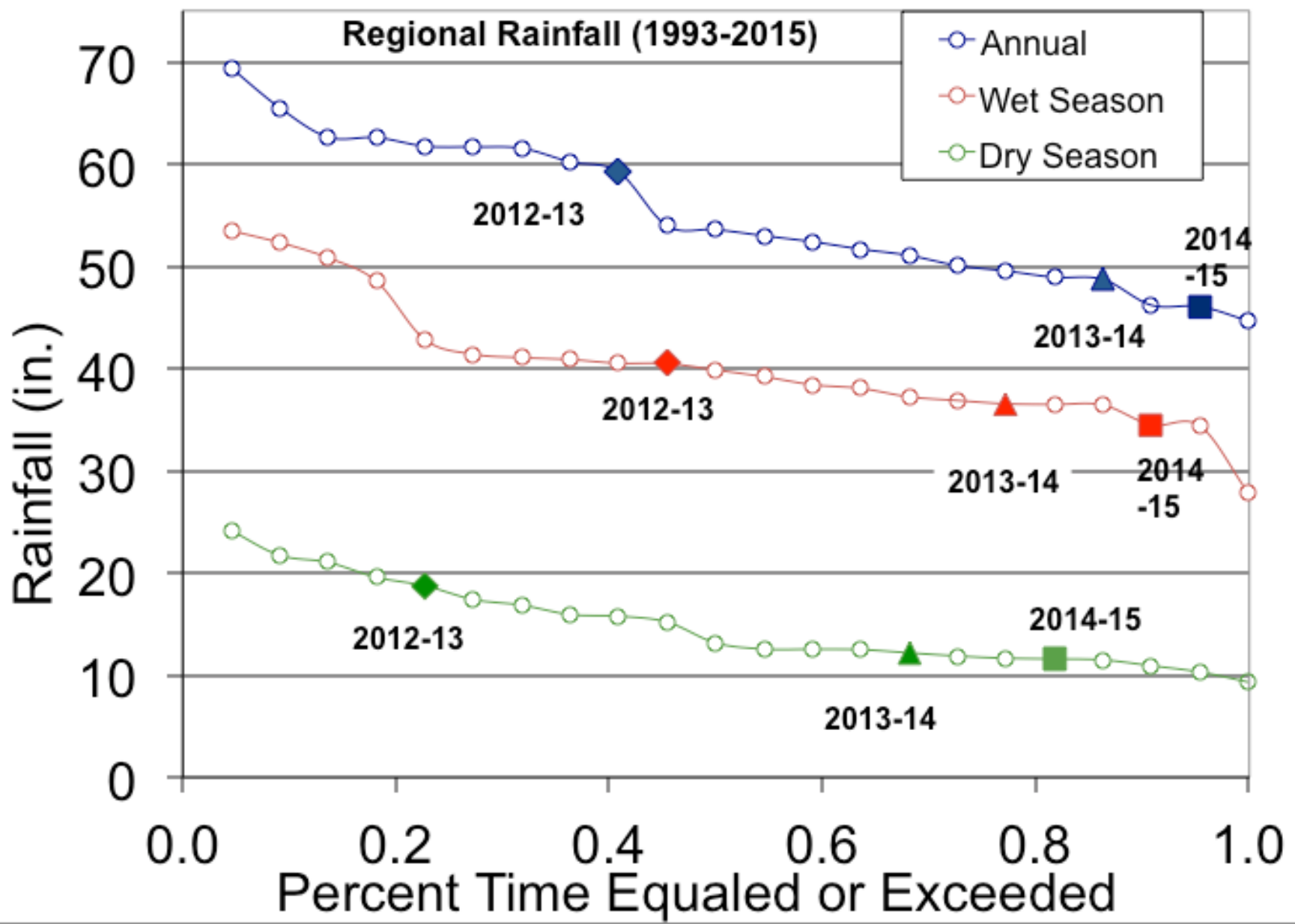
Pre Project

○ 2008-09

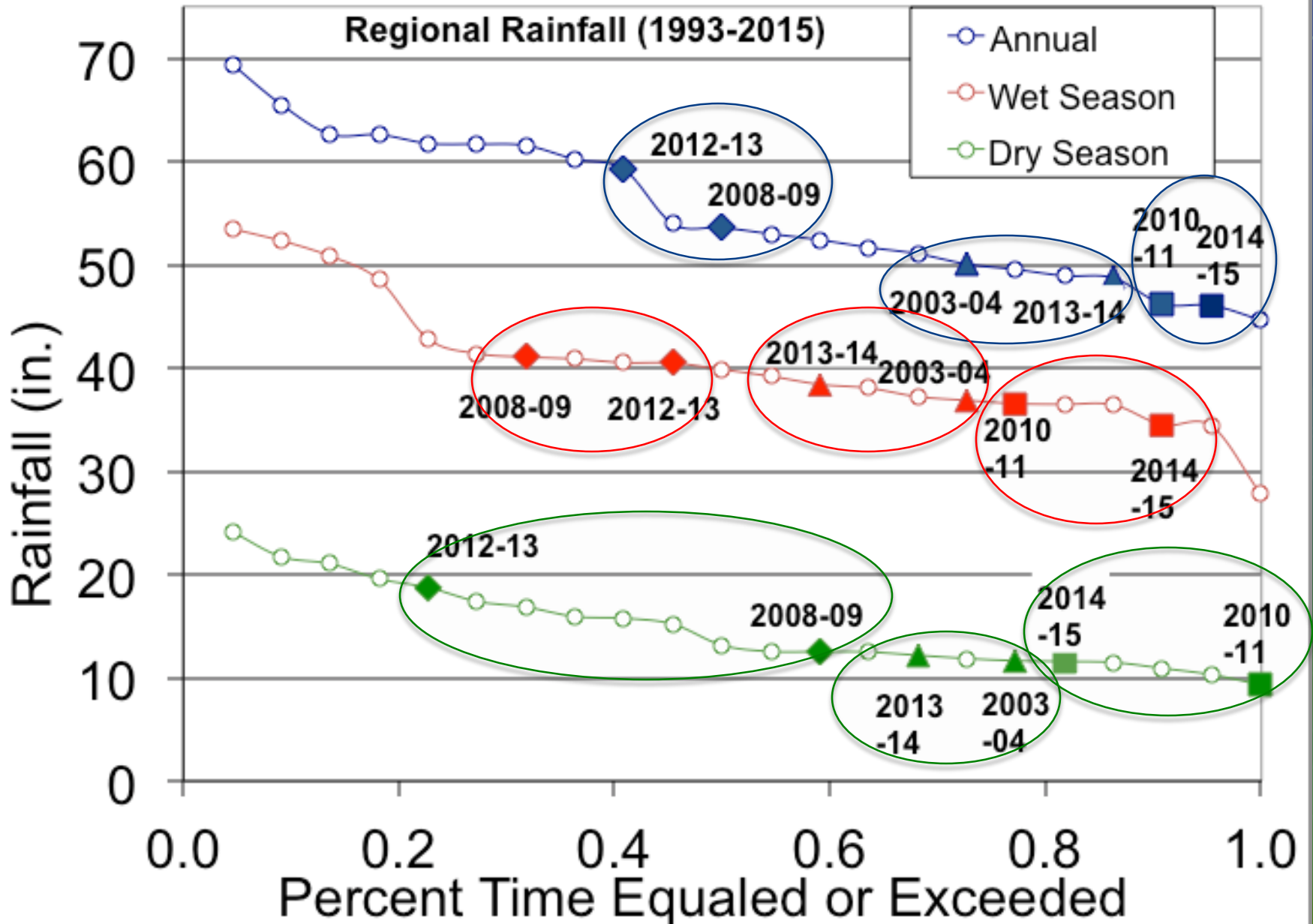
○ 2003-04

○ 2010-11

Regional Rainfall Exceedance Curve



Regional Rainfall Exceedance Curve



Year Pair Rainfall Characterization

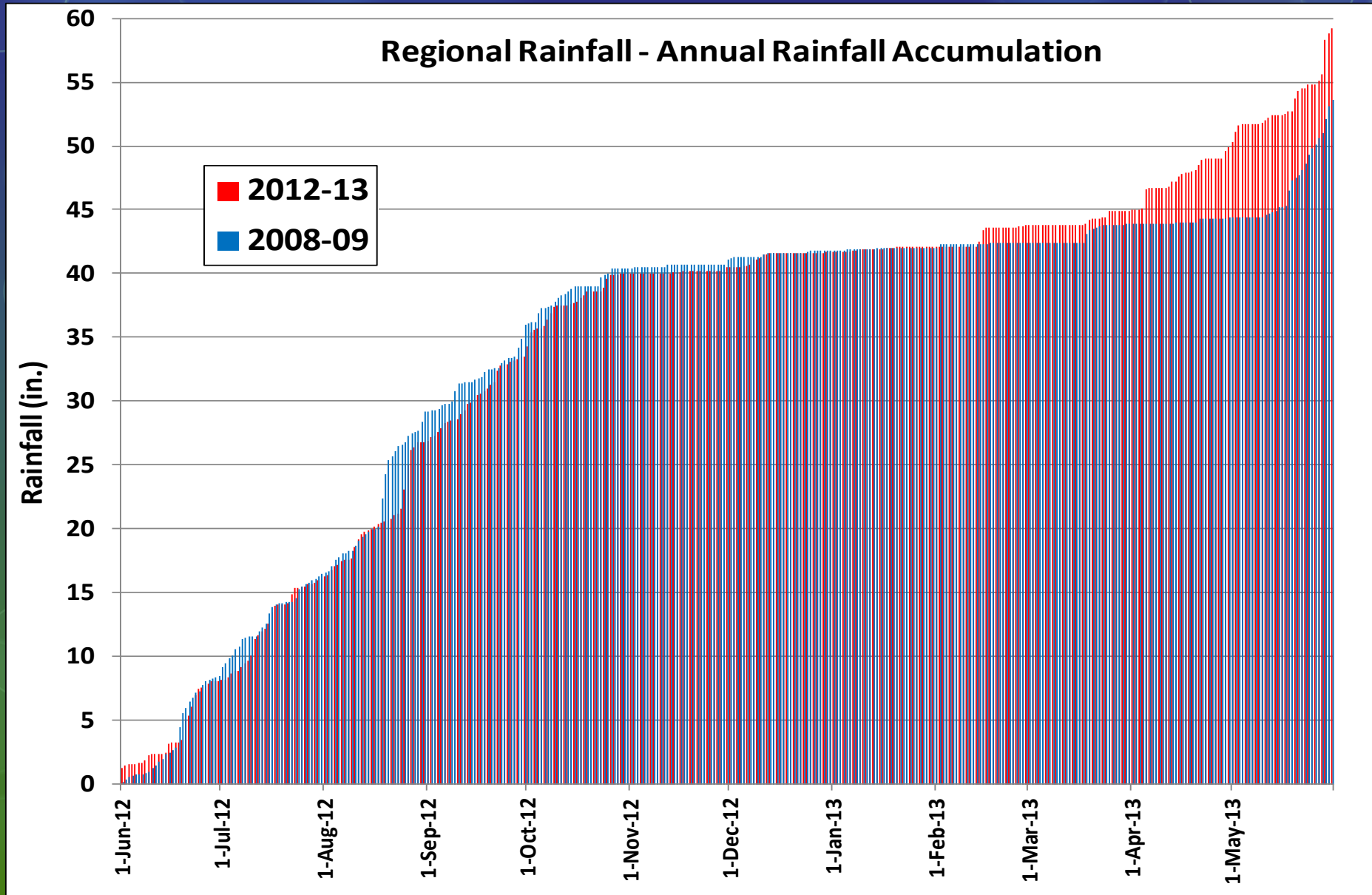
Post Project	Pre-Project	Rainfall
2012-13	2008-09	Moderate
2013-14	2003-04	Low
2014-15	2010-11	Drought

Our Pre-project predictions

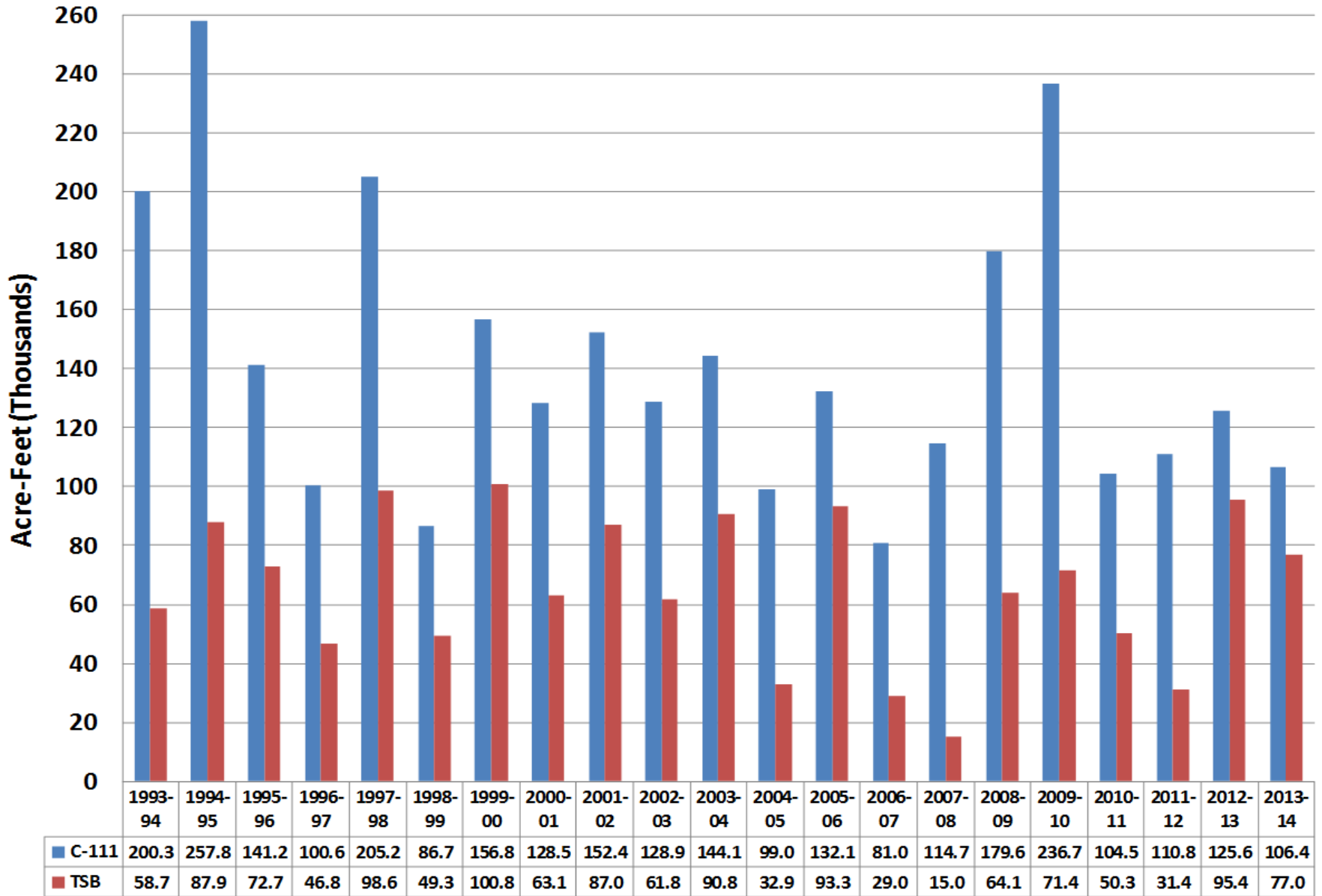
- Short-term Ecosystem Goals (1-2 years):
 - Increased freshwater conditions across the southern mangrove transition zone
 - Increase in SAV coverage by brackish and freshwater submerged grass and algae species
- Mid-term Ecosystem Goals (2-5 years):
 - Increased abundance of the freshwater prey-based fish communities in the southern mangrove zone

Year 1: 2012-2013 Compared
to 2008-09
Moderate Rainfall

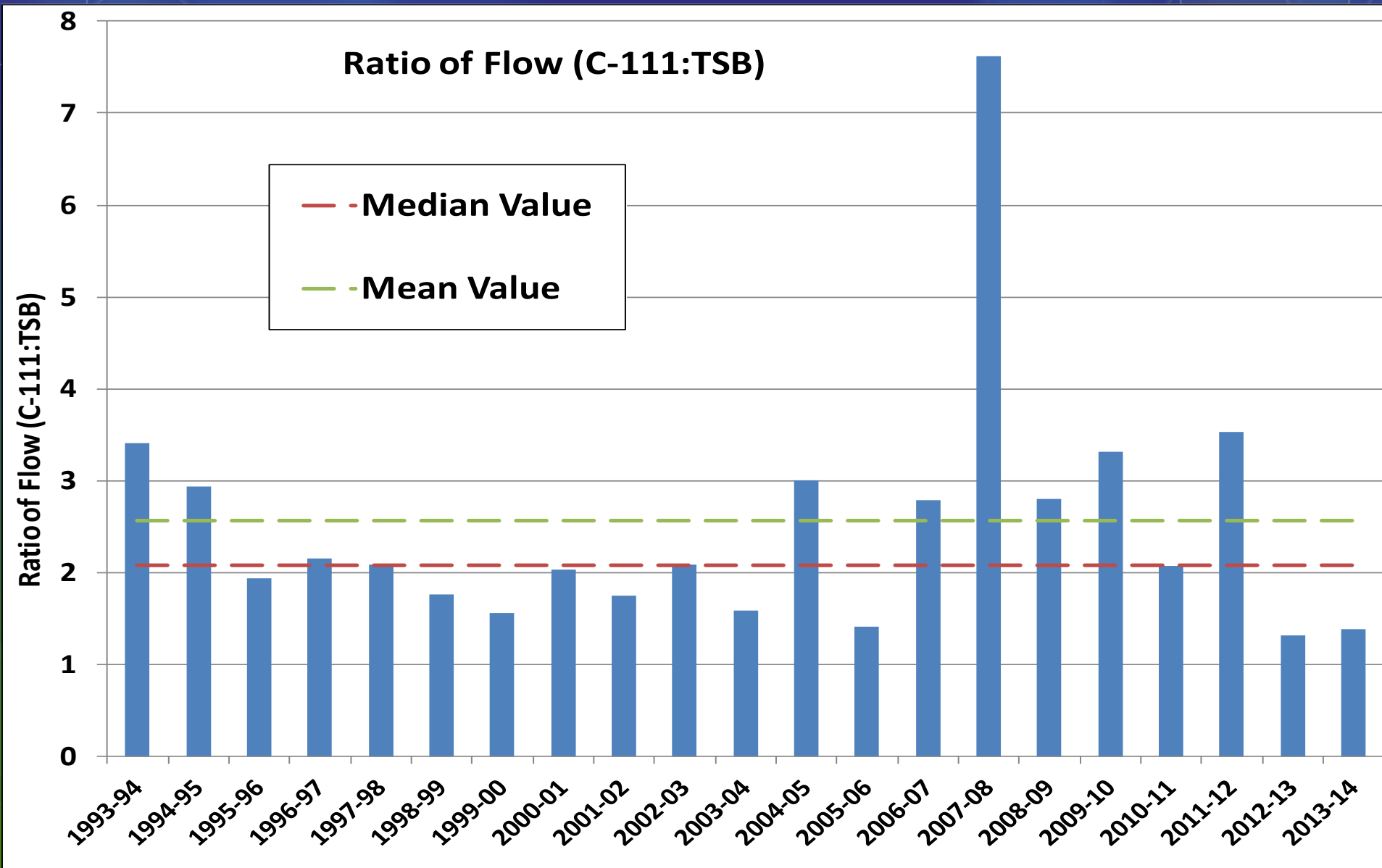
Comparison of 2012-13 to 2008-09 cumulative rainfall



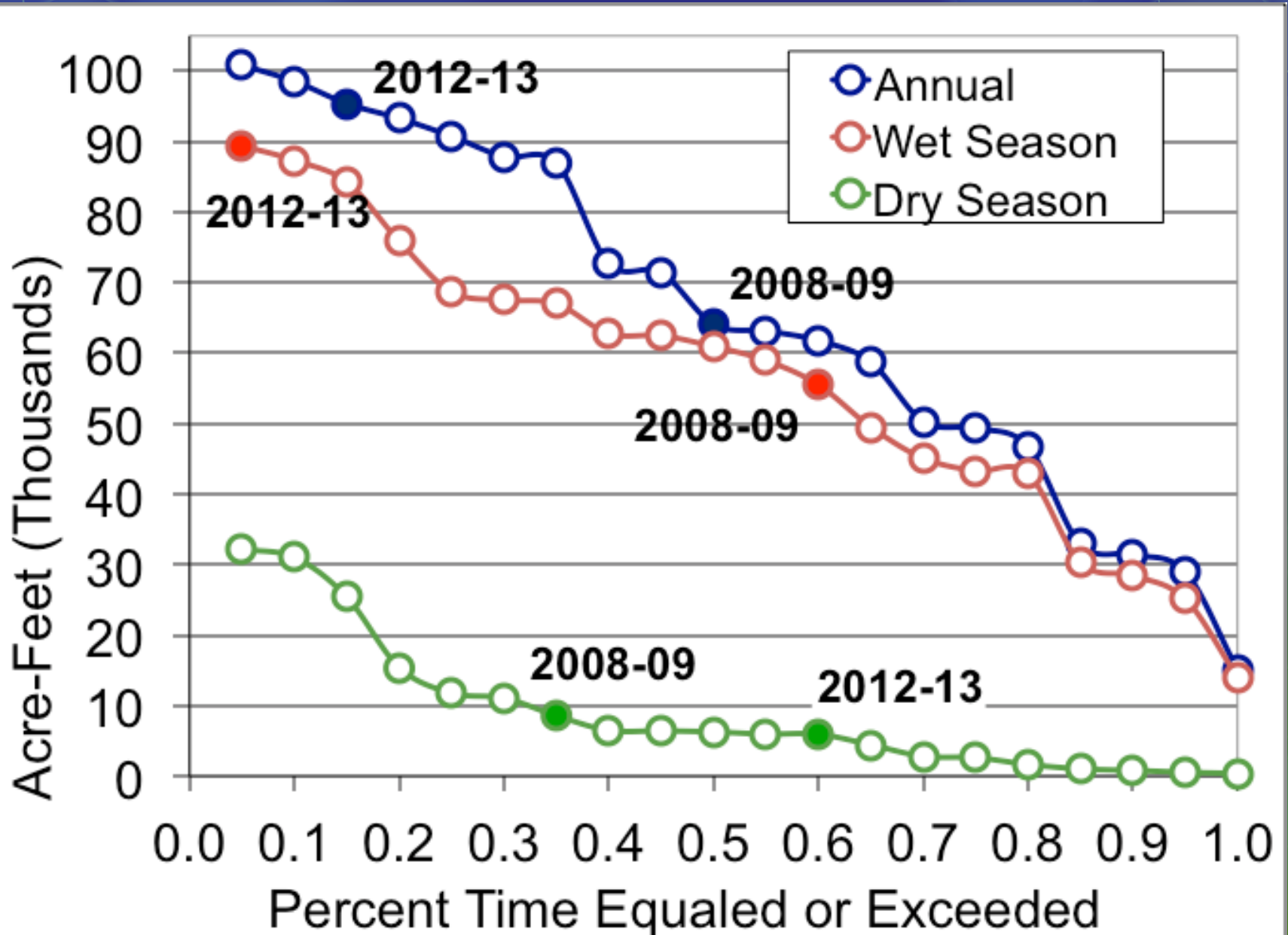
Annual Flow Rates For C-111 and TSB



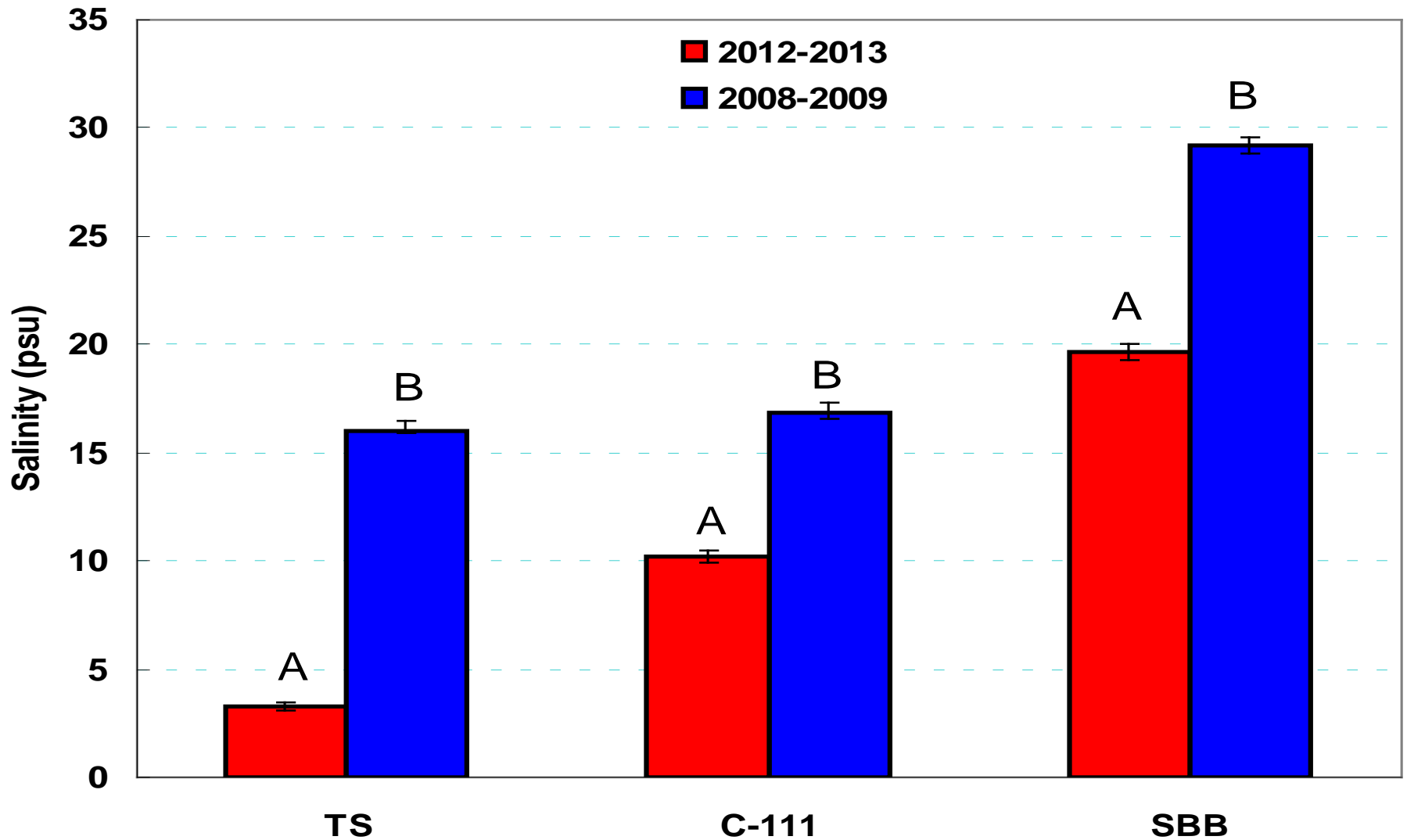
Ratio of Flow: C-111 to TSB



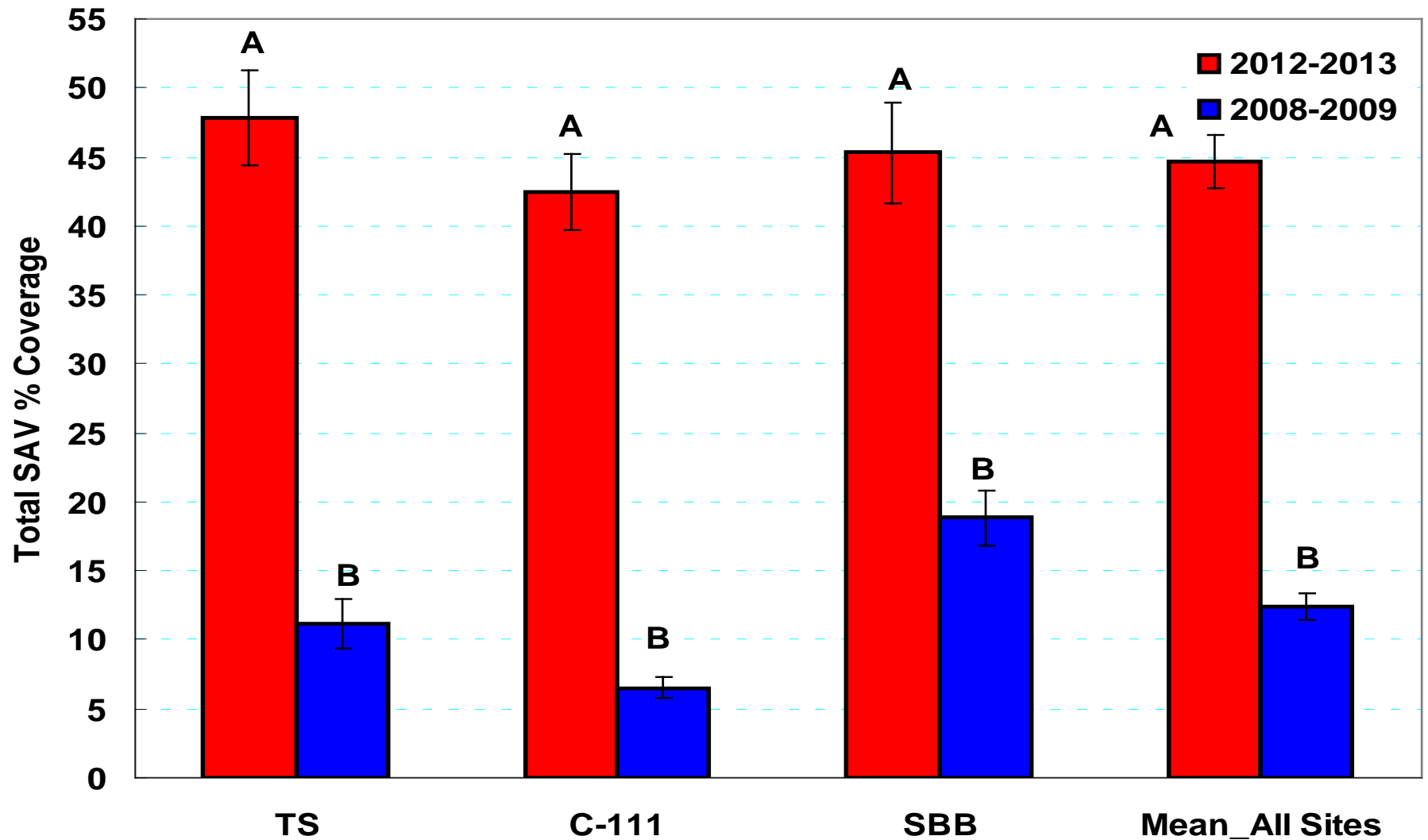
Taylor Slough Flows 2012-13 to 2008-09



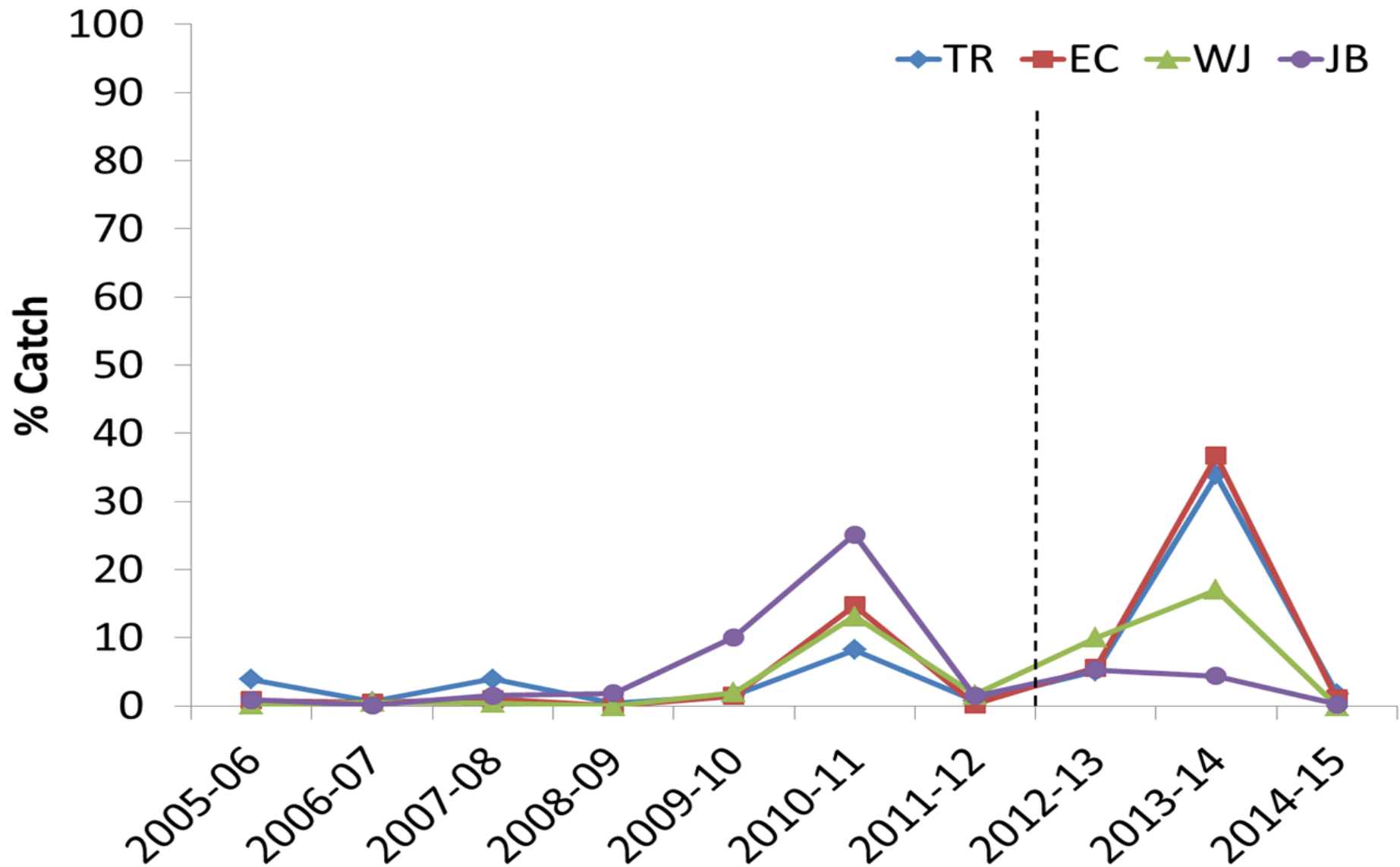
Salinity Comparison 2012-13 to 2008-09



SAV Comparison 2012-13 to 2008-09

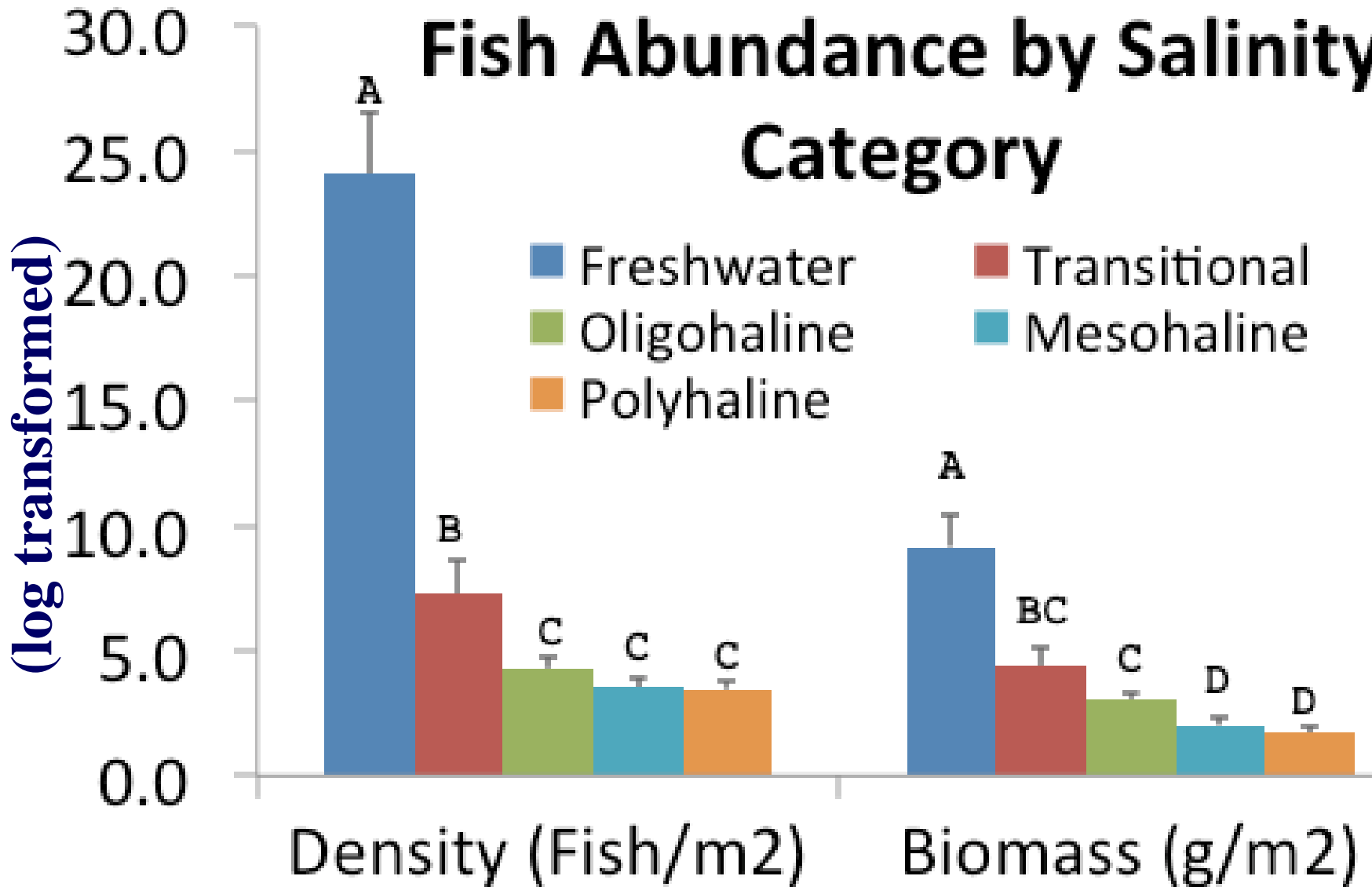


Percent Catch: Freshwater Fish Species

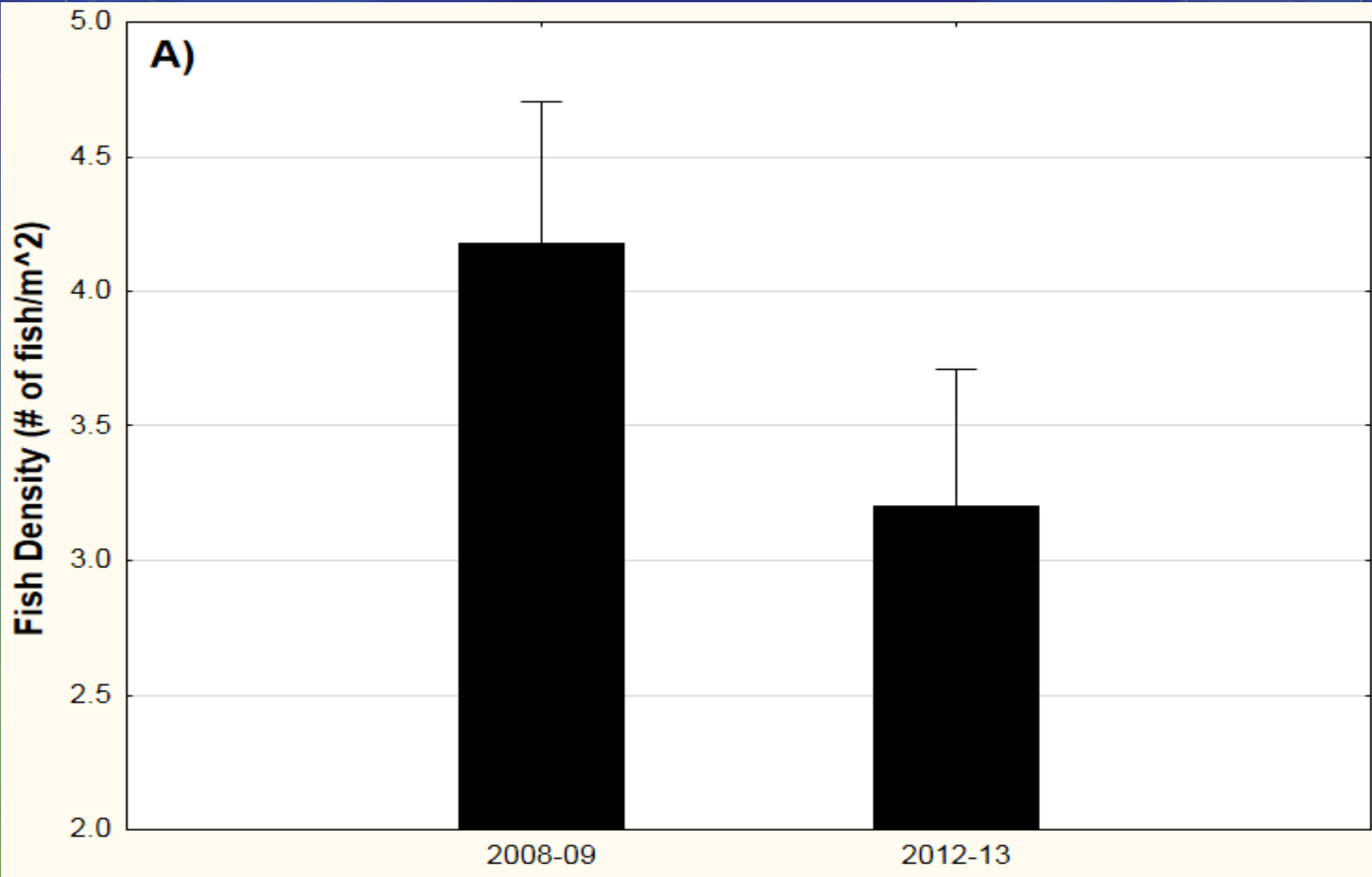


Fish Abundance by Salinity Category

Fish Abundance
(log transformed)

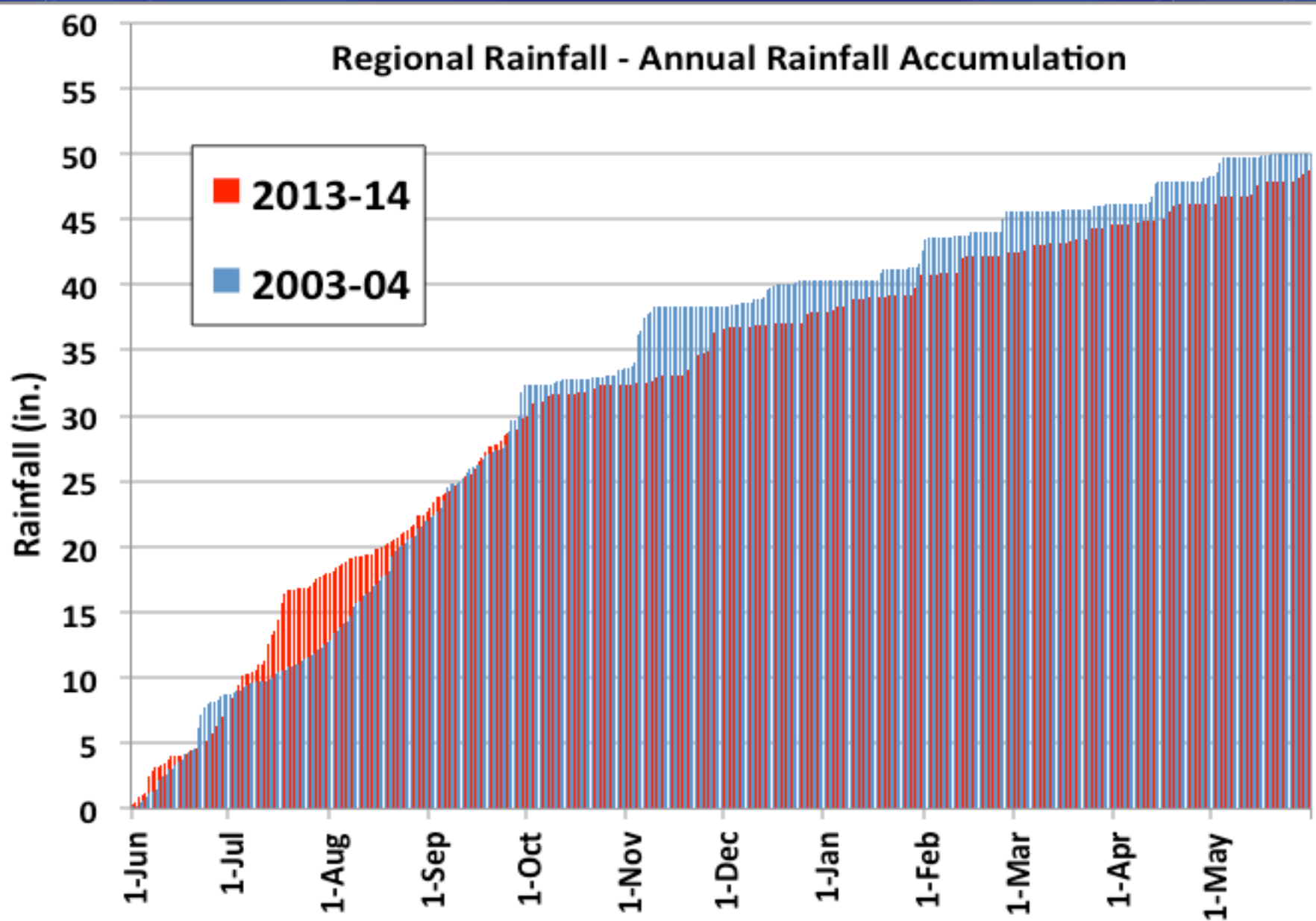


Prey Fish Density 2012-13 to 2008-09

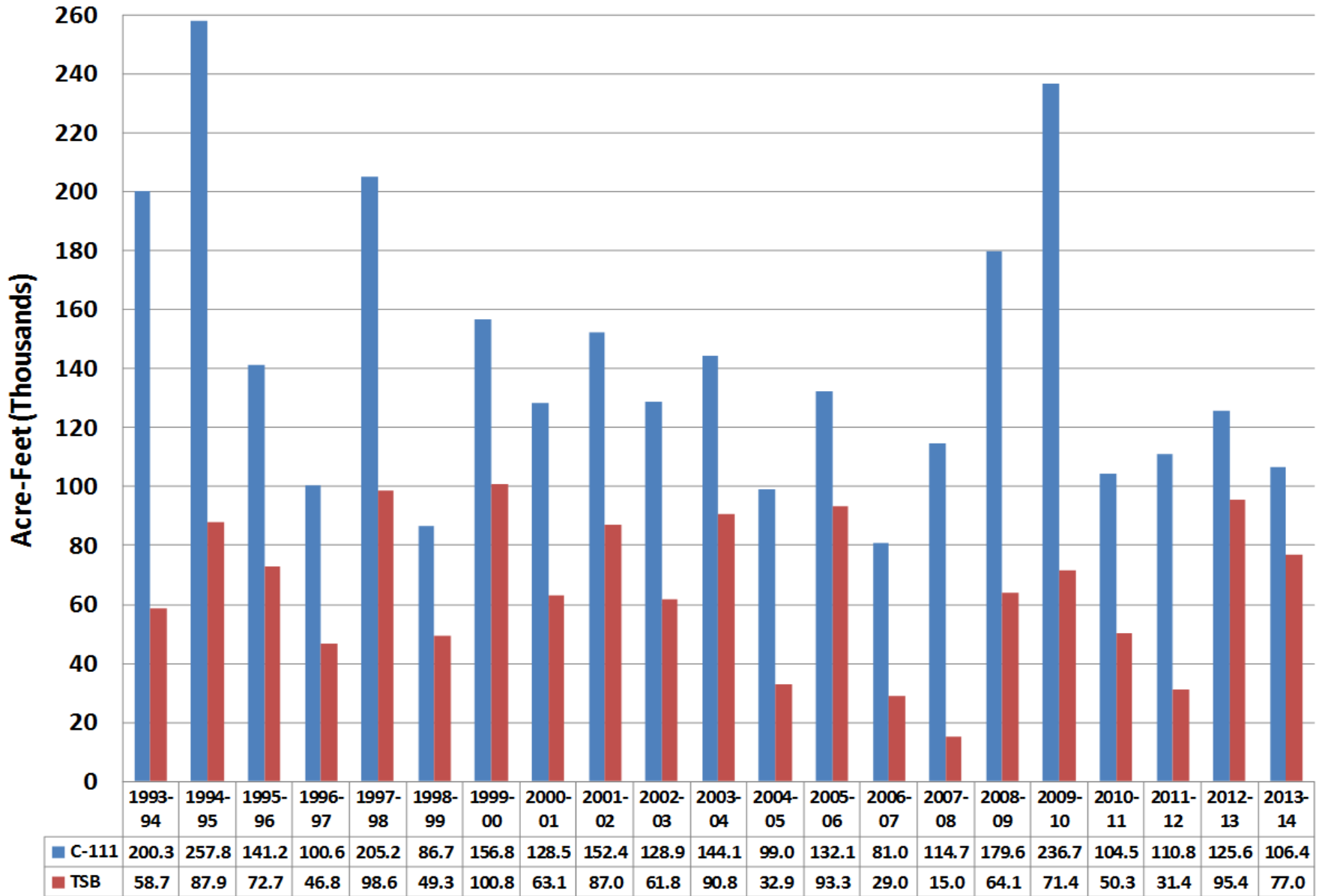


Year 2: 2013-2014 Compared
to 2003-04
Low Rainfall

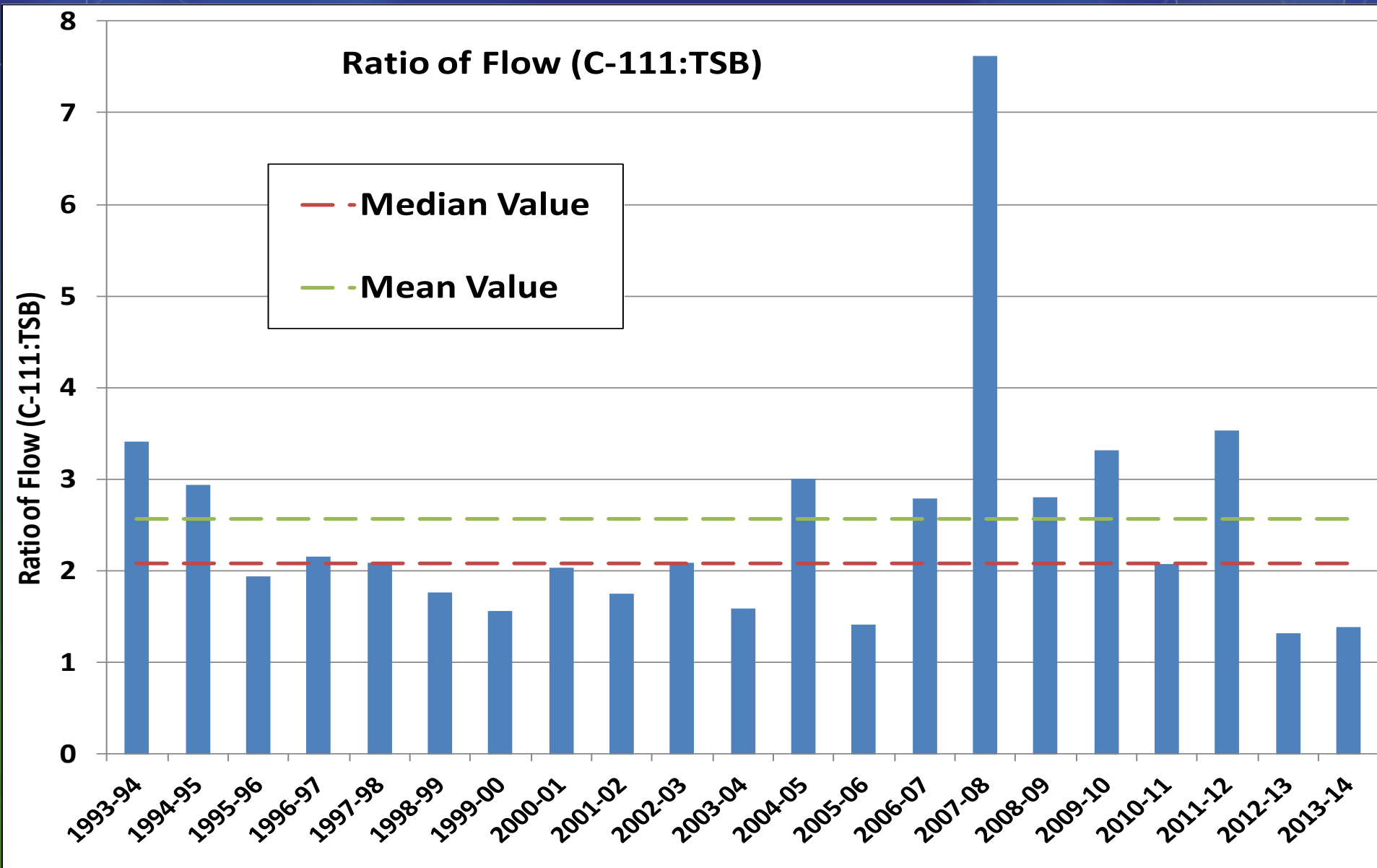
Comparison of 2013-14 to 2003-04 cumulative rainfall



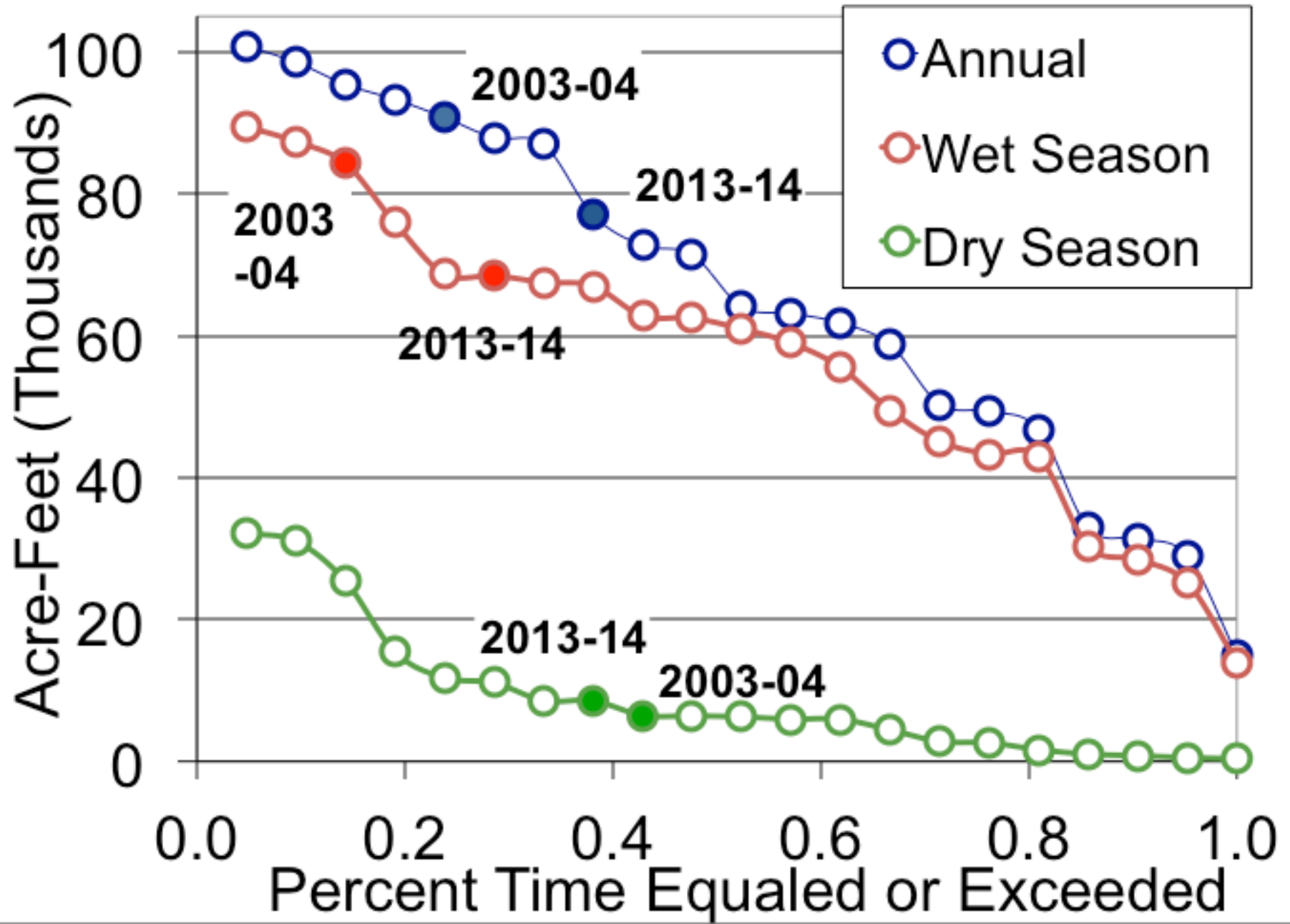
Annual Flow Rates For C-111 and TSB



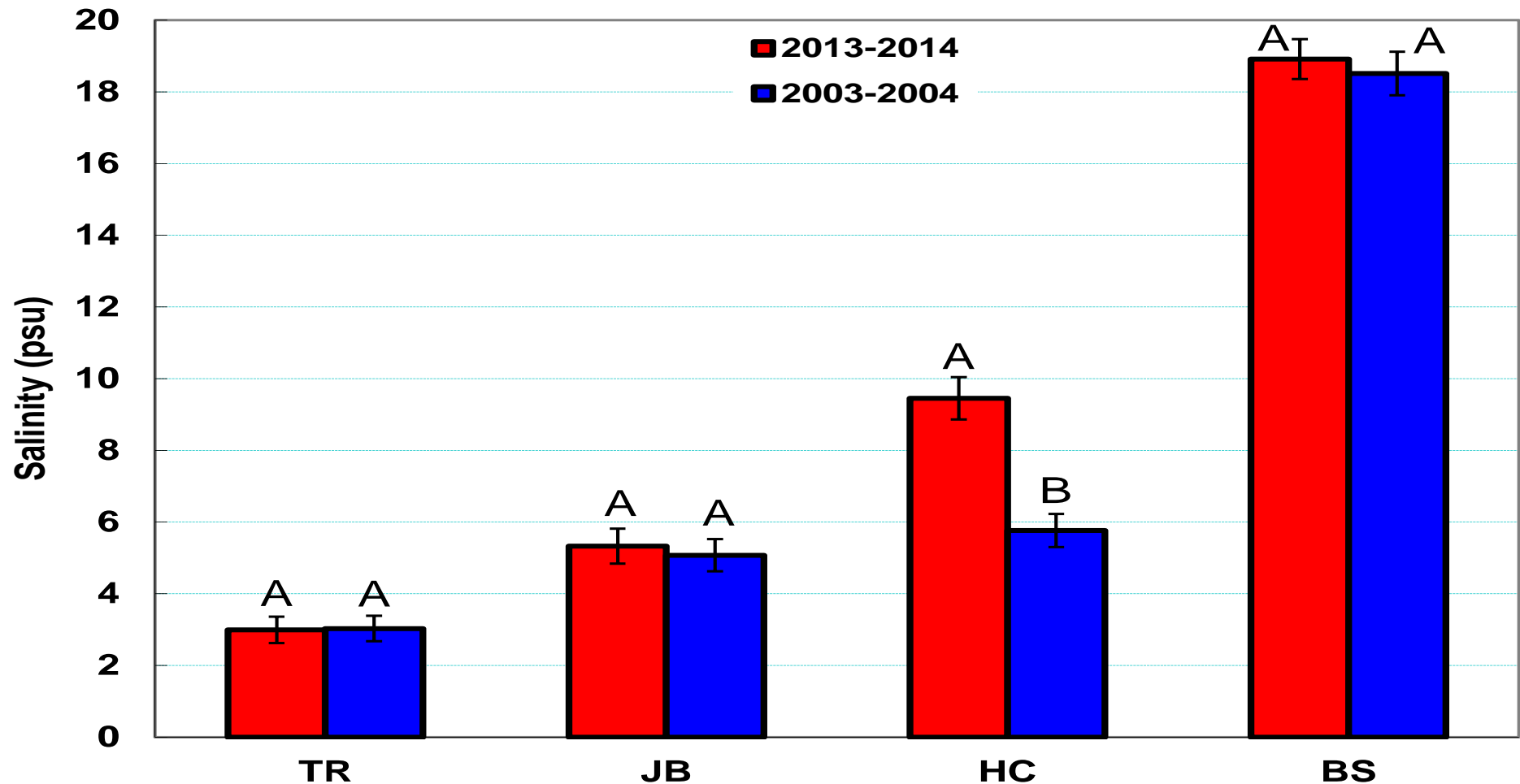
Ratio of Flow: C-111 to TSB



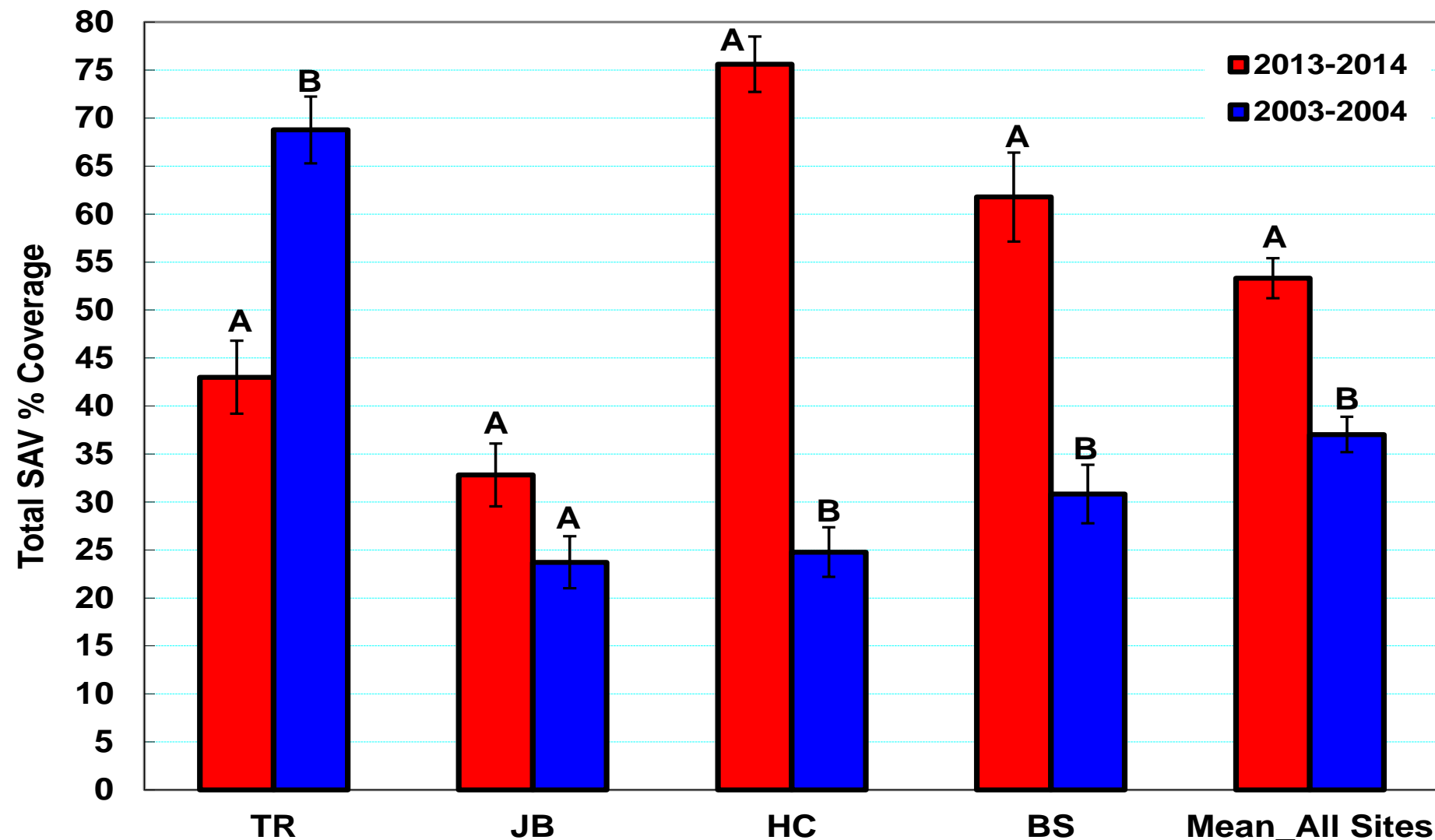
Taylor Slough Flows 2013-14 to 2003-04



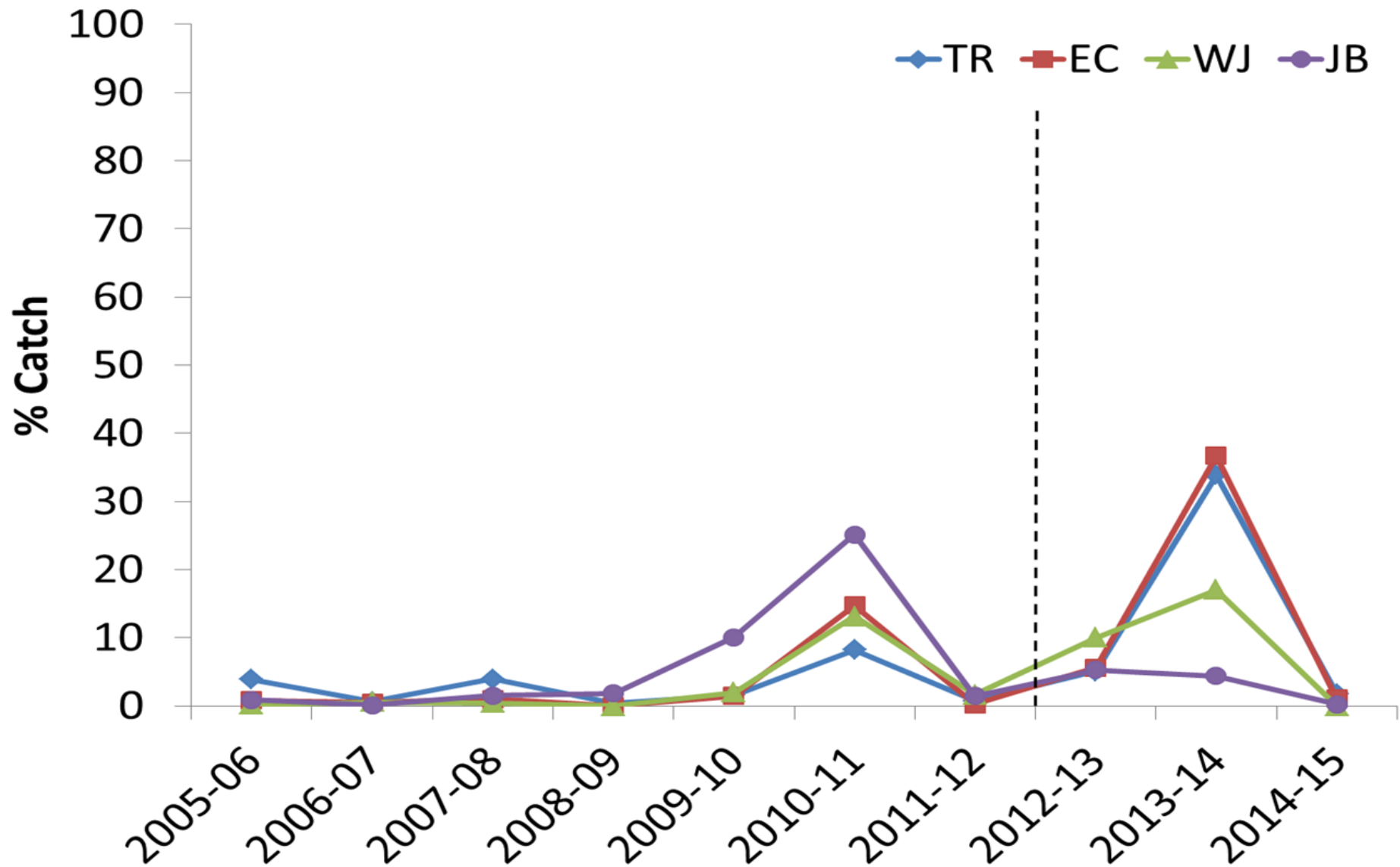
Salinity Comparison 2013-14 to 2003-04



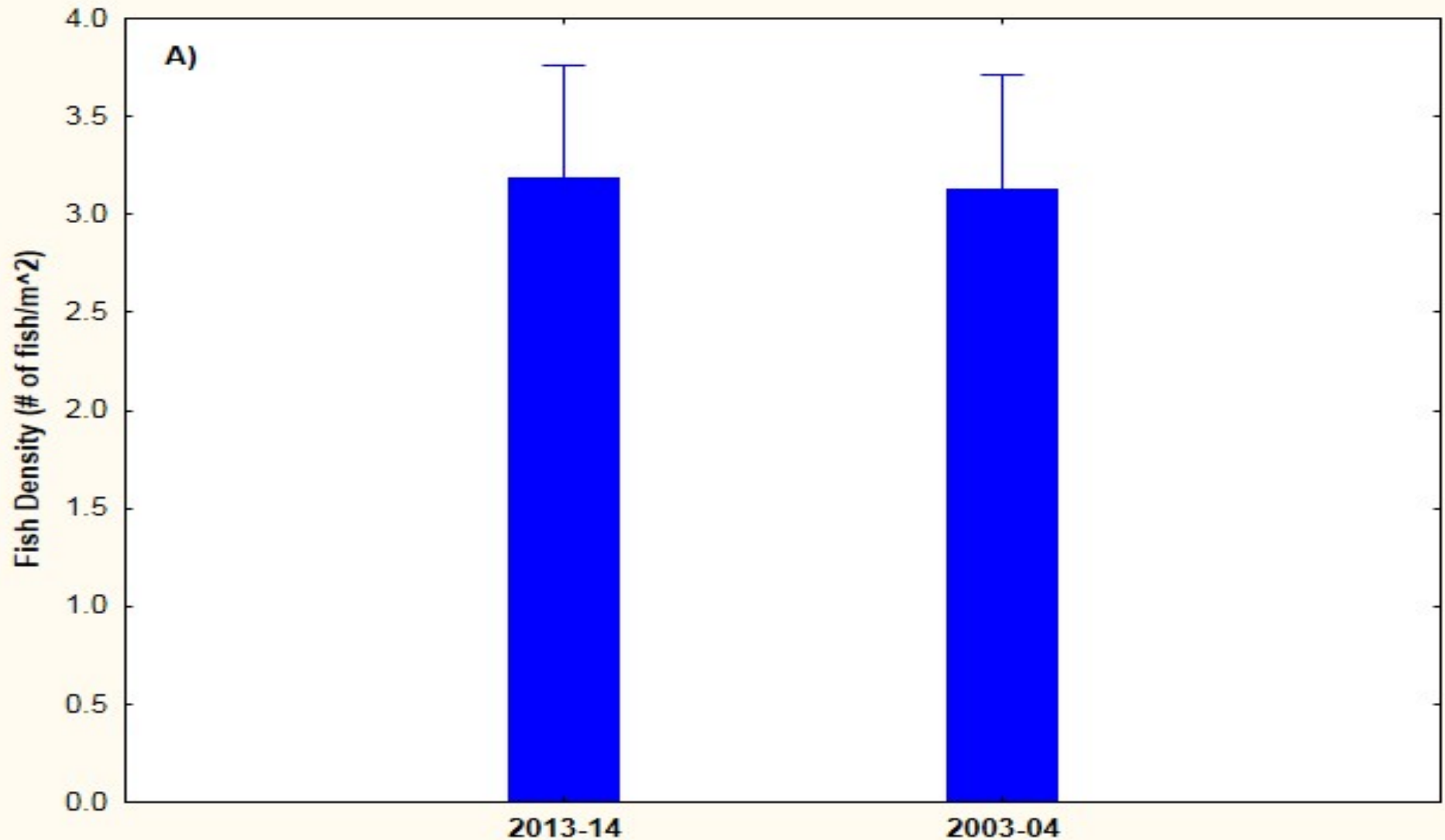
SAV Comparison 2013-14 to 2003-04



Percent Catch: Freshwater Fish Species

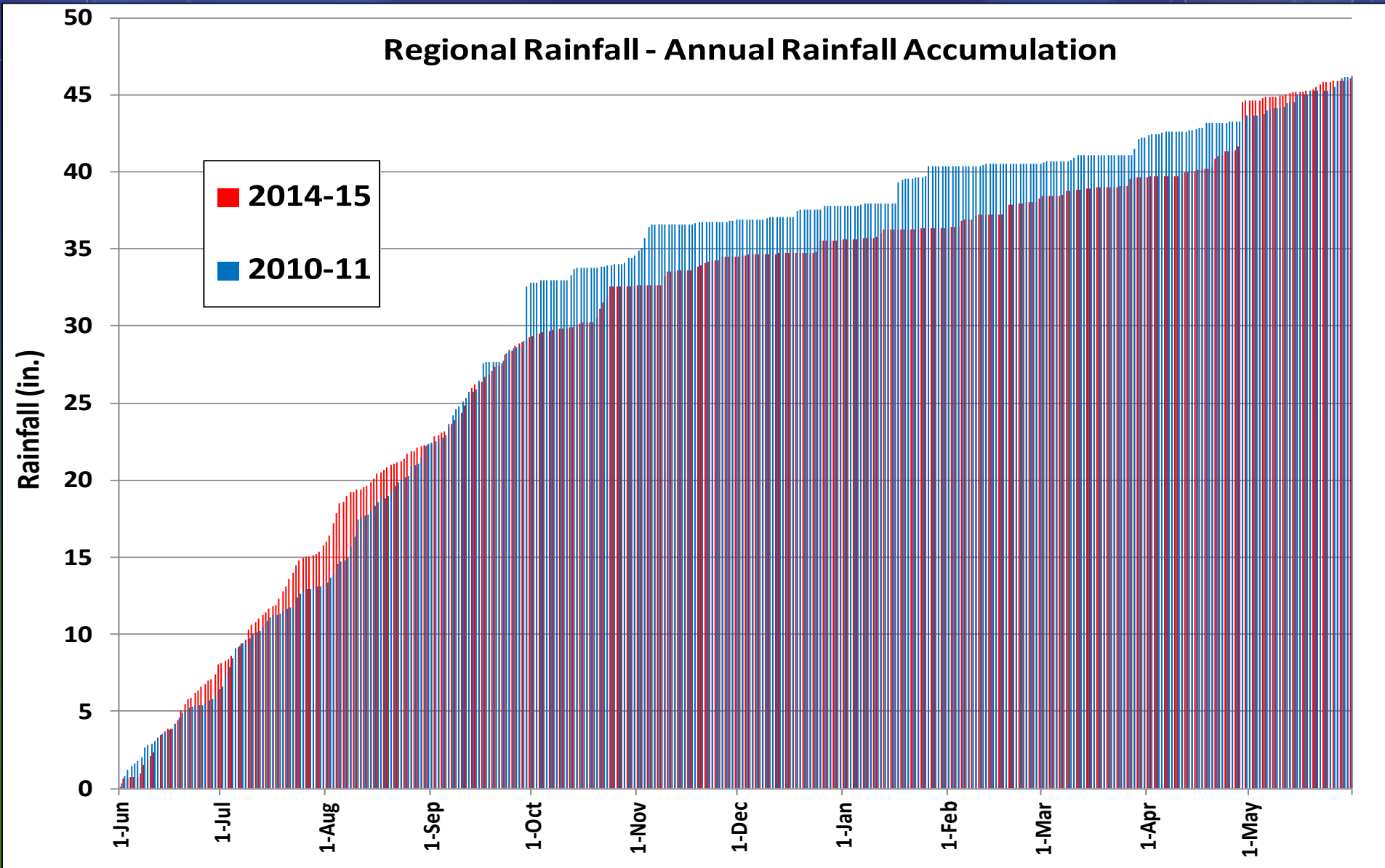


Prey Fish Density 2013-14 to 2003-04

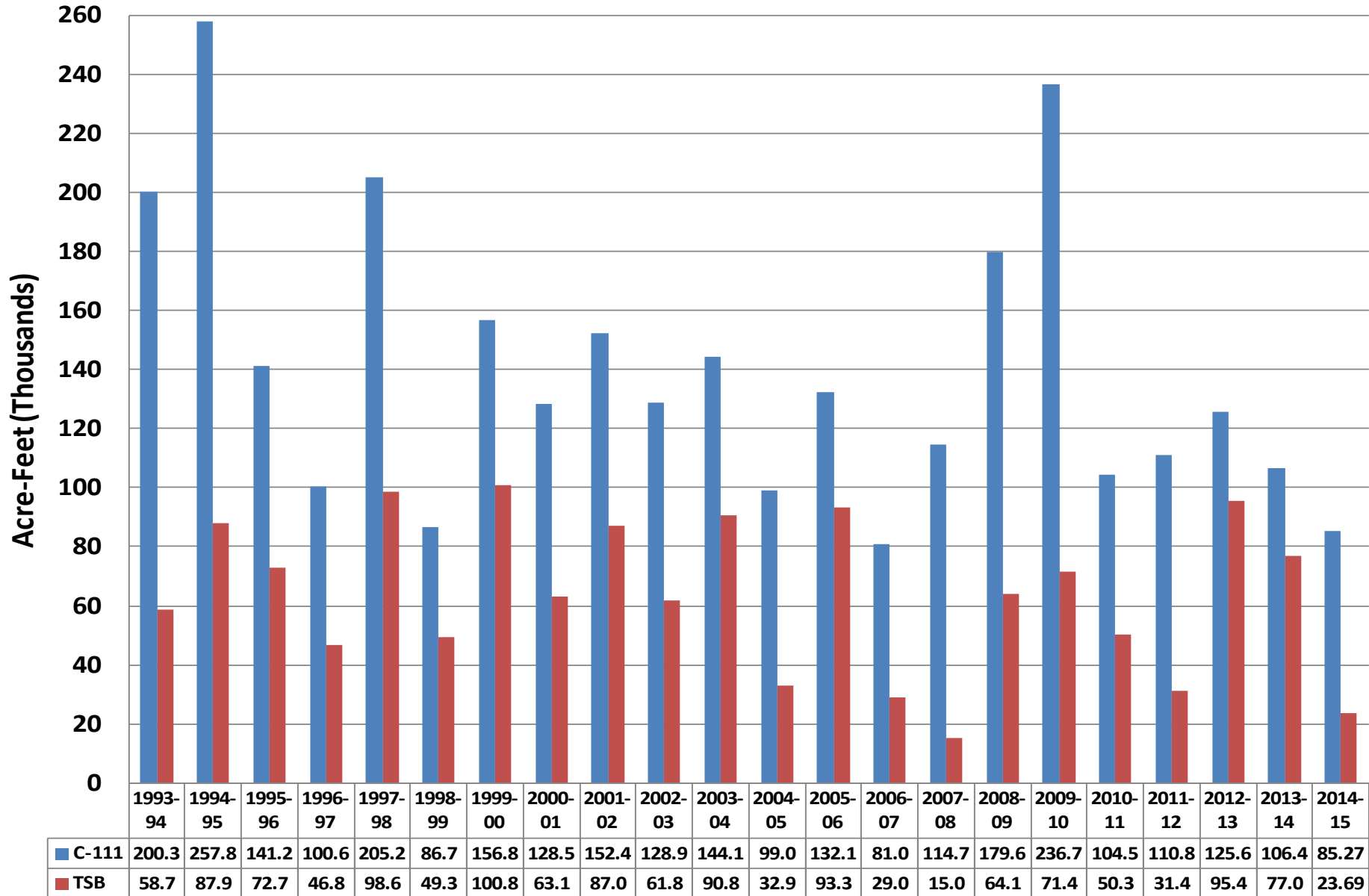


Year 3: 2014-15 Compared to 2010-11 Drought

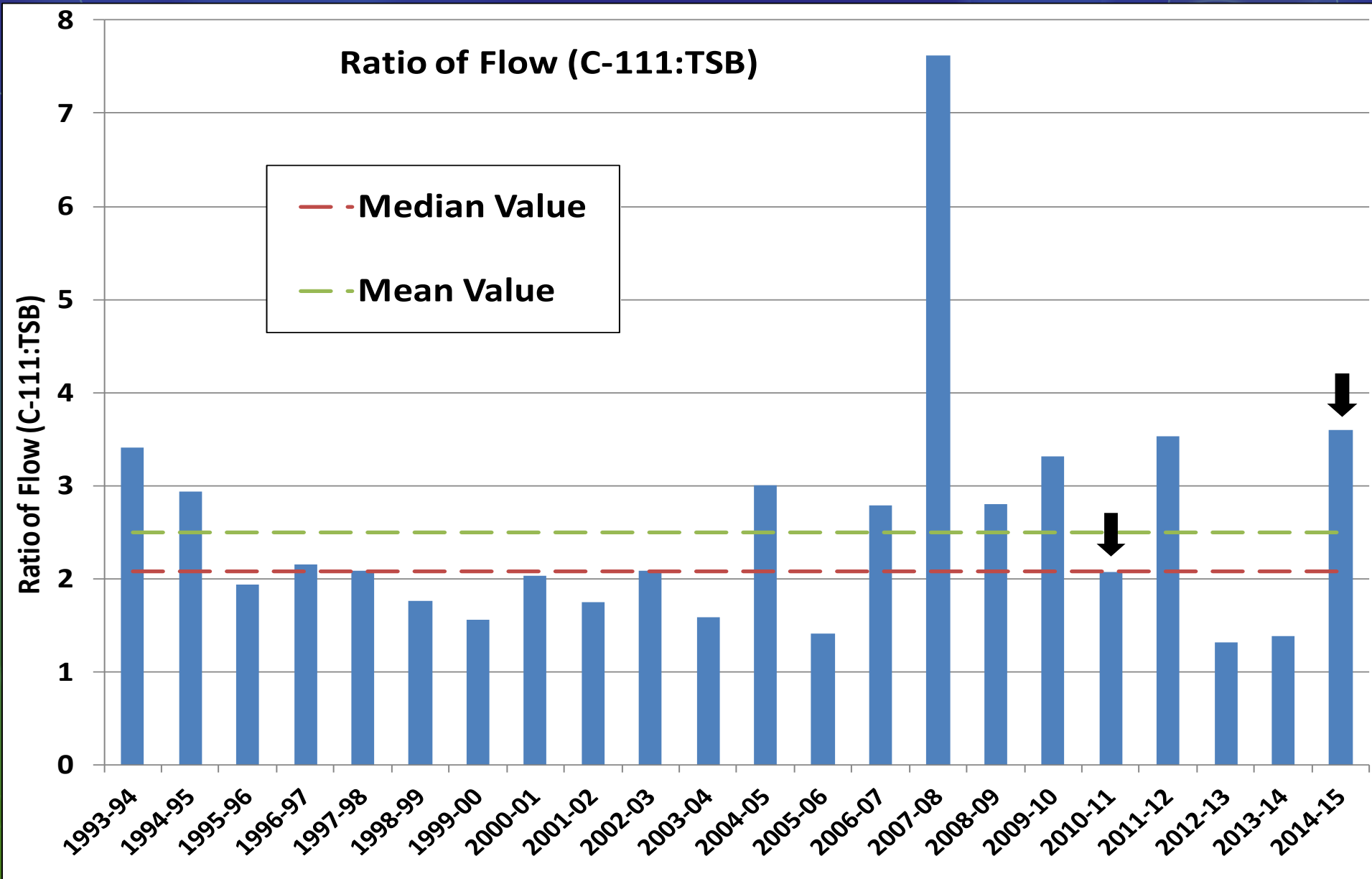
Comparison of 2014-15 to 2010-11 cumulative rainfall



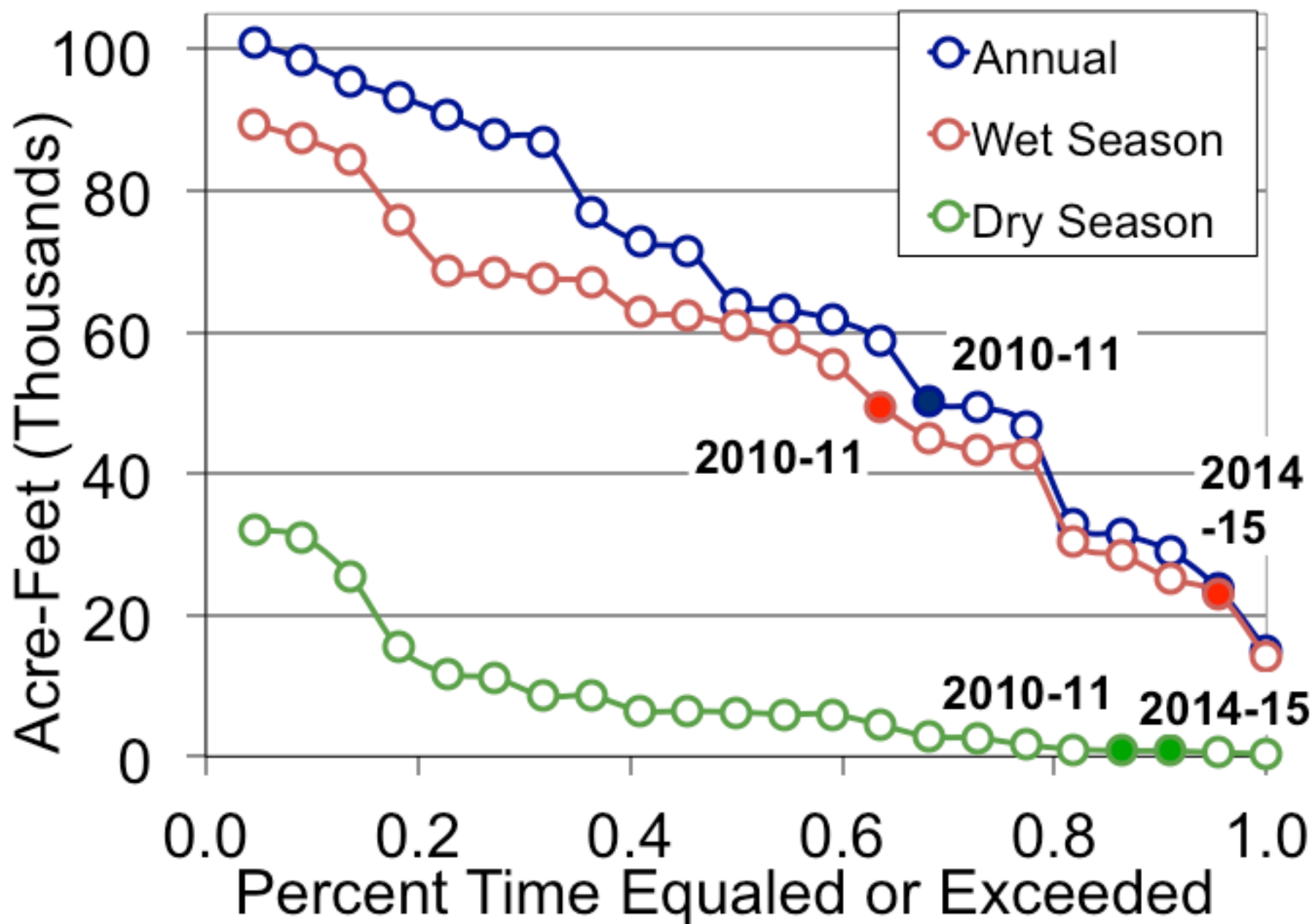
Annual Flow Rates For C-111 and TSB



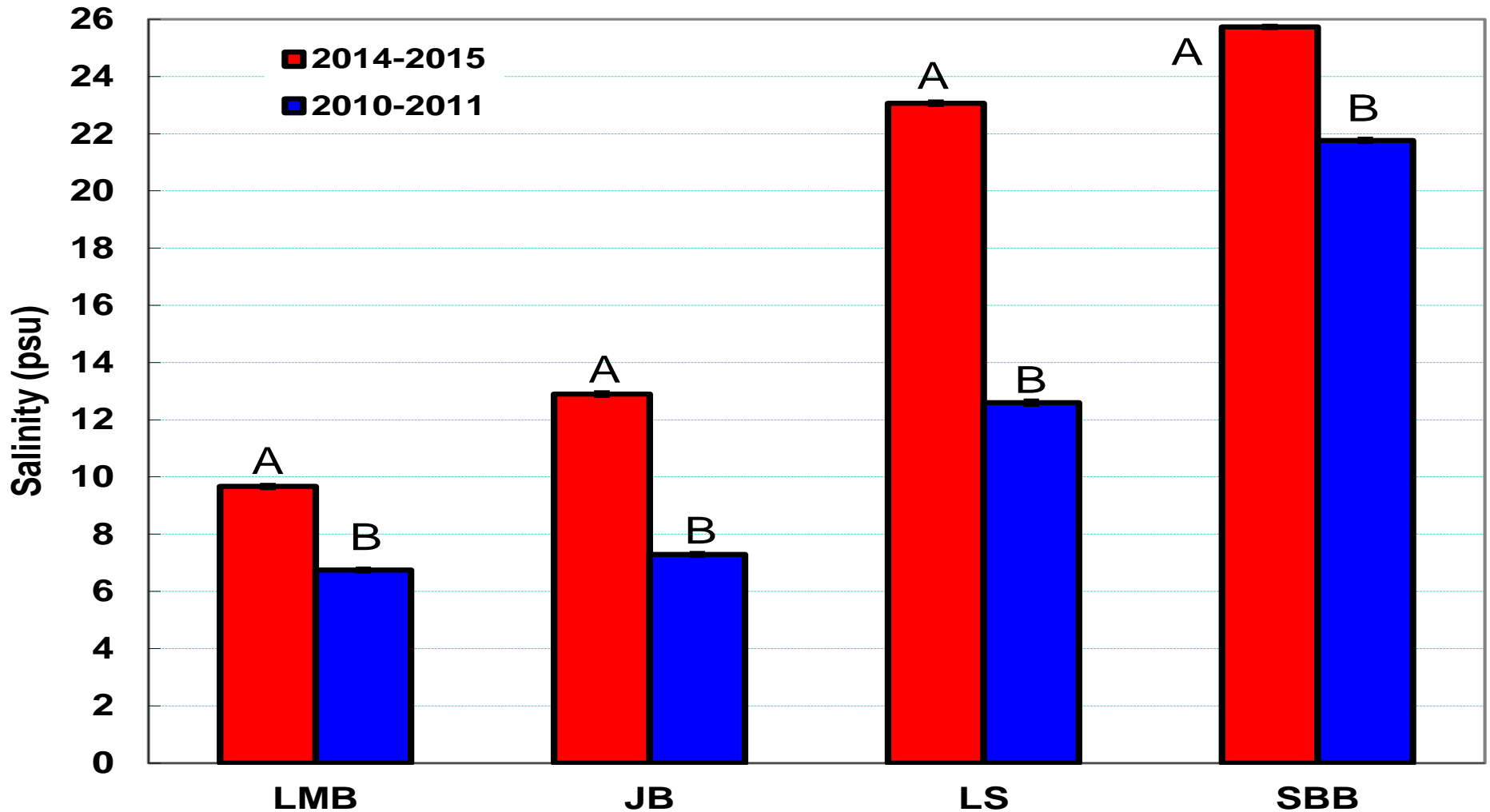
Ratio of Flow: C-111 to TSB



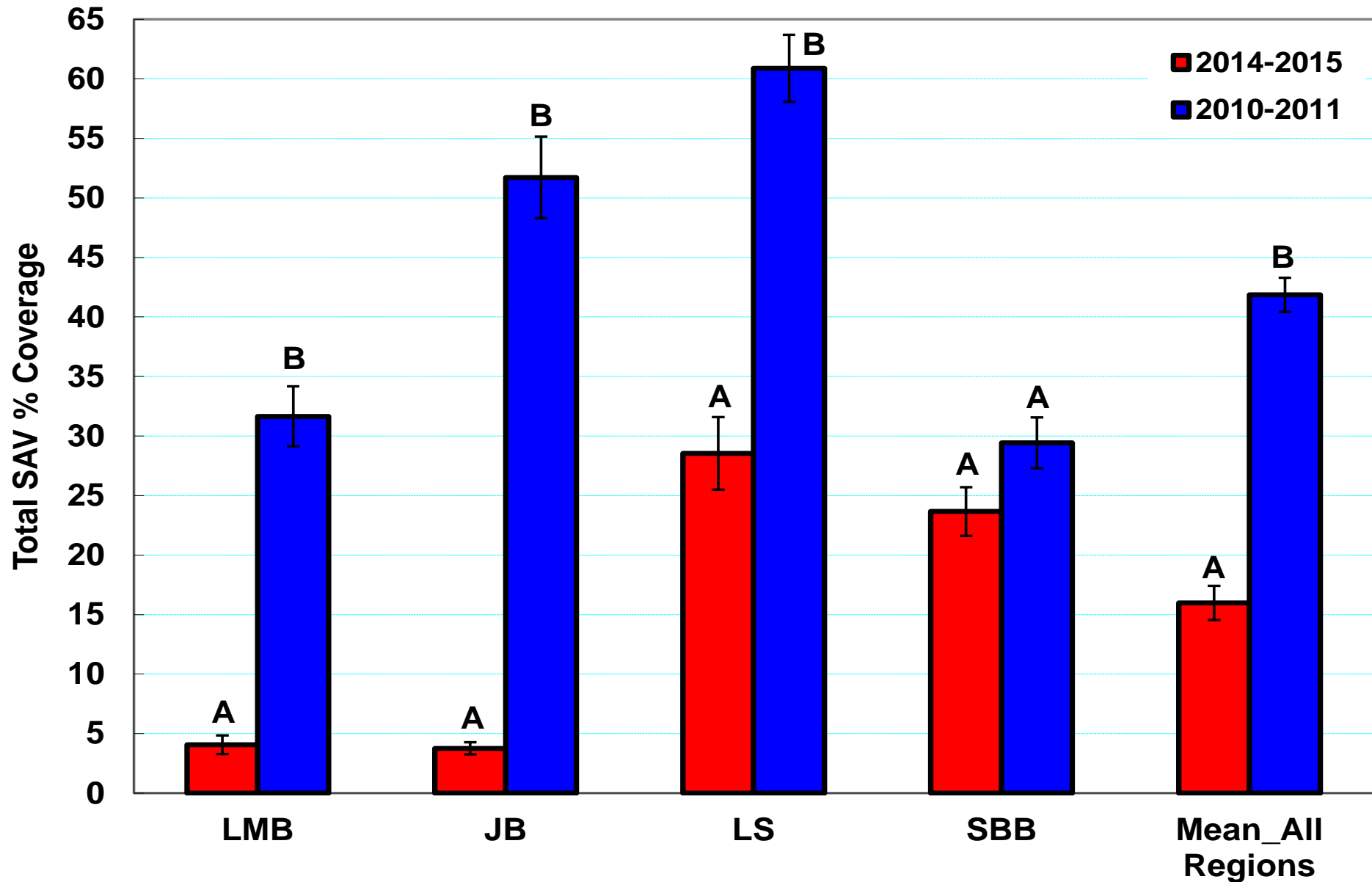
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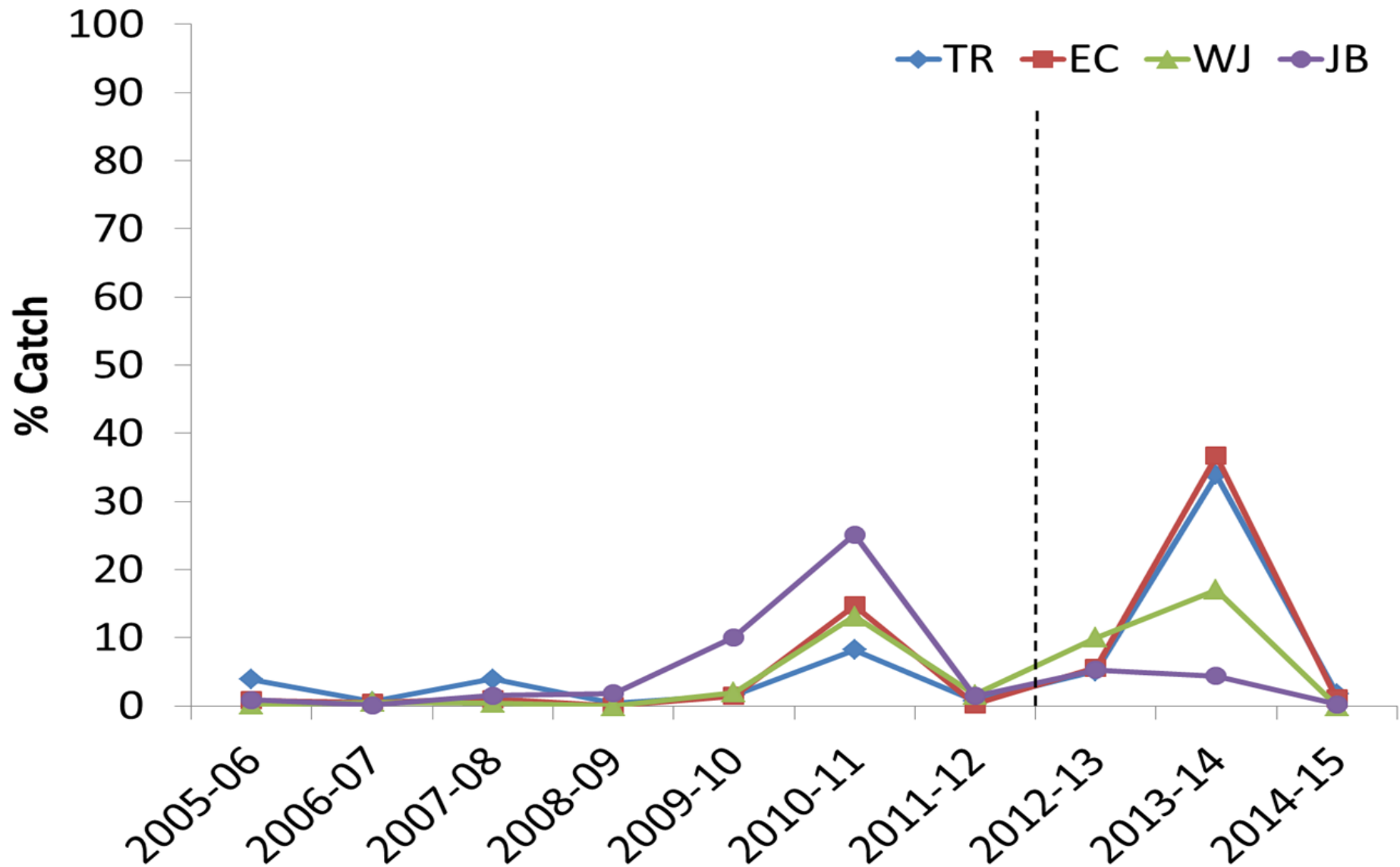
Salinity Comparison 2014-15 to 2010-11



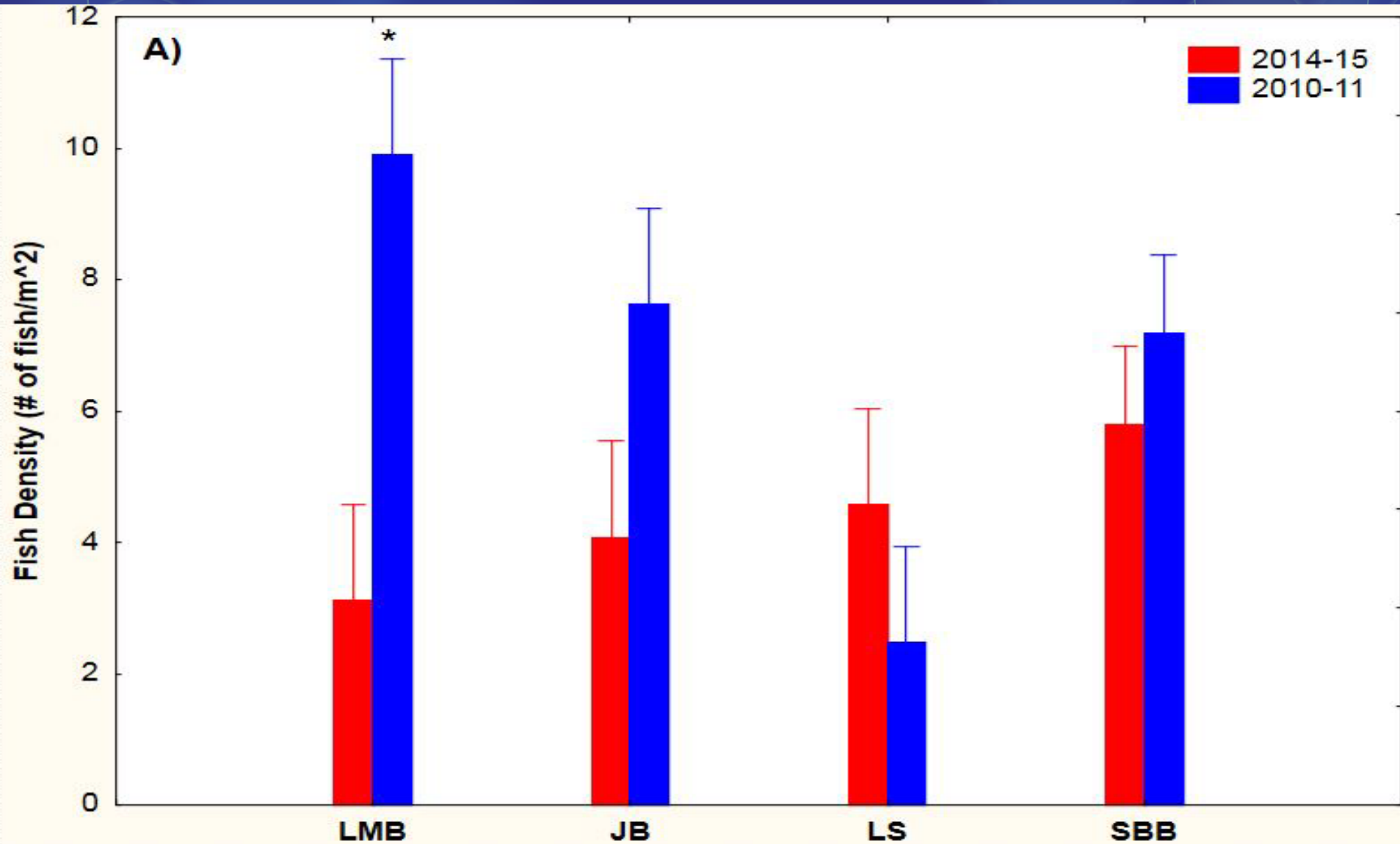
SAV Comparison 2014-15 to 2010-11



Percent Catch: Freshwater Fish Species



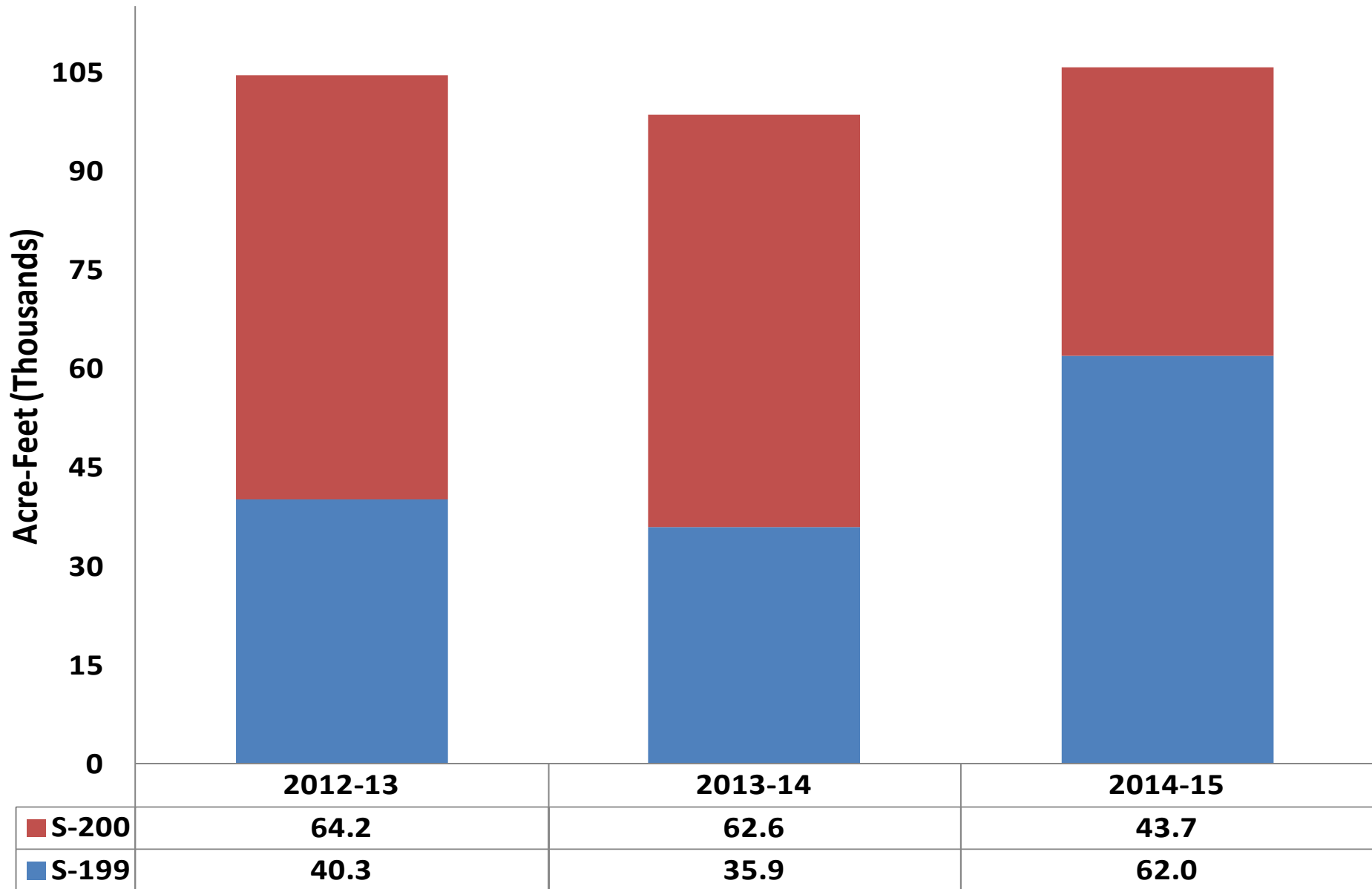
Prey Fish Density 2014-15 to 2010-11



Summary of Results

Year	Rainfall	Downstream Ecological Expectations
2012-13	Moderately High	Exceeded
2013-14	Moderately Low	Moderately Achieved
2014-15	Drought	Failed

C-111 SC Pump Activity

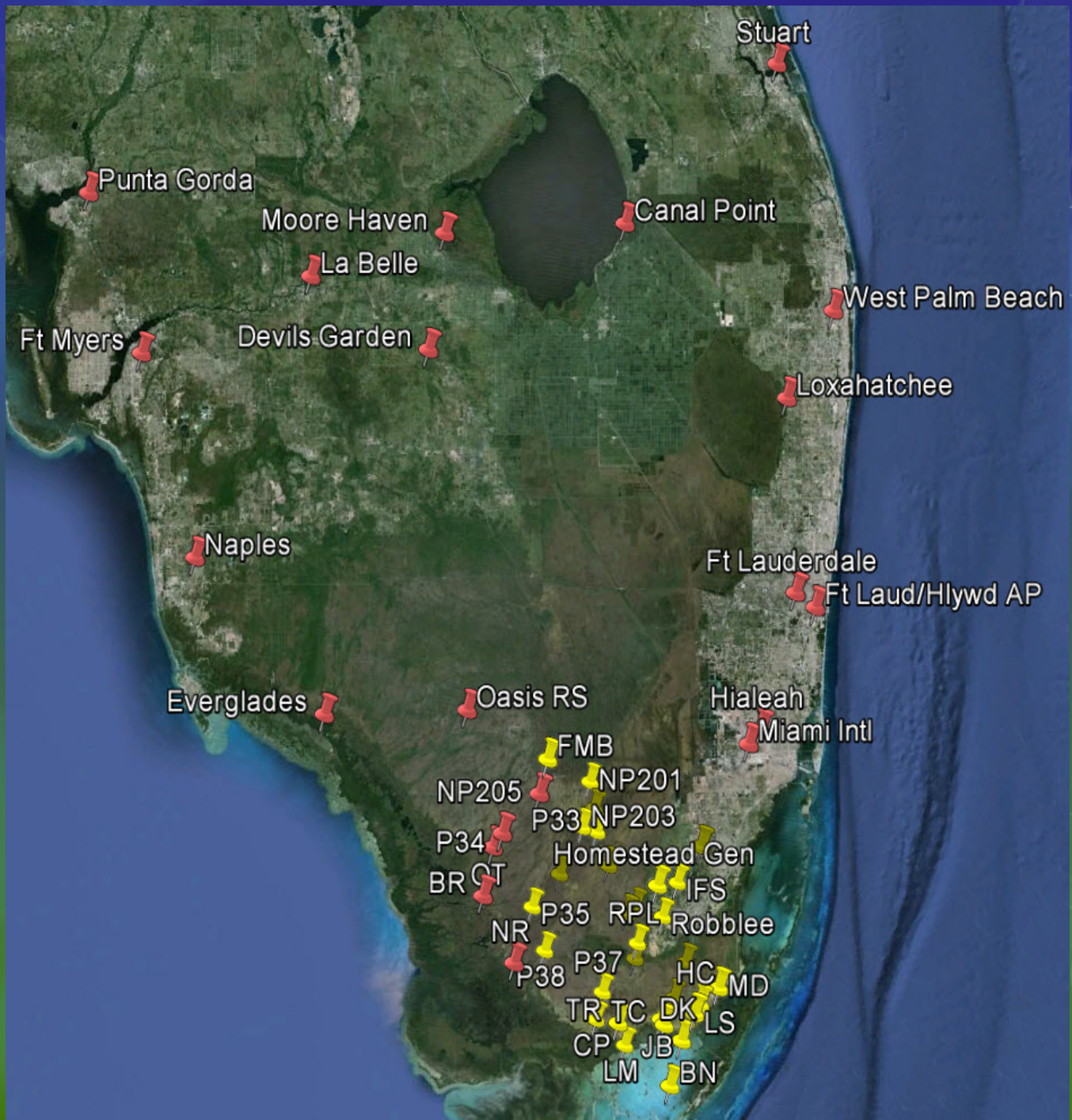


Frezza and Lorenz 2005

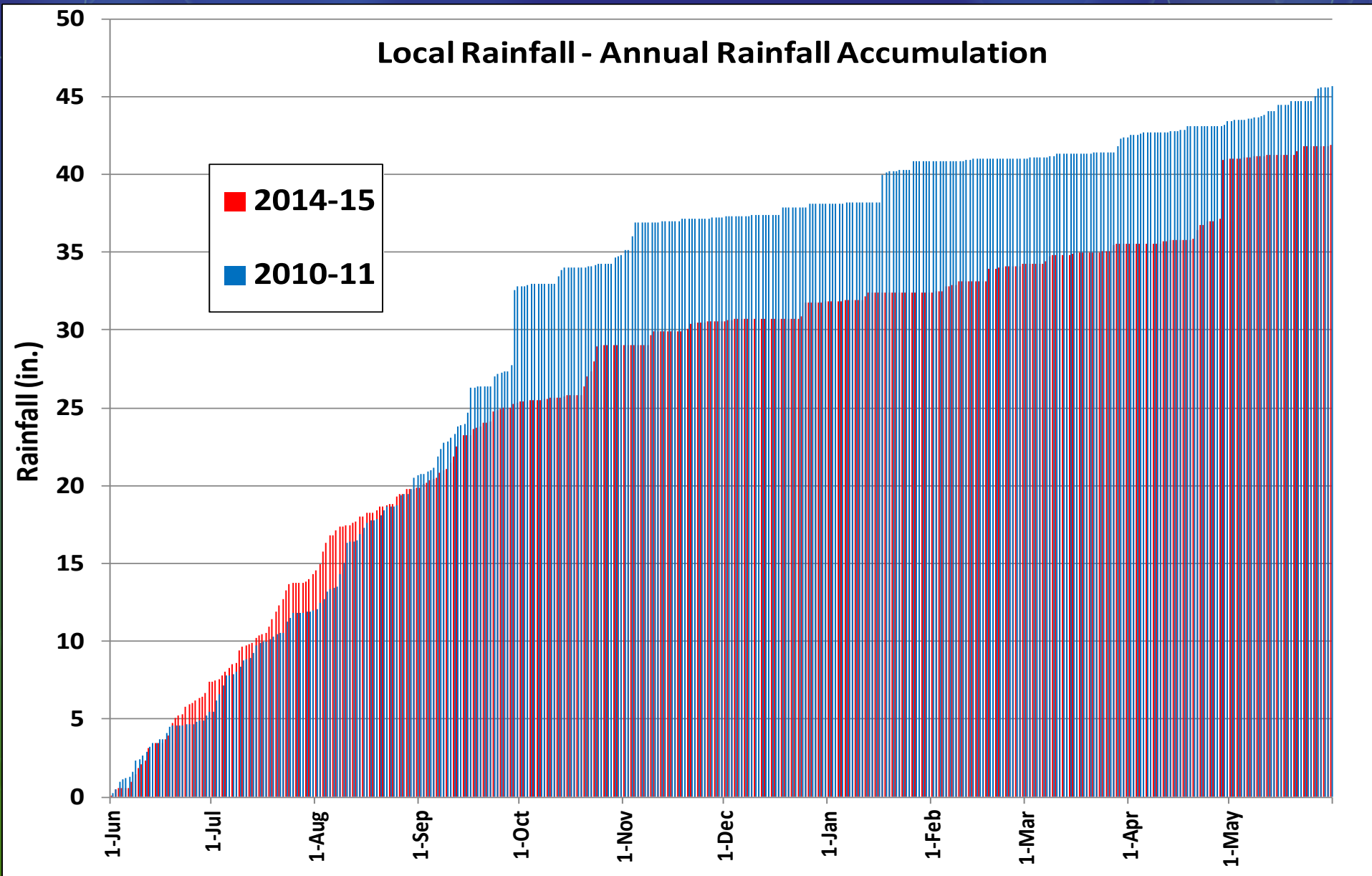
Florida Bay and Adjacent Marine Systems Science Conference Program

- **Greater Everglades had normal rainfall in 2004-05**
- **Very low rainfall in Taylor Slough/C-111 basins indicates that the basins are a rainfall driven system and do not receive adequate volumes of freshwater from upstream sources**
- **Under current water management practices, localized rainfall appears to be the primary determinant of salinity in the coastal mangrove zone of northeastern Florida Bay**

Hypersalinity Event in Northeastern Florida Bay 2004-05; What Caused it and its Implications for Everglades Restoration



Comparison of 2014-15 to 2010-11 local cumulative rainfall

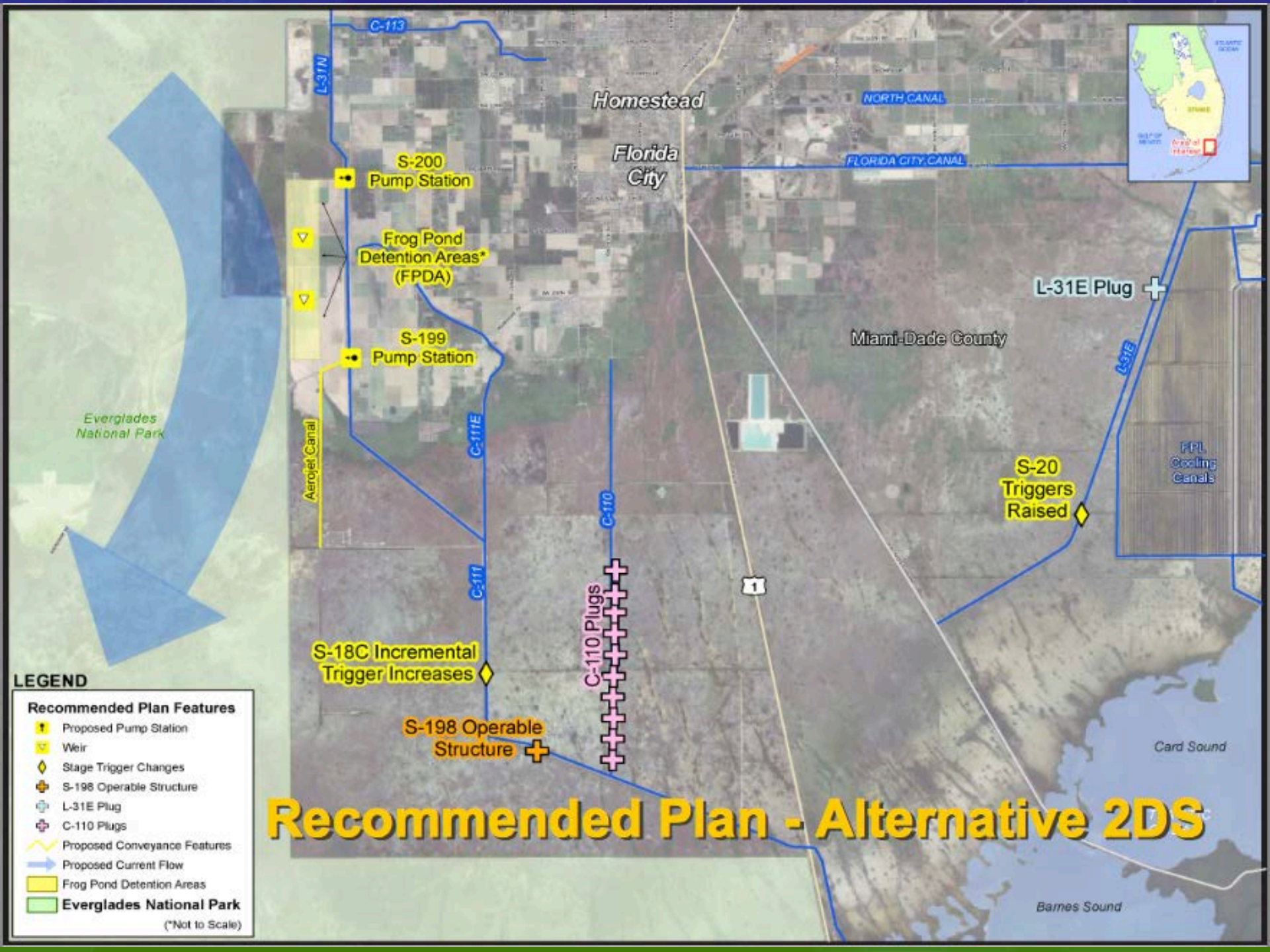


Conclusions

- The C-111 SPCW Performed to expectations all three years
 - Hydrologic Ridge Seepage Barrier kept the water that was in Taylor Slough from seeping into the C-111
- The hope that the project would provide additional water to Taylor Slough was not realized
- Taylor Slough remains a rainfall driven system with negligible flows from the rest of the Everglades.

Take Home

- The C-111 SCWP's function is to keep water in Taylor Slough. For this to provide any benefit, the Slough actually needs to have water in it
- Need CEPP, CERP to provide water from upstream for project to work in low rainfall years



Homestead

Florida City

FLORIDA CITY CANAL

NORTH CANAL

Miami-Dade County

L-31E Plug

FPL Cooling Canals

1

Card Sound

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Everglades National Park

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- Everglades National Park

(*Not to Scale)

Recommended Plan - Alternative 2DS

Questions?



Photo Compliments of Fenia Hiaasen