

A Half-Century of Crabs and Counting: New Analyses of the Chesapeake's Longest Scientific Blue Crab Survey

By: Amanda Bevans & Amber Staples



MORGANTM
PATUXENT ENVIRONMENTAL AND
AQUATIC RESEARCH LABORATORY

The Blue Crab:

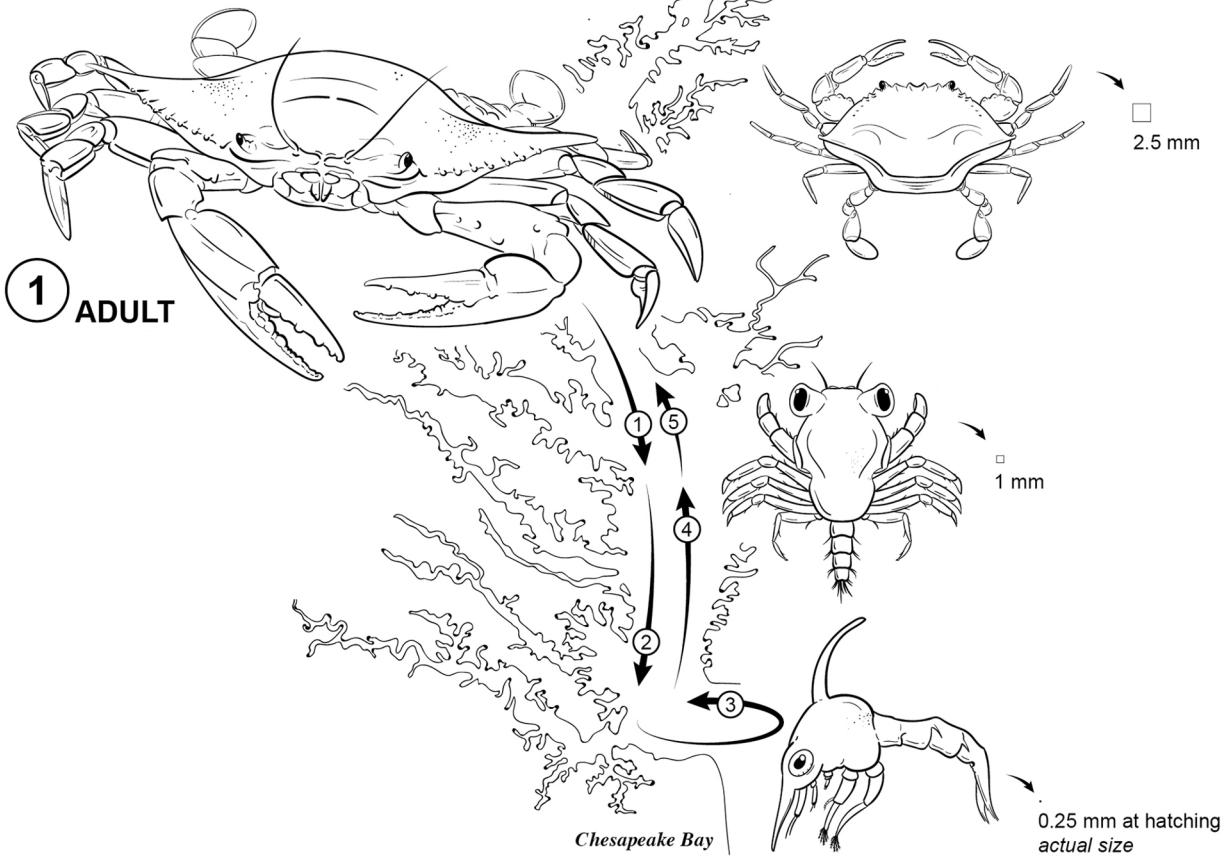
Callinectes sapidus

- **Swimming Crab:**
 - Native to Western Atlantic
 - Tropic to temperate distribution
- **Important Role in Estuarine Systems:**
 - Scavenger and predator of the benthos
 - Utilize all of the Bay's habitats
- **Growth and Reproduction:**
 - Molt to Grow
 - Mate and Spawn from Spring to Fall

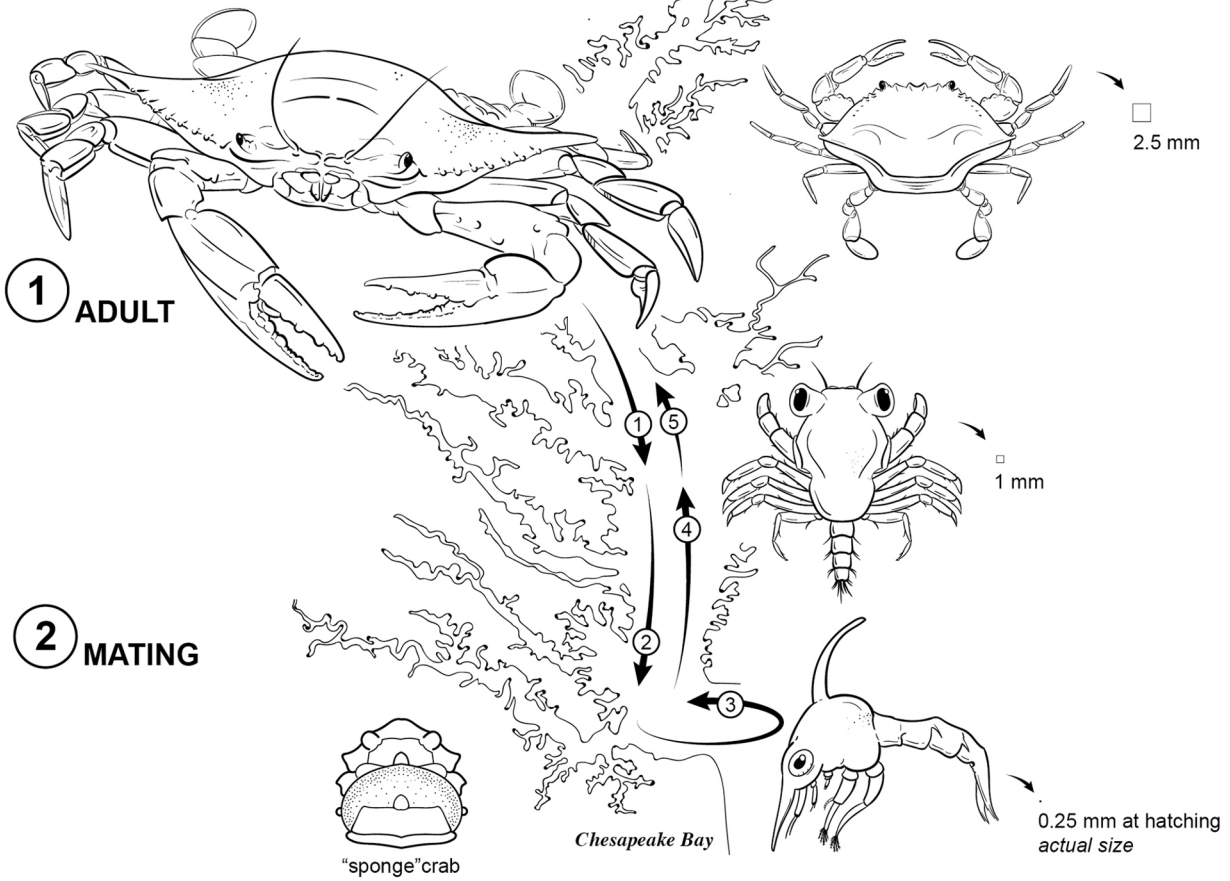


Source: [NOAA](#) and [Stock Assessment of the Blue Crab \(2011\)](#)

Life Cycle of the *Callinectes sapidus* The Blue Crab

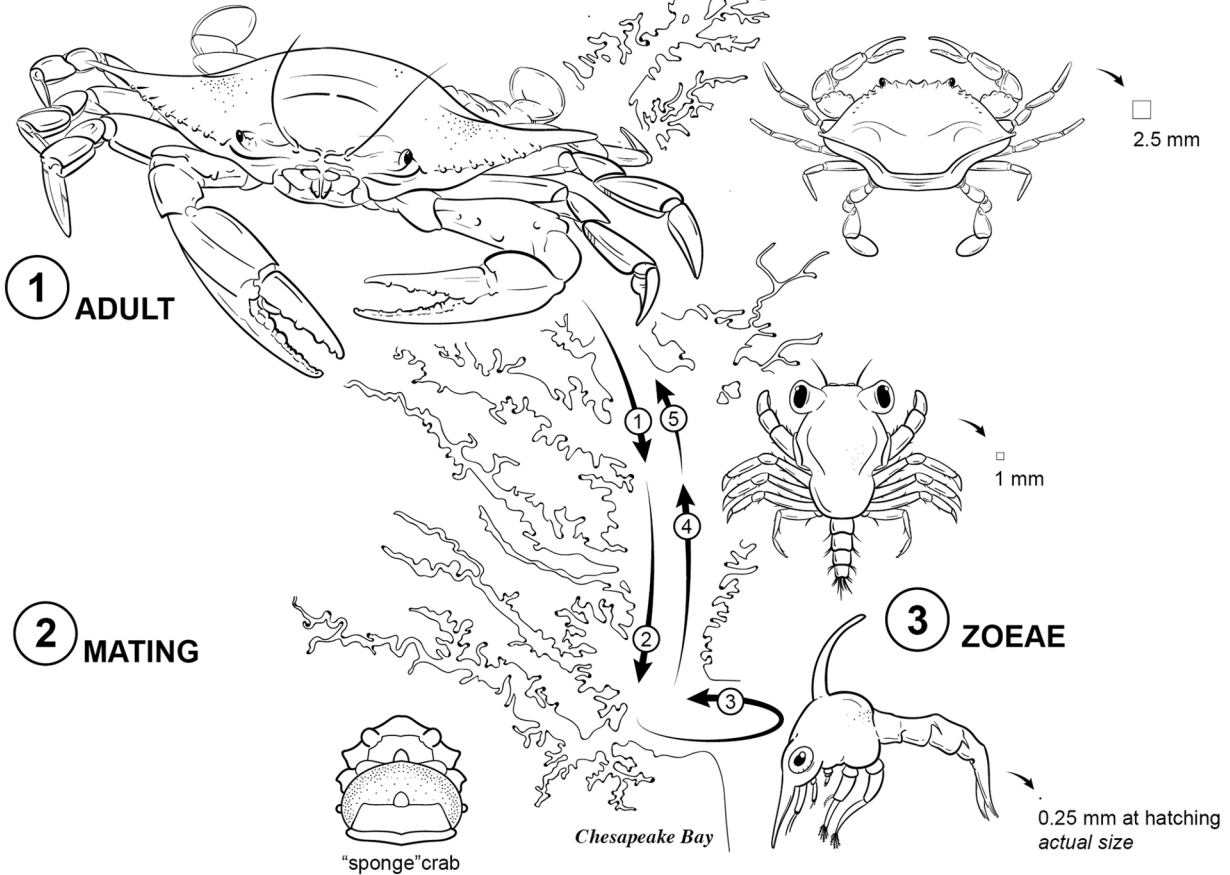


Life Cycle of the *Callinectes sapidus* The Blue Crab

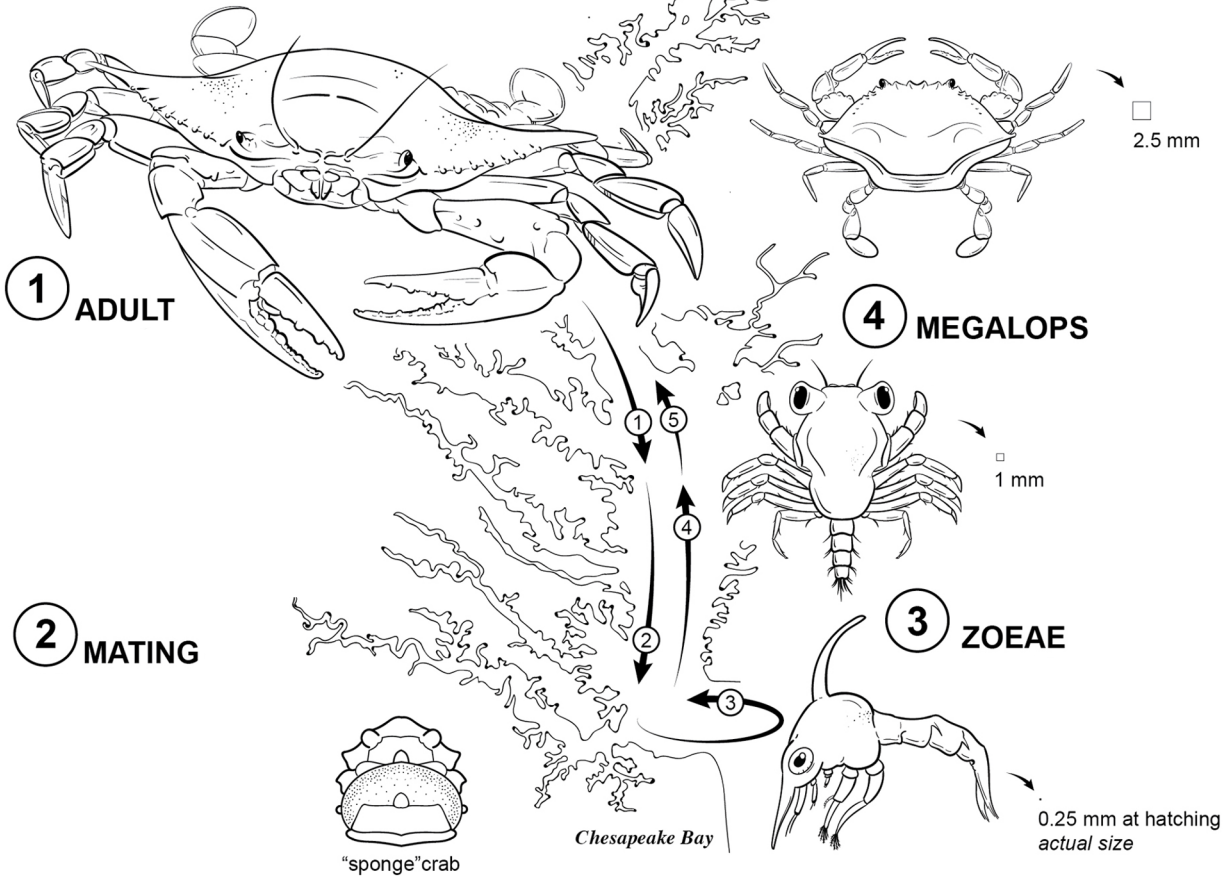


<https://www.behance.net/gallery/52087637/Blue-Crab-Life-Cycle>

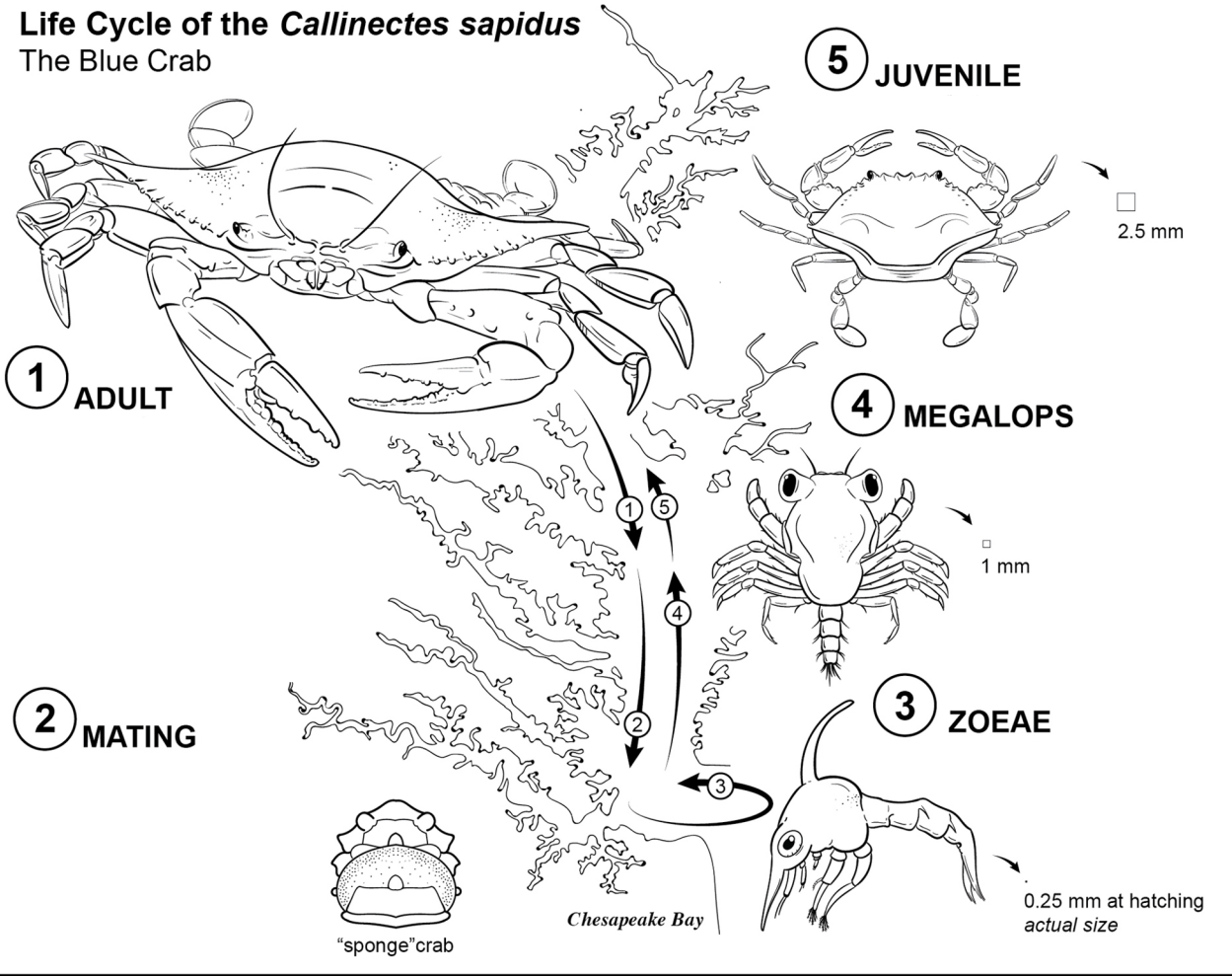
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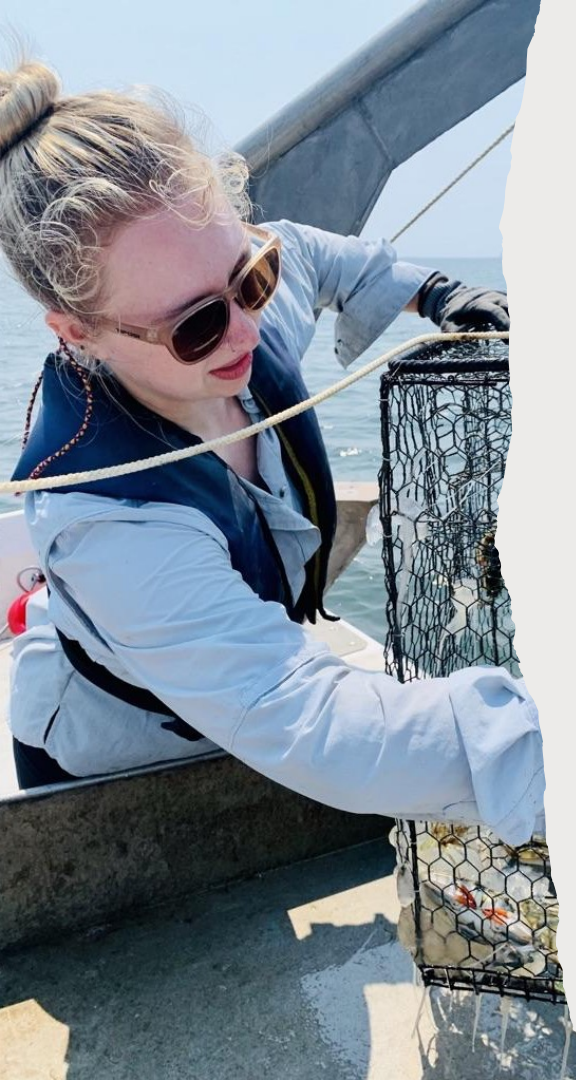


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Life Cycle of the *Callinectes sapidus* The Blue Crab





Morgan PEARL's Blue Crab Survey

- George Abbe began PEARL's Blue Crab Survey in 1967.
- Calvert Cliffs Nuclear Power Plant effect on blue crabs.

Over 50 years later...

- The longest scientific blue crab population study in the Chesapeake Bay (currently lead by Dr. Tom Ihde).





Figure from [GISGeography](#)

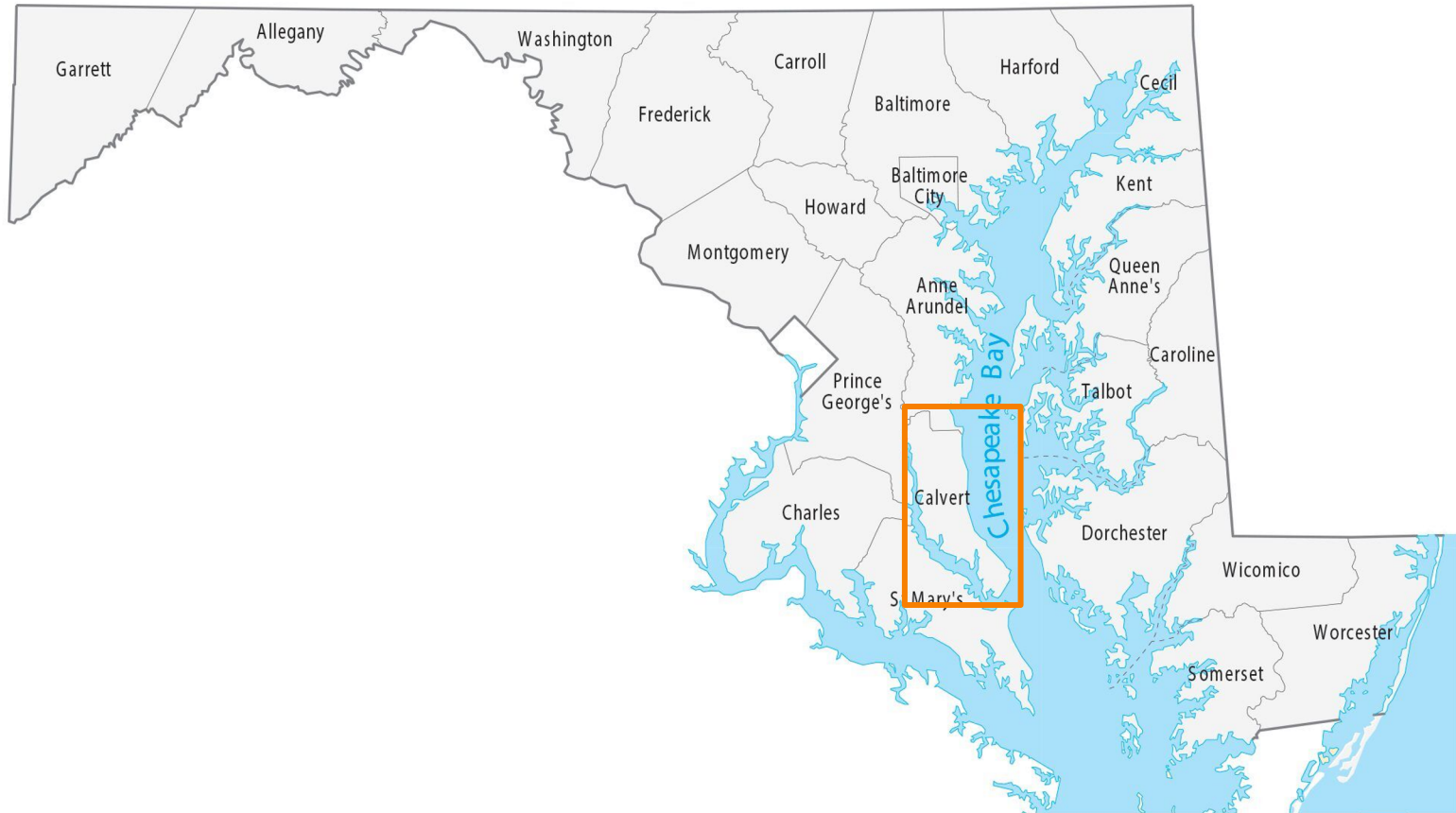
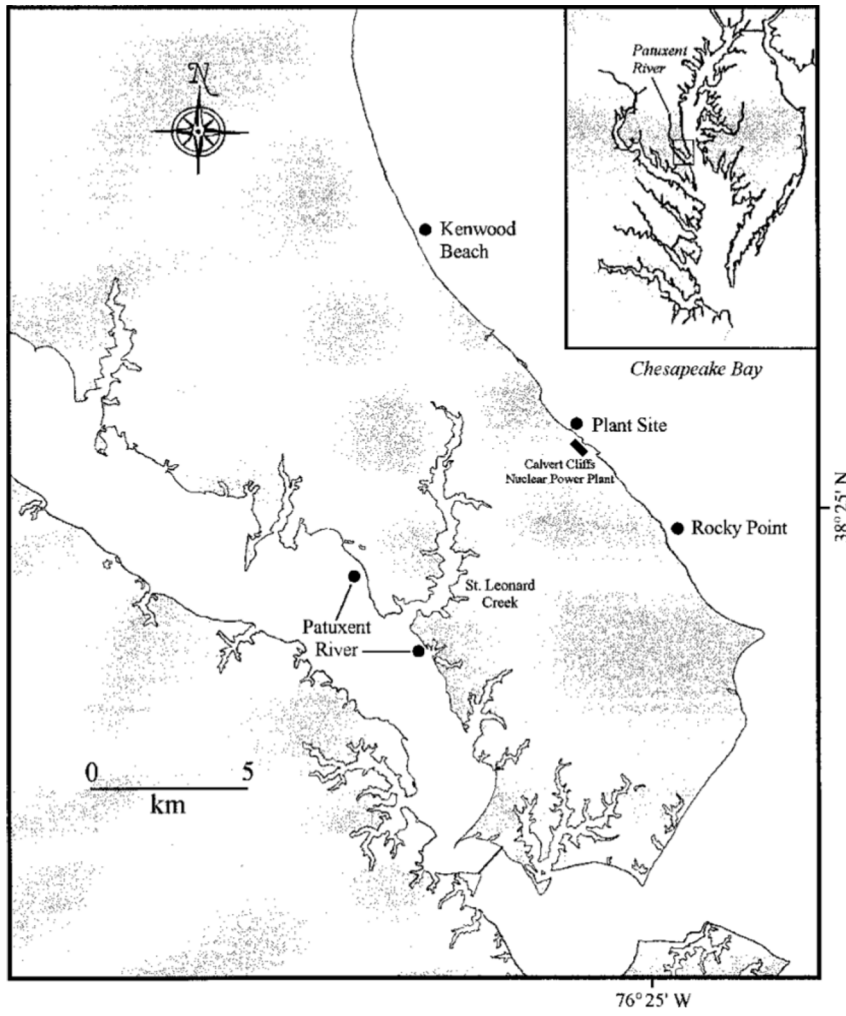


Figure from [GISGeography](#)



From Abbe, 2002

The Blue Crab Fishery & Landings in the Bay

The Value of Crustaceans:

- Highest valued commercial fishery in the Bay
- Chesapeake Bay represents ~34-42% of national Blue Crab landings and has historically represented up to 80%

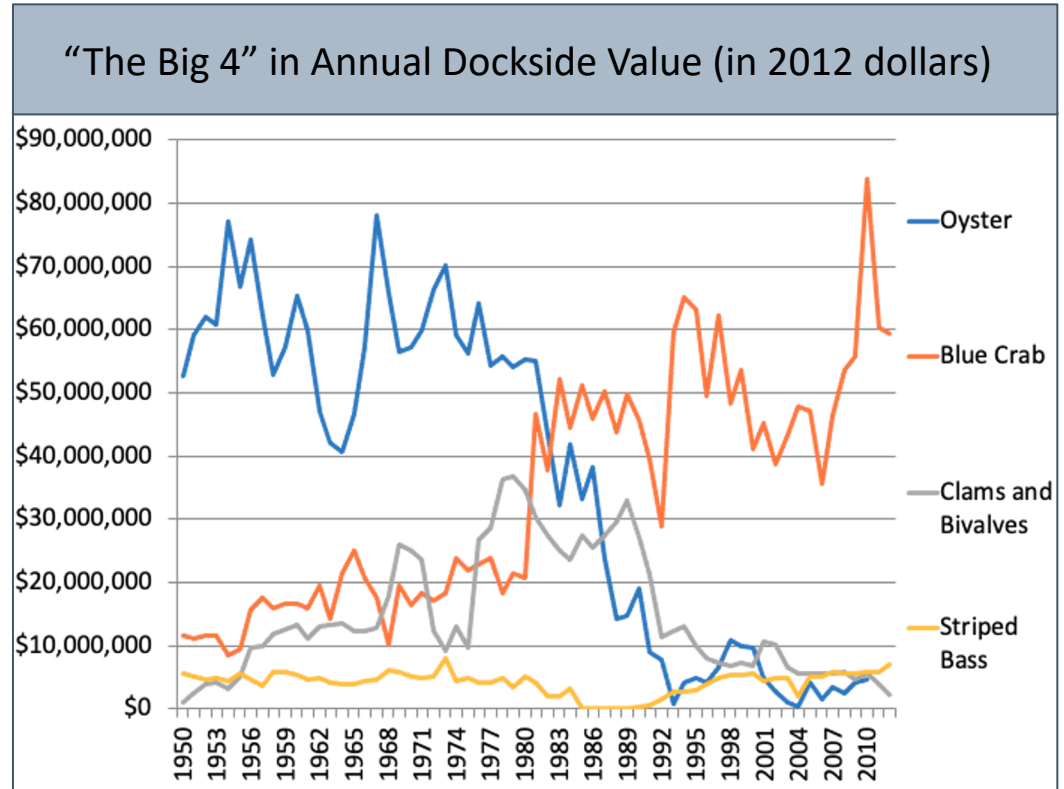
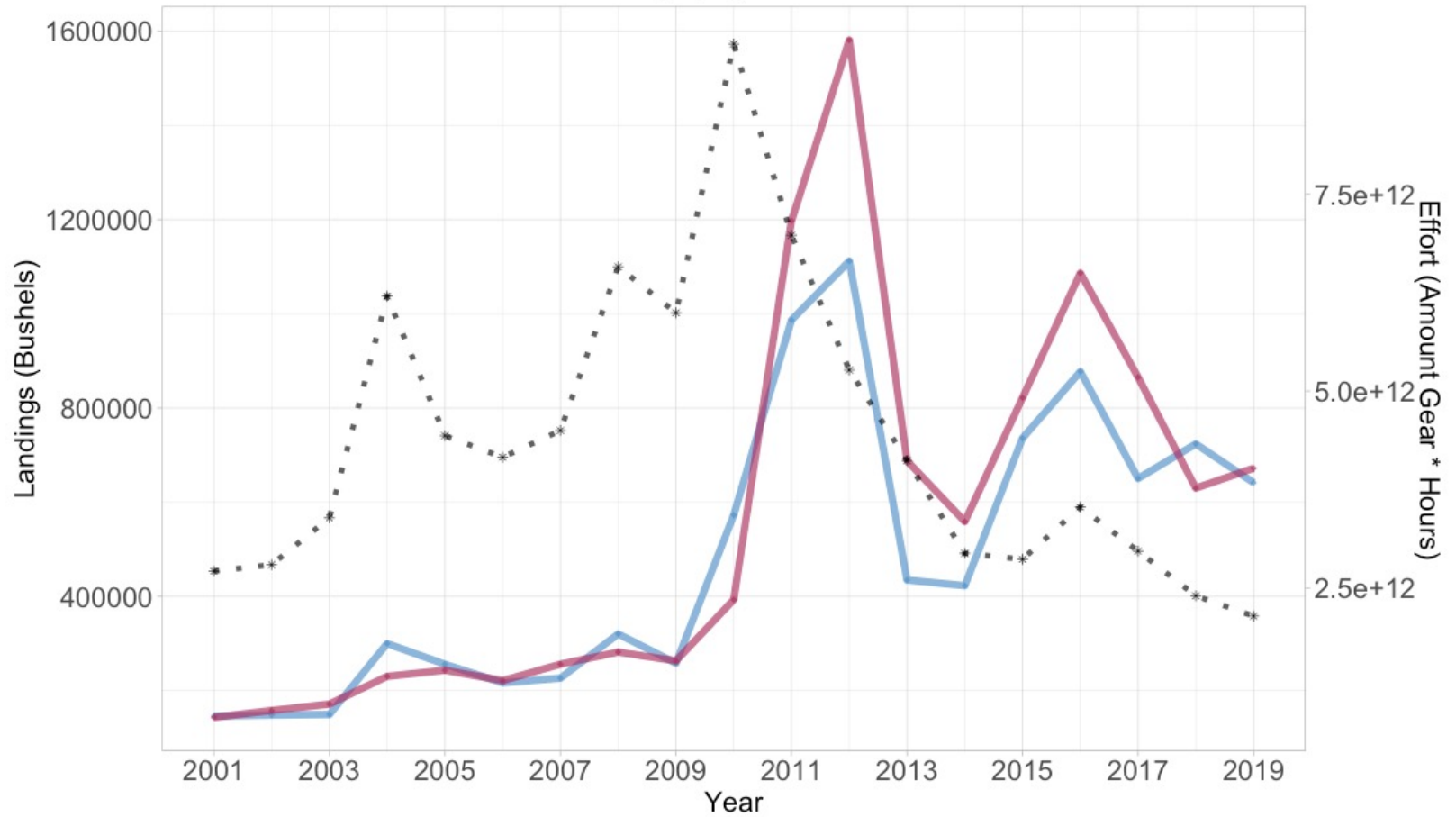


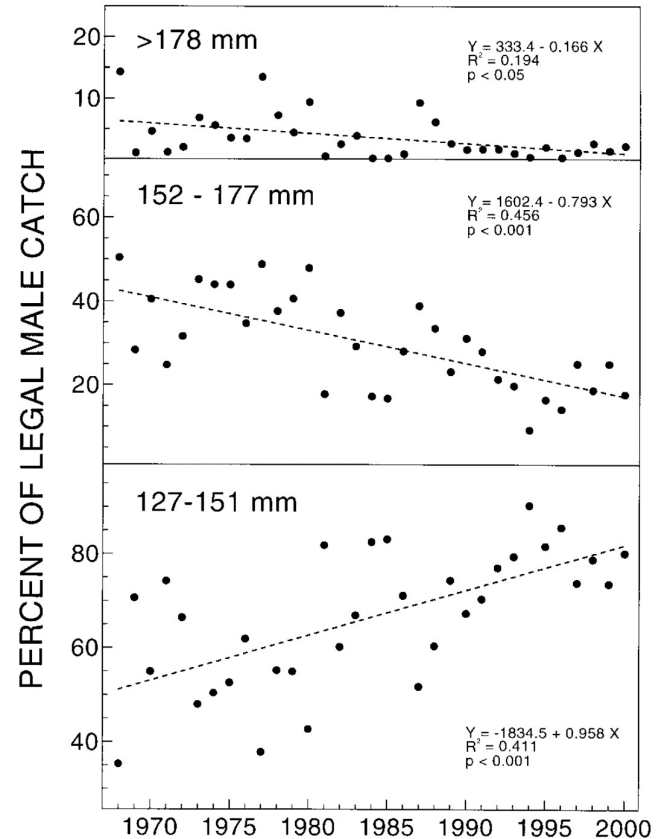
Figure: Kaitlynn Ritchie and Scott Knoche

Annual Commercial Landings (bu) and Effort Over Time BAYWIDE



George Abbe & Changing Blue Crab Status

- “Decline in Size of Male Blue Crabs from 1968-2000 near Calvert Cliffs, Maryland”
- Warning Signal
- Blue Crab Crash: In 2008, NOAA recognized the crash of the blue crab population



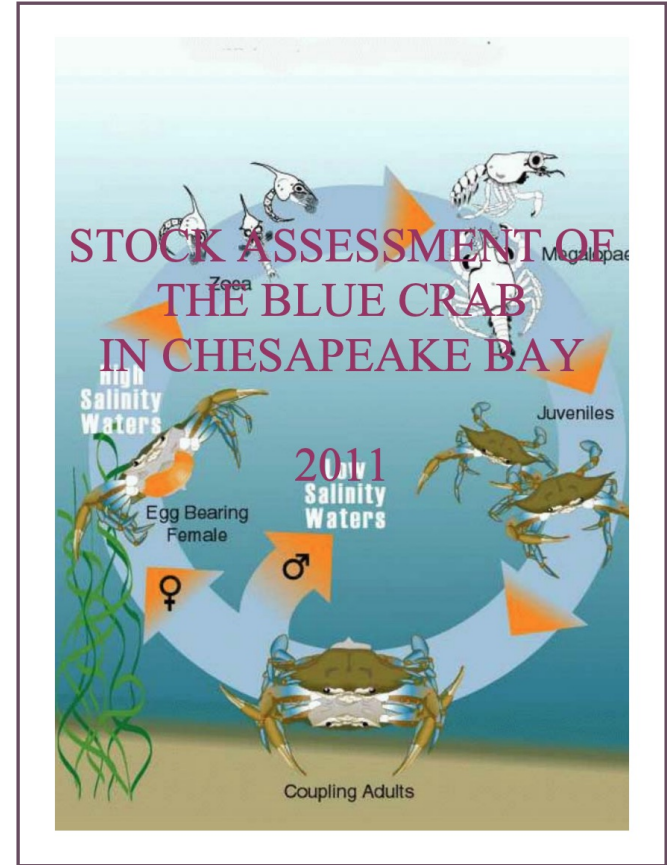
Surveys and Management

Changes in Management:

- 2011 - Winter Dredge Survey (WDS)

PEARL's Blue Crab Survey:

- Compliments WDS

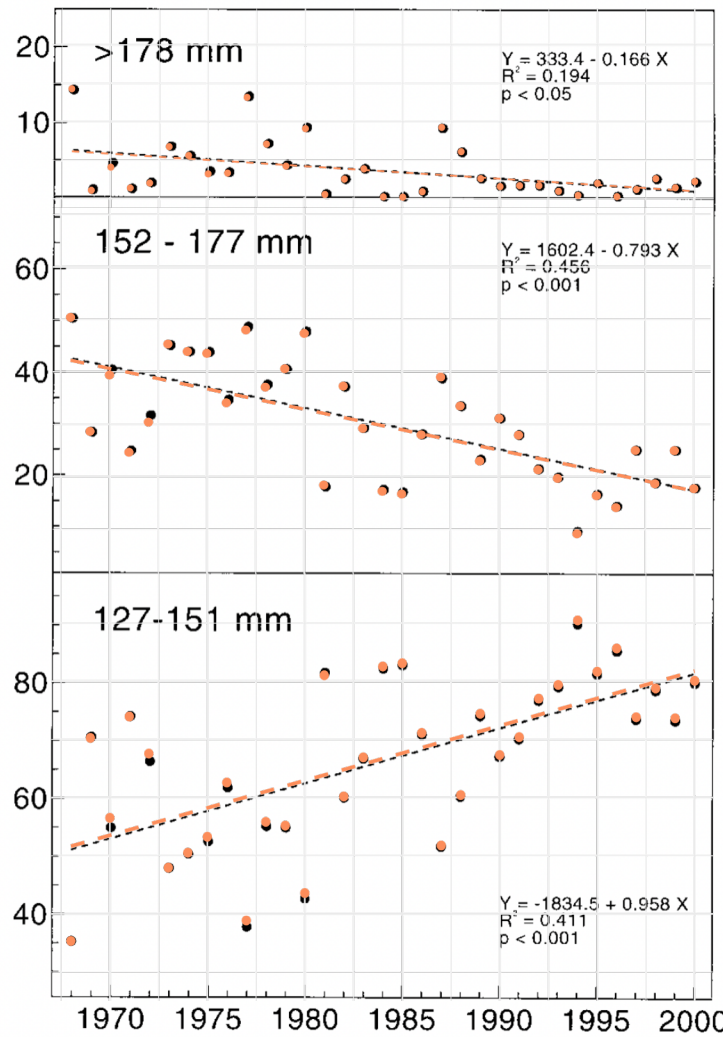


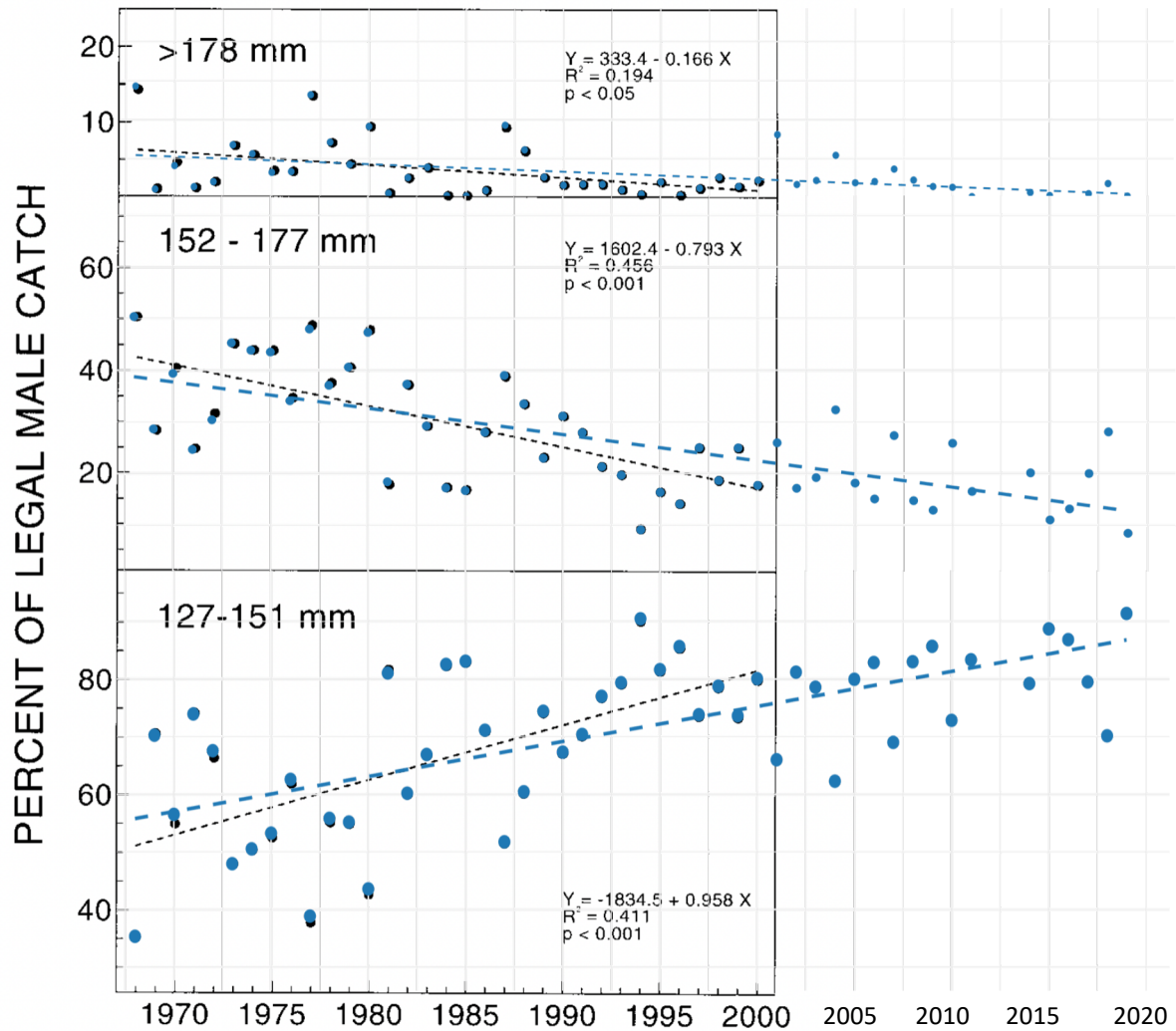
Data Analyses

Change in Size Over Time

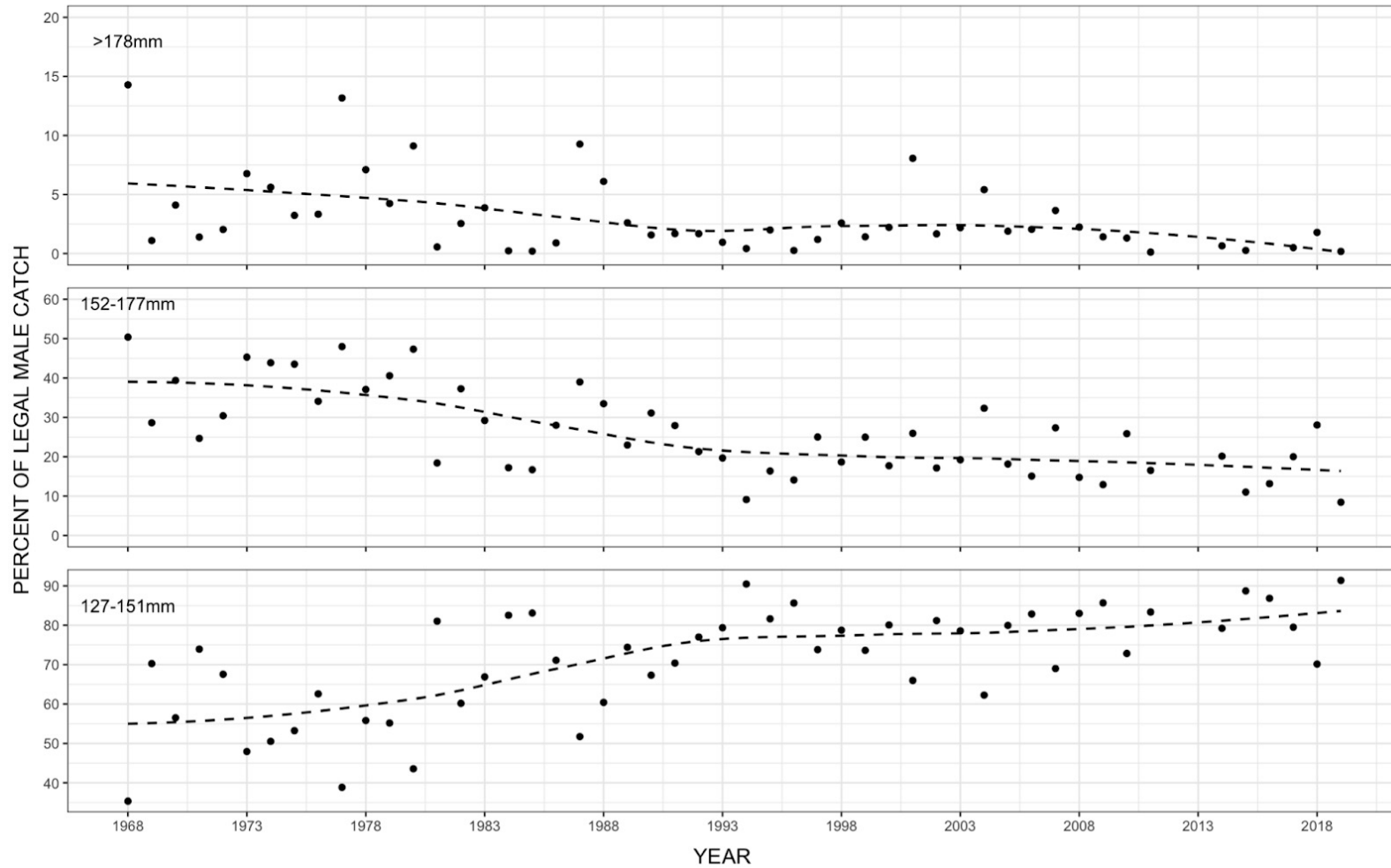
- **Is the abundance of large male crabs still declining?**

PERCENT OF LEGAL MALE CATCH

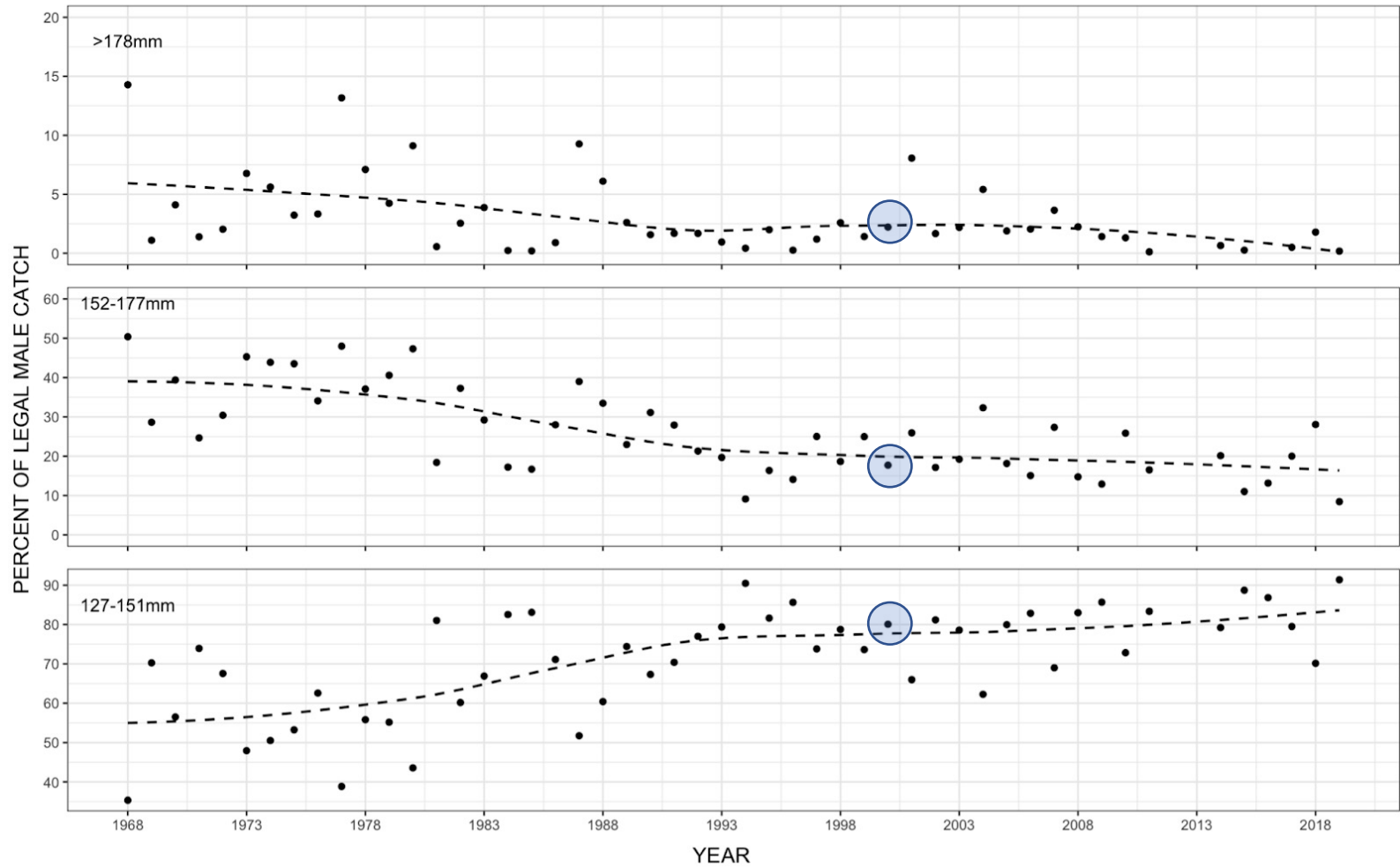




Change in Legal Male Crab Size (1968-2019)



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Data
Analyses

Climate Change

- **How do environmental factors influence blue crab catch?**

Principal Component Analysis (PCA)

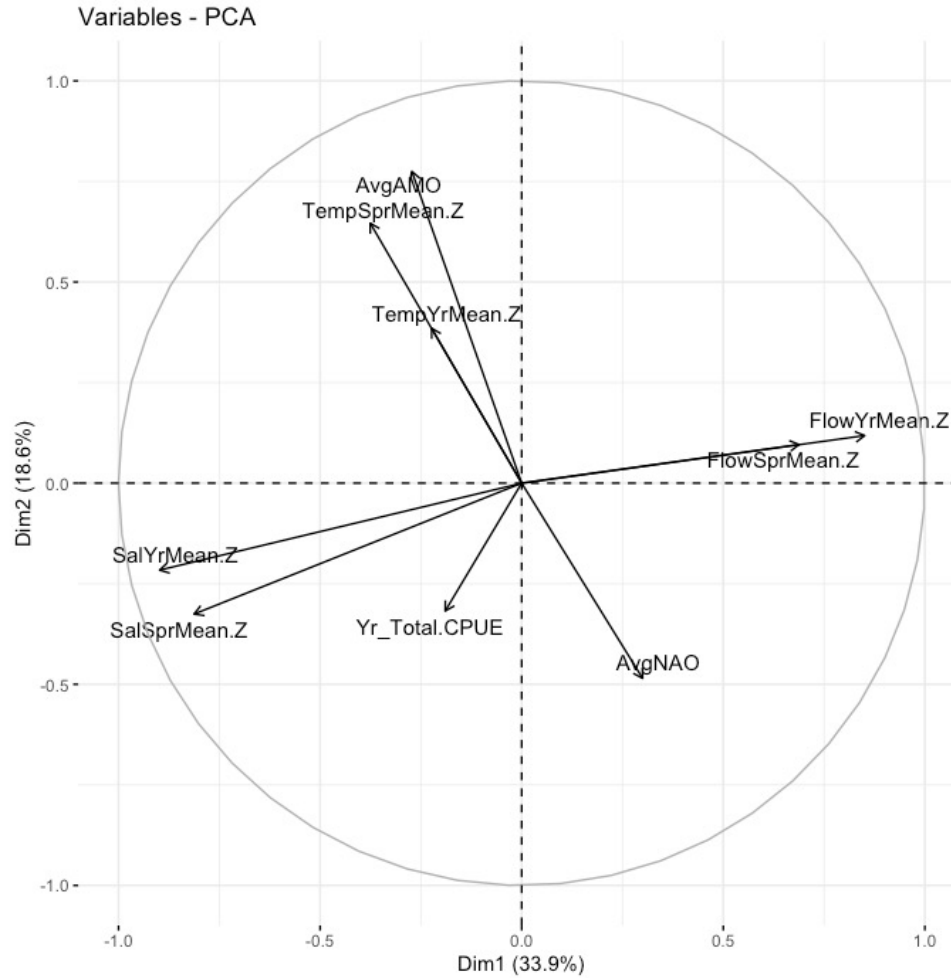


Reduces the number of variables in large datasets, while maintaining as much information as possible.



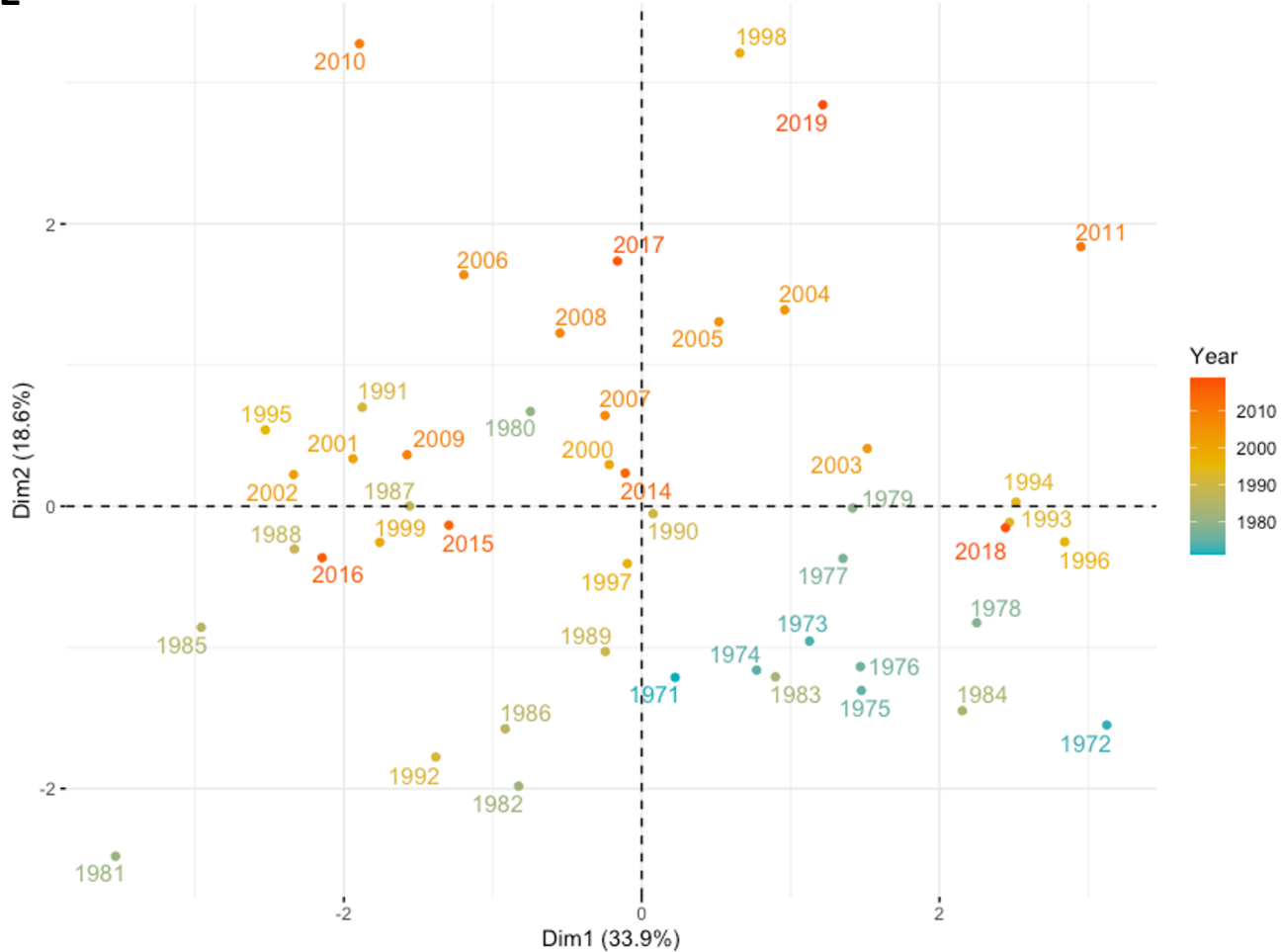
Plots relationships among many variables on a 2-D graph (reduces dimensionality)

TOTAL YEARLY CPUE



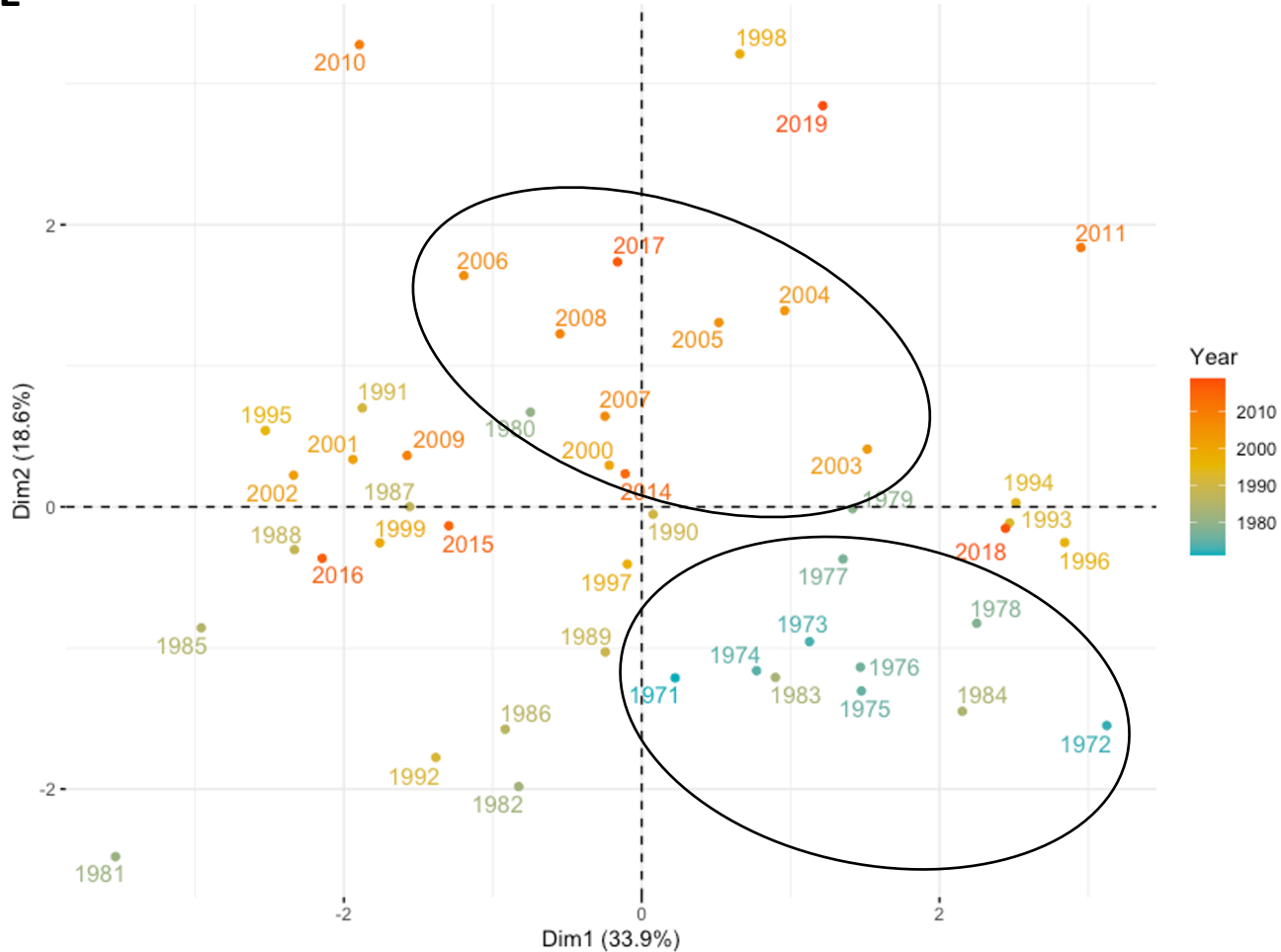
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Individuals - PCA

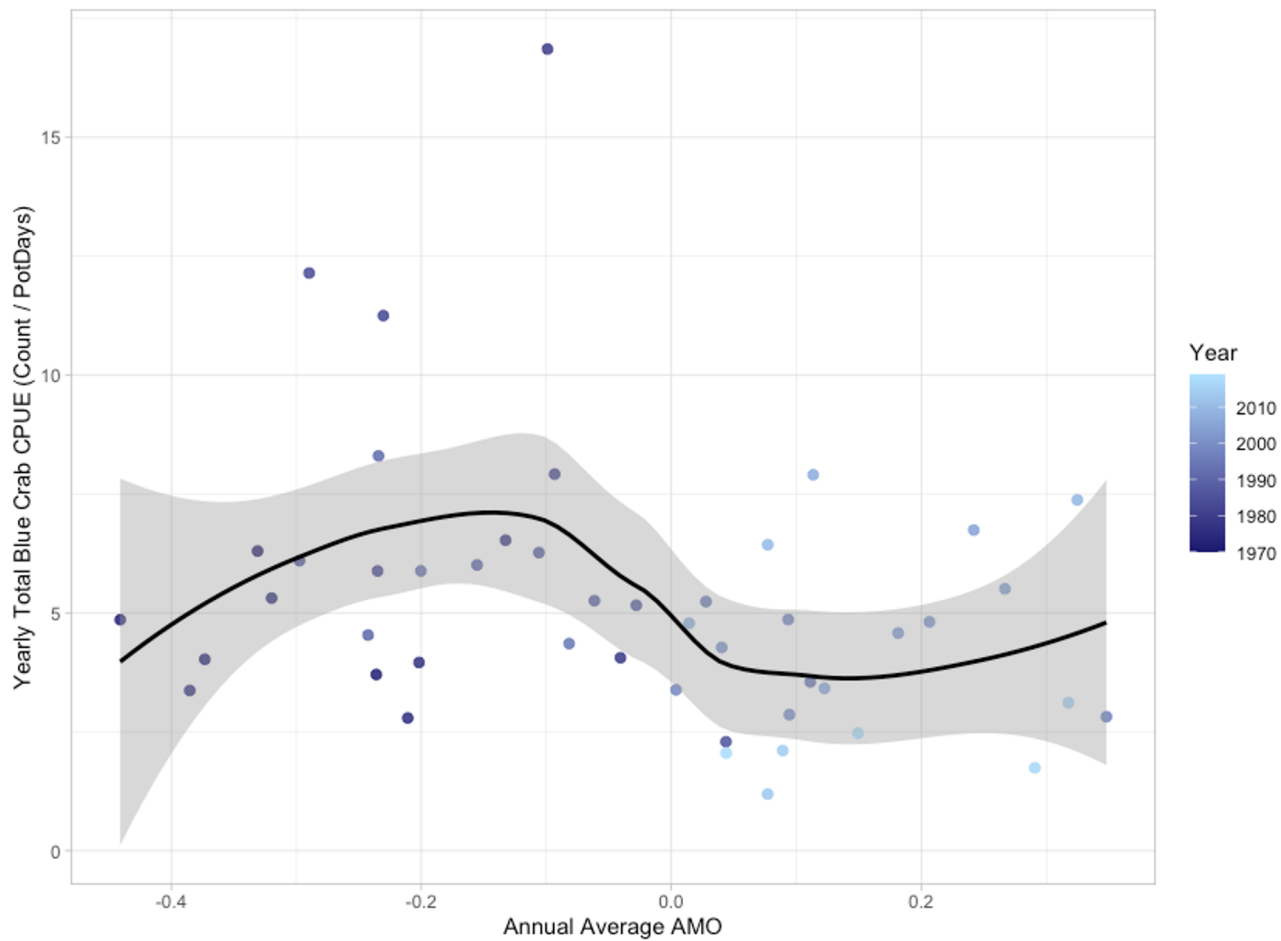


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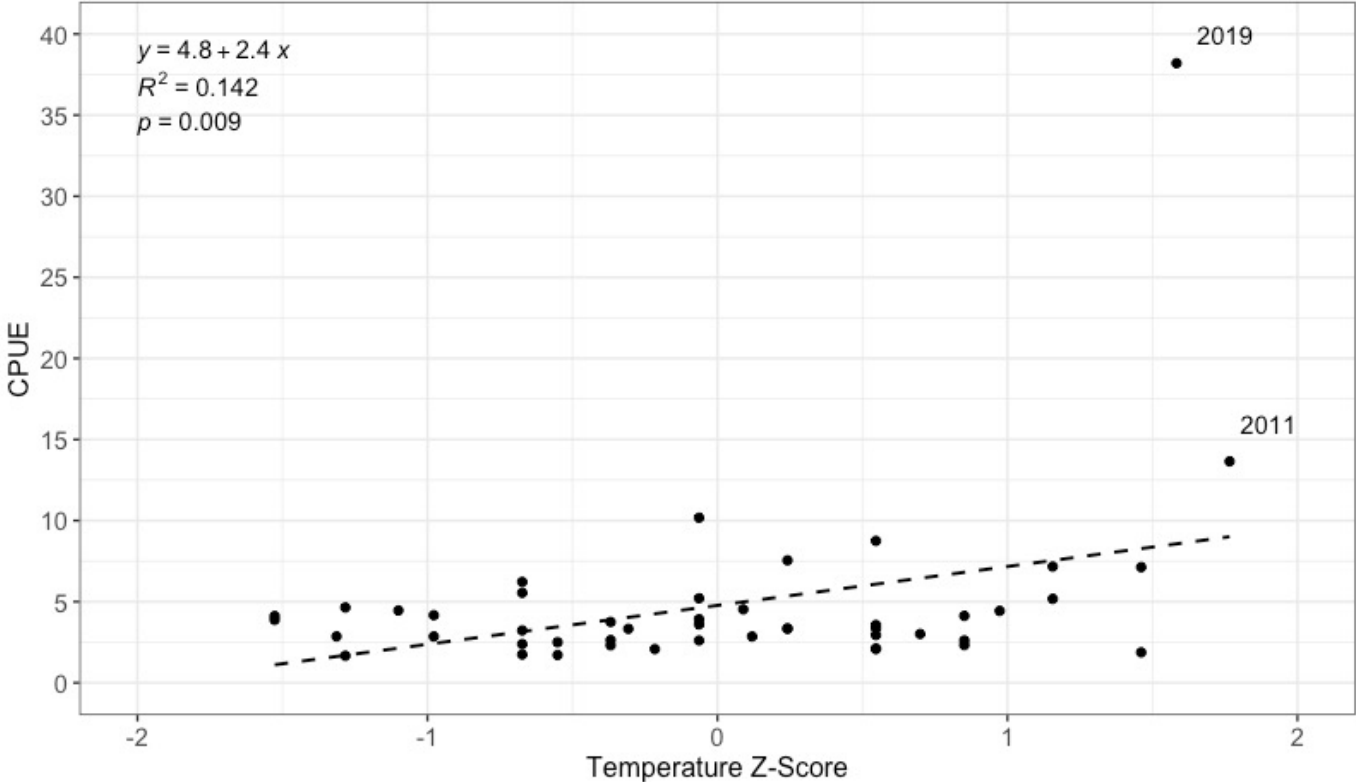
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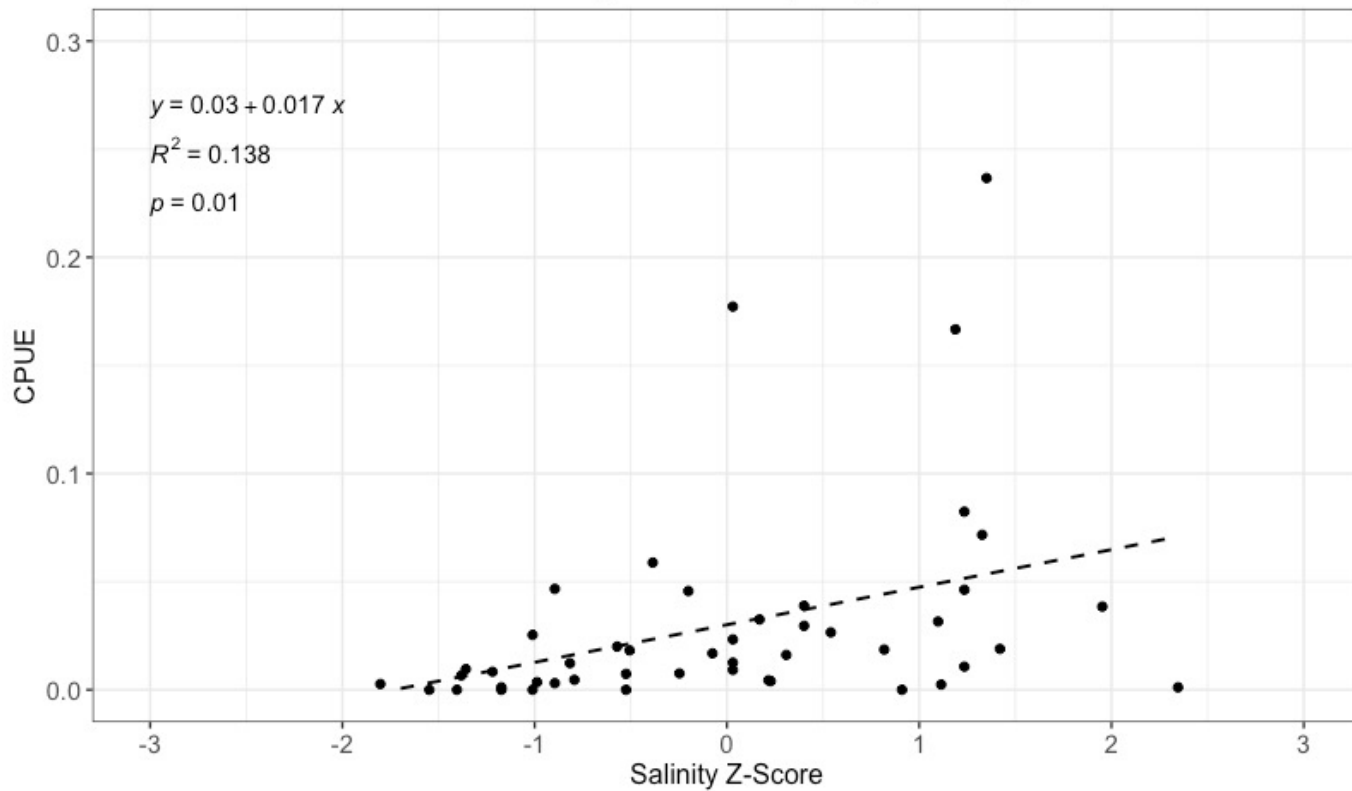
Annual Average Atlantic Multidecadal Oscillation (AMO)
to Yearly Total Blue Crab Catch (1971-2019)



Spring Total Blue Crab Catch vs. Spring
Median Water Temperature in Solomons, MD (1971-2019)



Yearly Sponge Crab Catch vs. Yearly Median Water Salinity in Solomons, MD (1971-2019)

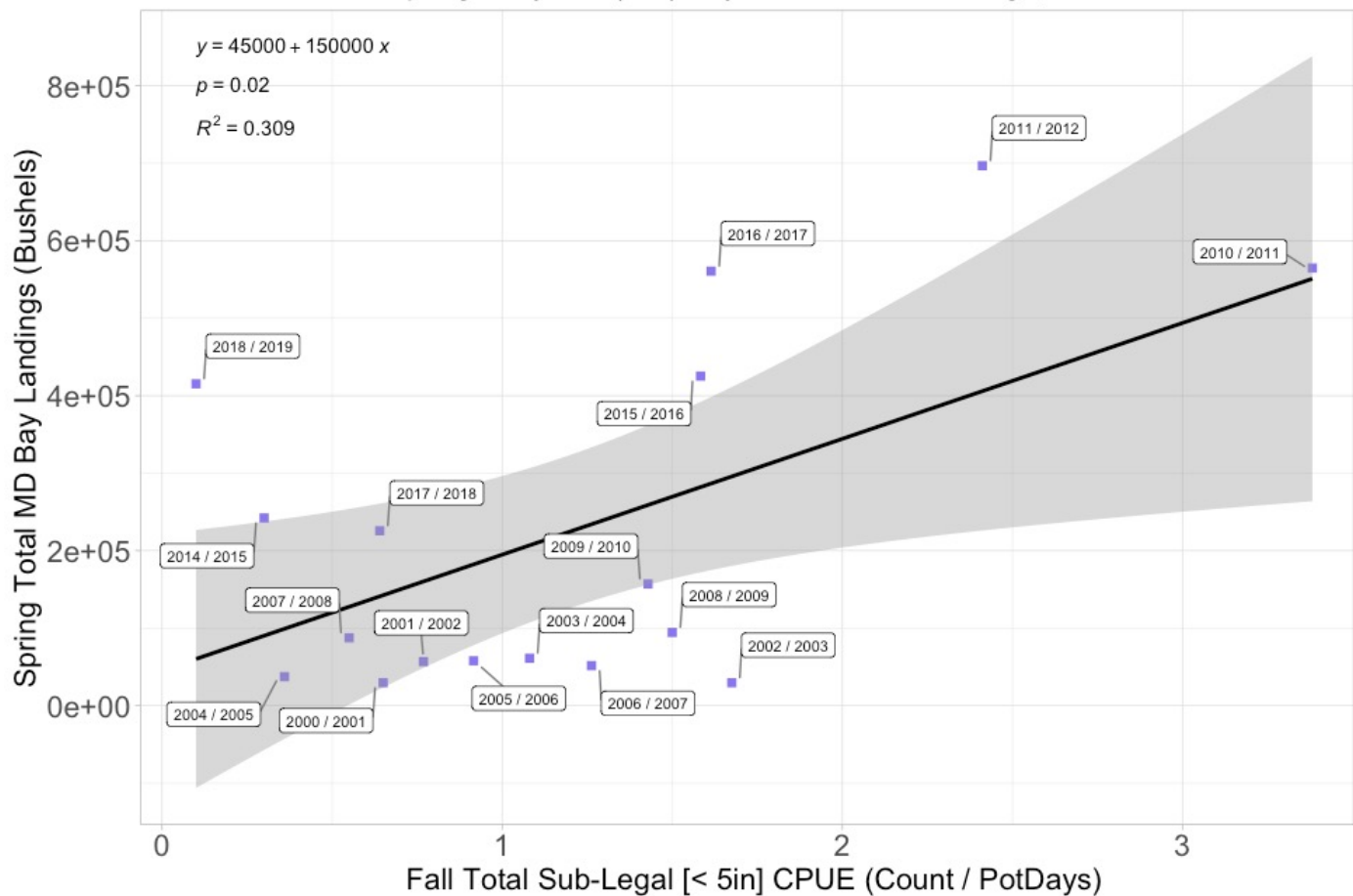


Data Analyses

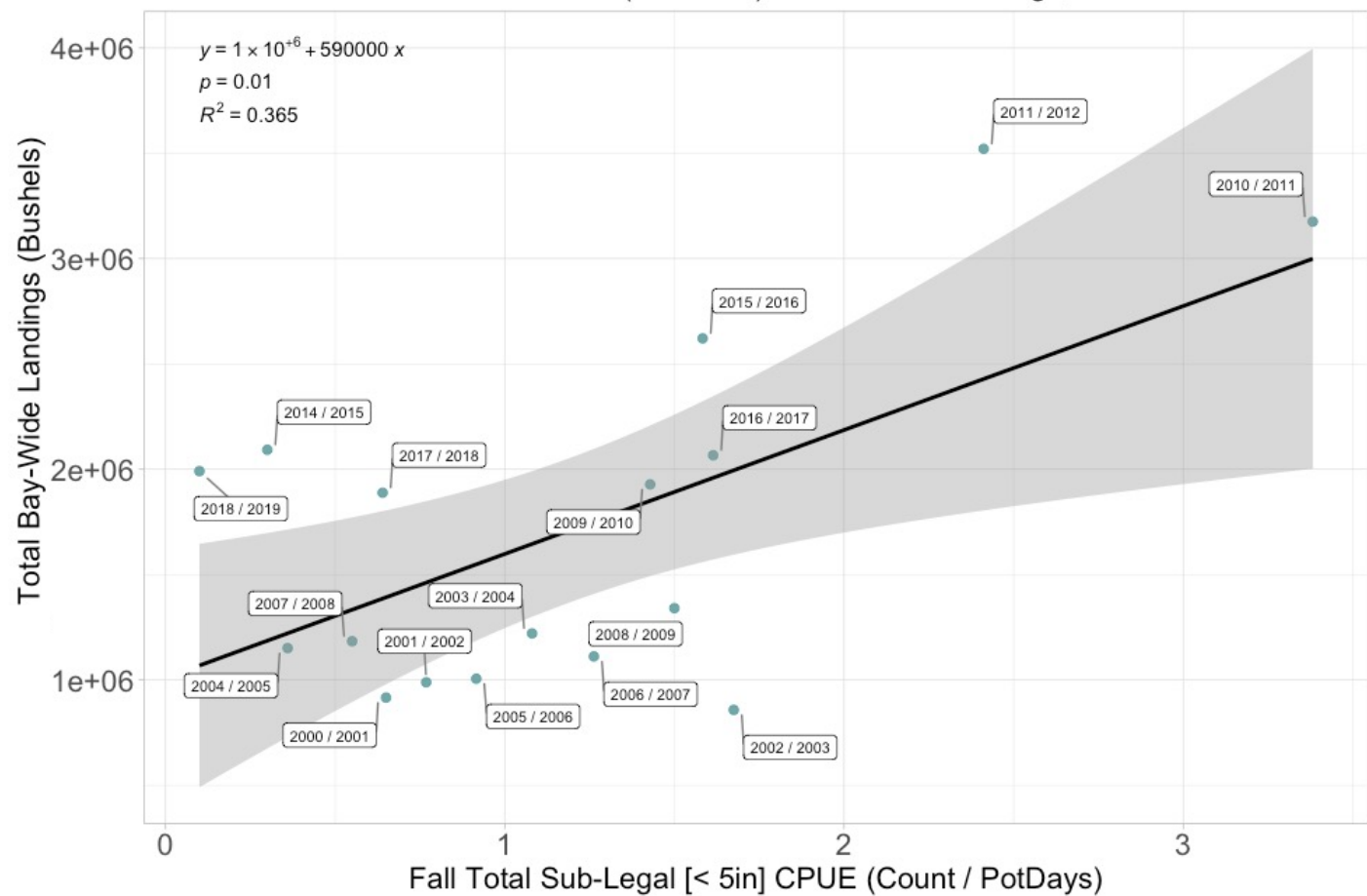
Indices & Landings Predictions

- **Can we predict blue crab commercial harvest for Maryland (or larger scale) using our data?**

Total Fall Sub-Legal Blue Crab Catch to
Total Spring Maryland (MD) Bay Commercial Landings, 2001-2019



Total Fall Sub-Legal Blue Crab Catch to
Total Annual BAY-WIDE (MD & VA) Commercial Landings, 2001-2019



Implications

Is the abundance of large male crabs still declining?

Our data suggests yes.
Catch of crabs greater than 6" is still decreasing.

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How do environmental factors influence blue crab catch?

Temperature and salinity (separately) have a relatively weak relationship with CPUE.
AMO and CPUE have a stronger relationship.

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How do environmental factors influence blue crab catch?

Temperature and salinity (separately) have a relatively weak relationship with CPUE.
AMO and CPUE have a stronger relationship.

Can our data predict commercial harvest?

Our data suggests yes.
Fall CPUE predicts Spring MD landings, as well as annual Bay-wide landings.

Next Steps & Future Research

- Next Steps:
 - Temperature, Salinity, Dissolved Oxygen Data
 - Further Analyses of Sponge Crab Occurrence
 - Environmental Drivers
 - Juveniles → Submerged Aquatic Vegetation
 - Winter Mortality Estimates



Thank you!! – Audience and...

Our Mentor –
Dr. Tom Ihde

Statistics Consultant -
Dr. Elgin Perry

Data Entry - Kyle Wood
and Zophia Galvan

Additional Support –
Dr. Amanda Knobloch

PEARL & Dr. Scott
Knoche – for making
the blue crab survey
and Amanda's
internship possible.

Dr. Chunlei Fan – for
making Amber's
internship possible.

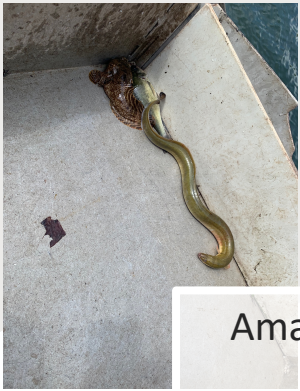


Chesapeake Bay Program
Science. Restoration. Partnership.

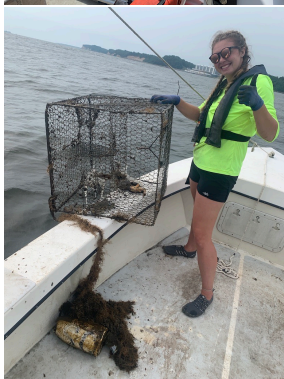
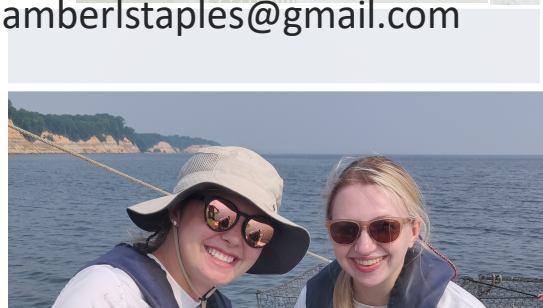


Acknowledgements



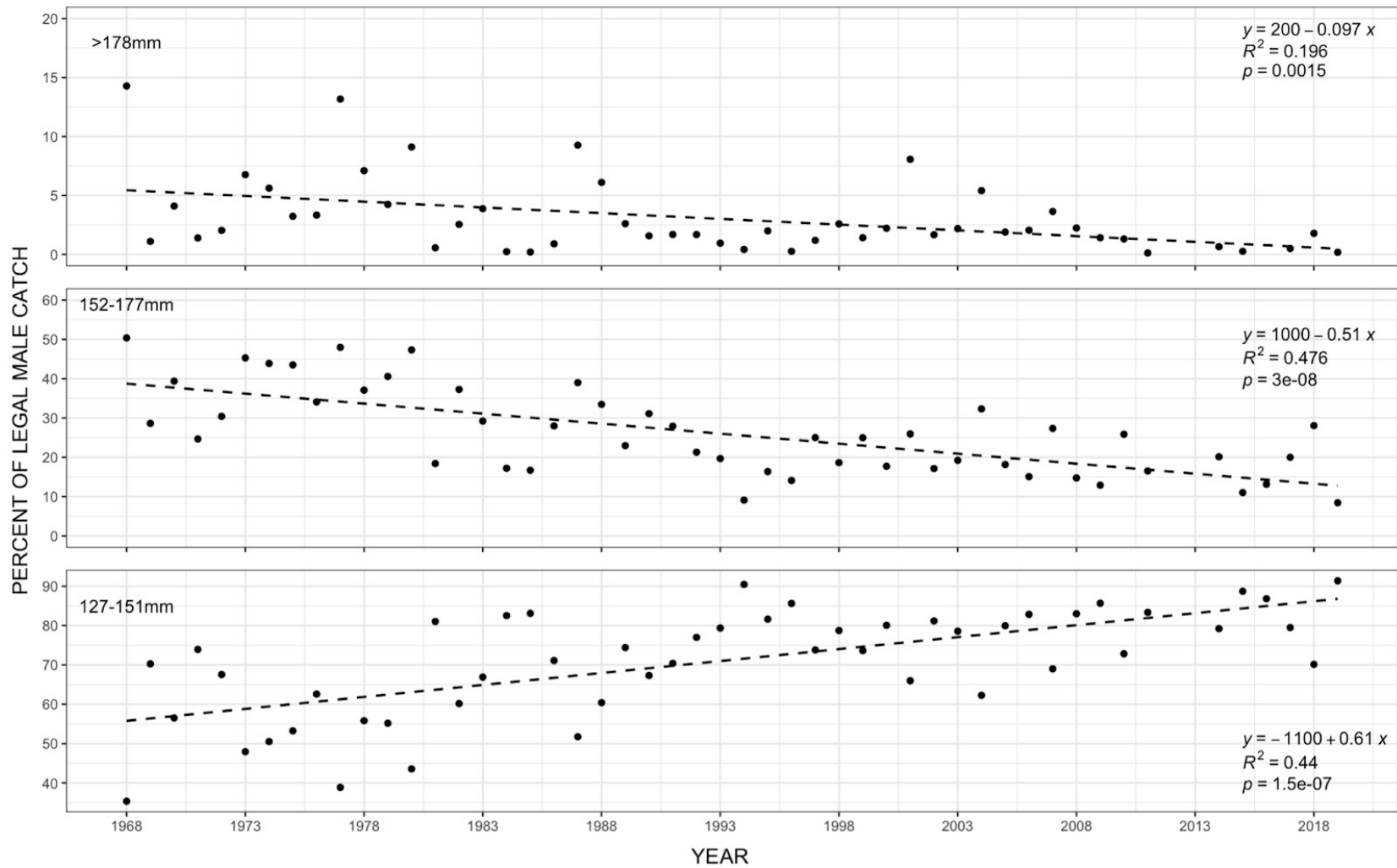


Amanda Bevans: amandatbevans@gmail.com
Amber Staples: amberstaples@gmail.com



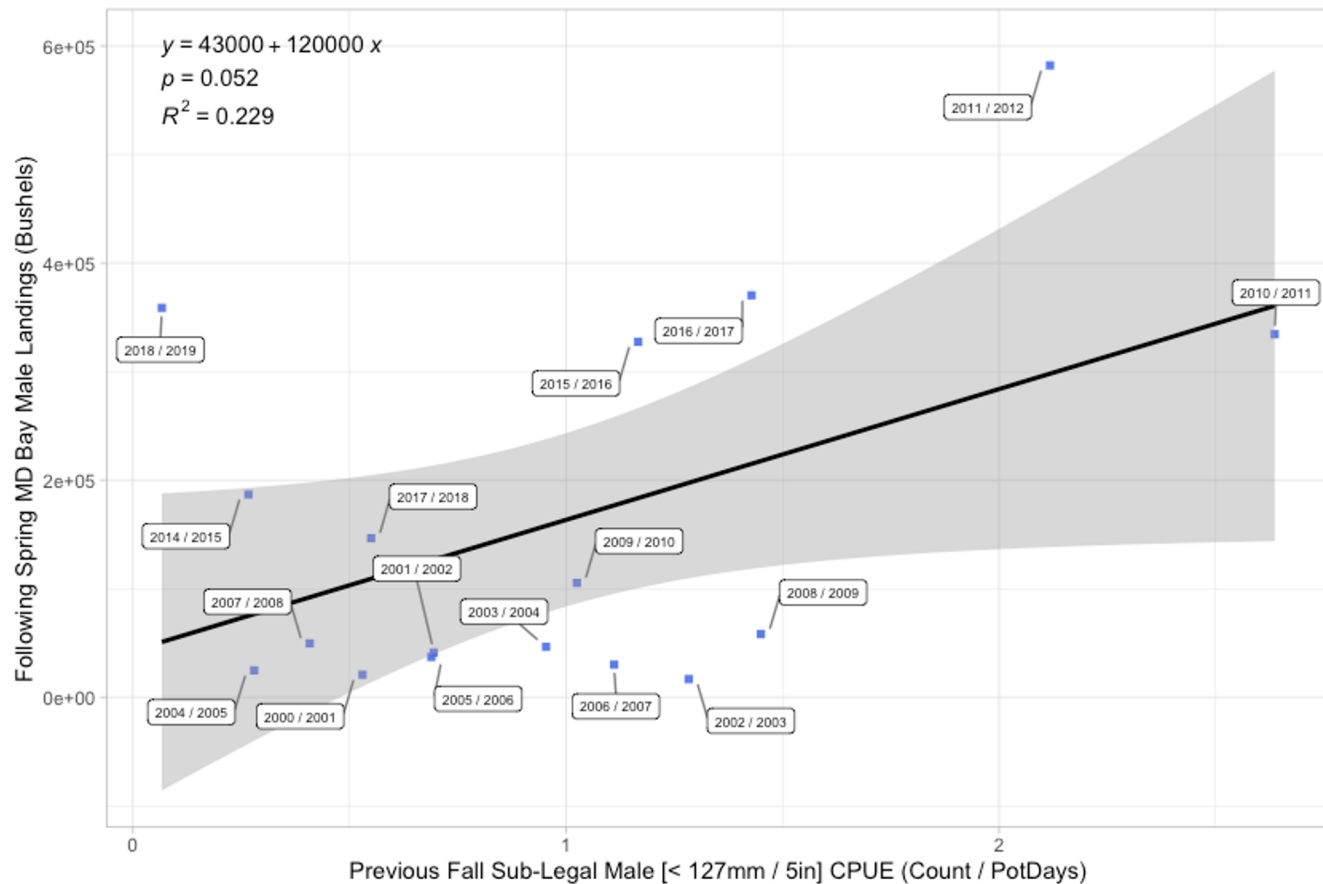
Extra Graphs

Change in Legal Male Crab Size (1968-2019)



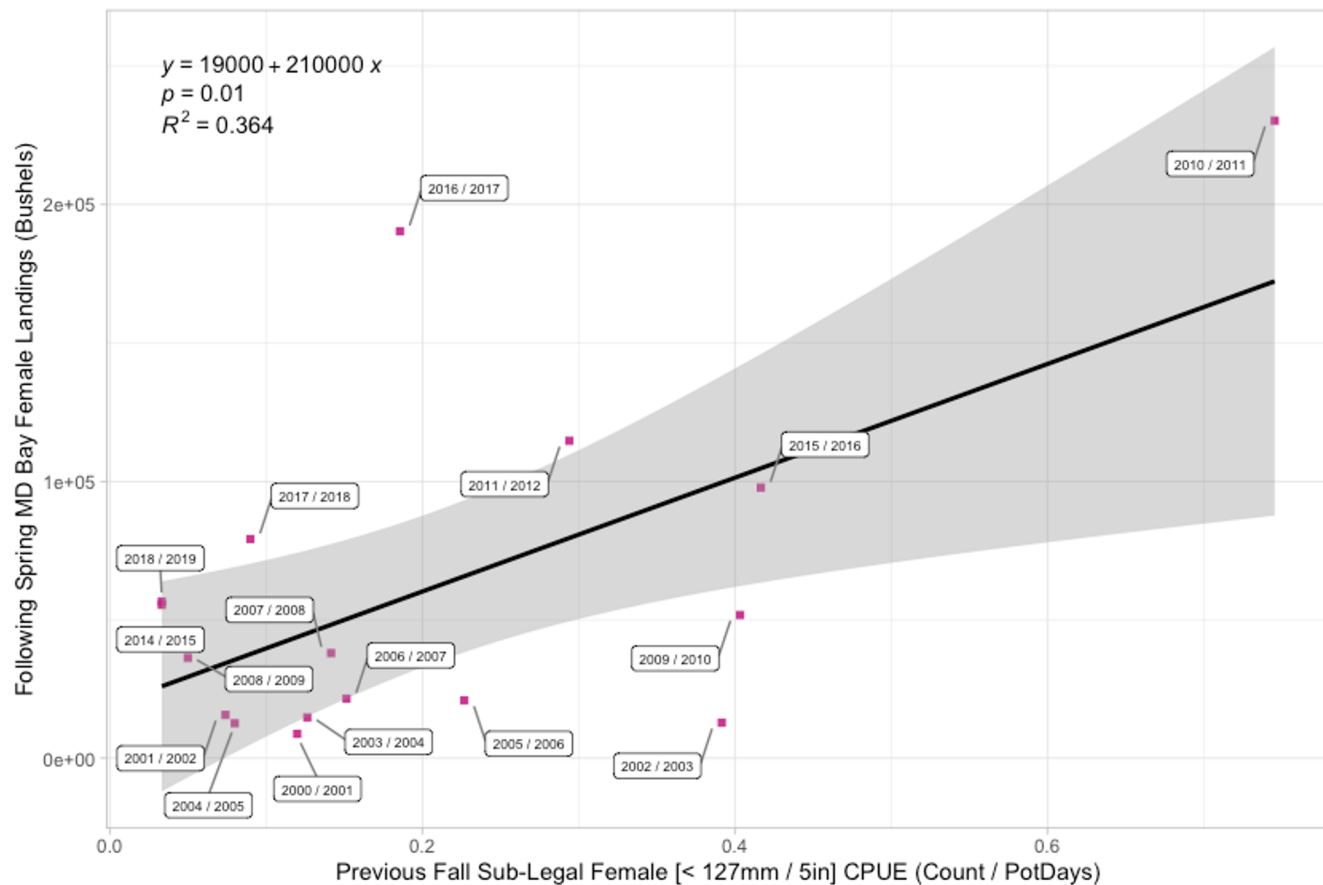
Fall (Sept.) Sub-Legal Male Blue Crab Catch to
Following Spring (April + May) Maryland (MD) Bay Male Commercial Landings 2001-2019

Legend: ■ Spring MD Bay Landings of Male Blue Crab
- Dates Correspond to Fall CPUEs and Following Spring Landings -

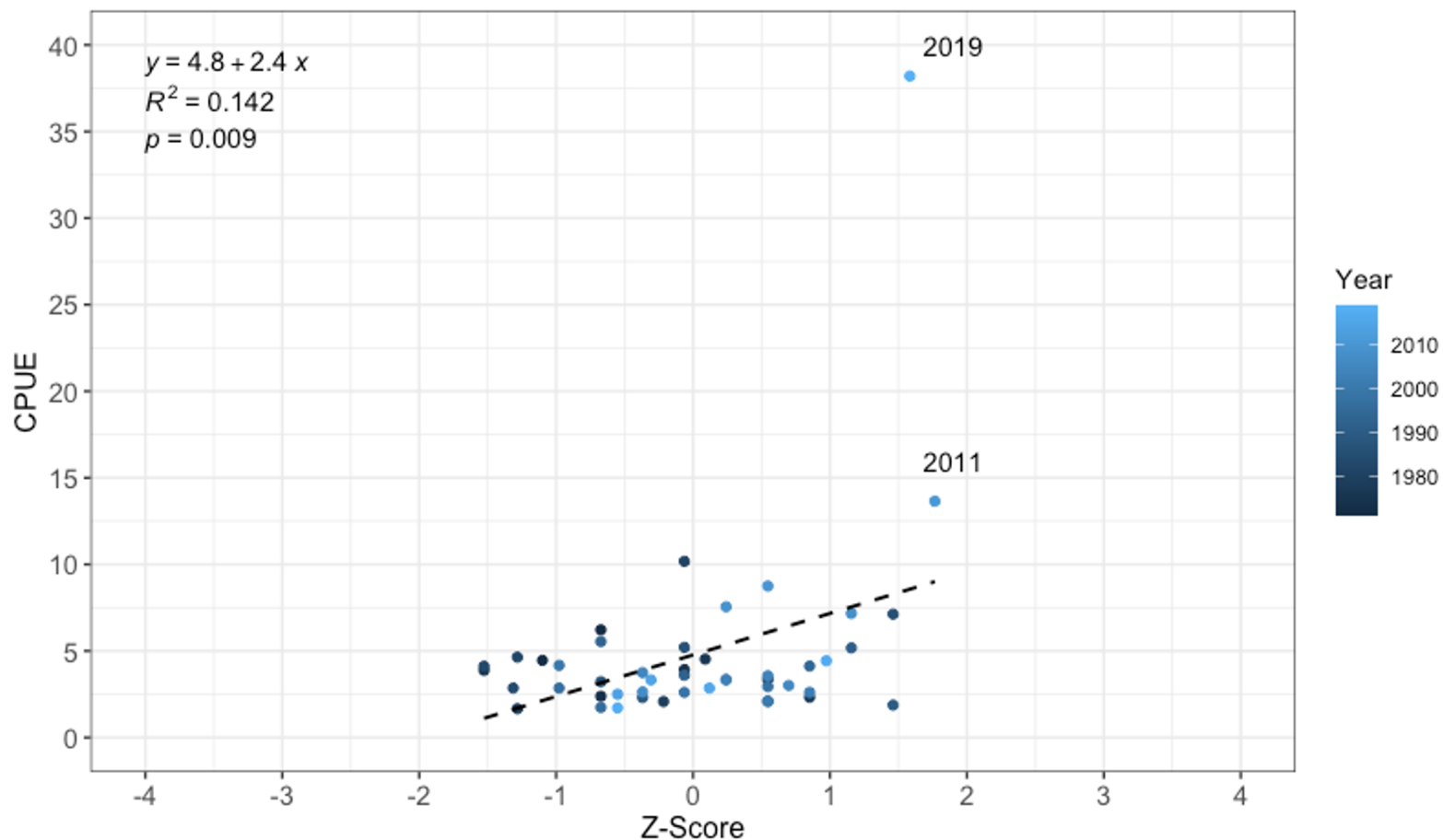


Fall (Sept.) Sub-Legal Female Blue Crab Catch to
Following Spring (April + May) Maryland (MD) Bay Female Commercial Landings 2001-2019

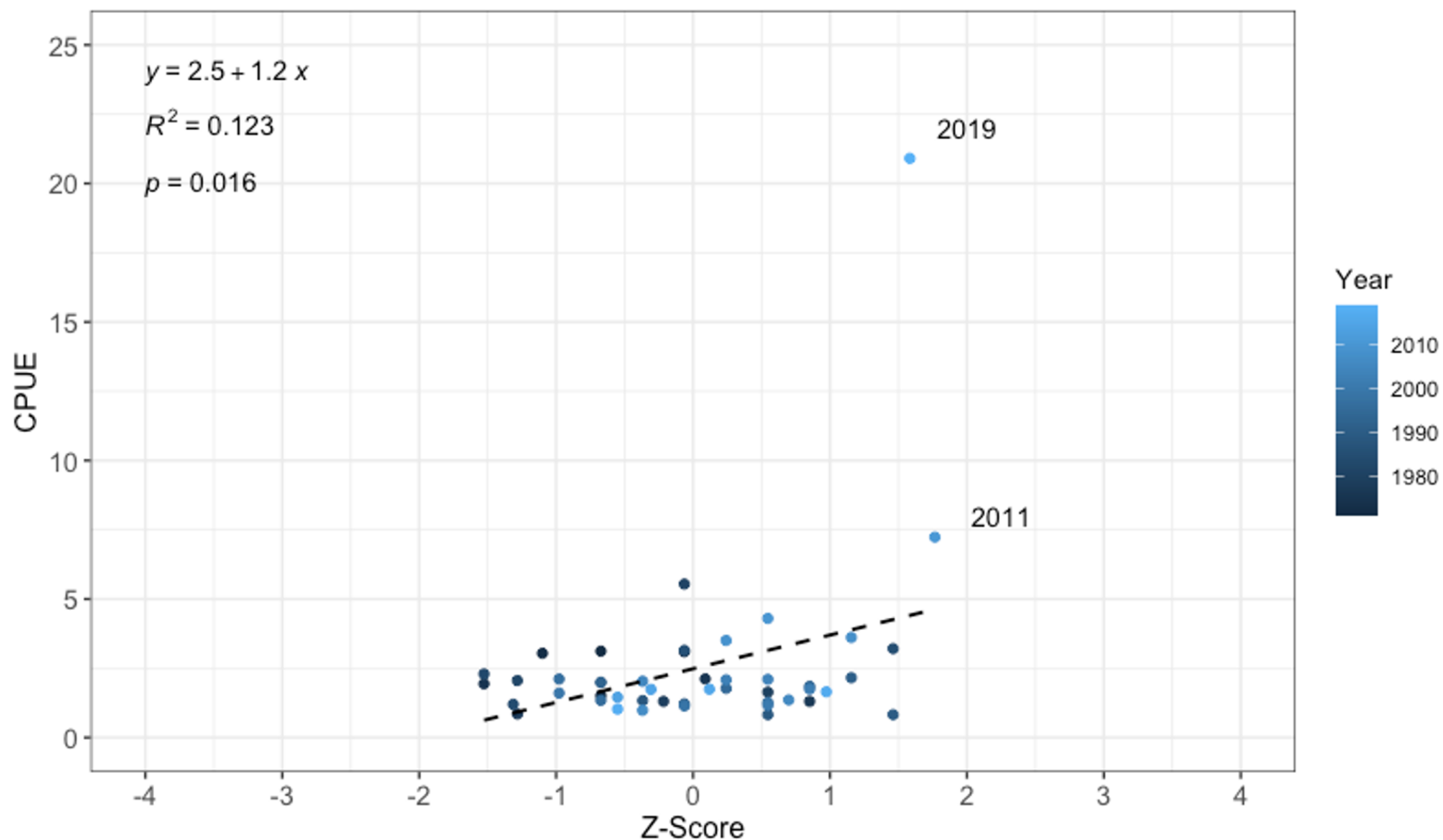
Legend: ■ Spring MD Bay Landings of Female Blue Crab
- Dates Correspond to Fall CPUEs and Following Spring Landings -



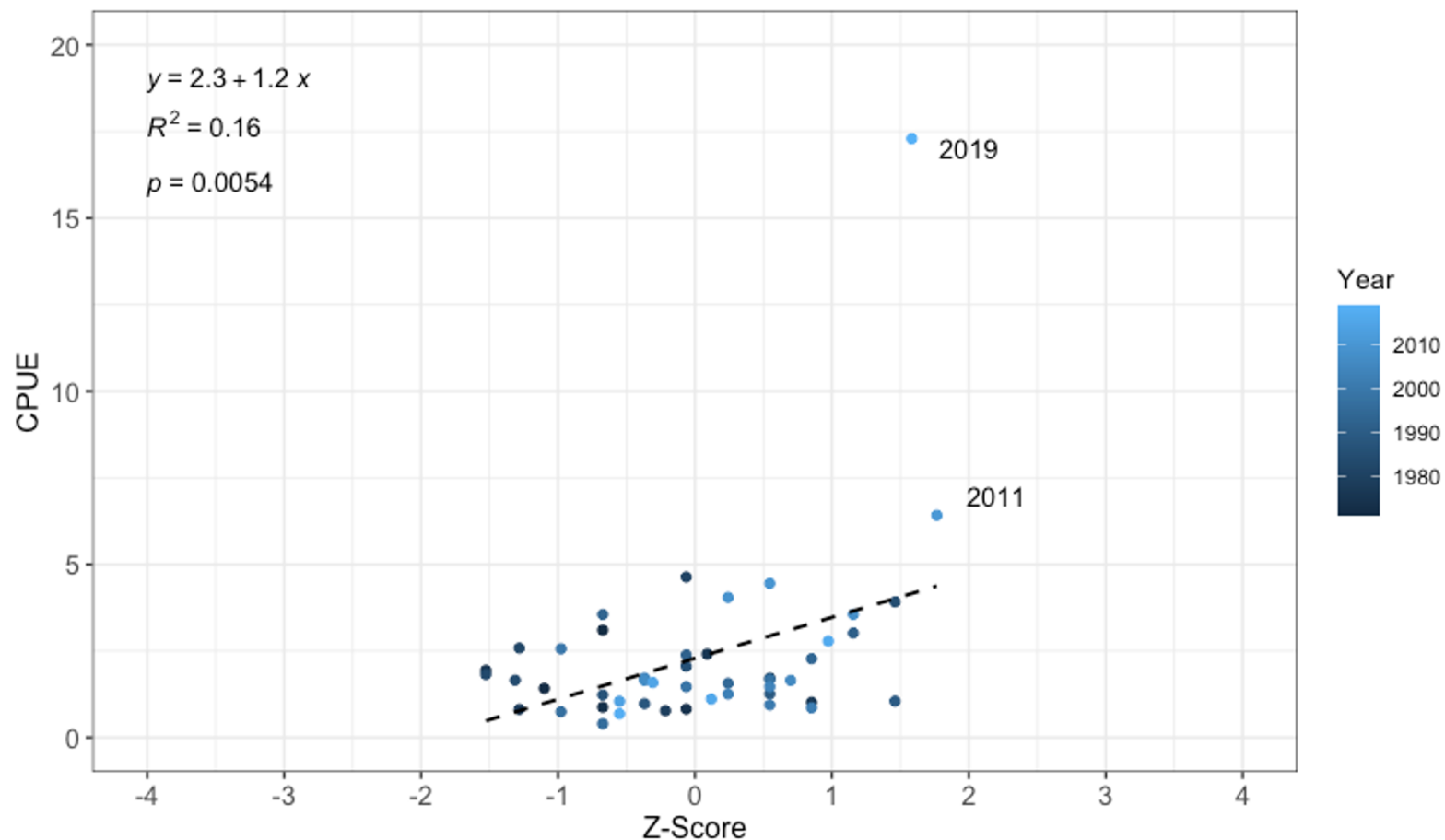
Spring (June) Total Blue Crab Catch vs. Spring (Apr-May)
Median Water Temperature in Solomons, MD (1971-2019)



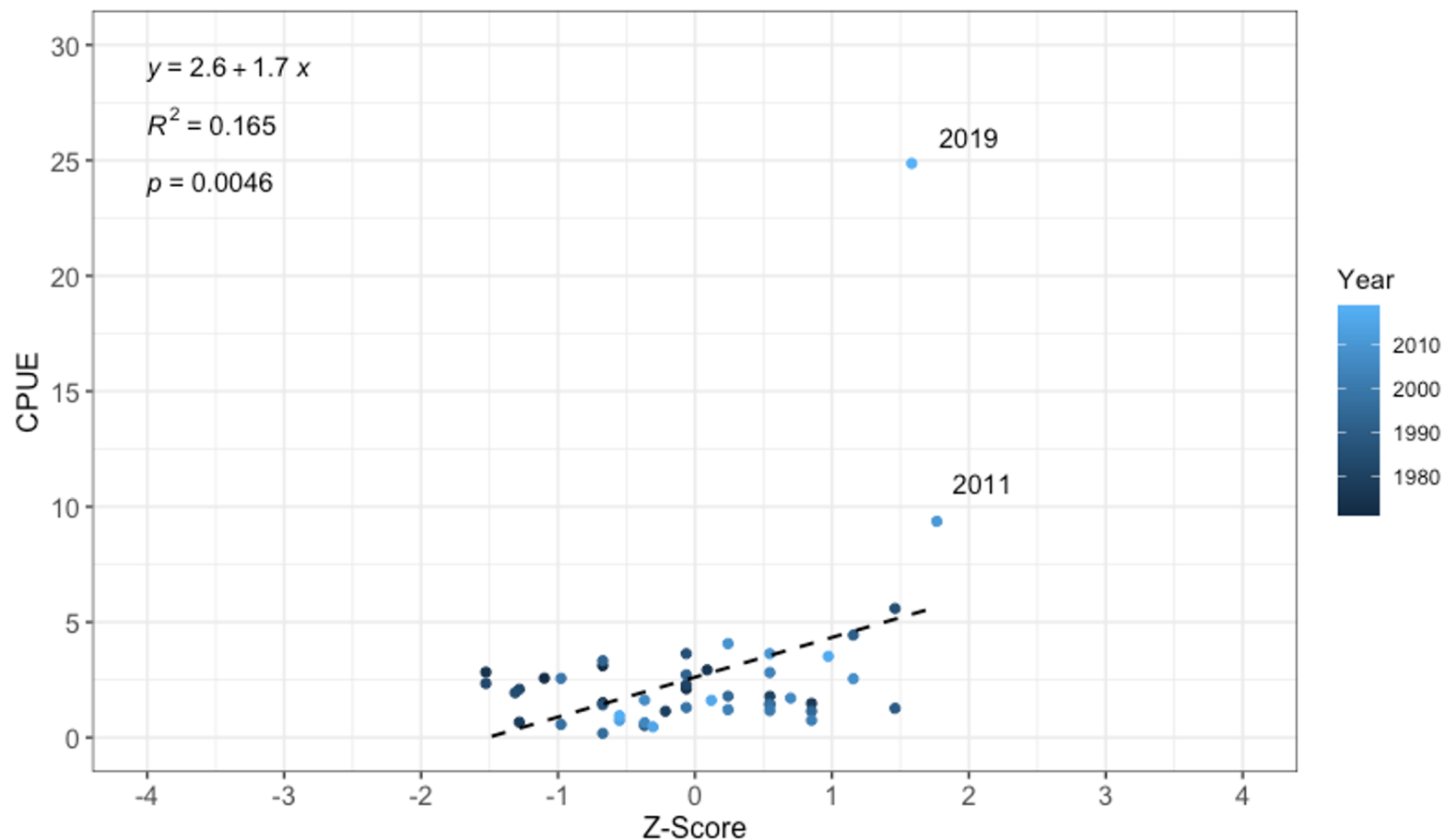
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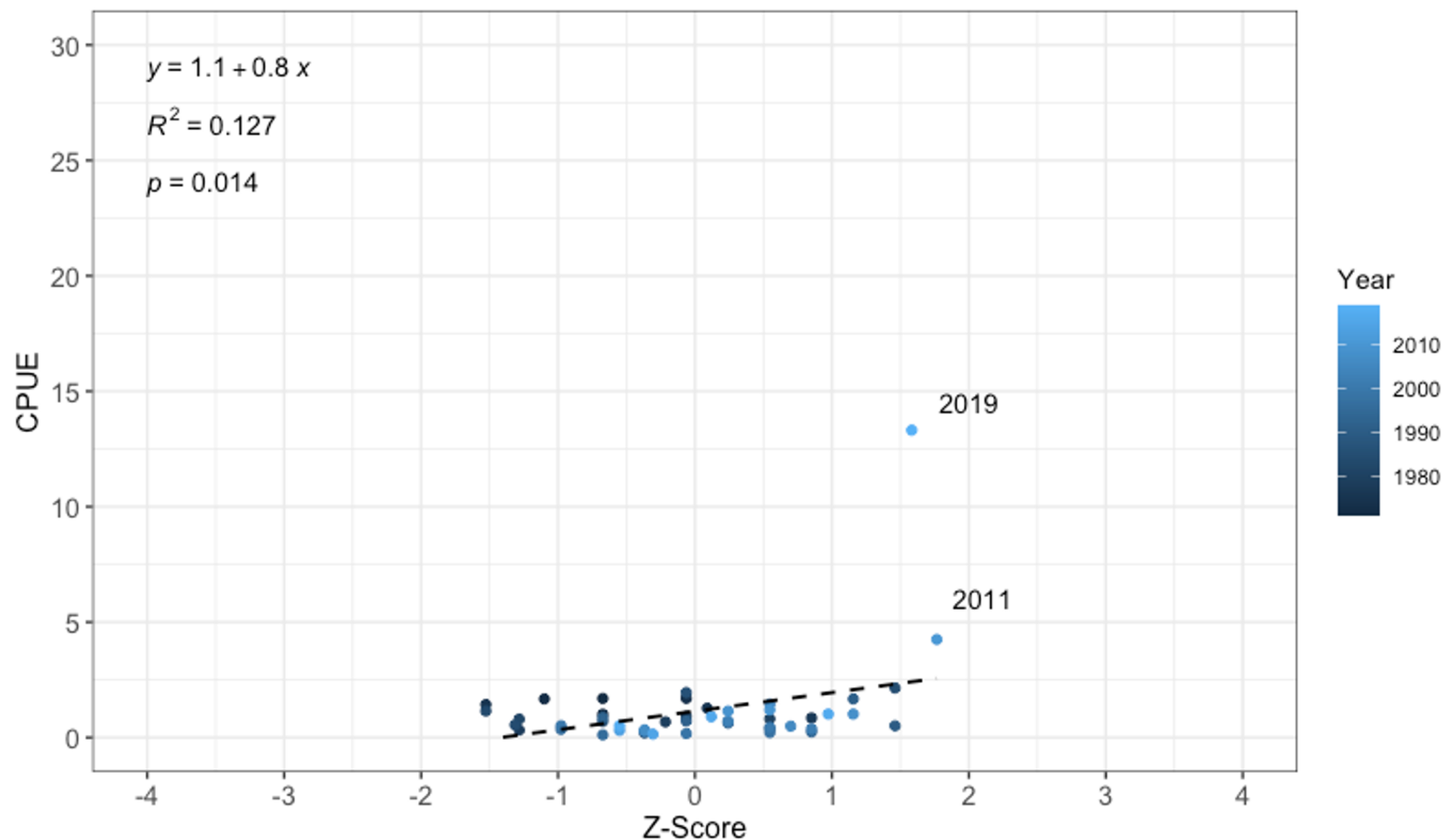
Spring (June) Female Blue Crab Catch vs. Spring (Apr-May)
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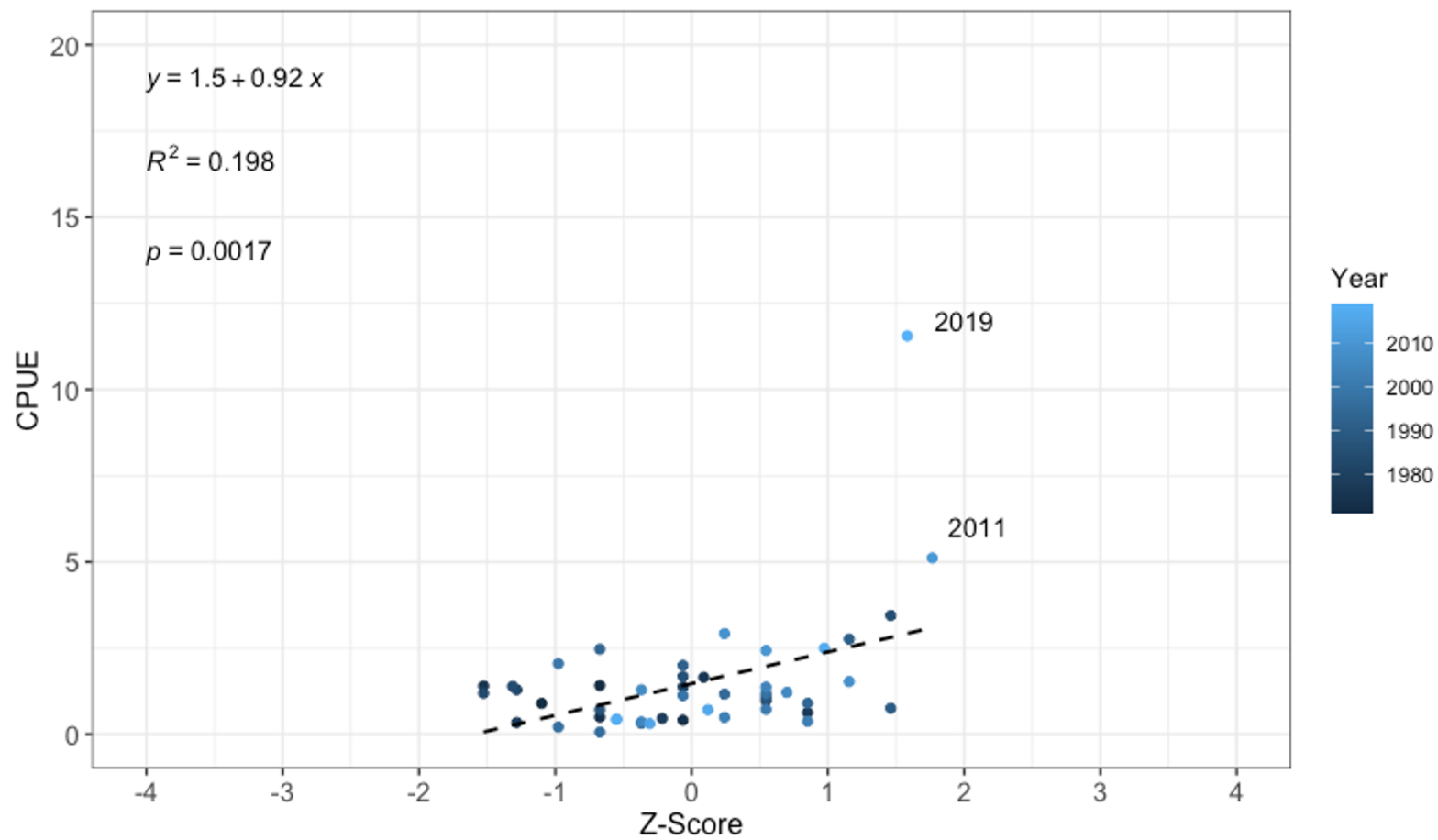
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Yearly Sponge Crab Catch vs. Yearly Median Water Salinity in Solomons, MD (1971-2019)

