Exploring blue crab stock assessment model assumptions
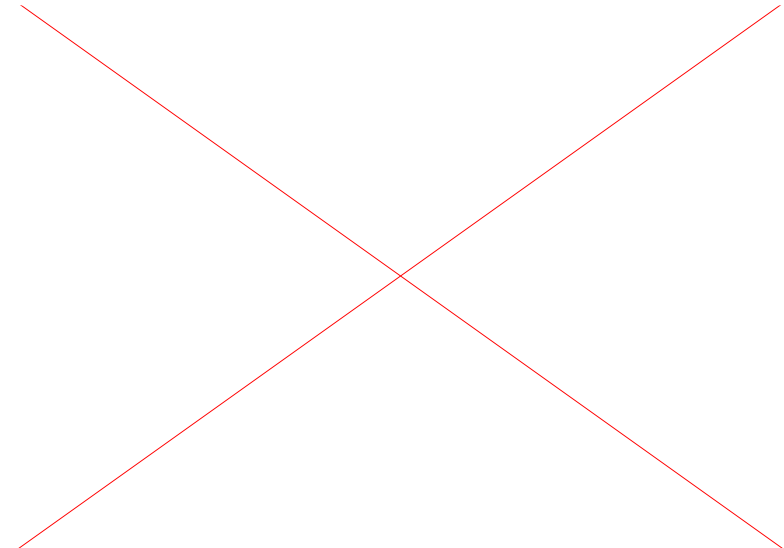
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Introduction

- Blue crab abundance has been substantially lower than expected given recent female fishing mortality rates

- This poor performance has raised questions about the adequacy of the previous stock assessment for providing management advice

- The objective of this presentation is to describe potential issues with the previous stock assessment and how can a new assessment help

1. Problem matching the sex composition of the WDS and catch

Winter dredge survey
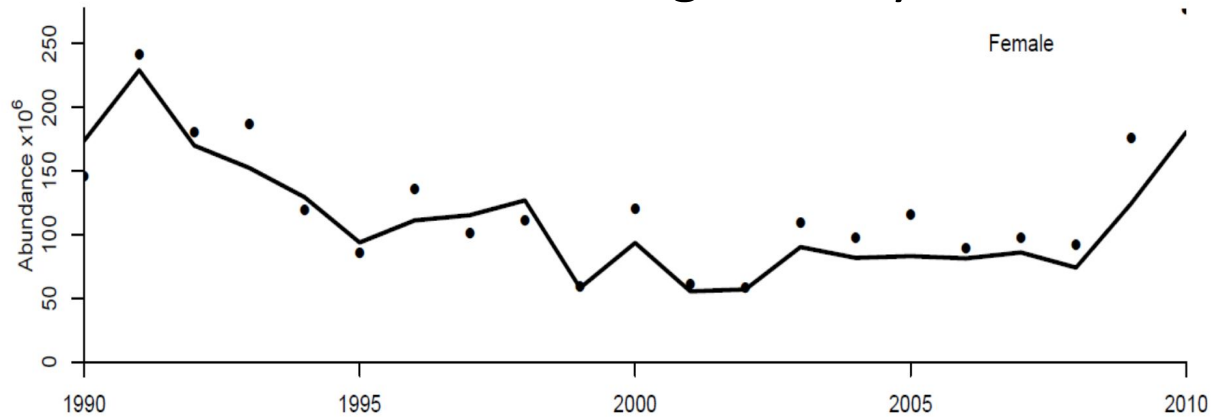
Fishery catch
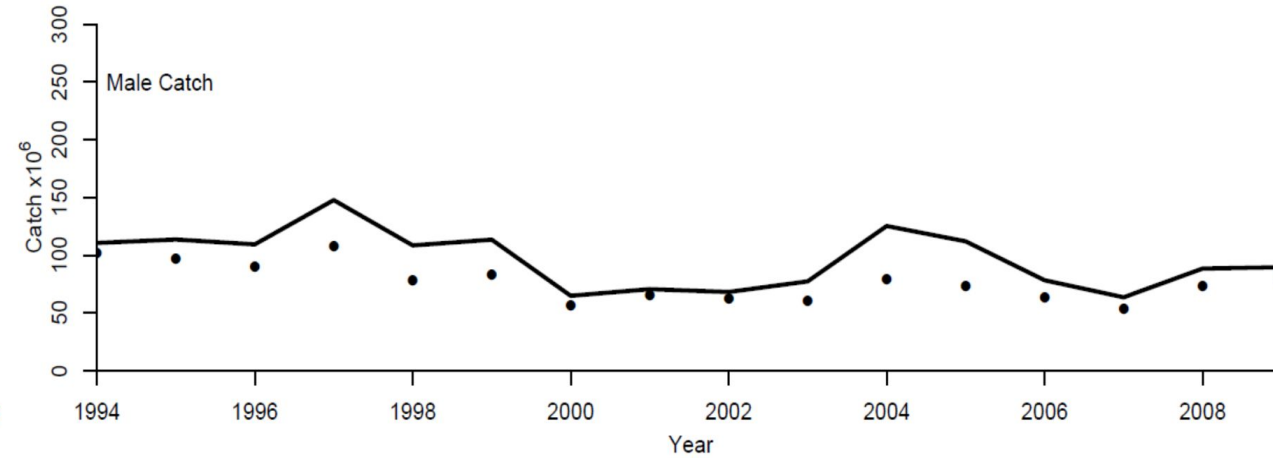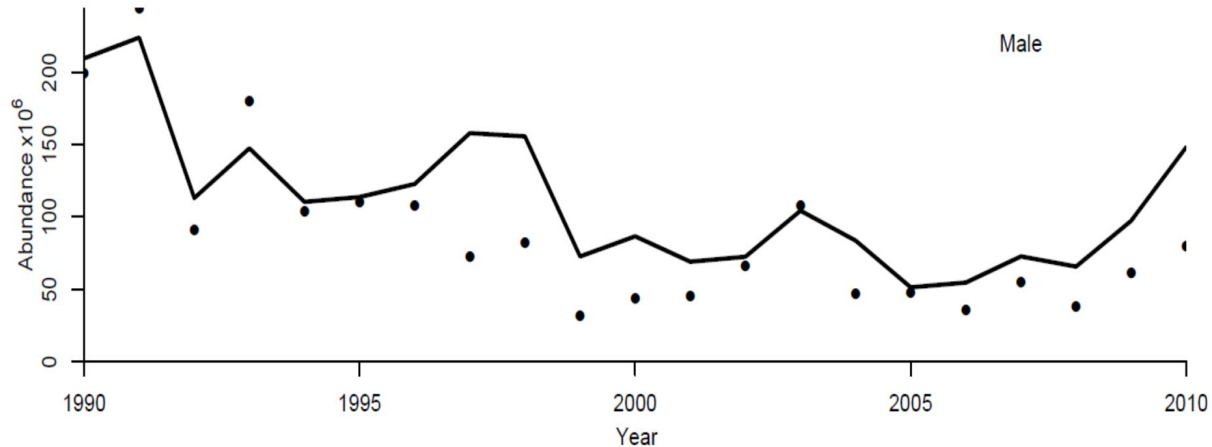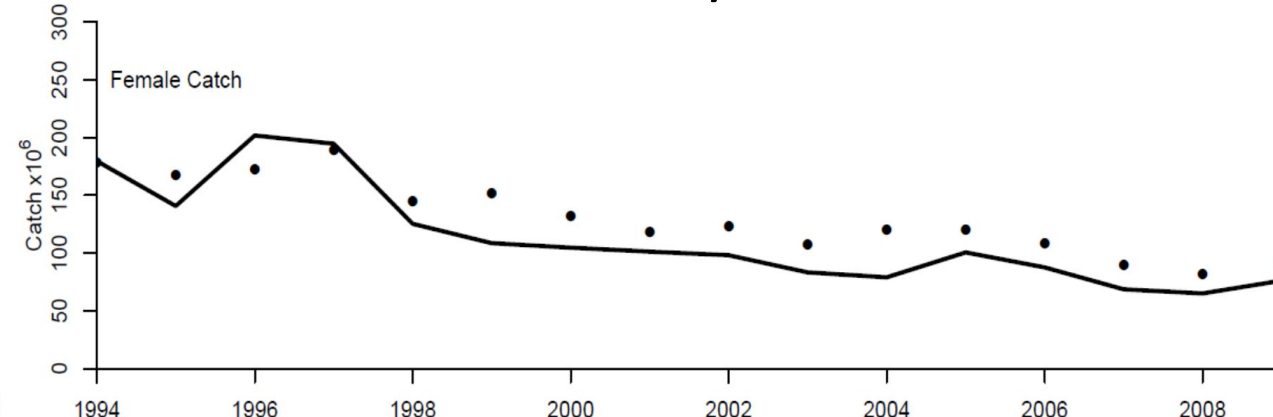
Potential sources of the problems

- WDS calibration
- Catch reporting
- Sex ratio at recruitment
- Natural mortality rates
- Fishery selectivity (for age-0)

WDS calibration

- The model assumes that the WDS estimates of abundance are accurate, on average, for age-1+ males and females

- WDS estimates of abundance are calculated by applying a dredge efficiency to the observed catch, which is then scaled up to the whole Bay

- The efficiency estimates are very different for MD and VA, which may cause biases in the abundance estimates and could cause the observed issues

Catch reporting

- Commercial catch (by sex) is unbiased

- Recreational catch is a constant proportion of commercial (8% for both sexes)

- Bias in catch reporting or incorrect assumptions about recreational catch could cause the observed problems

Sex ratio at recruitment

- Assume 52% of the recruits at age-0 are female

- It is difficult to determine the sex of small crabs in the field, so information is limited

- Differences in the sex ratio at recruitment could cause the observed problems (differences would need to be unrealistically large)

Natural mortality rates

- Both sexes are assumed to have M = 0.9 per year

- This estimate was derived from tagging of mature females in VA

- Differences in M between sexes could cause the observed problems (differences would need to be unrealistically large)

Fishery Selectivity

- Age-0 experience 60% of the fishing mortality rate of age-1+

- Arrived at by expert judgement

- Same for both sexes

- Differences from this value could explain the catch and abundance differences

2. Spawning

- The assessment model assumes that 60% of the age-0 female crabs from the winter will spawn that summer (if they survive)

- The assessment model assumes that 37% of the mortality occurs before spawning (based on MD pot effort during 2007-2010)

Reference Points

- Model assumes a sex-specific Ricker stock-recruitment function with only egg limitation
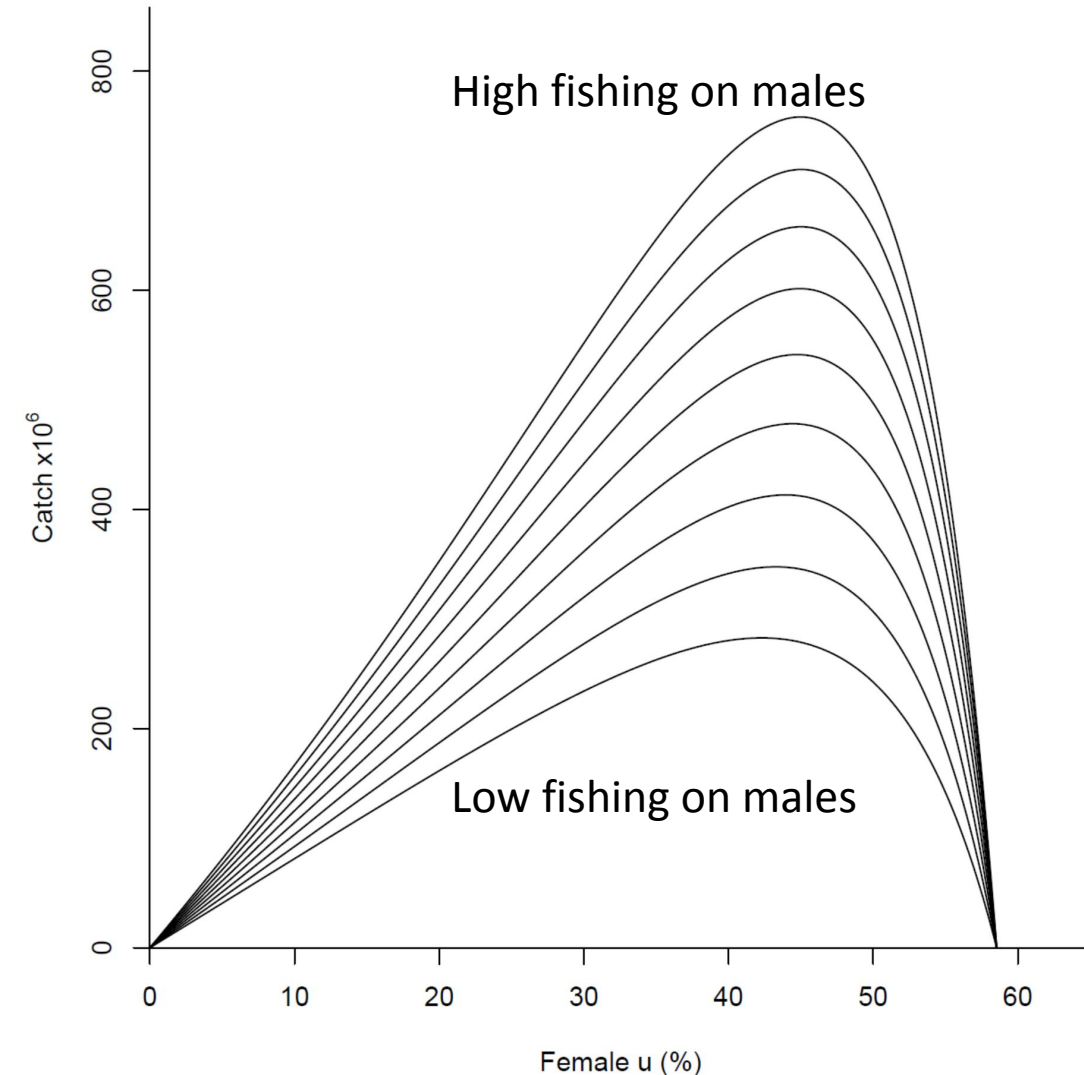
Historical catch

- Fishery catches were corrected outside of the assessment model for changes in reporting

- Catches after 1997 are thought to be accurate

- In the previous model, earlier catches were not influential on reference point estimates

Are there areas for improvement?

- Yes!

- Data are available that were not formally used in previous assessments

- Alternative model structures could be used that would make fuller use of the available data

Data sources not fully used

- Trawl surveys
  - Monthly indices
  - Length data
  - Spatial data

- Maryland Cooperative Commercial data
  - Catch per unit effort
  - Length data
  - Spatial data

Alternative Model Structures

- Length-based
  - Estimate growth using length frequency data

- Short (e.g., monthly) time step
  - The current model uses an annual time step and assumptions about proportion of mortality before spawning, etc.

  - With the available data, we could move to a shorter time step that would allow estimation of some of these values and allow for changes over time

Revised look at reference points

- The population is not responding in the way we would expect given the current model and reference points

  - Reconsider the reference point model including the stock-recruitment function

  - Reconsider the types of reference points

Thank you!

- Assessment documentation available at
    https://hjort.cbl.umces.edu/crabs/Assessment.html

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