Blue crab management: successes and challenges

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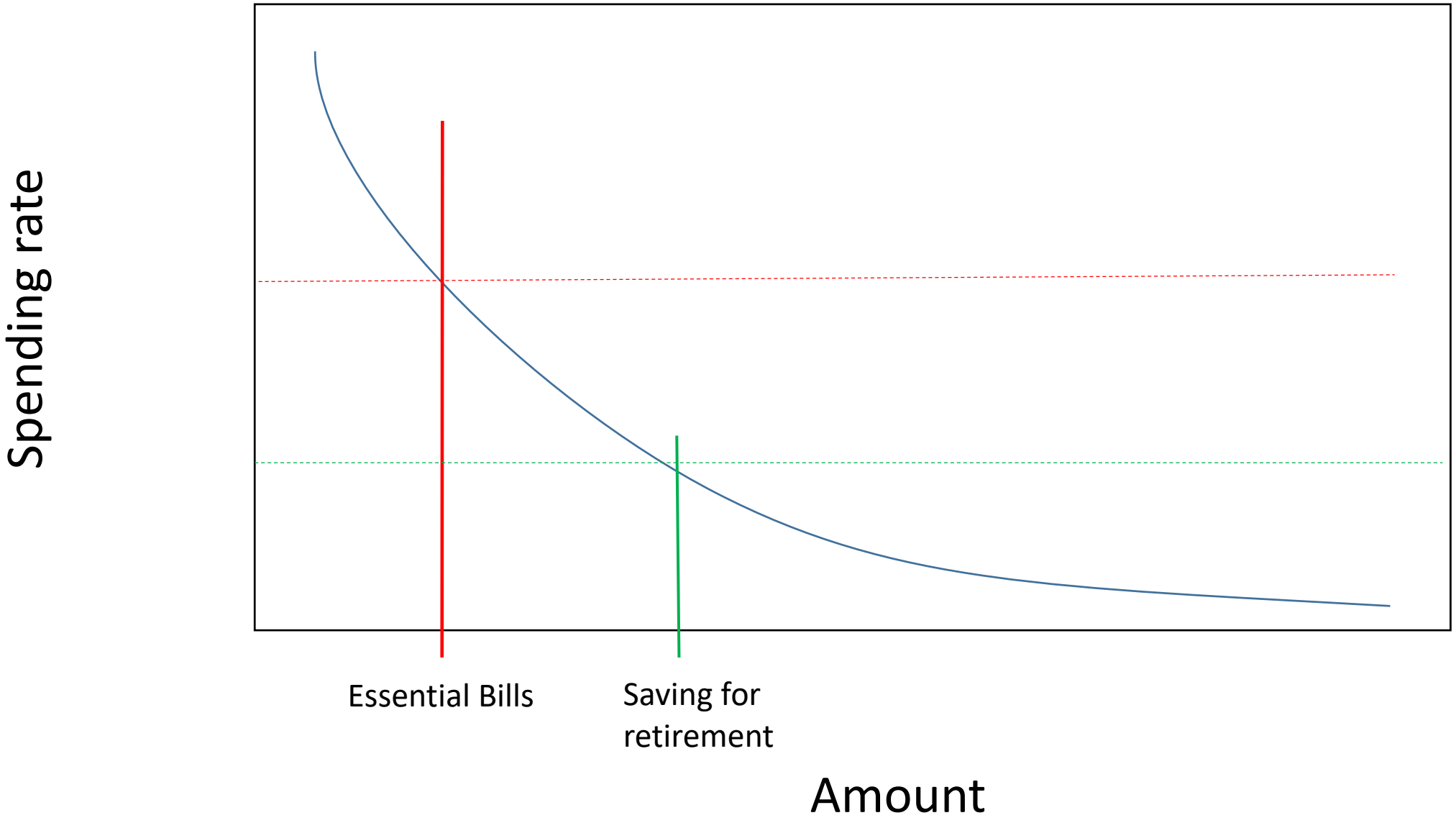
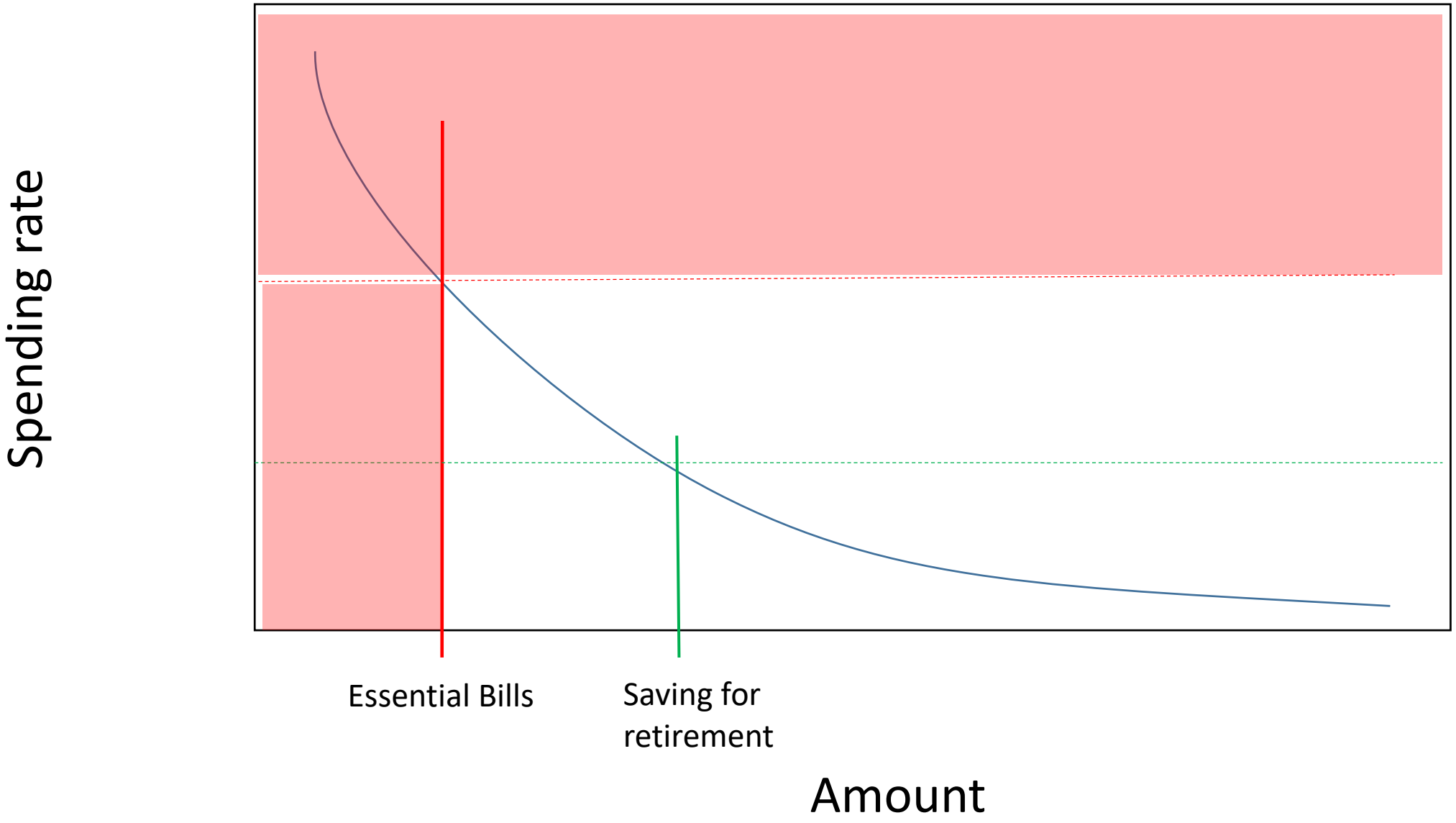
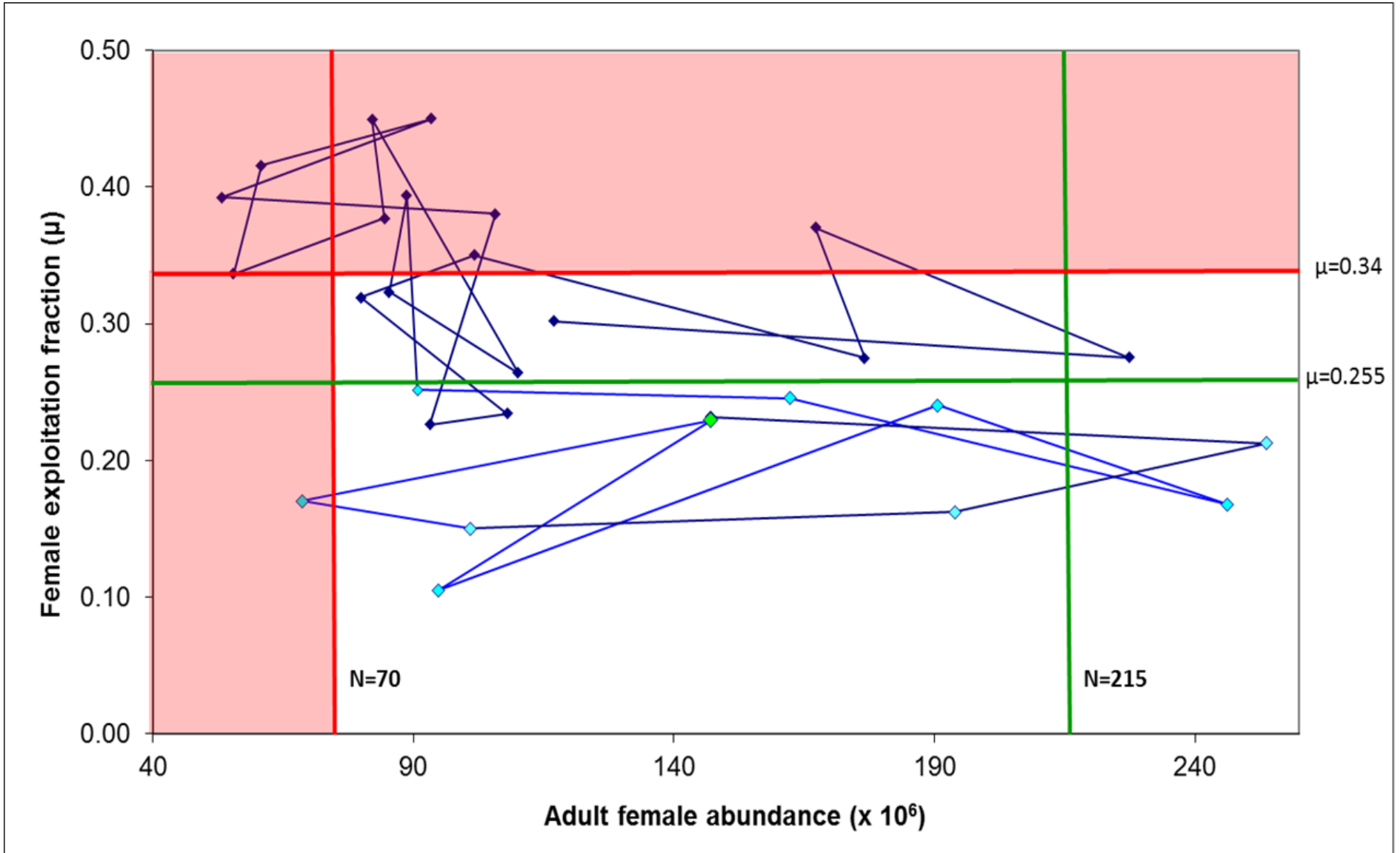
Management framework



Management framework

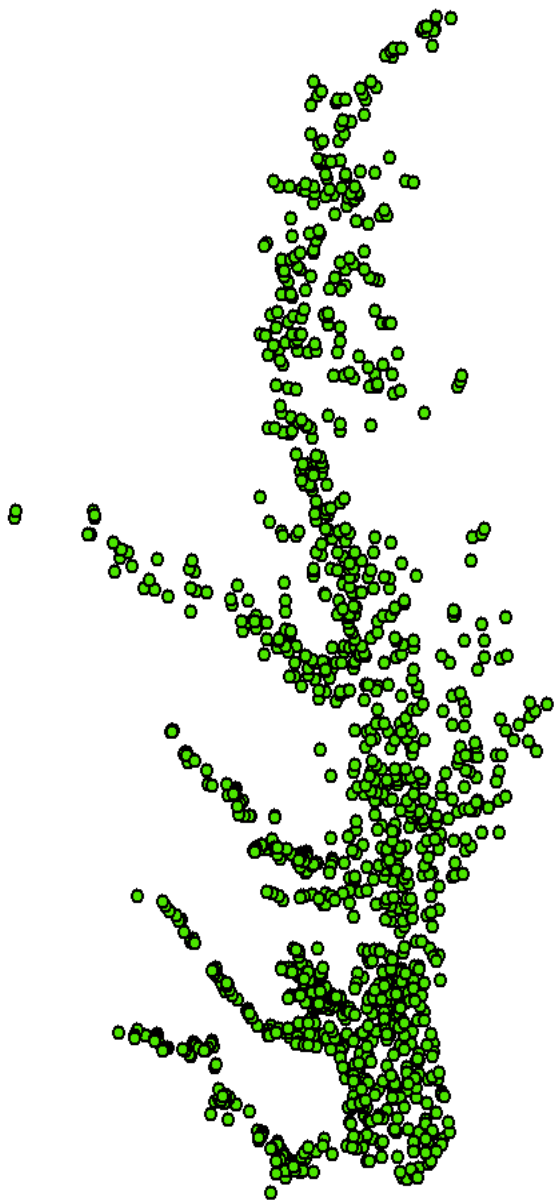


Blue crab control rule

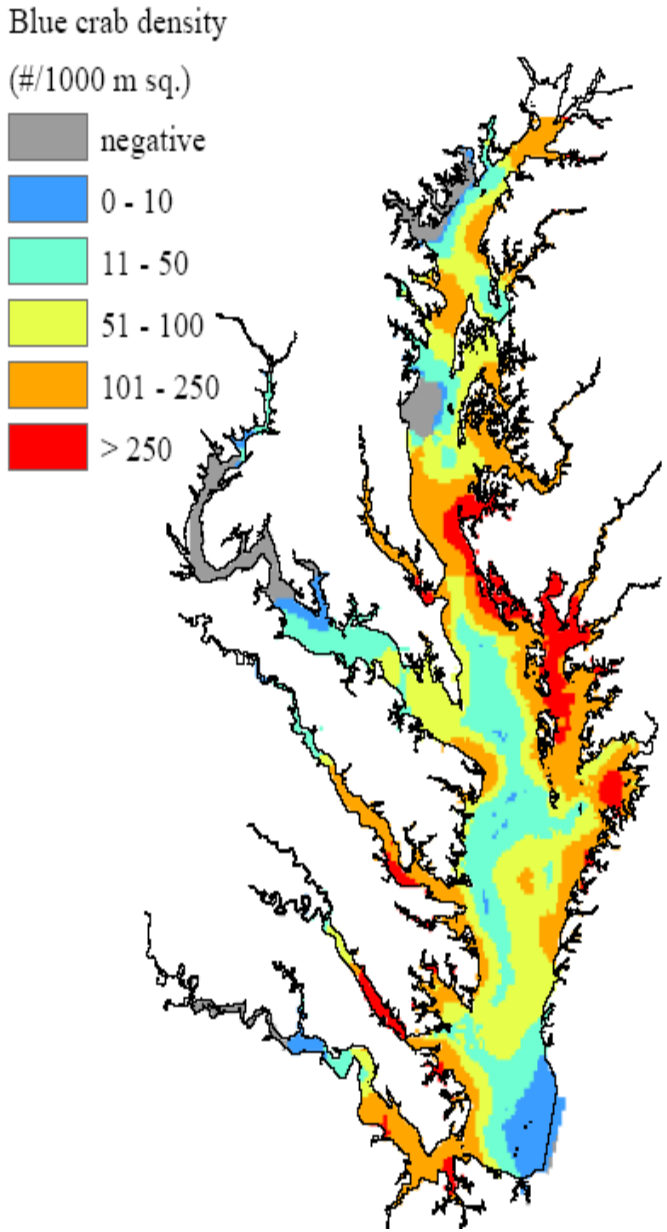


Estimating abundance – winter dredge survey

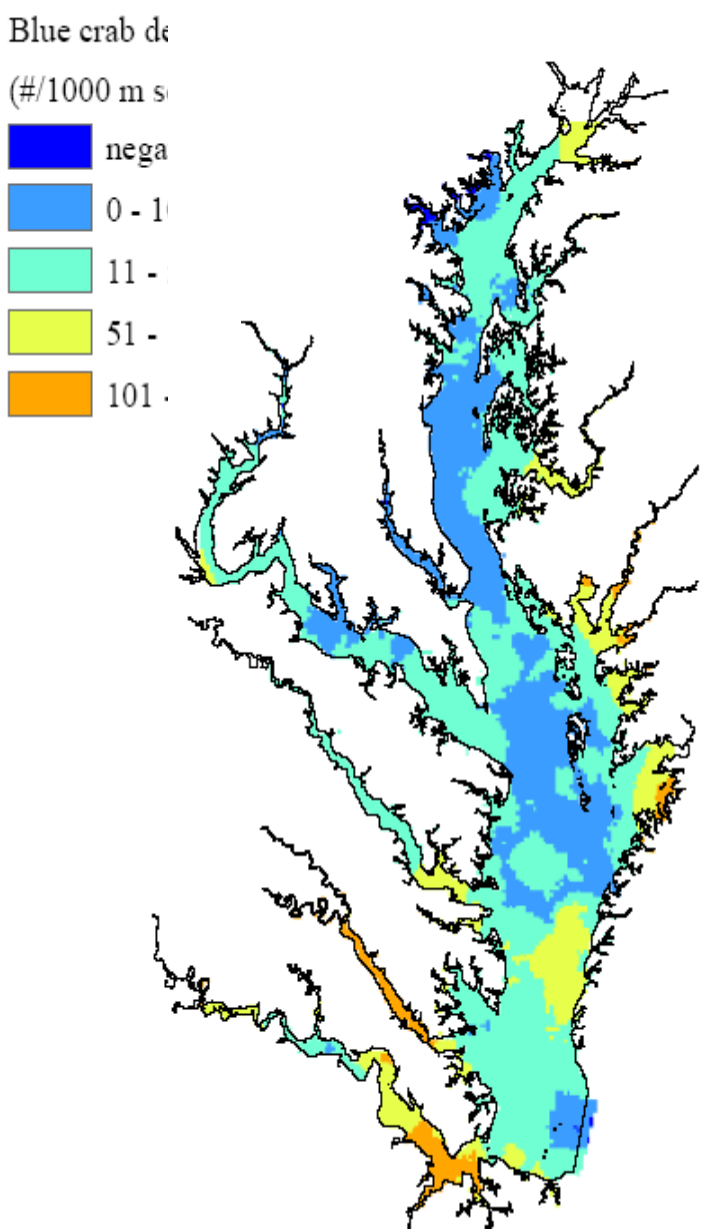
- Conducted yearly since 1990
- Winter – crabs are dormant, no movement
- 1 minute tow of a crab dredge
- ~1,500 stations per year



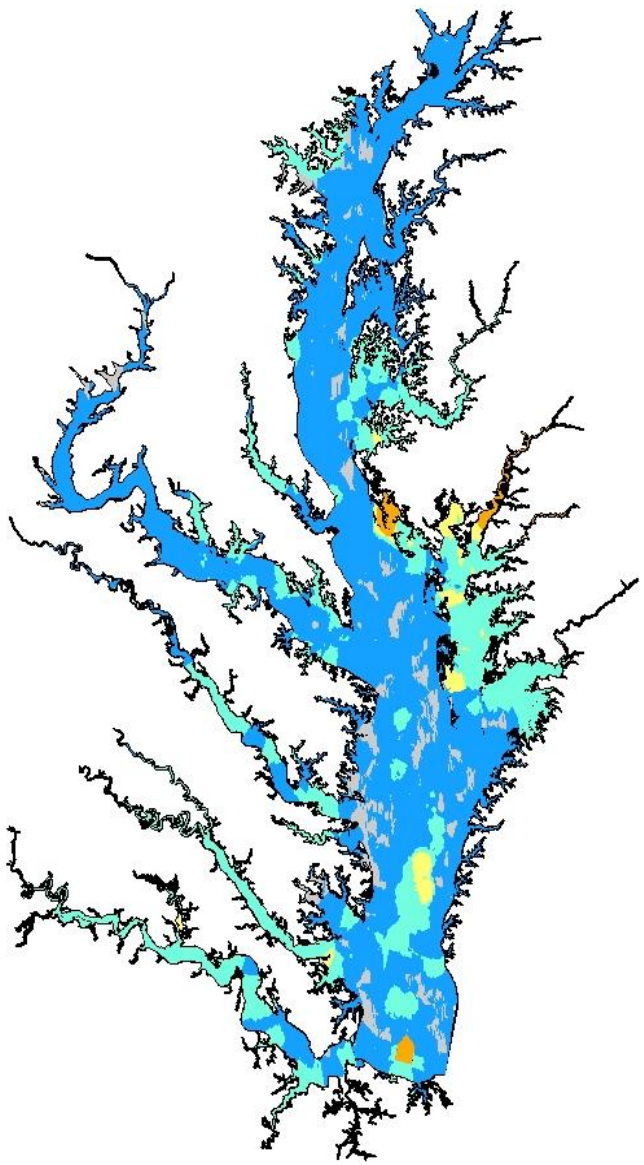
1990-91



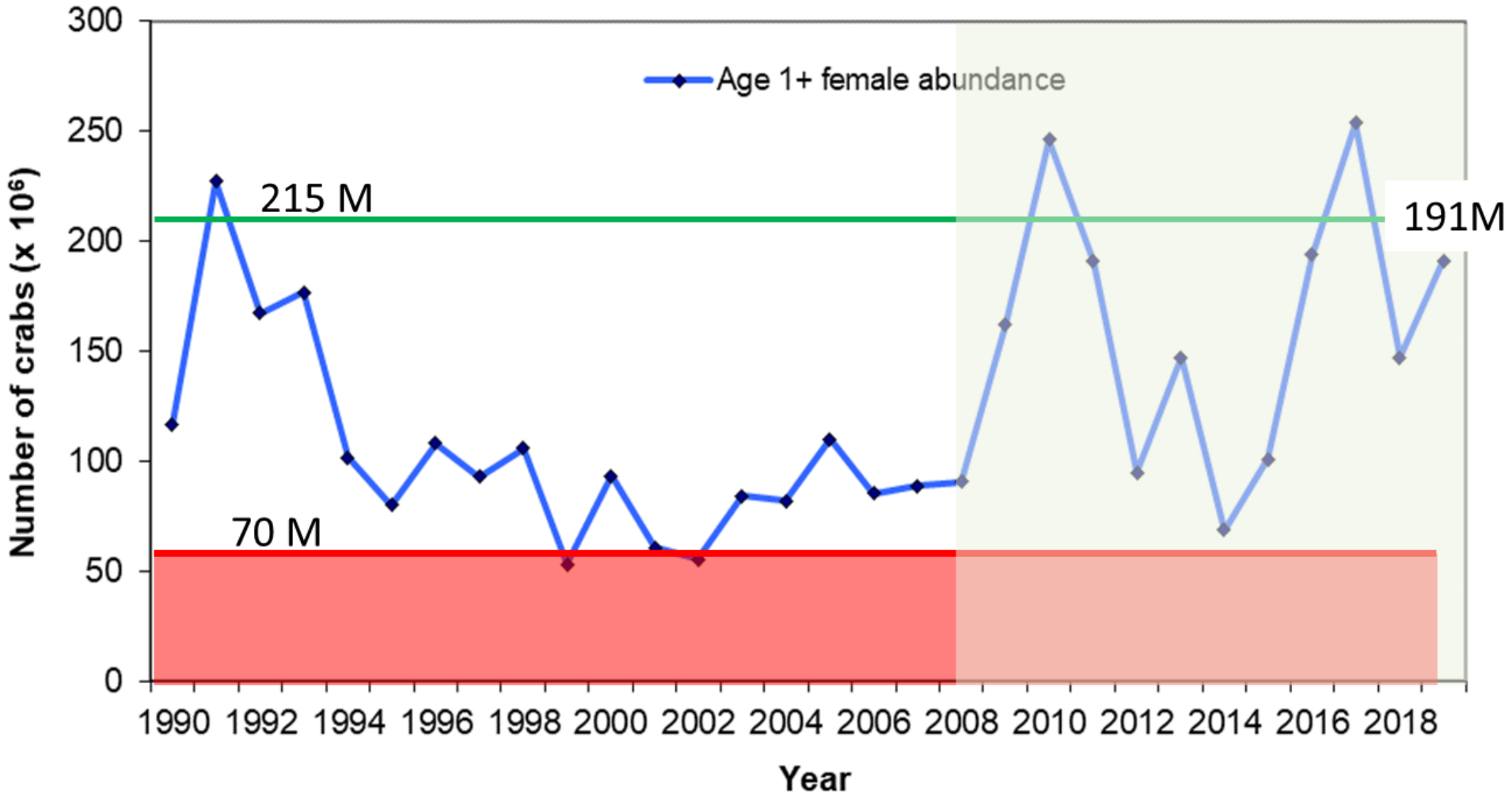
2000-01



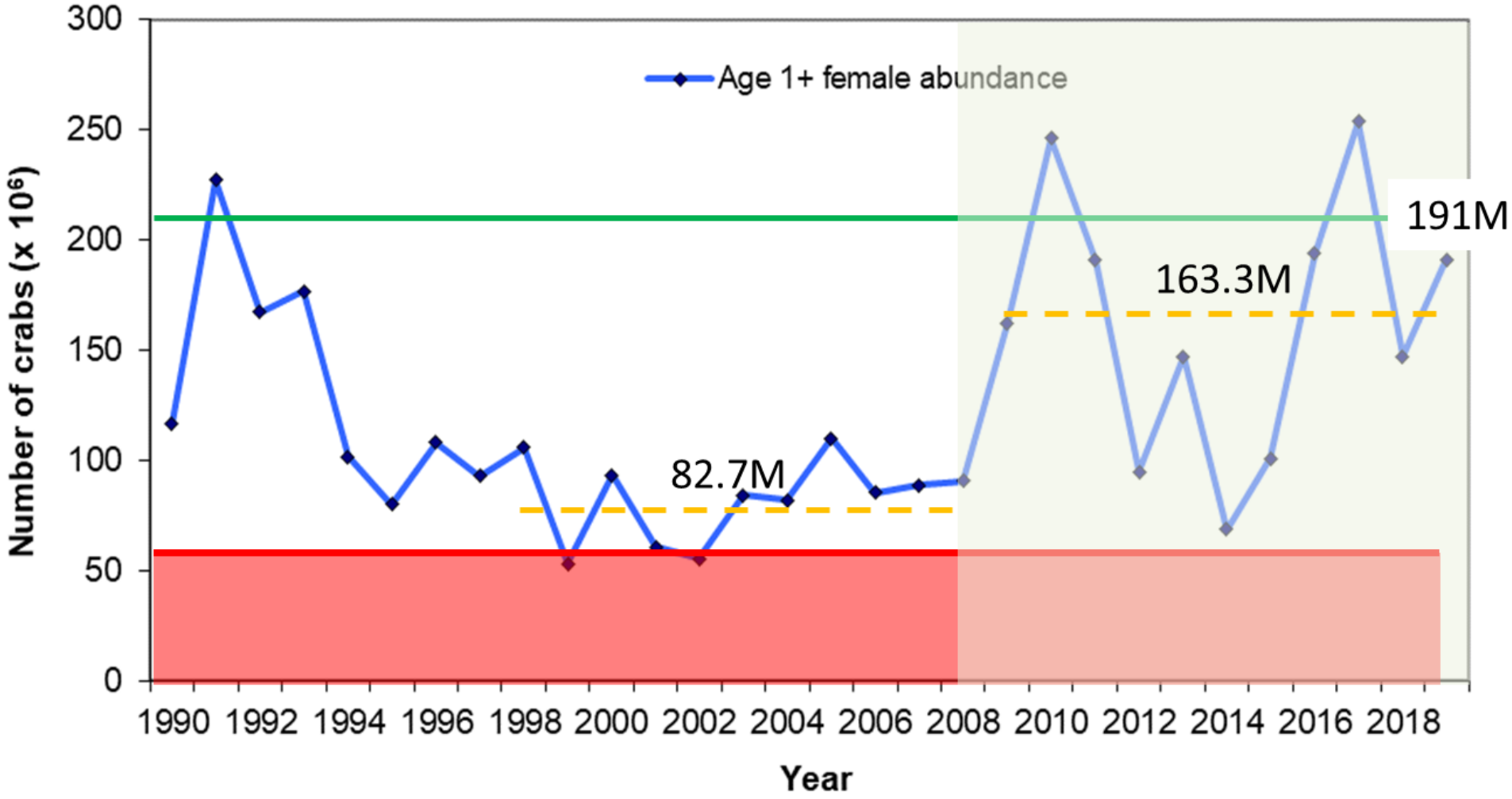
2008-09



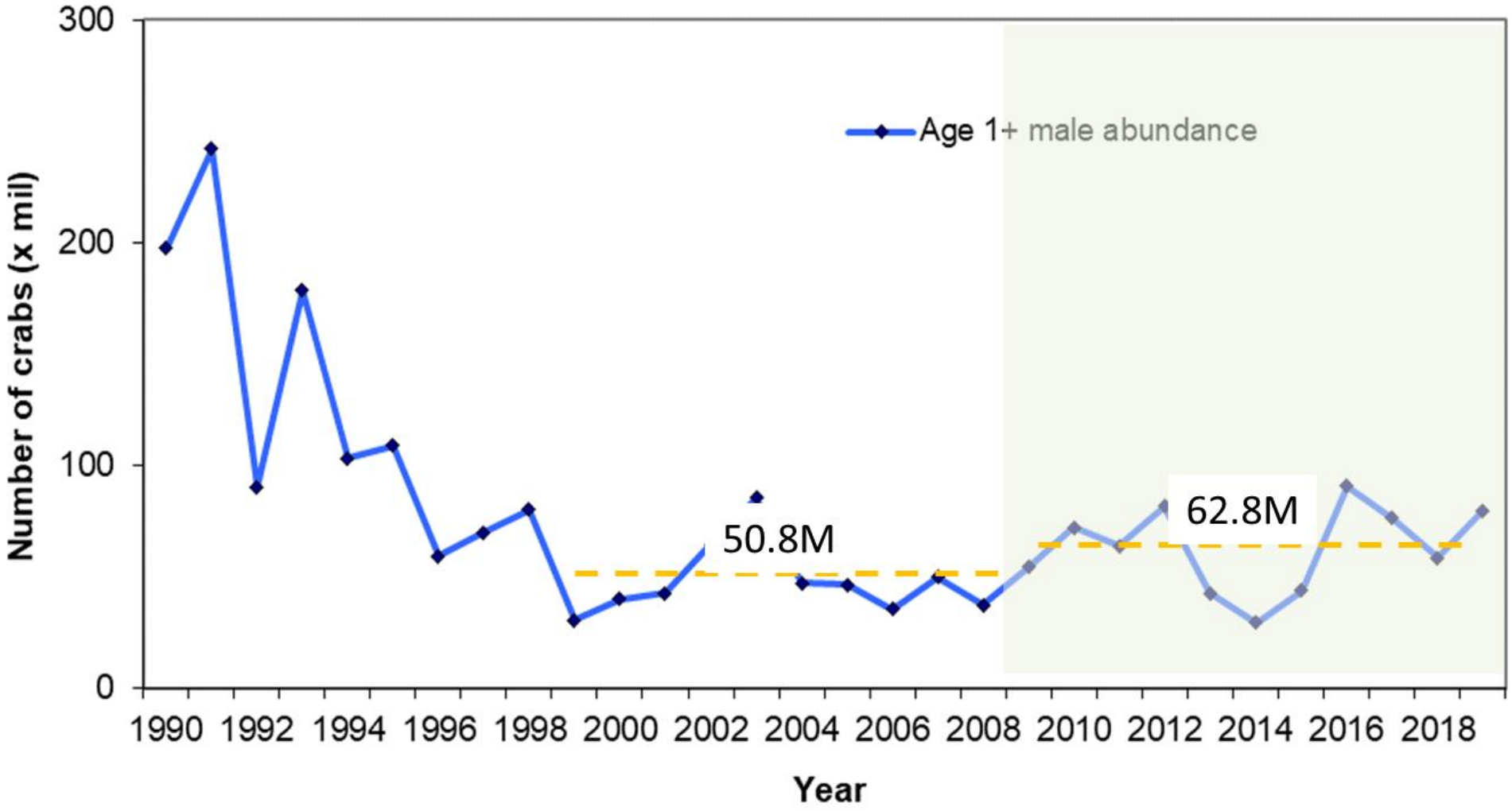
Adult females



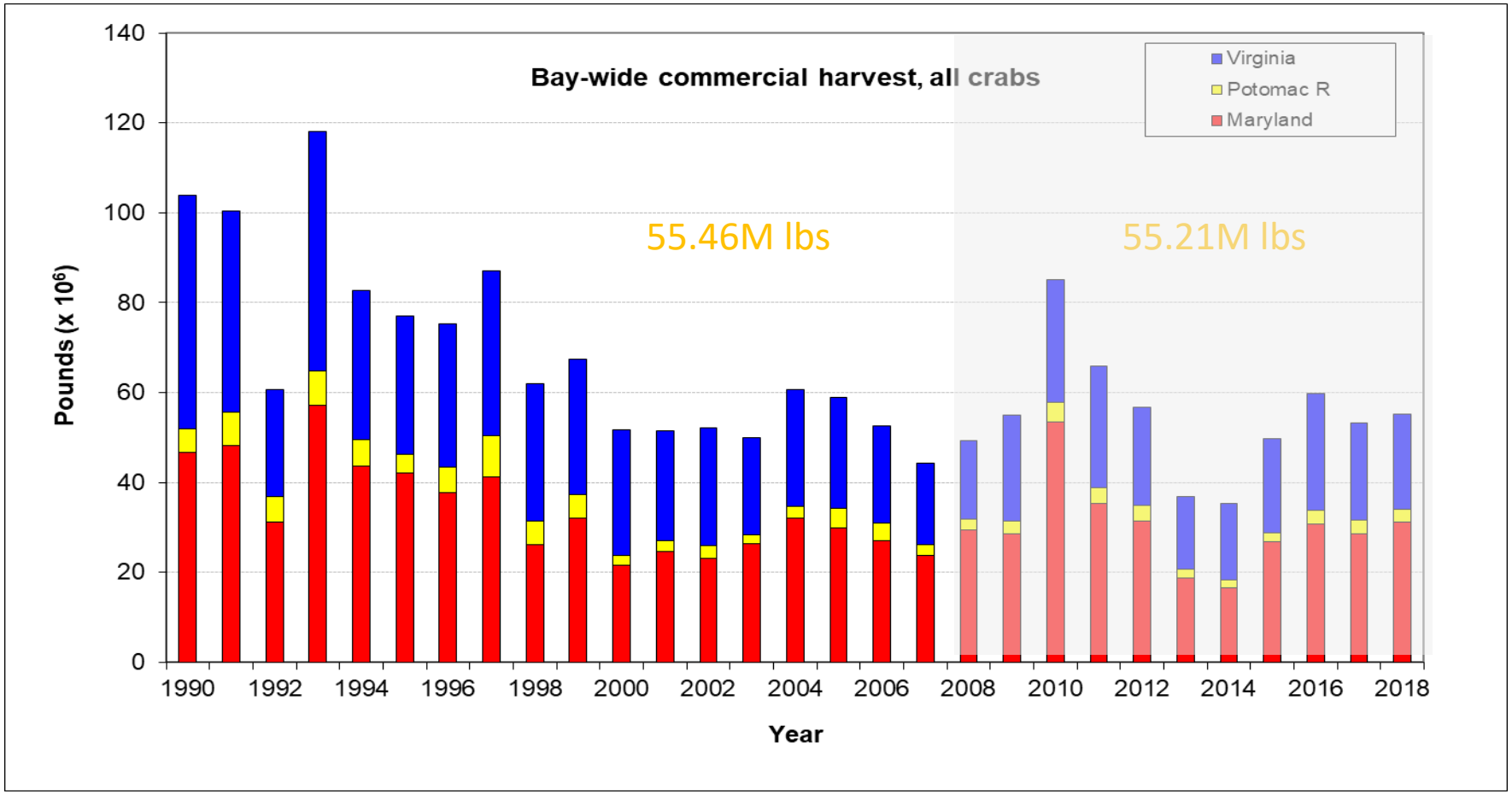
Adult females



Adult males


300
200
100
0
Number of crabs (x mil)
Age 1+ male abundance
50.8M
62.8M
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
Year

Total commercial blue crab landings (all market categories) in Chesapeake Bay, 1990-2018



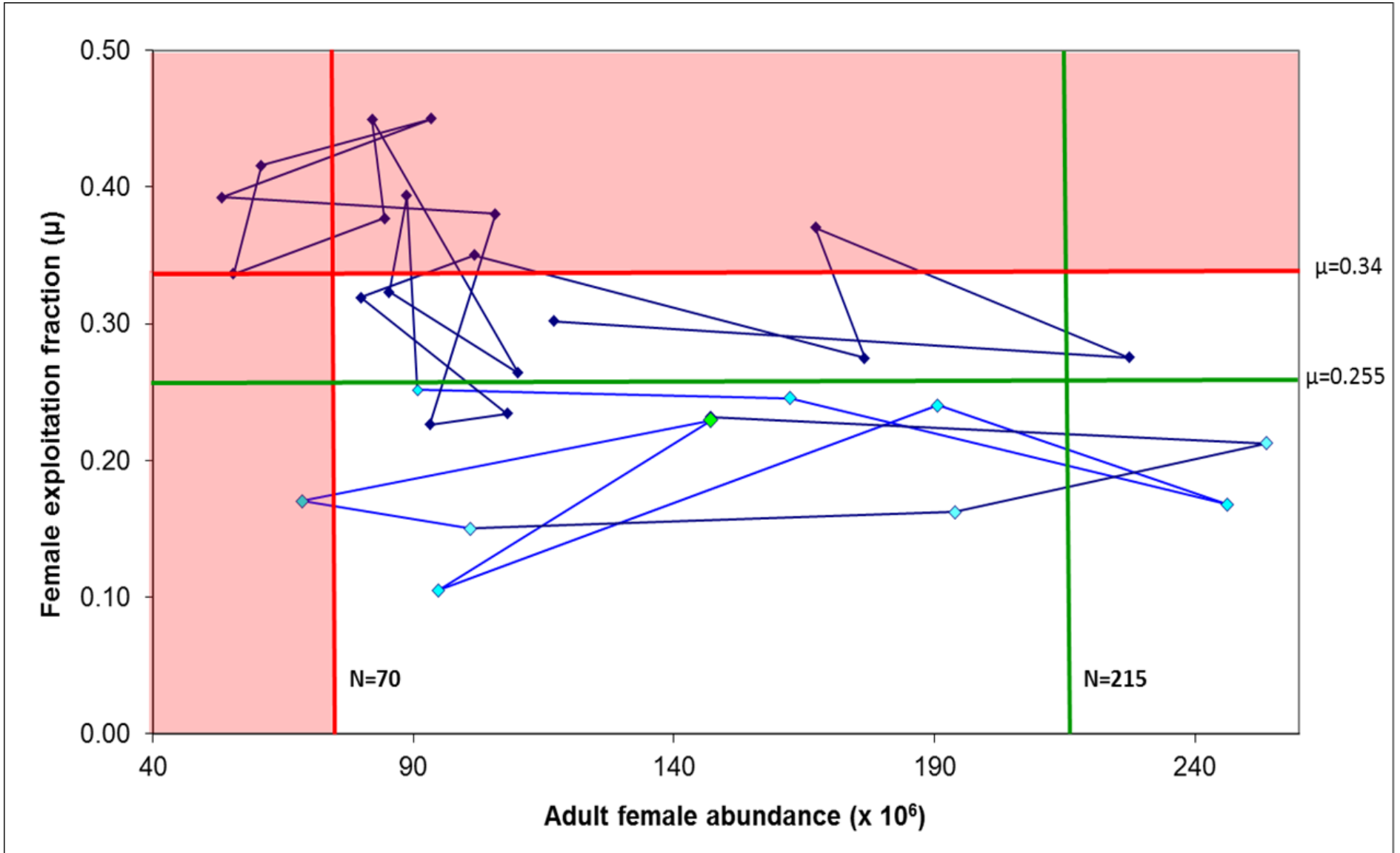
Summary

- Mature female abundance (191M crabs) is at 88% of the target
  - Management action has likely lead to a 97% increase in abundance of mature females since 2008
- Female exploitation rate is below the target for the 10th straight year
  - Management action has likely reduced exploitation rate by almost 90% since 2008
- Recruit abundance (323M crabs) is higher than pre-management action
- Male abundance remains low (79.7M crabs), but even here is 24% higher than pre management
- Total crab abundance (594.5M crabs) is 56% higher than in the decade pre-management
- Harvest remains approximately equal to levels observed in the decade pre-management

Opportunities and challenges for crab management

- Communication – Can we please stop separating abundance and catch as indices.

Blue crab control rule

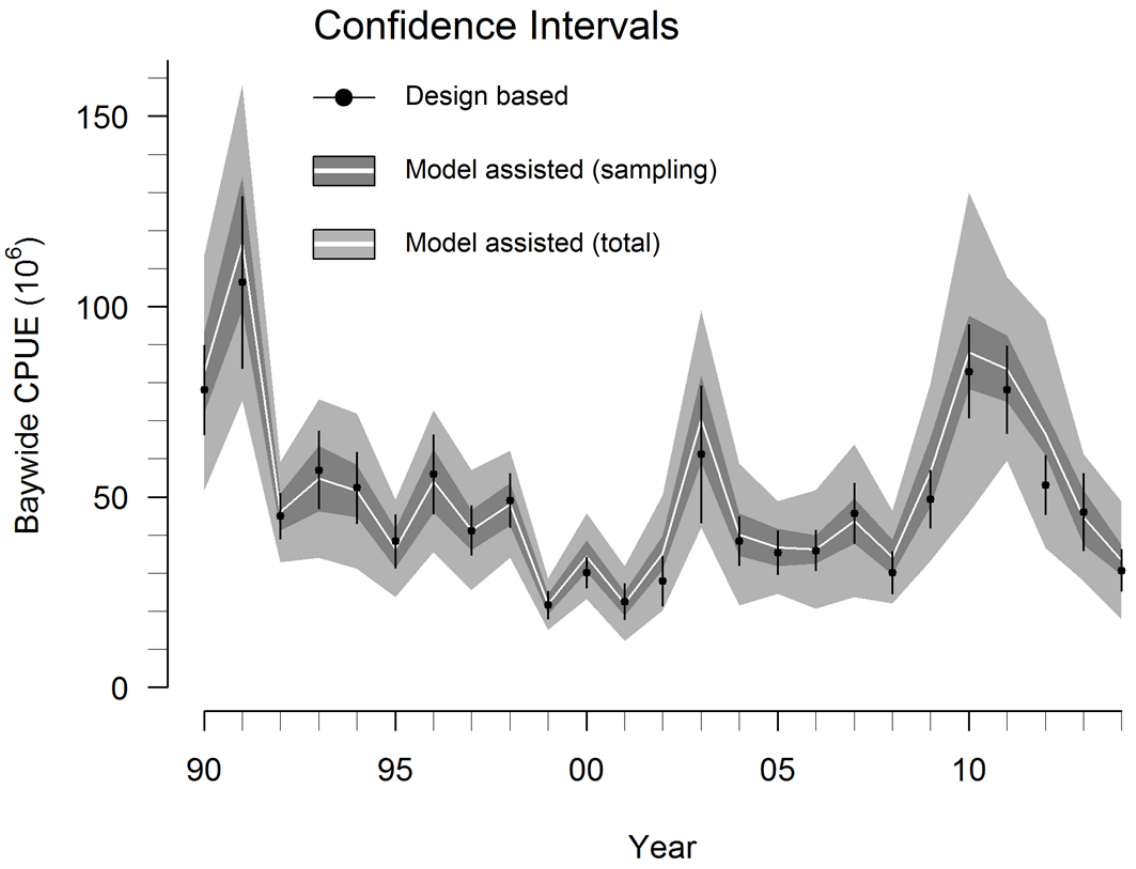


Opportunities and challenges for crab management

- Communication
- Estimating reference points
  - Improved stock assessment methodology.
  - Need to define target in a socio-ecological context.

Enhanced stock assessments

- Fuller recognition of uncertainty
- Robust decision making
  - Allows managers to understand risk when taking decisions (Wilberg et al. 2019. Mar. Coastal Fish.)
  - Requires inclusion of stakeholders in determining targets – what does society want the fishery to provide (Miller et al. 2010. Fisheries)

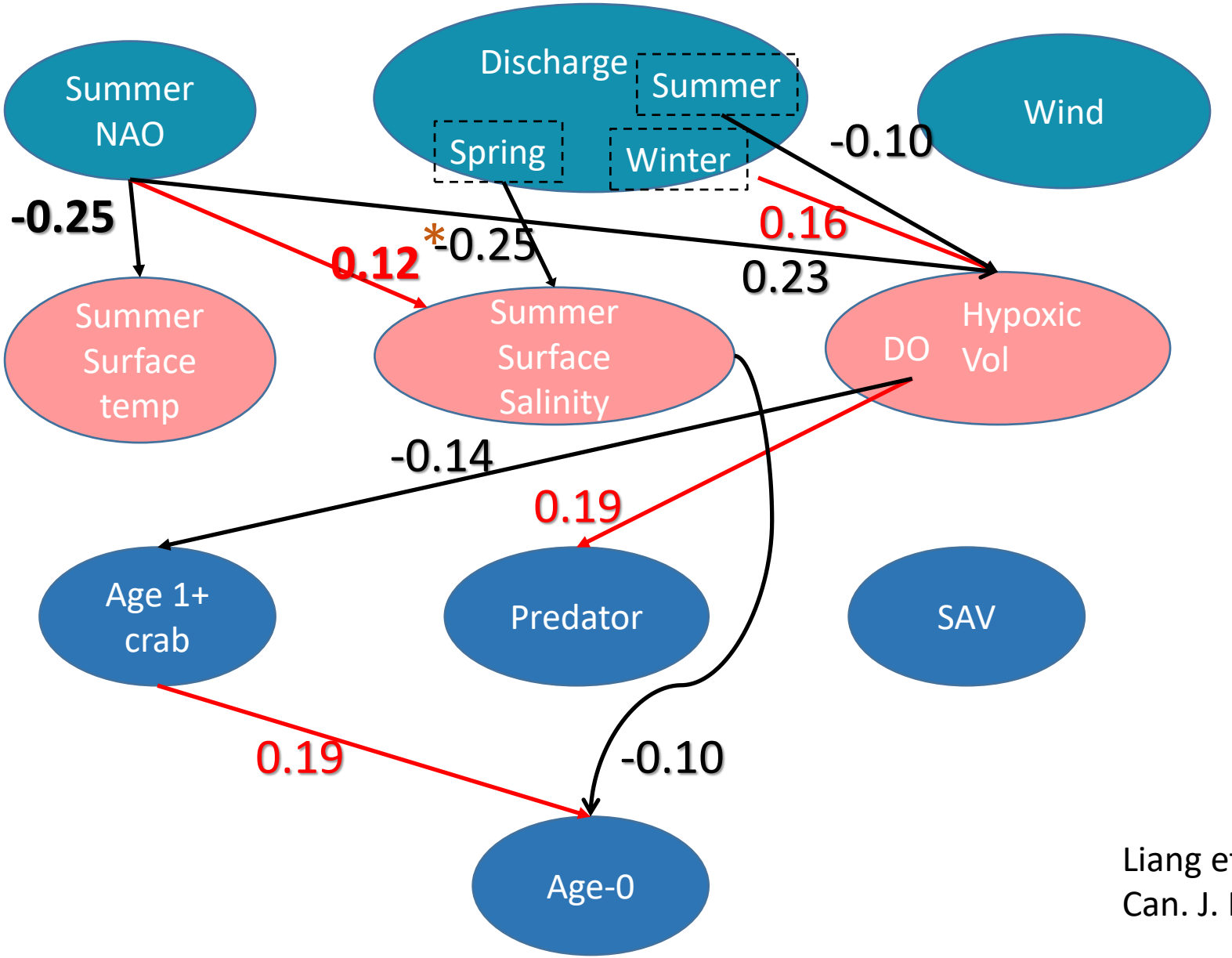


Liang et al. 2017. J. Ag. Biol. Env. Stats

Opportunities and challenges for crab management

- Communication
- Estimating reference points
- Ecosystem-based effects

Ecosystem impacts on blue crab recruitment



Liang et al. (in press).
Can. J. Fish. Aquat. Sci.

Opportunities and challenges for crab management

- Communication
- Estimating reference points
- Ecosystem-based effects
- Climate change
  - Acidification
  - Winter temperature change

Climate change - acidification

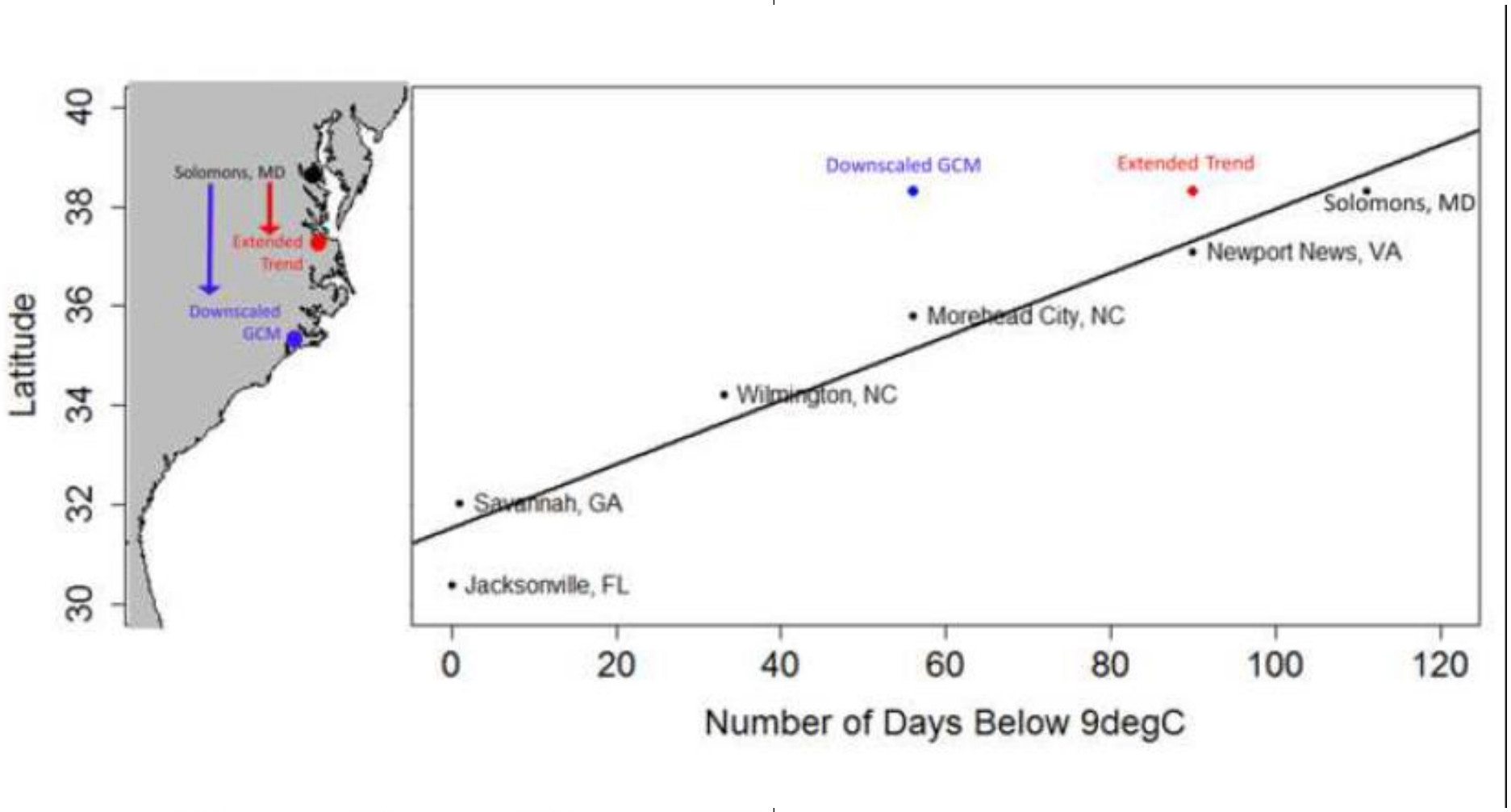
Response	Temperature	pCO2
Growth per Molt	No effect	No effect
Growth Rate	Increase	No effect
Food Consumption	Increase	No effect
Metabolic Rate	No effect	No effect
Carapace Thickness	Decrease	No effect
% HMC	Decrease	Increase
Mg:Ca	Increase	Increase

(Glandon et al. 2018. J Exp. Mar. Biol. Ecol.)

Sacrificing carapace integrity for growth

Maintenance of physiological properties

Climate change – winter temperature



(Glandon et al. 2019. PLoS One)

Opportunities and challenges for crab management

- Communication
- Estimating reference points
  - New joint Academic-State-Federal partnership needed
- Ecosystem-based effects
  - Enhanced research presence
  - Enhanced data hub
- Climate change
  - Additional research on all life stages
  - Incorporation into ecosystem-based models

http://hjort.cbl.umces.edu