Opportunities and challenges in blue crab management

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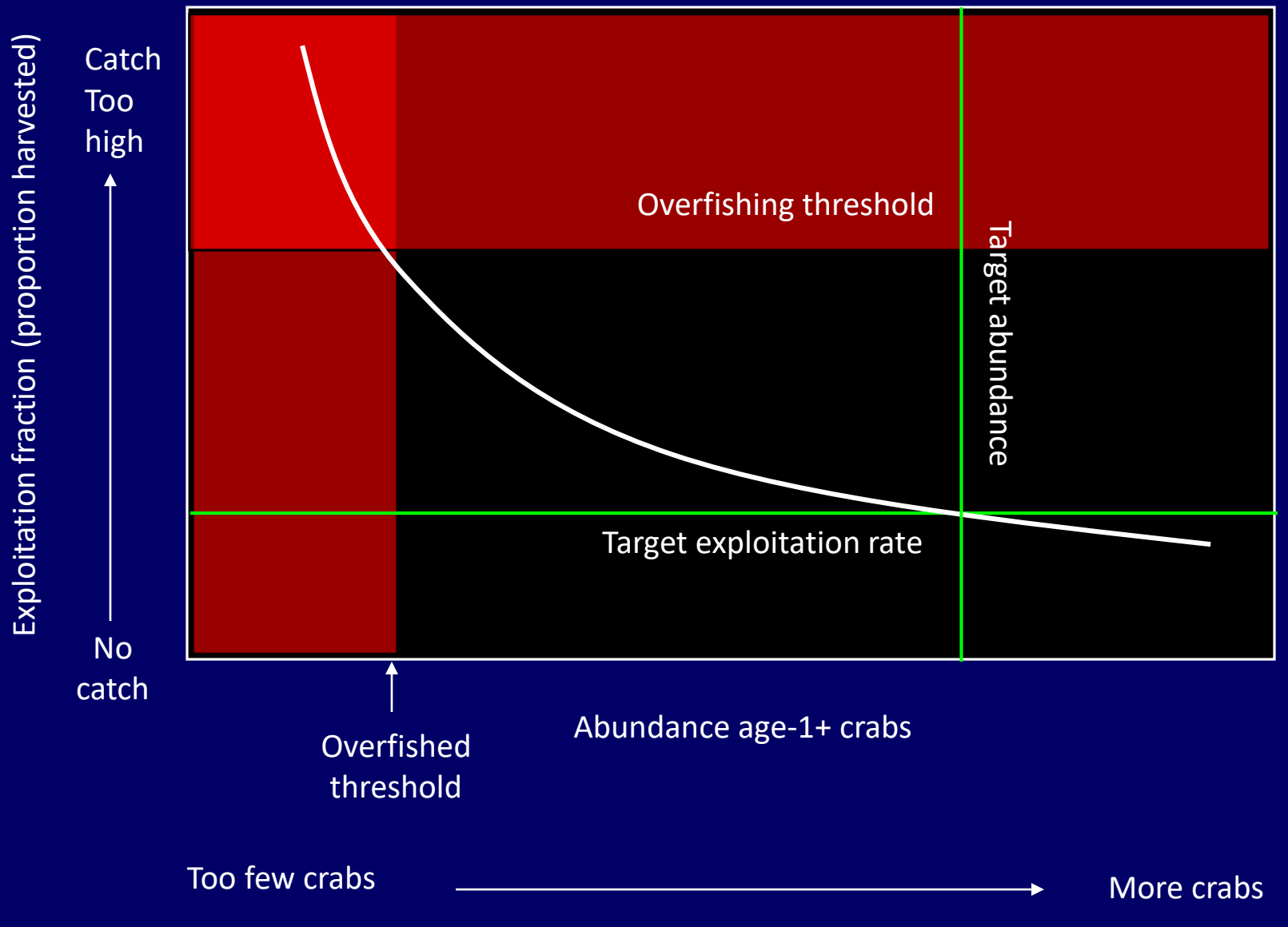
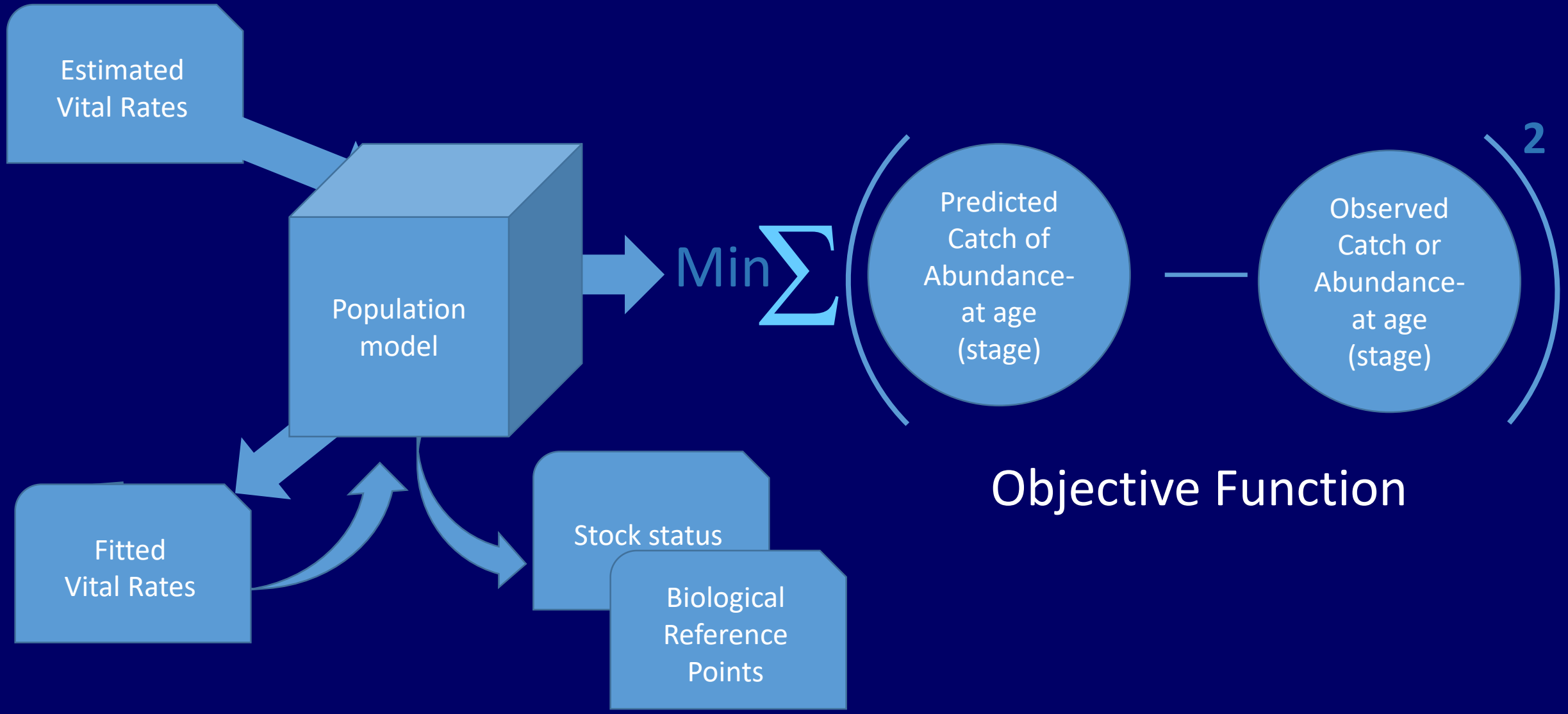
History and development of assessment approaches to blue crab

- Historical fishery with harvest records (spotty) back to 19th Century
  - Management by traditional size and season limits
- Ad hoc management until first assessment in 1997
  - Limit reference point ($F_{10\%}$)
  - Stock was fully exploited
  - Length based F estimation, index based abundance
- Winter dredge survey implemented 1998/1999
- Bi-State Blue Crab Commission - Target and Threshold Framework (1999 – 2001)
- 2005 Bay Wide Stock Assessment
  - Adjustment of harvest for reporting changes
  - Catch-multiple survey model
- 2011 Sex-specific stock assessment
  - Female based management
  - Integrated harvest and abundance reference points

Biological reference points

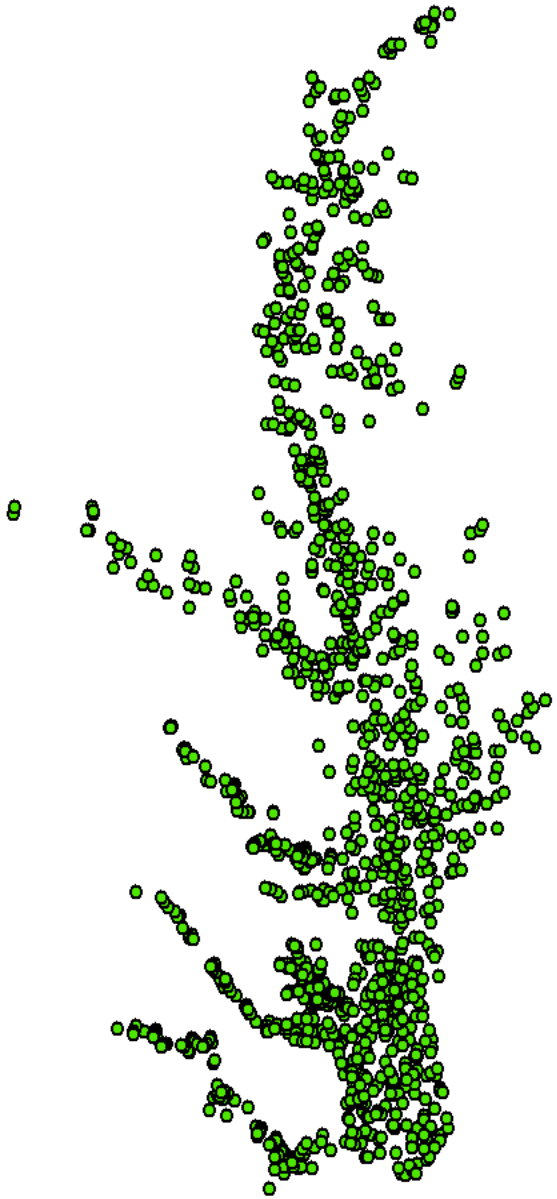


What is a stock assessment?

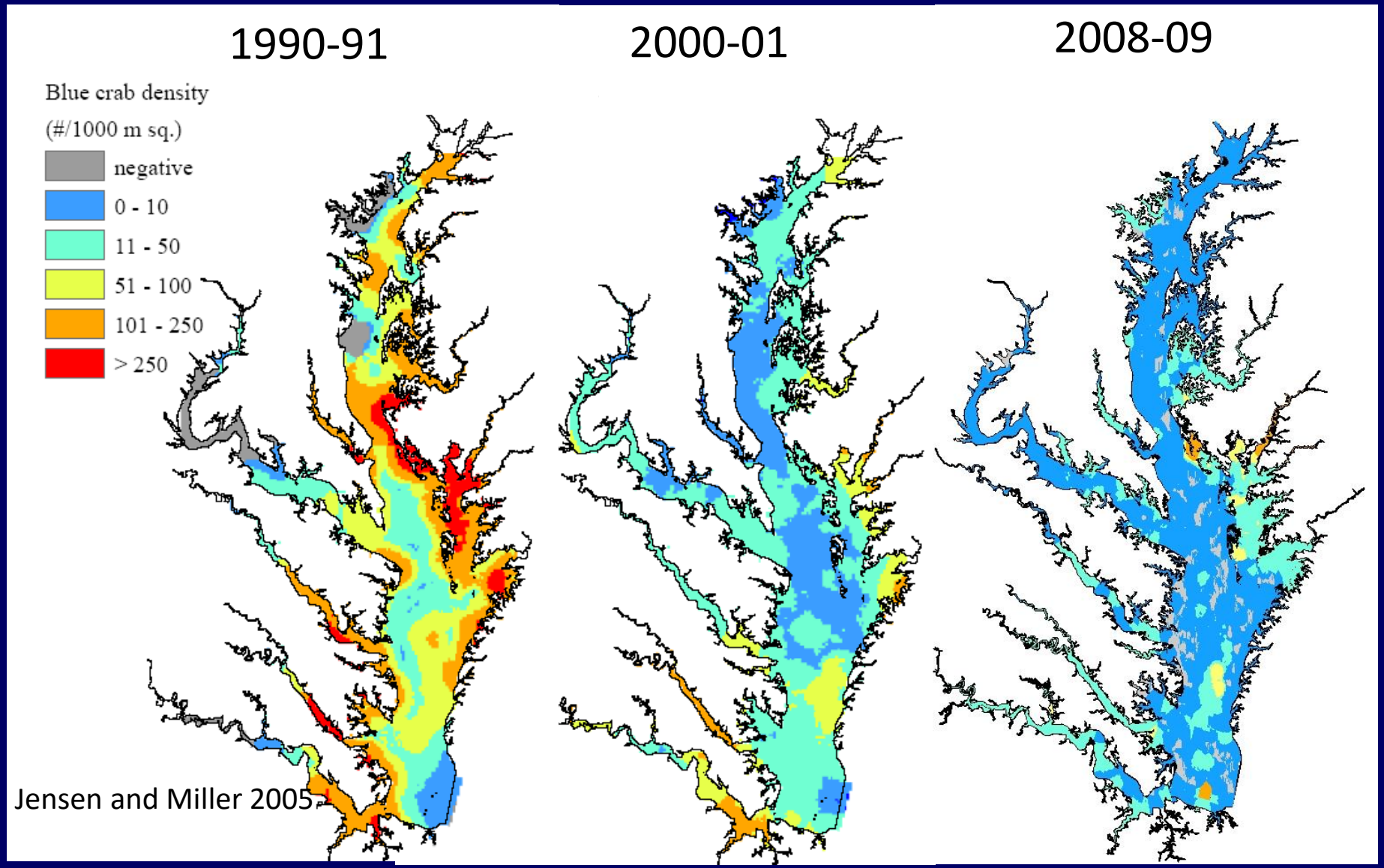


The Winter Dredge Survey (WDS)

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

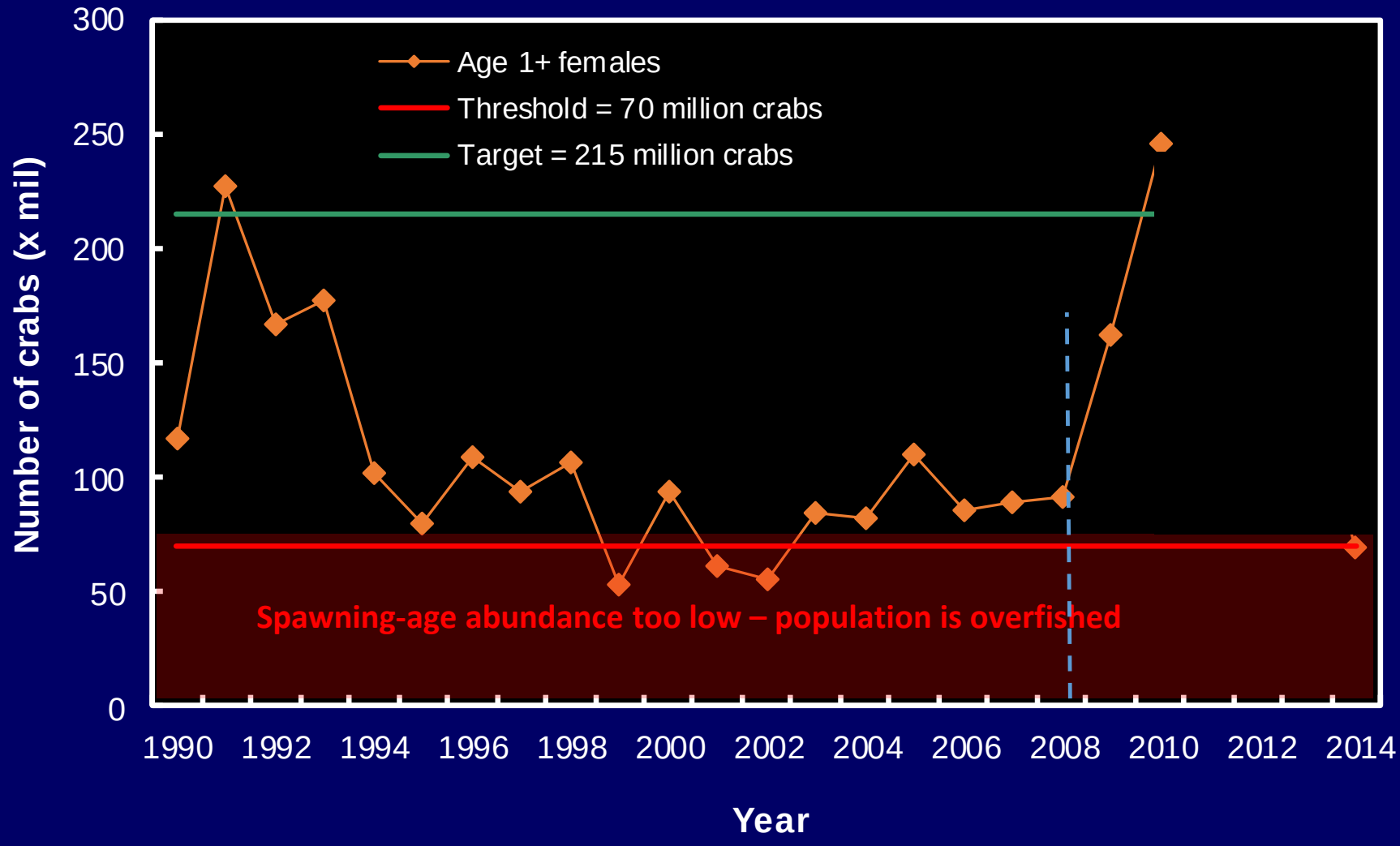


Crab distribution maps

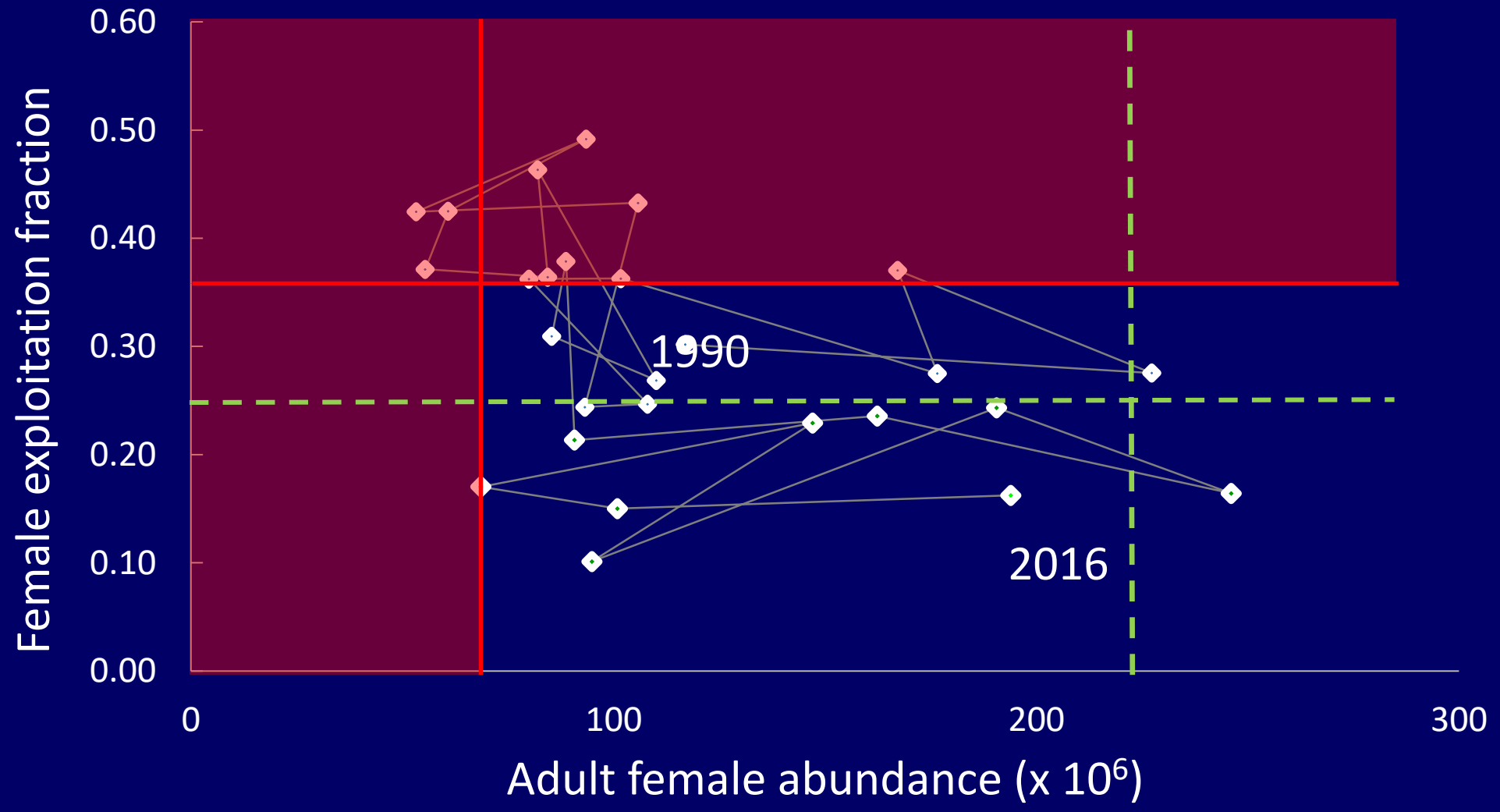


Jensen and Miller 2005

WDS – female abundance



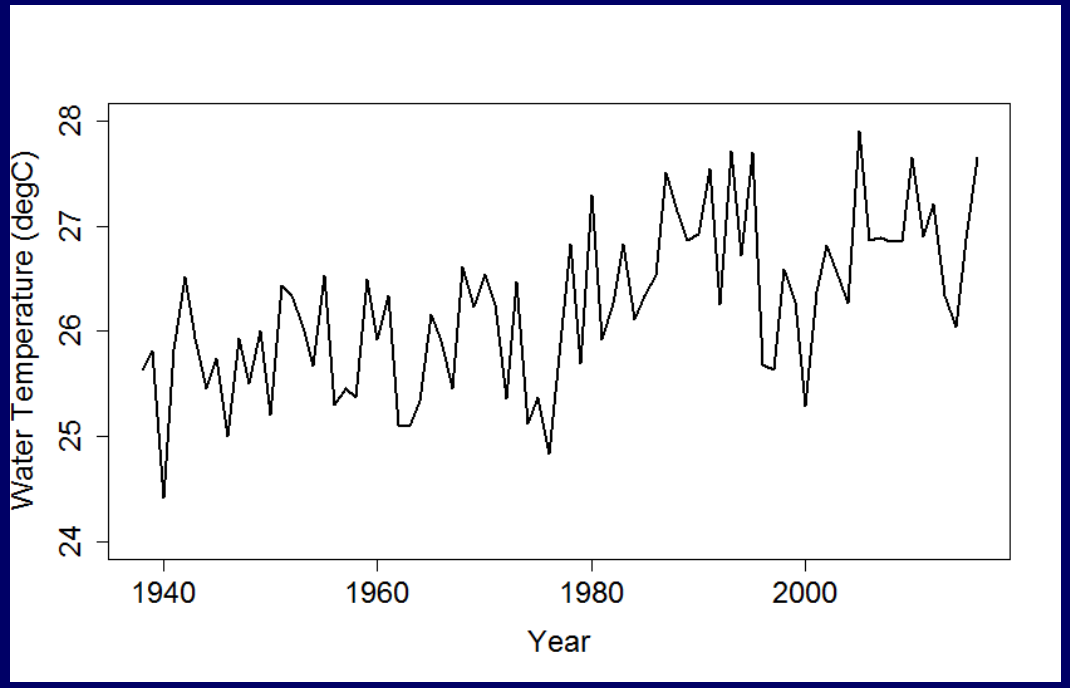
2016 Stock status



Opportunities and challenges

- Management framework is robust, focusing on protection of reproductive females
  - What about males?
  - Consequences of ecology to state allocations
    - Critical scientific advances needed
    - Critical engagement with stakeholders needed
- Economic consequences of management
  - Bioeconomic tools available to support policy evaluation
- Consequences of a changing world

It’s tough to make predictions – especially about the future



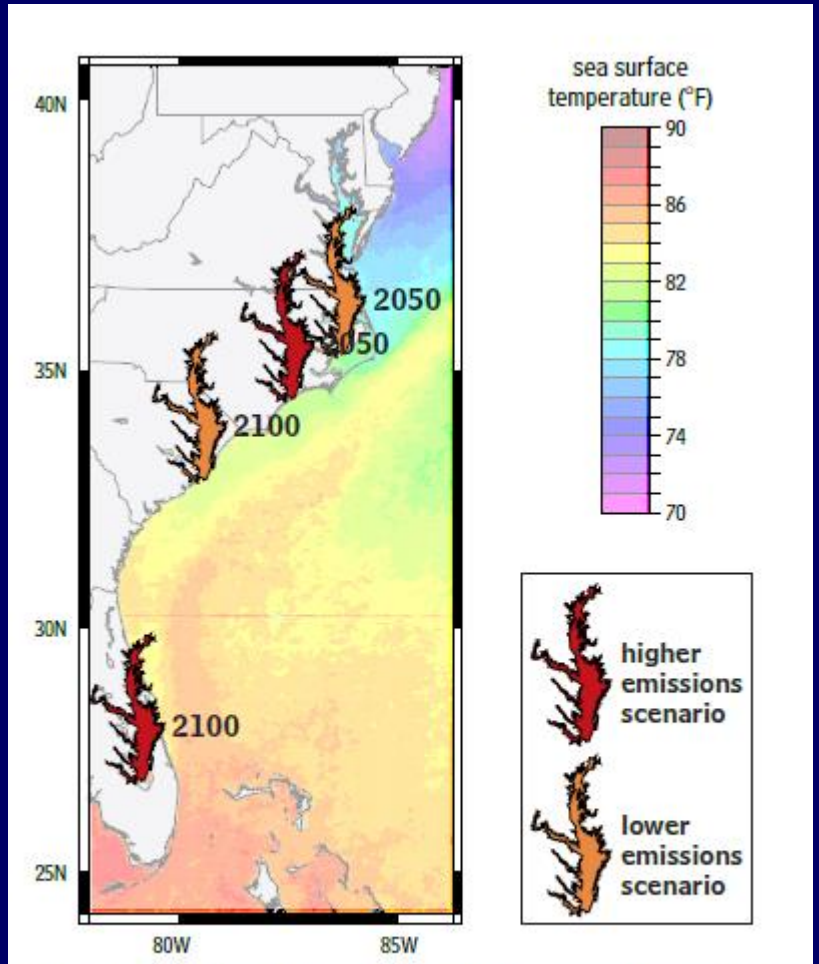
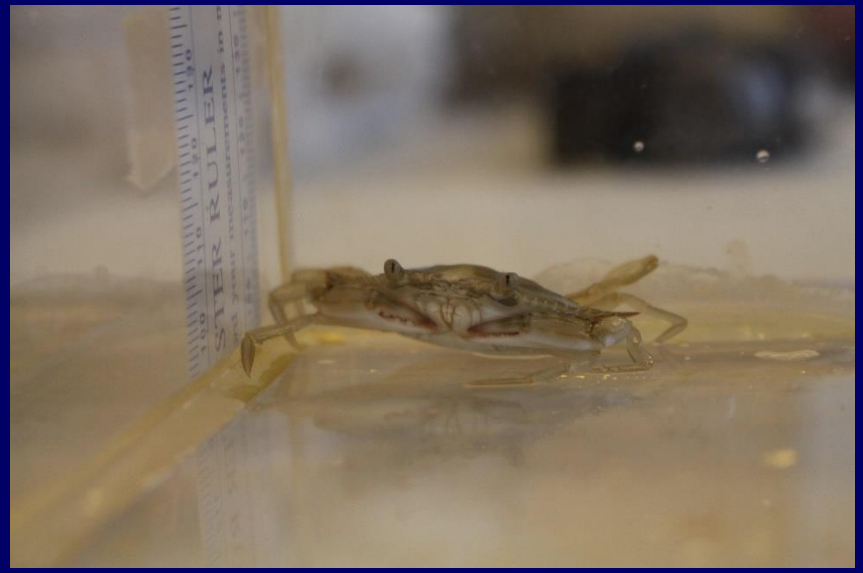


Figure 4.7. Summertime surface water temperatures in the Chesapeake Bay are projected to approximate those of estuaries well down the Atlantic Coast by 2050 and 2100.

Boesch et al. 2008

Hot crabs on acid



Summary of results

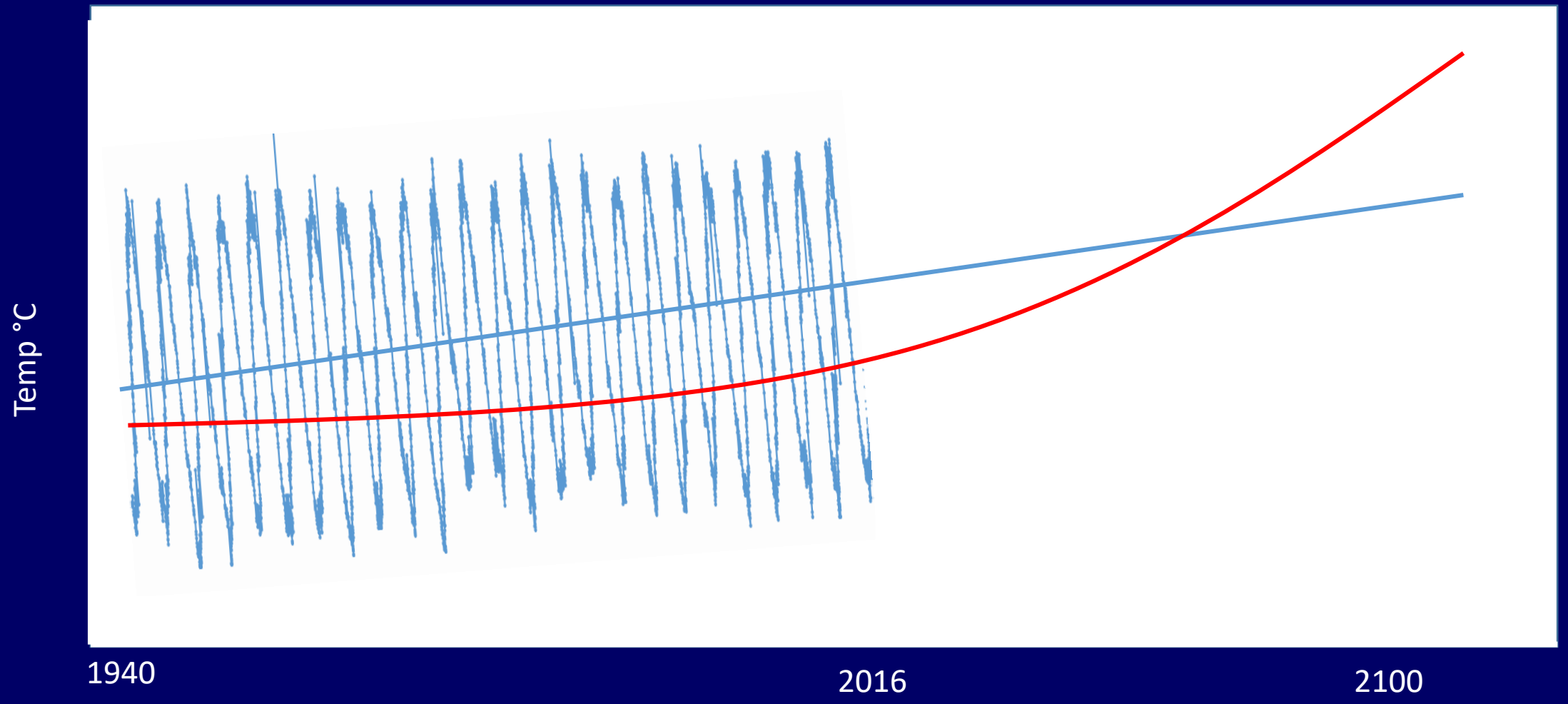
Response	Temperature	pCO2
Growth per Molt	No effect	No effect
Growth Rate	Increase	No effect
Food Consumption	Increase	No effect
Metabolic Rate	No effect	No effect
Carapace Thickness	Decrease	No effect
% HMC	Decrease	Increase
Mg:Ca	Increase	Increase

H. Glandon, Ph.D. 2017
Glandon and Miller, 2017
Glandon et al. in press
Gland et al., submitted a, b

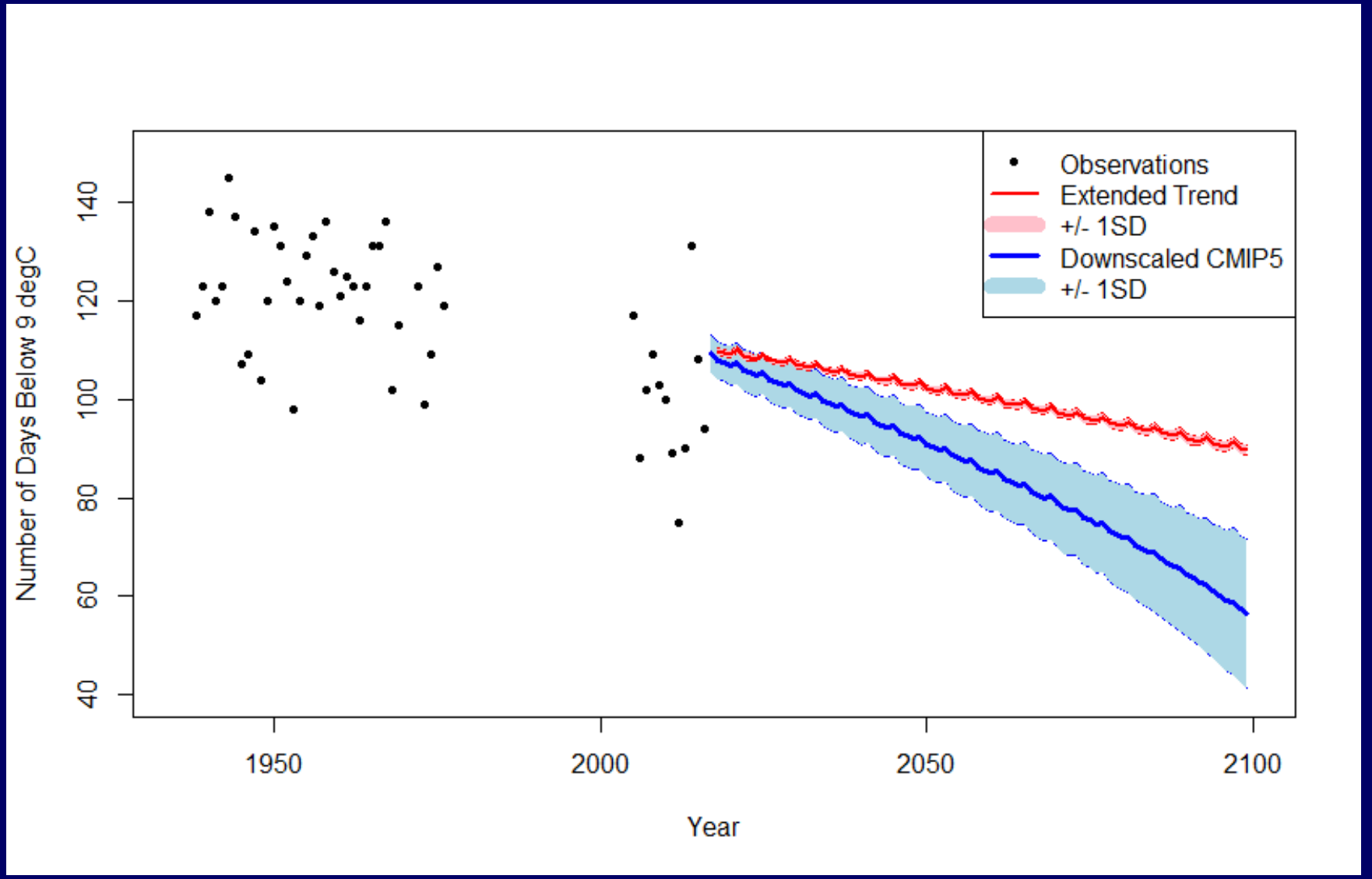
Sacrificing carapace integrity for growth

Maintenance of physiological properties

Climate change models for blue crab in the Bay

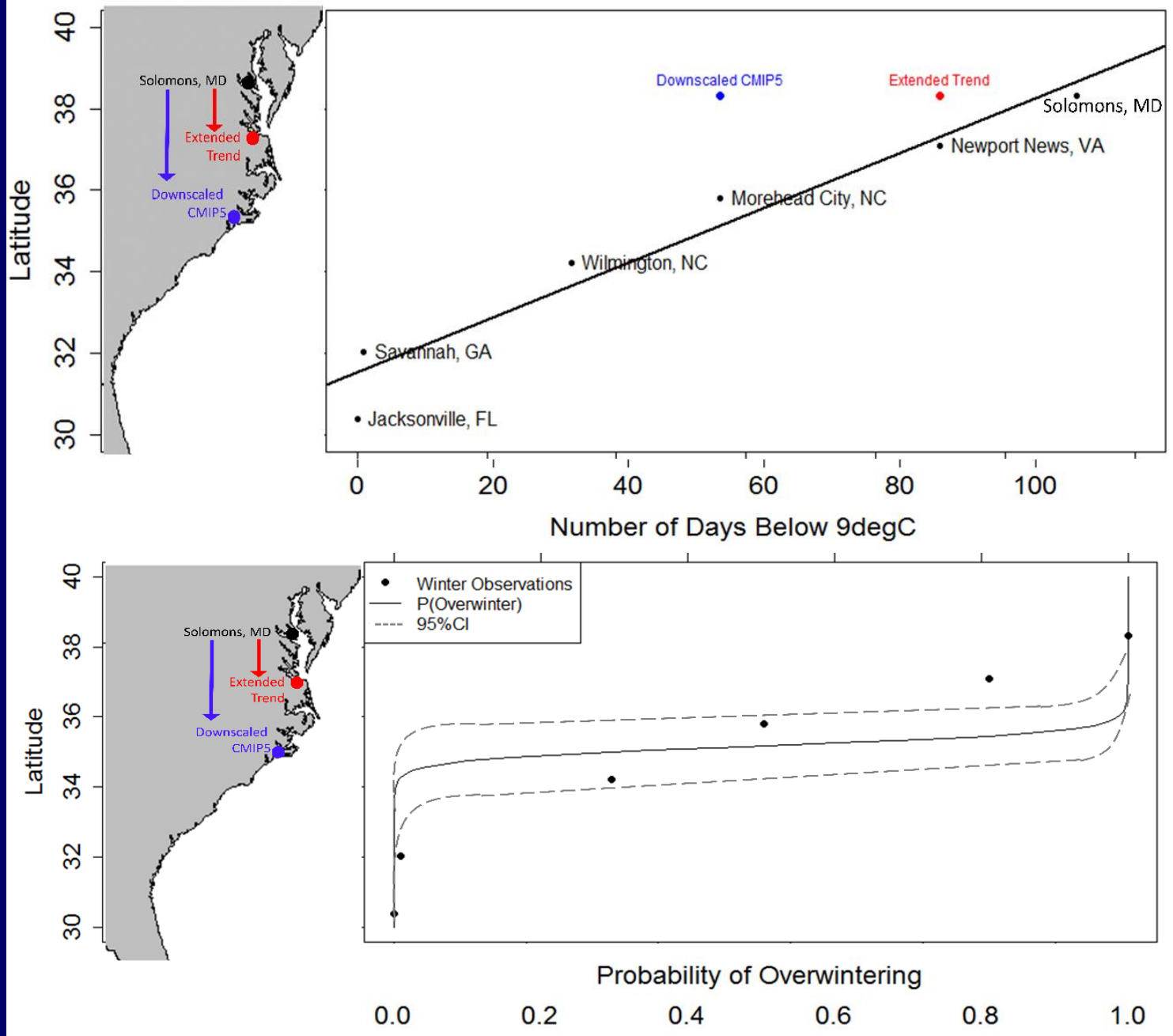


Climate impacts of overwintering



So what

- Chesapeake Bay will experience shorter “winters” and shorter overwintering periods
- Pressure to extend seasons, and open *de facto* closed season



What is needed

- Improved understanding of performance of current and proposed management policies
  - Resilience under uncertainty
  - Ecological and fishery allocation
  - Stakeholder-centered approach to targets – what do we want?
- Discussions of societal objectives for blue crab fisheries in a changing world
  - Forecasts of future conditions
  - Impacts of stock productivity
  - What do we want?

Spatial aspects of the blue crab life history & fisheries

- Complex life history involving both estuarine and coastal phases
- Diverse fisheries, involving gear use that is segregated in space and time.
- Spans three jurisdictions
- Most approaches to management to date, ecological and applied, have ignored the spatial component.