Working towards healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by 2015

Delaware Bay Ecosystem Technical Committee Update

Horseshoe Crab Management Board
October 2012

Overview

- Two parts to presentation
- ARM-based harvest recommendation
- Overview of HSC and shorebird survey results
- Time for questions between

ARM Framework

- Overall objective statement – what is goal of FMP
- Multispecies population model (horseshoe crab and red knot)
  - # Information on life history, population dynamics, etc.
  - # Competing models regarding how species interact
  - # Judgments on species “value” or “utility”
- Optimization routine
  - # Adaptive stochastic dynamic programming
  - # Simulation to evaluate uncertainty
- System state information
  - # Horseshoe crab survey abundance through 2011
  - # Shorebird survey abundance through 2012
- Determination of optimum harvest

ARM harvest options

Option	Allowable male harvest	Allowable female harvest
1	0	0
2	250,000	0
3	500,000	0
4	280,000	140,000
5	420,000	210,000

ARM optimum harvest

Option	Allowable male harvest	Allowable female harvest
1	0	0
2	250,000	0
3	**500,000**	**0**
4	280,000	140,000
5	420,000	210,000

State specific allocation

- Considerations for state-specific allocation (Addendum VII)

1. Proportion of population that is of Delaware Bay origin

2. Historical allocation among states

3. Harvest cap to protect non Delaware Bay crabs

4. Additional male harvest to offset female moratorium

Recommended allocation

State	Del Bay quota		Total quota	
	Males	***Females***	***Males***	***Females***
New Jersey	162,136	0	162,136	0
Delaware	162,136	0	162,136	0
Maryland	141,112	0	255,980	0
Virginia	34,615*	0	81,331*	0

* Virginia numbers apply to areas east of the COLREGS line

ARM Framework

- Questions?

State	2013 quota recommendation	
	Males	***Females***
New Jersey	162,136	0
Delaware	162,136	0
Maryland	255,980	0
Virginia	81,331*	0

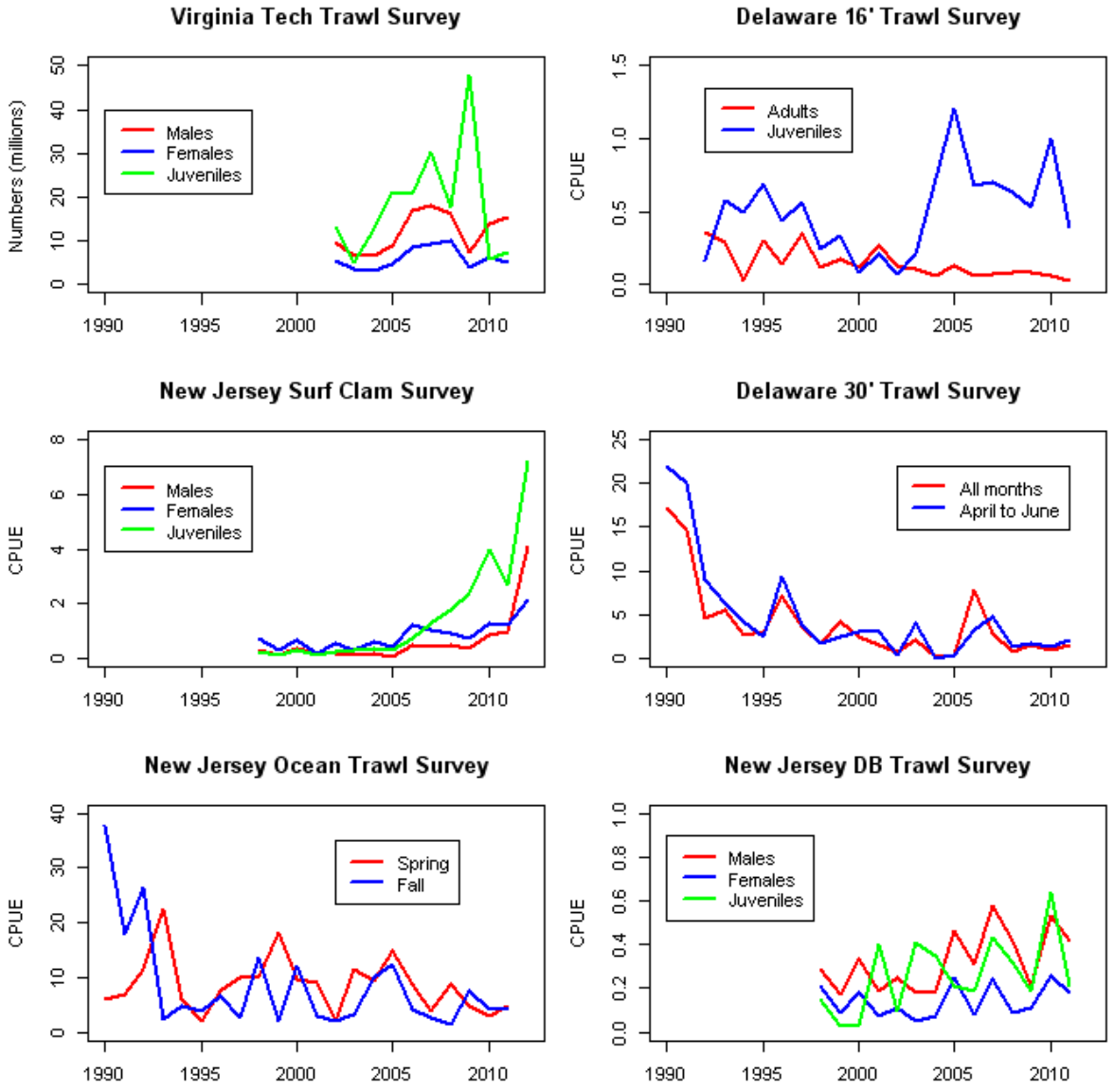
Data sources

- Six horseshoe crab trawl surveys
- Two horseshoe crab spawning surveys
- Bay-wide horseshoe crab egg survey
- Winter red knot counts
- East coast (stop over) red knot counts
- Red knot weight gain

Trawl surveys

- Declines observed during 1990s
- Stabilization in early 2000s
- Variable results since 2005
- Confidence intervals are large
- Not shown in figures to minimize clutter

Trawl survey results



Trawl surveys

- No clear trend apparent in recent data
- Confident that population has at least stabilized
- Noted that expected increases have not been realized
  - # Insufficient time since management actions imposed
  - # Early life history (recruitment) bottleneck
  - # Excessive mortality
  - # Ability of surveys to capture trends
  - # Ecological shift
- Not all equally weighted by all TC members

Virginia Tech Trawl

- Virginia Tech Trawl Survey not fully funded for 2012
- Va Tech provided “menu” of options given available funding
  - All options required fewer stations
- DBETC selected most appropriate option
  - Last minute donation from Lonza will maintain full core area of survey
- “Reduced” survey may impact ability to use ARM framework
- Recommend Board secures long term funding for survey
- TC will investigate survey changes to increase cost efficiency

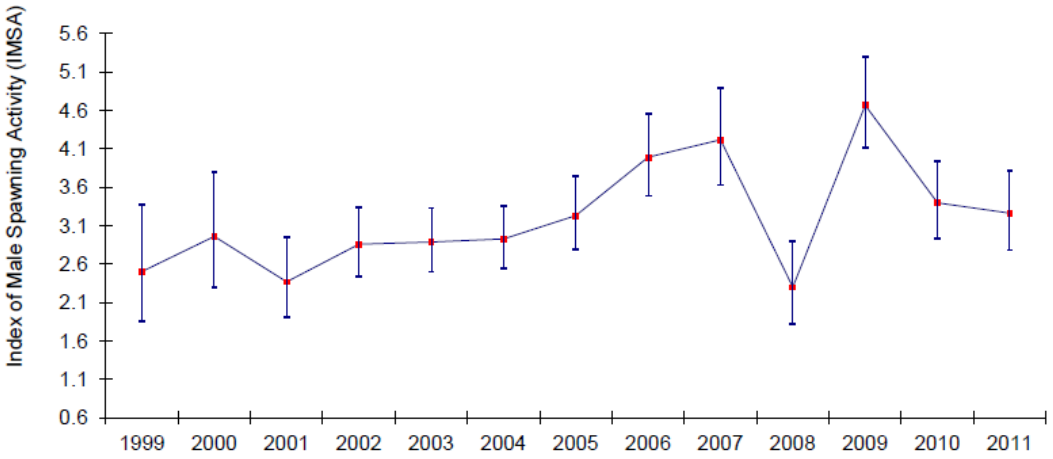
Spawning surveys

- Delaware Bay Spawning Survey
  - # Increase in male spawning density
  - # No trend in female spawning density
  - # Increase in male:female ratio

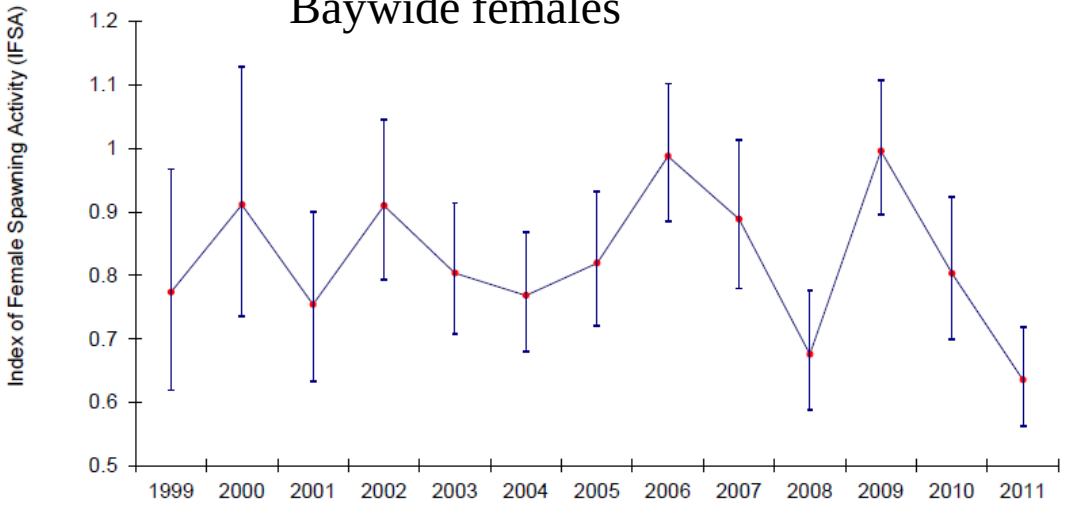
- Maryland Coastal Bays Spawning Survey
  - # Recent changes to survey design make it too short to evaluate trends

Delaware Bay Spawning Survey

Baywide males



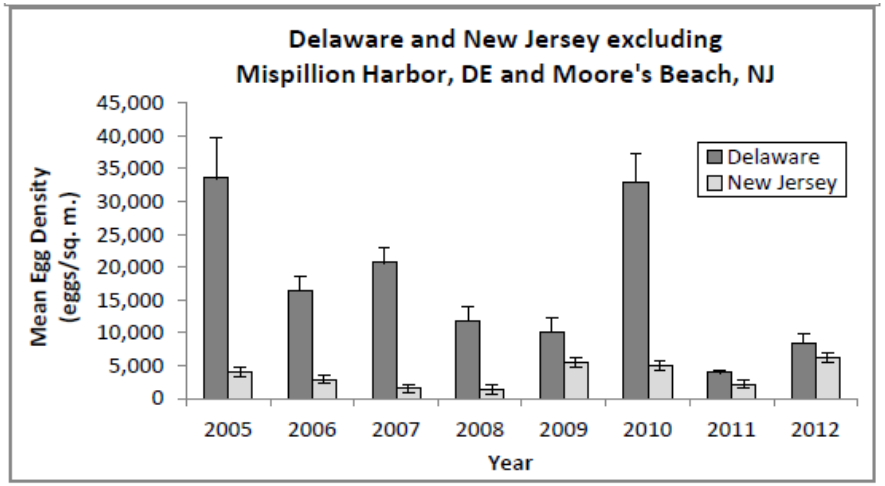
Baywide females

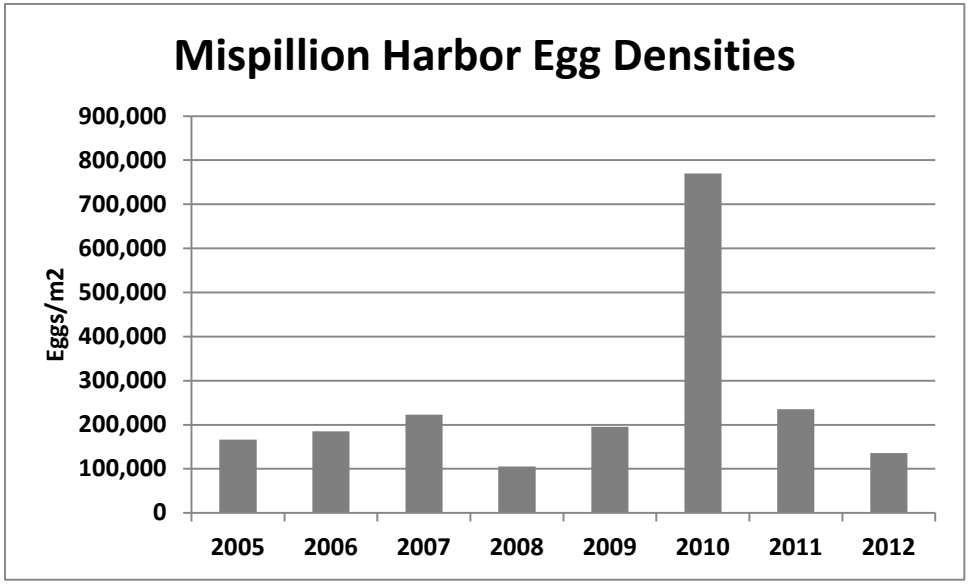


Egg survey

- Significant positive trend in NJ egg densities
- No significant trend in DE egg densities
- No significant trend in baywide egg densities
- Certain beaches can strongly influence estimates

Egg survey results





Egg survey

- Disagreement concerning survey utility

- Against
  - # Methods undocumented and not standardized
  - # Results highly variable
  - # Density not always a measure of availability
  - # Not used in ARM Framework

- For
  - # NJ legislation references survey results to re-open fishery
  - # Red knot weight gain significantly correlated to survey-based densities

- TC formed subcommittee to evaluate methods

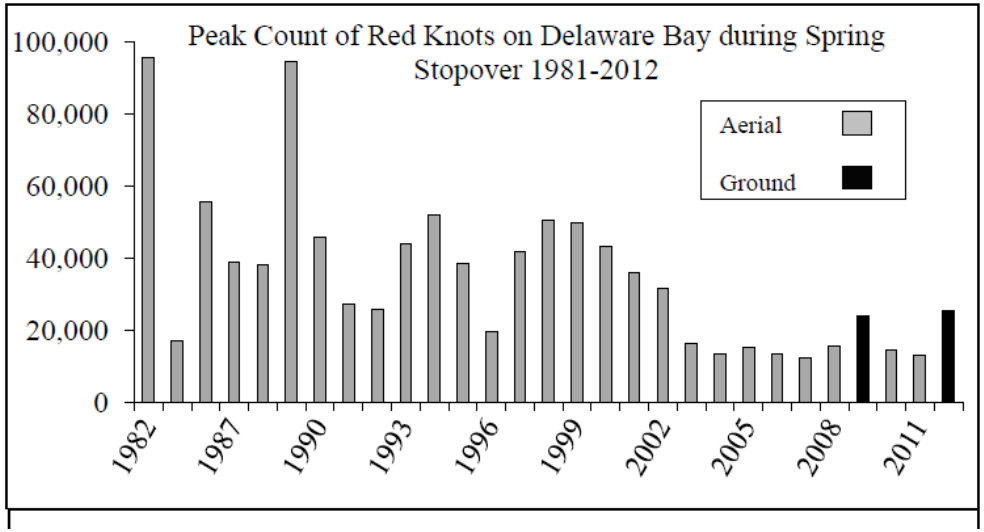
Red knot counts

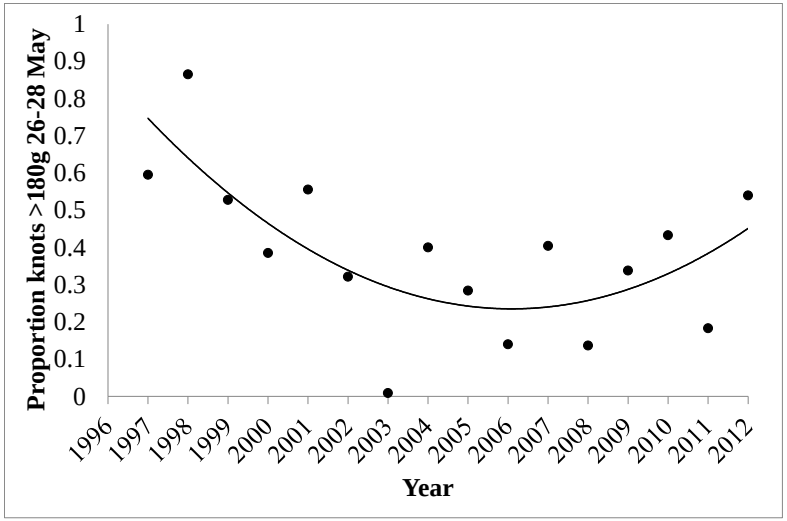
- Delaware Bay counts approximately doubled from 2007 to 2012
  - 12,000 to 25,000
  - Strong recruitment in 2009-2010
  - Large staging events
  - Different methodology in 2009 and 2012
  - Still low relative to long term trend (50,000)

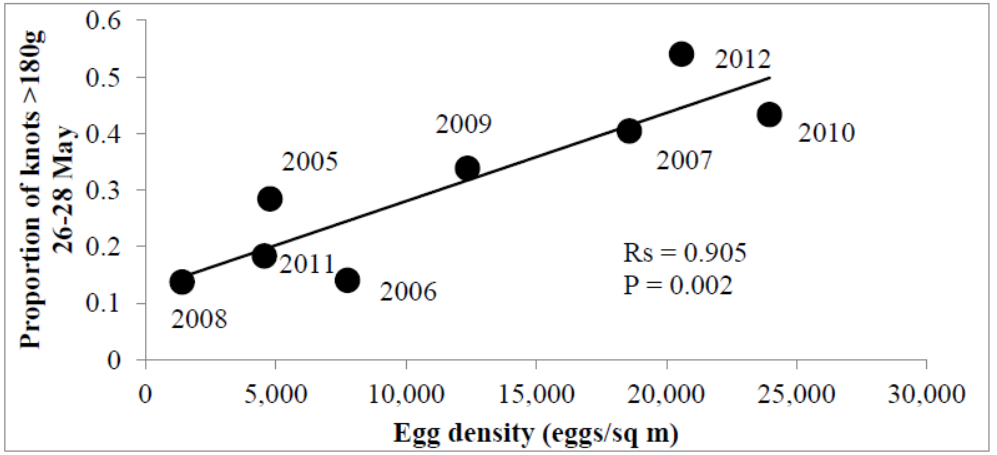
- Mass gains have increased in recent years
  - Likely due to good environmental conditions

- Peak count not ideal - investigating tag-recapture method to produce more reliable estimate of true population

Del Bay counts and weight gain

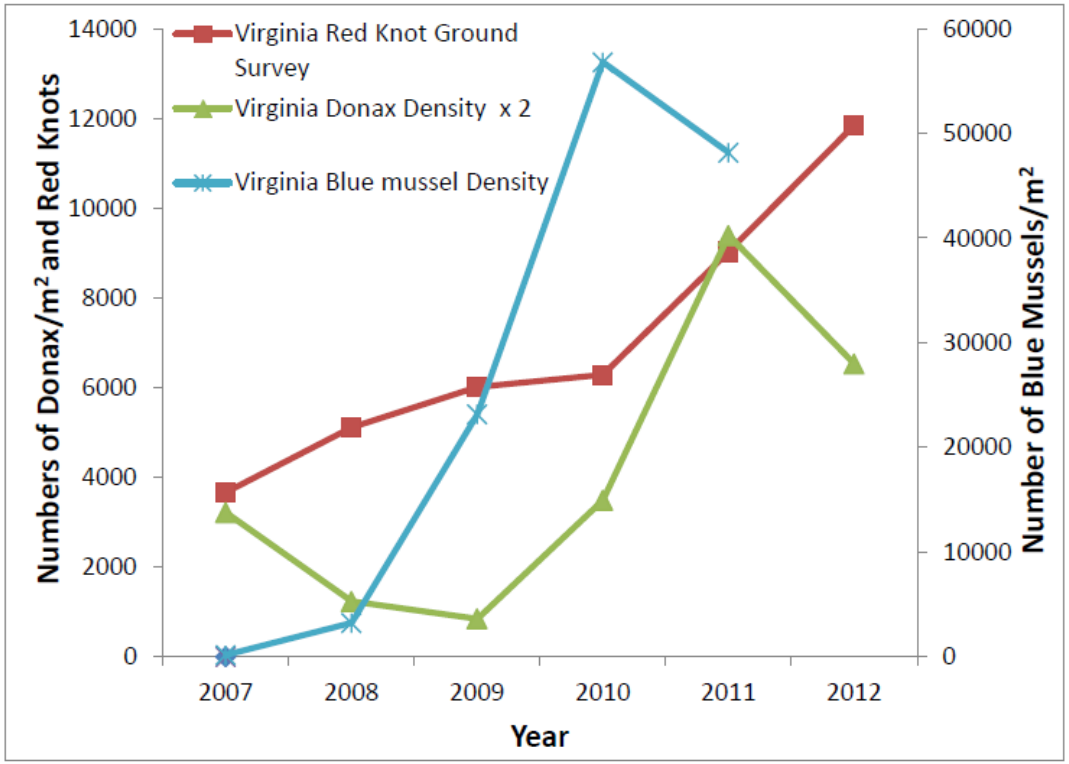






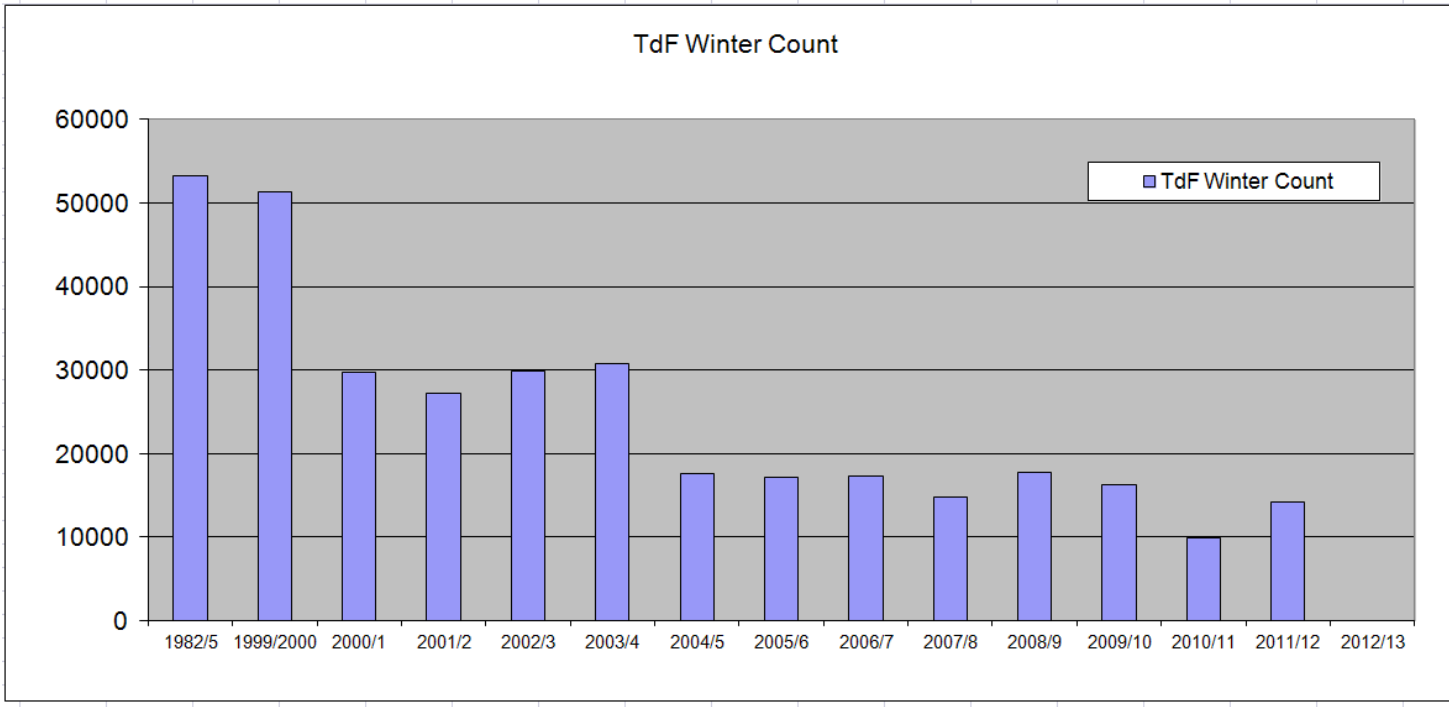
Virginia red knot counts

- Virginia counts tripled 2007 to 2012
  - # 4,000 to 12,000
  - # Higher prey availability
  - # Recent numbers not significantly different than long term average (10,000)



Red knot counts

- Tierra del Fuego winter counts have stabilized around 15,000 since 2004
  - # Resident counts, therefore more stable than stop over counts
  - # Below long term peaks of more than 50,000
  - # Probable range contraction



Survey uncertainty

- Substantial discussion on survey uncertainty and appropriateness
- Is the survey design sufficient/appropriate to capture trends
- Modifications to improve method and/or cost efficiency
- Alternate methods to analyze data
- Concerns not new, but hopefully sufficient data for investigation
- Initial focus on two surveys used in ARM framework

Summary

- Horseshoe crab abundance stabilized by ~2005; mixed results since then
- Female spawning and egg densities show no significant trends at baywide level
- Red knots show slight improvement recently, perhaps largely due to favorable environmental conditions
- Evaluation of survey methodology and analysis