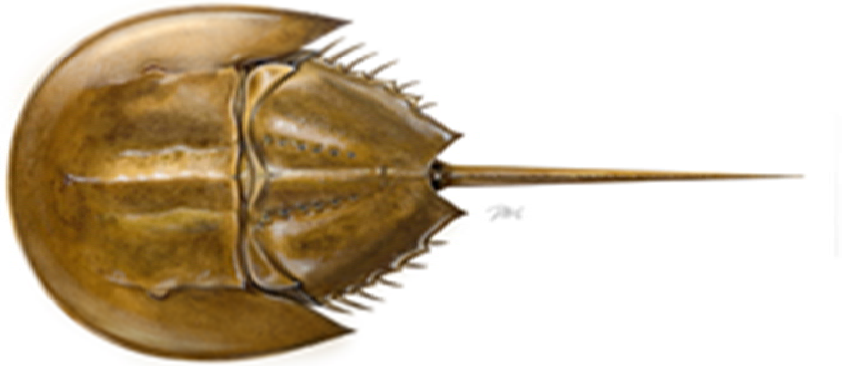
ARM Subcommittee Report and Harvest Recommendation for 2017



Oct 26, 2016

Adaptive Resource Management (ARM)

Manage harvest of horseshoe crabs in the Delaware Bay to maximize harvest but also to maintain ecosystem integrity and provide adequate stopover habitat for migrating shorebirds

- Red knot and HSC population thresholds
- Red knot and HSC abundance estimates
- 5 harvest packages
- 2017 harvest recommendations

Thresholds in ARM

1. Population thresholds

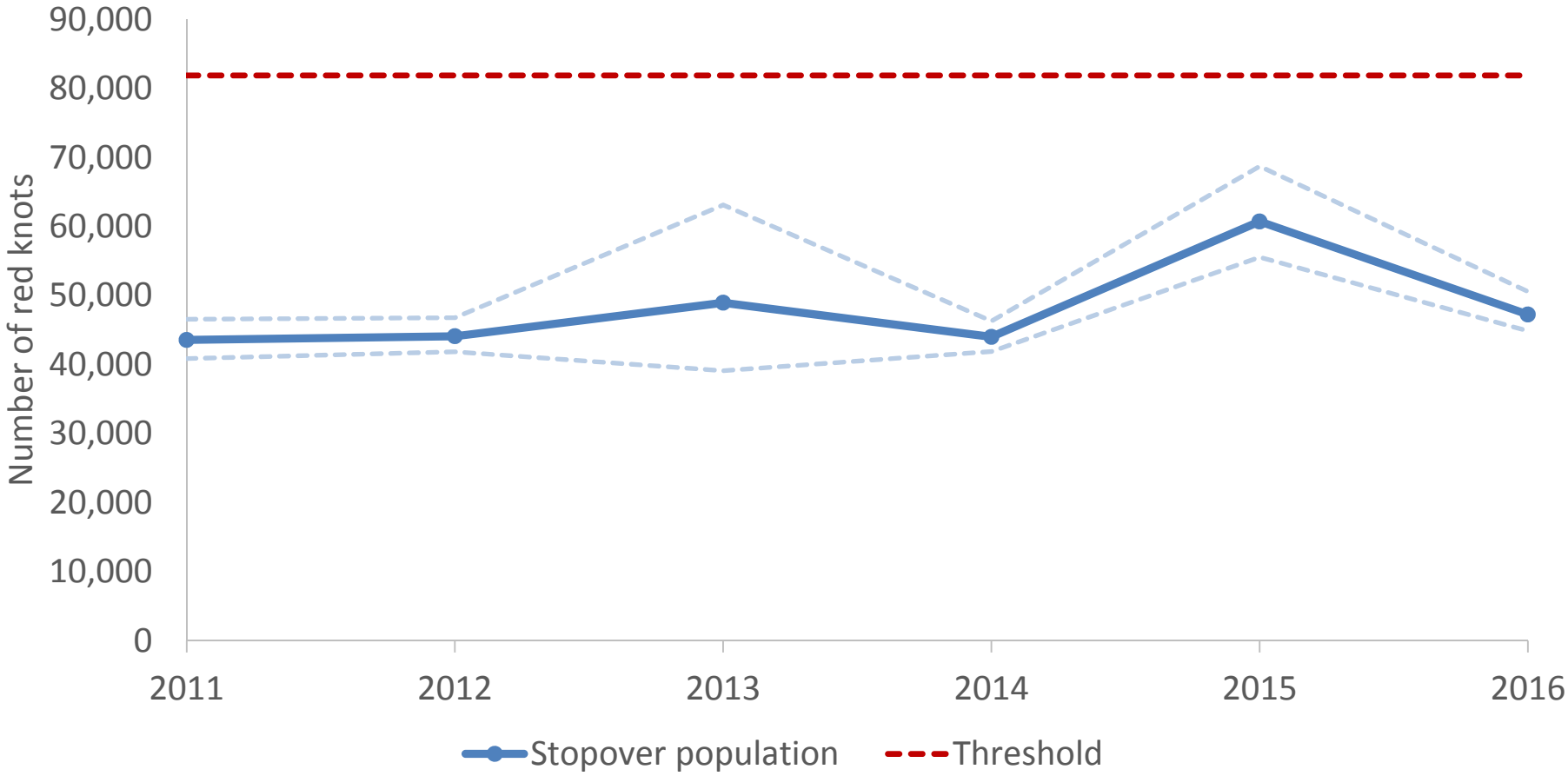
Female HSC:
80% carrying capacity
(or 11.2 million F crabs)

Red knot:
81,900 birds

2. Maintain a spawning beach sex ratio of 2M:1F

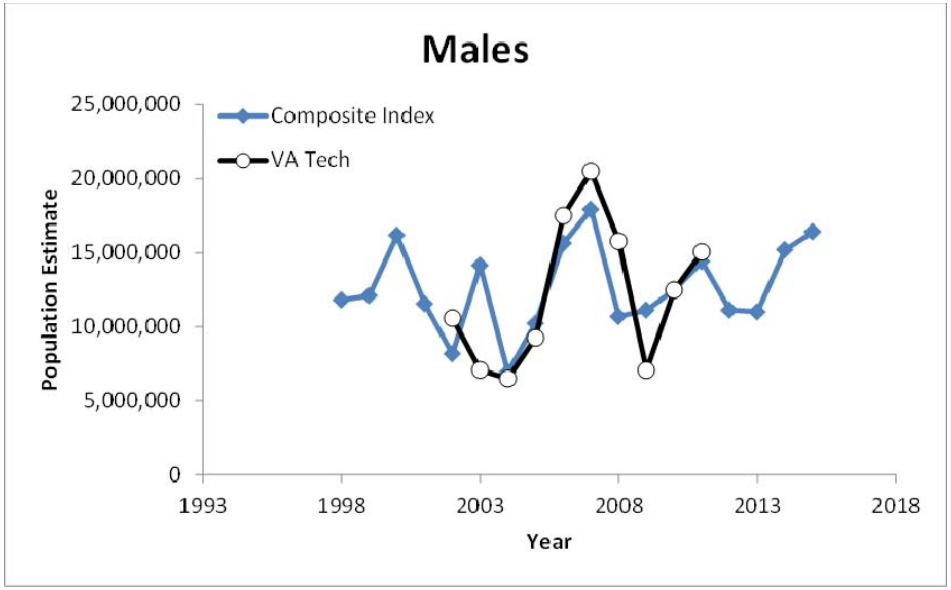
- If both population estimates are below threshold, *no female HSC harvest*
- If sex ratio falls below 2M:1F, *no male HSC harvest*

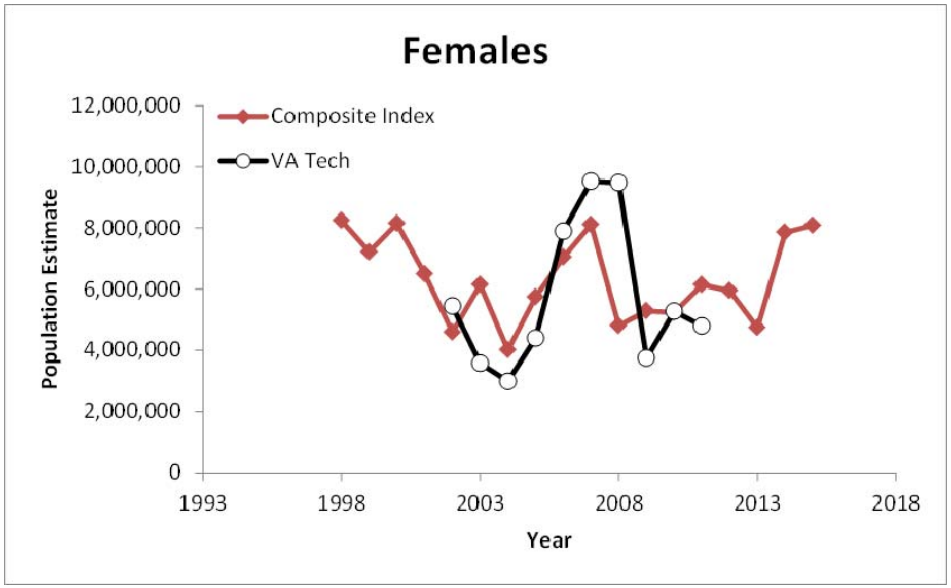
Red Knot Abundance



- Red knot abundance from mark-resight investigations
- Fewer birds stopped in DB in 2016 than in 2015, similar to 2014
- 2016 estimate of 47,300 birds is below threshold of 81,900 birds

Horseshoe Crab Abundance





- HSC abundance estimates are based on VT trawl survey
- VT trawl survey not funded every year, so composite index was developed
  - Uses DE 30' trawl, NJ DB trawl, and NJ ocean trawl surveys
- VT trawl is underway for 2016
- 2015 estimate of 8.1 million females is under the 11.2 threshold

Harvest Packages

- 5 harvest policies range from full moratorium to a max harvest of 420,000 males and 210,000 females, including two male only harvest options

Harvest package	Male harvest (×1,000)	Female harvest (×1,000)
1	0	0
2	250	0
3	500	0
4	280	140
5	420	210

2017 Harvest Recommendation

HSC and red knot abundance estimates:

Horseshoe crab abundance (millions)			Red knot abundance (×1,000)	
Year	Male	Female	Year	Male and female
2015 (Fall)	16.4	8.1	2016 (Spring)	47.3

Harvest package recommendation for 2017:

Recommended harvest package	Male harvest (×1,000)	Female harvest (×1,000)
3	500	0

- Both red knots and female HSC are below threshold, therefore no female harvest is recommended

Upcoming challenges

- ARM model underwent a review this summer
- The incorporation of biomedical is the largest challenge
- Biomedical currently not accounted for in ARM
  - Biomedical ~8-12% of coastwide mortality
- ARM subcommittee put forward a preferred option and a minority opinion for including it

"Preferred" Option

- Biomedical mortality incorporated into harvest packages
- Uses 3-5 year average (data confidentiality issues)
- Model runs the same way, but with adjusted packages: (example)

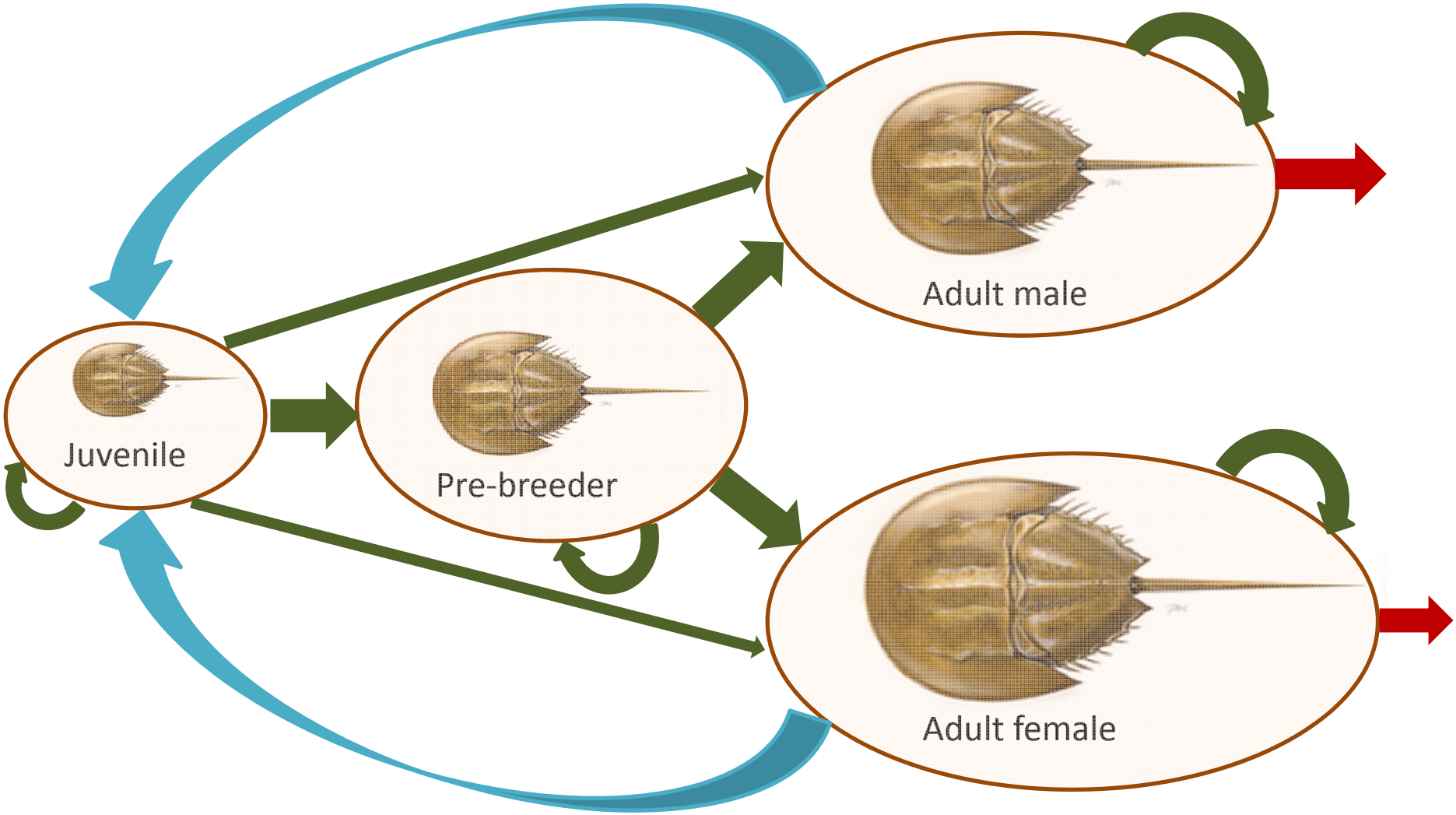
Current Harvest Packages			Option 4 Harvest Packages			
Harvest Package	Bait Harvest		Bait Harvest		Biomedical Mortality	
	Males	Females	Males	Females	Males	Females
1	0	0	0	0	36,000	18,000
2	250,000	0	214,000	0	36,000	18,000
3	500,000	0	464,000	0	36,000	18,000
4	280,000	140,000	244,000	122,000	36,000	18,000
5	420,000	210,000	384,000	192,000	36,000	18,000

- The biomedical is NOT a quota, rather an estimation of annual mortality attributed to the industry

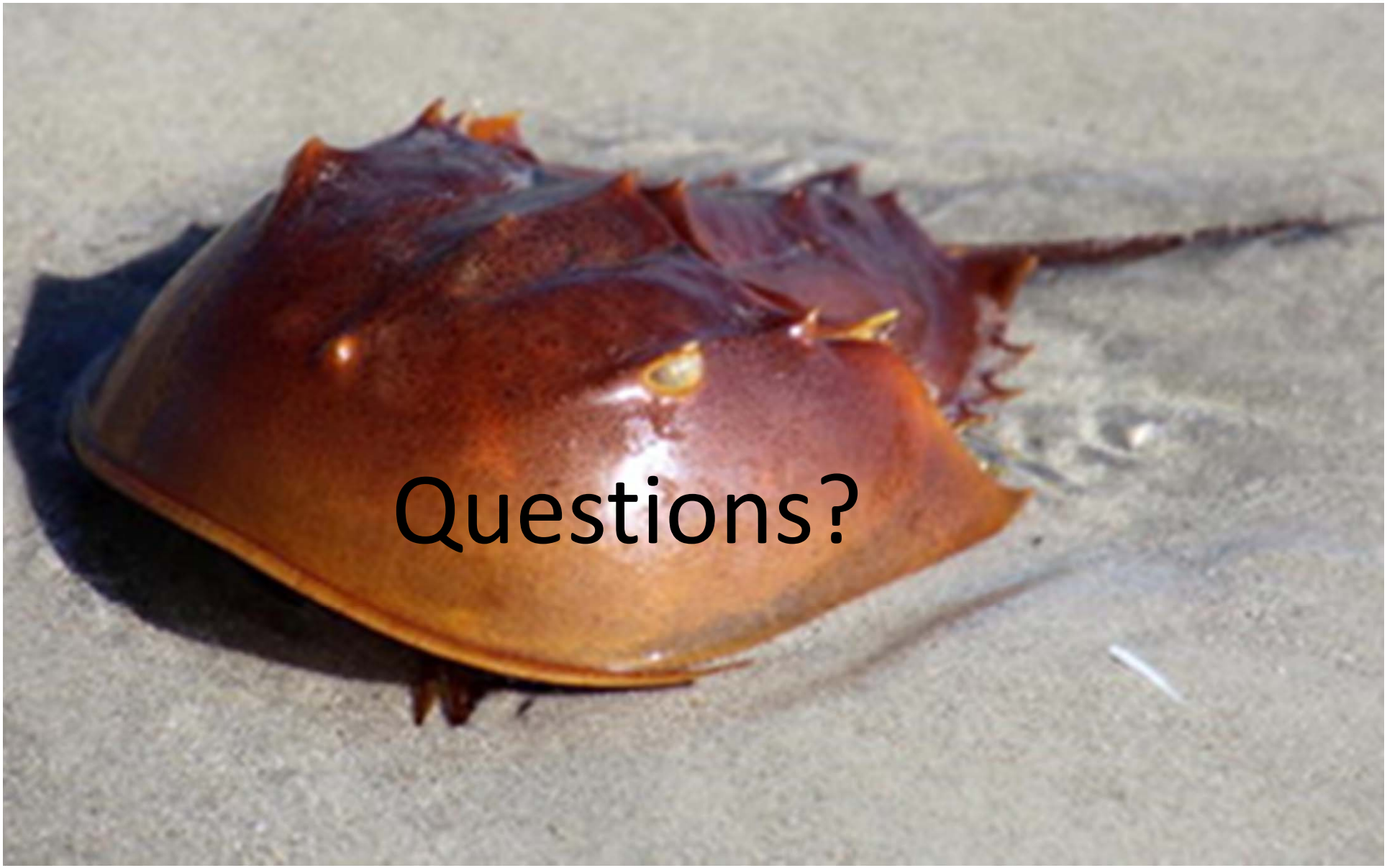
“Minority” Option

- To incorporate biomedical, add an additional mortality to account for the bled crabs die into the population dynamics model
- Using the 15% mortality for bled crabs
- Time consuming – multiple iterations under different assumptions possible

ARM Population Dynamics



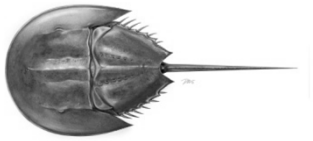
HSC = # juvs to adult + # pre-bdr to adult + # adults - # bait harvest


Questions?

Draft Addendum VIII, Biomedical Mortality, and the ARM Model

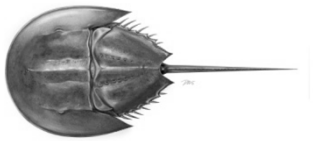
Presented to Horseshoe Crab Management Board

October 26, 2016



Outline

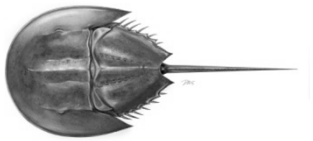
- August 2016 Board Meeting
- Developing Draft Addendum VIII
- ARM Subcommittee Comments
- Next Steps
- Questions
- Consider Board Action



August 2016 Board Meeting

- Presented ARM Subcommittee, and TCs recommendations on biomedical mortality into the ARM Model
  - Preferred Option: reduce bait harvest, account for biomedical
  - 'Minority' Option: add biomedical mortality in the population model
- Board Motion:

Move to initiate an addendum to the HSC management plan to address the ARM Subcommittee's recommendation to the ARM framework regarding 1) mortality associated with the biomedical industry; and 2) bait harvest packages which allow female horseshoe crab harvest as presented in Appendix C of the framework review.



Developing Draft Addendum VIII

- Initial Decision Tree on Biomedical Mortality
- Appendix C Harvest packages
  - 'Choose your own adventure'
  - Multiple variations depending on biomedical mortality option selected
    - TC and ARM Subcommittee's 'Preferred' Option would adjust all Harvest packages in Appendix C

Current Harvest Packages			Option 4 Harvest Packages			
Harvest Package	Bait Harvest		Bait Harvest		Biomedical Mortality	
	Males	Females	Males	Females	Males	Females
1	0	0	0	0	36,000	18,000
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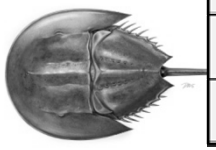
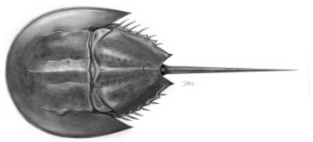


Biomedical Mortality Decision tree

Whether to include biomedical mortality

- ‘No’
  - Status Quo
- ‘Yes’: Two options
  - ARM Subcommittee Recommended Method: account for biomedical mortality with multi-year average and adjust bait harvest packages
  - Secondary Option: Add the biomedical mortality multi-year average in the population model, no adjustment to current harvest packages



Biomedical Mortality + Harvest Package Decision tree

Whether to include biomedical mortality

'No'

Status Quo

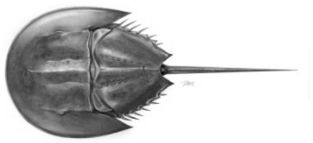
'Yes': Two options

ARM Subcommittee Recommended Method: account for biomedical mortality with multi-year average and adjust bait harvest packages

Secondary Option: Add the biomedical mortality multi-year average in the population model, no adjustment to current harvest packages

What set of Harvest Packages to select from

What set of Harvest Packages to select from



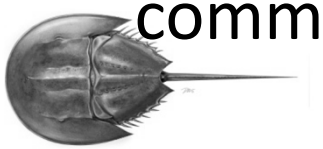
Harvest Packages

(Decision Tree Extended)

- Modified Biomedical mortality decision (2 possible versions of sets harvest packages)
- Status Quo (current 5 Harvest Packages) X2

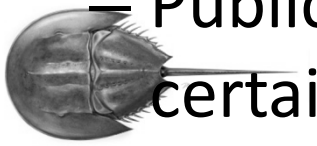
+

- Appendix C. 4 additional sets of Harvest Packages X2
- Potential for **18** possible management options variations in Draft Addendum VIII
  - Possibly too many for Public to consider & provide comment on



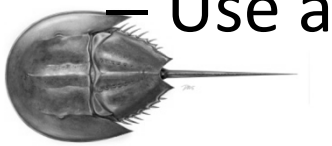
Harvest Packages

- Alternative packages were evaluated during the ARM model review
  - Adding additional packages with more female harvest did not increase the likelihood of getting female harvest
- Harvest package is chosen based on population thresholds
  - If there are not enough female HSCs in the population, there will be no female harvest
- Possible further confusion in public comment process of Draft Addendum VIII
  - Public may select set of harvest packages expecting certain result- possibly misleading



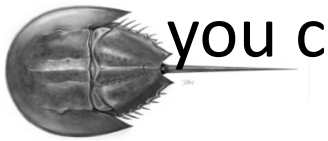
Board Member concerns

- Not clear on how biomedical mortality would impact harvest output
- Interest in sensitivity analysis
  - Exploring biomedical mortality impact on the harvest packages over the last 5-10 years
- Two scenarios/tracks
  - 1) Preferred Option (account for biomedical mortality in harvest table)
  - 2) 'Minority' Option (input biomedical mortality in population dynamics model)
  - Use abundance index inputs over last 5-10 years



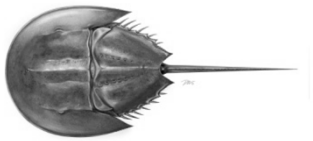
ARM Subcommittee Comments

- Concerns
  - ARM process & decision-making should not be results driven
  - 'Sensitivity analysis' work would take some time
- Feedback
  - Anecdotally ARM Subcommittee members think that with numbers around 34k (a 'negligible) number won't change optimized harvest package. The reason why the magnitude of biomedical take is very small compared to the magnitude of the abundance bins.
  - Separate note: harvesting of female crabs when you are below the abundance threshold will delay the time until you can have more Female harvest.



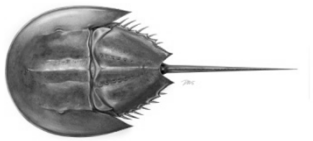
ARM Subcommittee follow-up

- Initial timetable from the ARM Subcommittee on when the two tracks of sensitivity analyses could be completed
  - Sensitivity Run Option #1) Fall 2016
  - Sensitivity Run Option #2) Summer 2017
    - Time-consuming to run iterations of mortality dynamics
    - Software availability and experience limitations



Additional Considerations

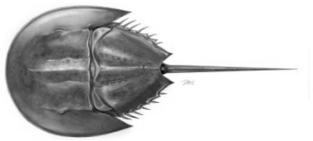
- Draft Addendum VIII Timetable & 2018 Benchmark Stock Assessment
  - Addendum completed by fall 2017 would impact 2018 harvest
  - Work will begin on Stock Assessment in 2017
    - Assessment results would be available in 2018
    - Potential for new information on the regional populations
  - Possibility of addendum and/or other management action needed in response to 2018 Stock Assessment results
    - Possibly repeat process of developing addendum



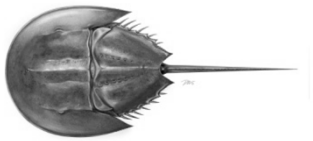
Next Steps

- Staff is looking for guidance from the Board on whether to proceed in continuing development of Draft Addendum VIII

- Consider addressing Draft Addendum VIII <u>after</u> 2018 Benchmark Stock Assessment is completed



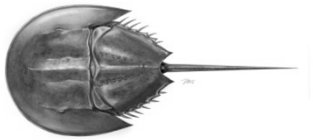
Questions?



2017 Horseshoe Crab Specifications for Delaware Bay Region

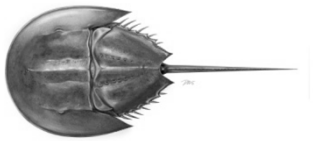
Presented to Horseshoe Crab Management Board

October 26, 2016



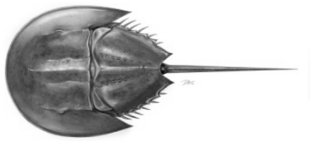
ARM Harvest Recommendations

- Model is based on estimates of red knot and horseshoe crab abundance
  - HSC abundance data from Composite Index
  - Shorebird Abundance from 2016 Mark-Recapture Survey
- ARM Model recommends harvest package 3; same as previous three years



ARM Optimum Harvest Packages

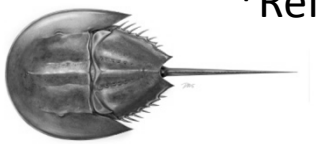
Harvest package	Male harvest (×1,000)	Female harvest (×1,000)
1	0	0
2	250	0
3	500	0
4	280	140
5	420	210



HSC Quota By State

	Delaware Bay Origin HSC Quota		Total Quota	
State	*Male*	*Female*	*Male*	*Female*
Delaware	162,136	0	162,136	0
New Jersey	162,136	0	162,136	0
Maryland	141,112	0	255,980	0
Virginia	34,615*	0	81,331*	0

*Refers to harvest east of the COLREGS line.



Questions?

State	Total Quota	
	Male	Female
Delaware	162,136	0
New Jersey	162,136	0
Maryland	255,980	0
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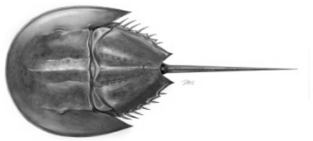
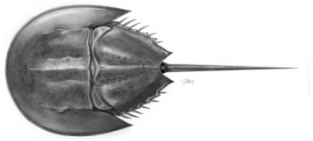


Horseshoe Crab Technical Committee Report

Presented to Horseshoe Crab Management Board

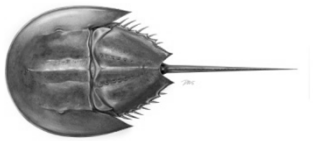
October 26, 2016



Overview

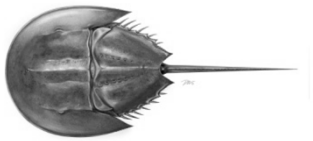
Five parts to presentation

1. ARM Framework Optimal Harvest Recommendation for 2017 season
2. Review of Horseshoe Crab Surveys
3. Review of Shorebird Survey
4. Recommendations for alternative bait trials moving forward
5. USFWS response to ESA listing- Update



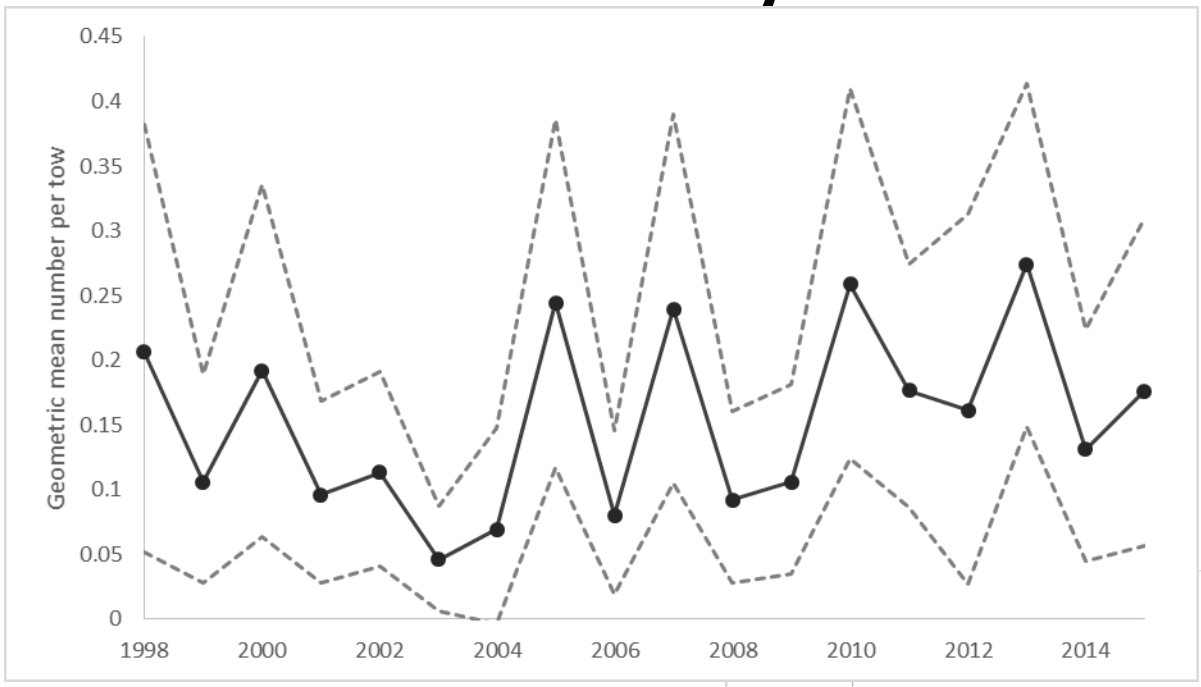
ARM Framework Optimal Harvest for 2017 season

- **<u>Harvest Package #3</u>**: 500K male only harvest
- **VT trawl survey not conducted in recent years, was re-instated in 2016**
- **Composite Index (abundance increase from 2014-2015 for both male & female crabs)**
- **Red Knot mark-resight population estimate (decrease in stopover population estimate in 2016)**
- **TCs agreed with ARM Subcommittee Harvest Package recommendation**



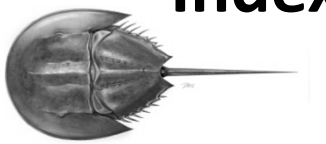
Horseshoe Crab Surveys

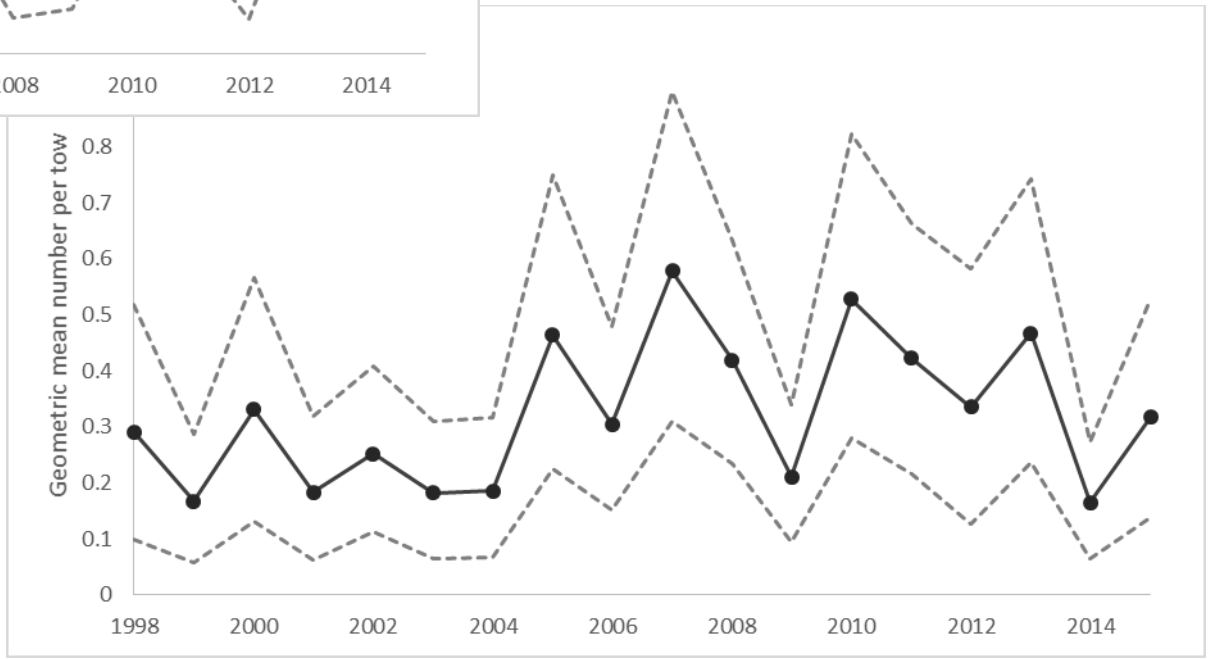
New Jersey Delaware Bay Trawl



Female Abundance Index

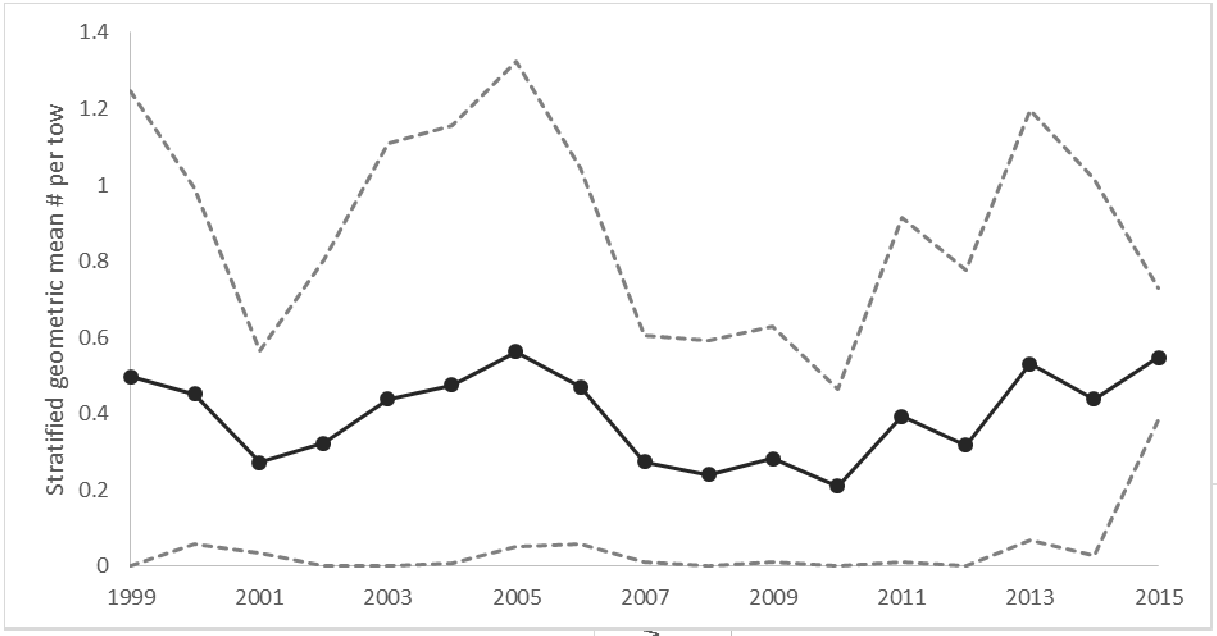
Male Abundance Index





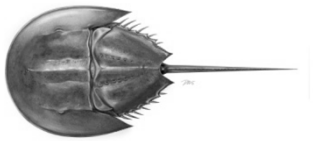
Horseshoe Crab Surveys Cont'd

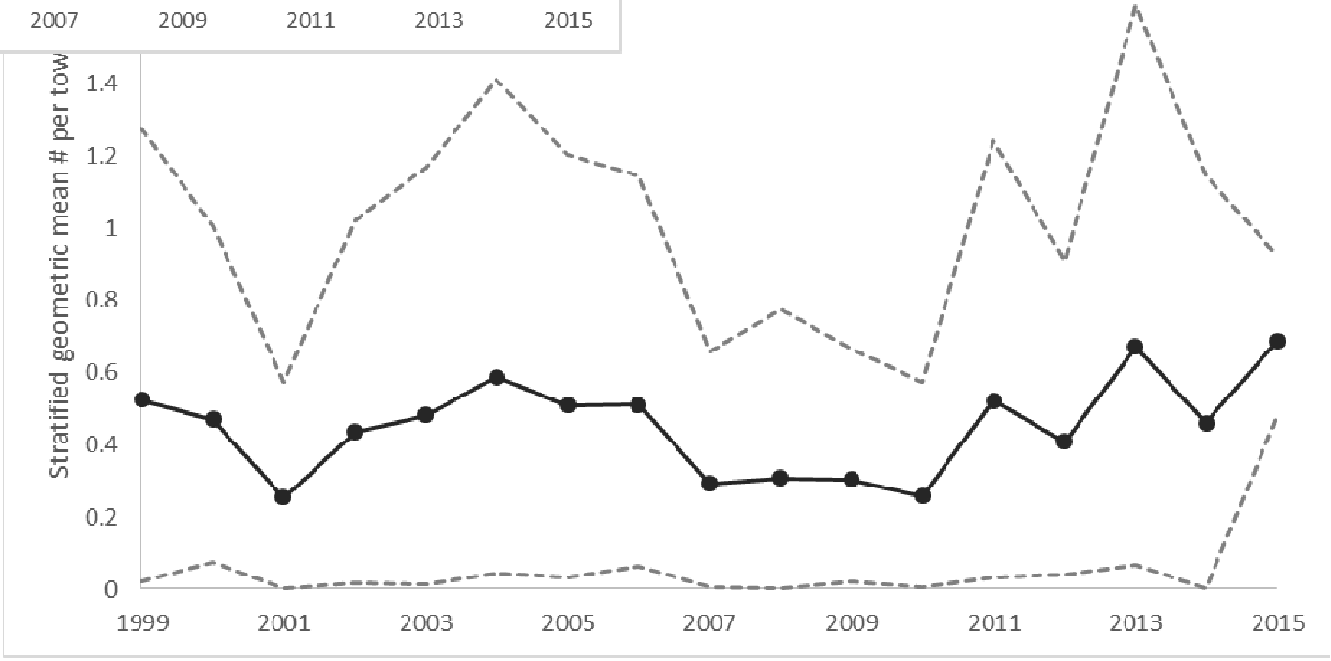
New Jersey Ocean Trawl survey



Male Abundance Index

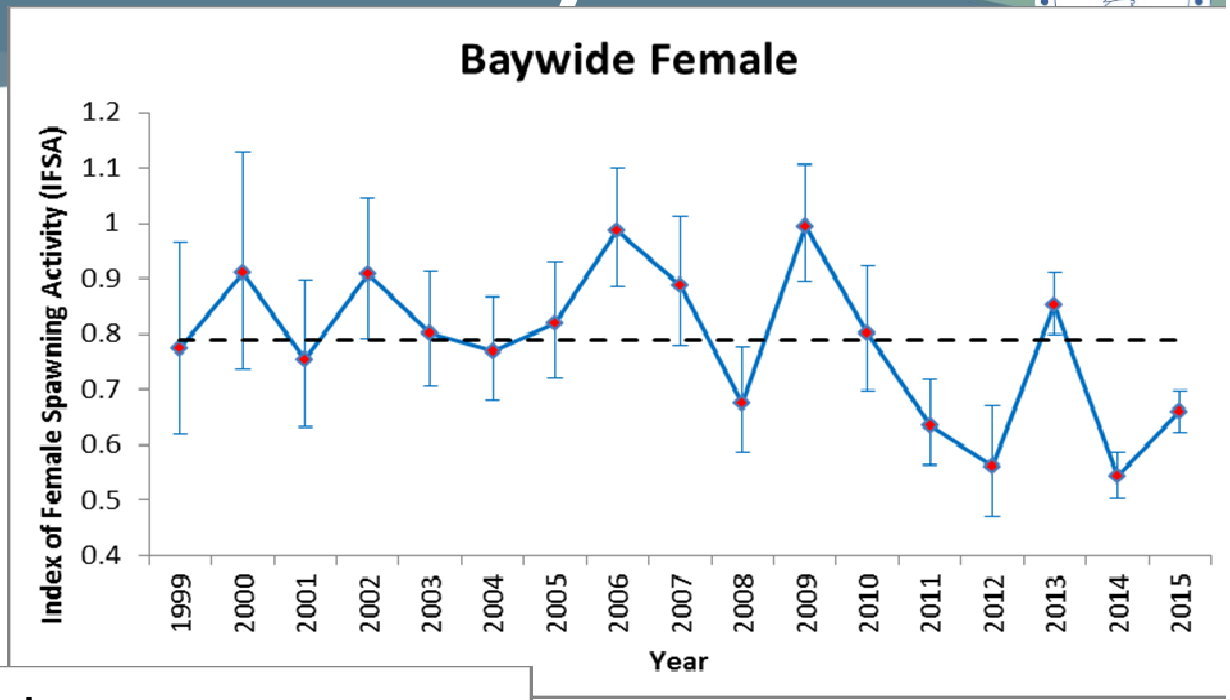
Female Abundance Index

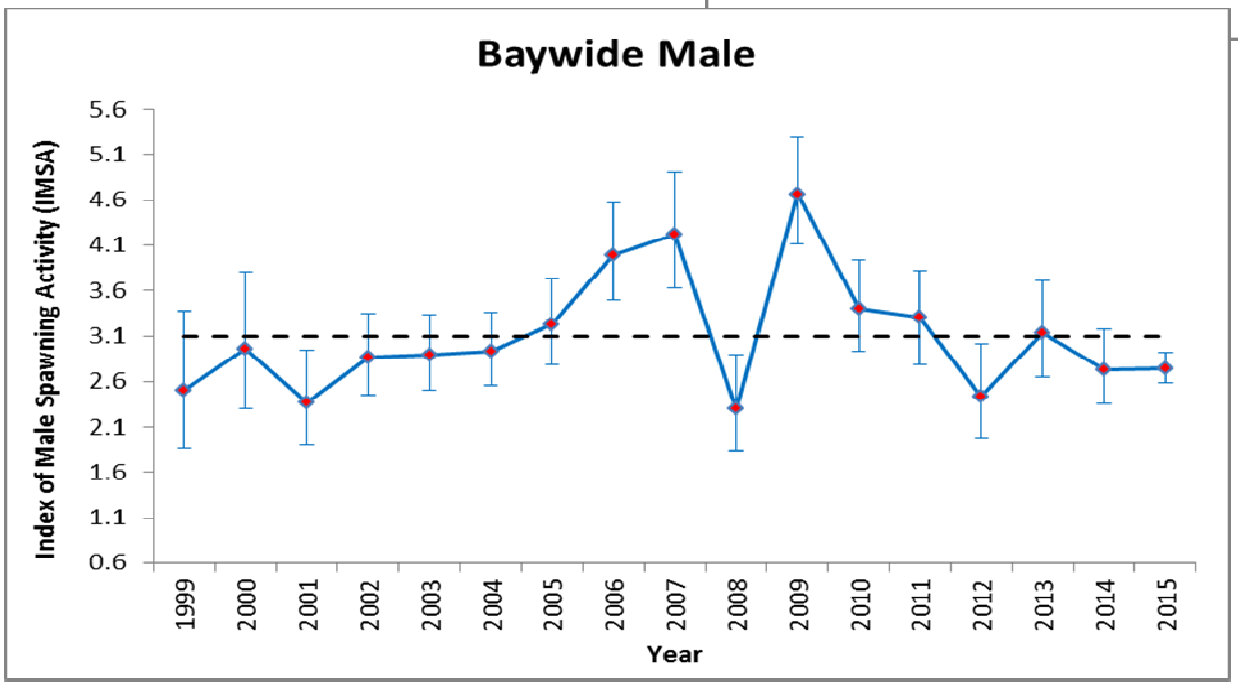




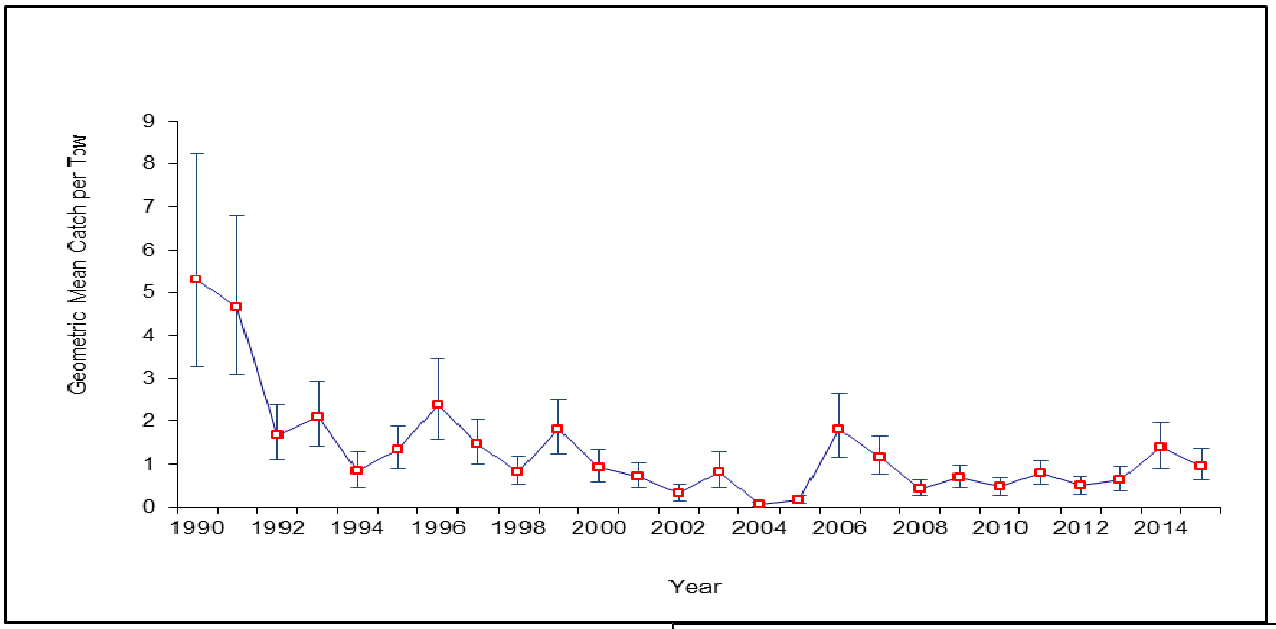
Horseshoe Crab Surveys Cont'd

Delaware Spawning Survey





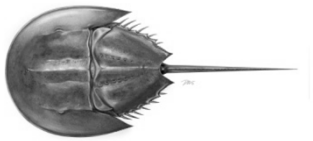
Horseshoe Crab Surveys Cont'd

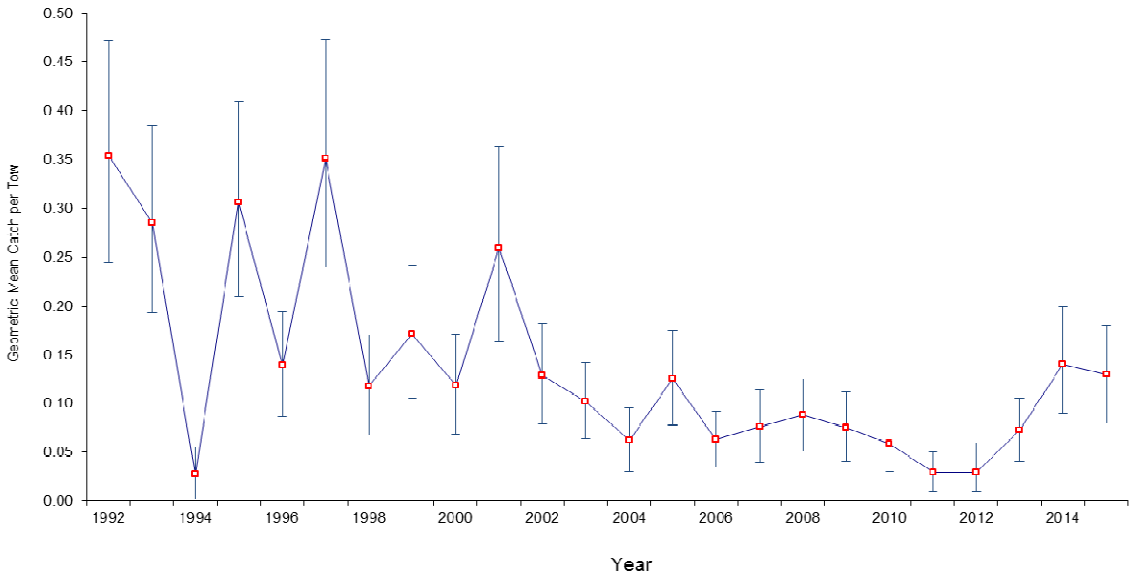


Delaware Surveys

30ft trawl survey

16ft trawl survey (adult)



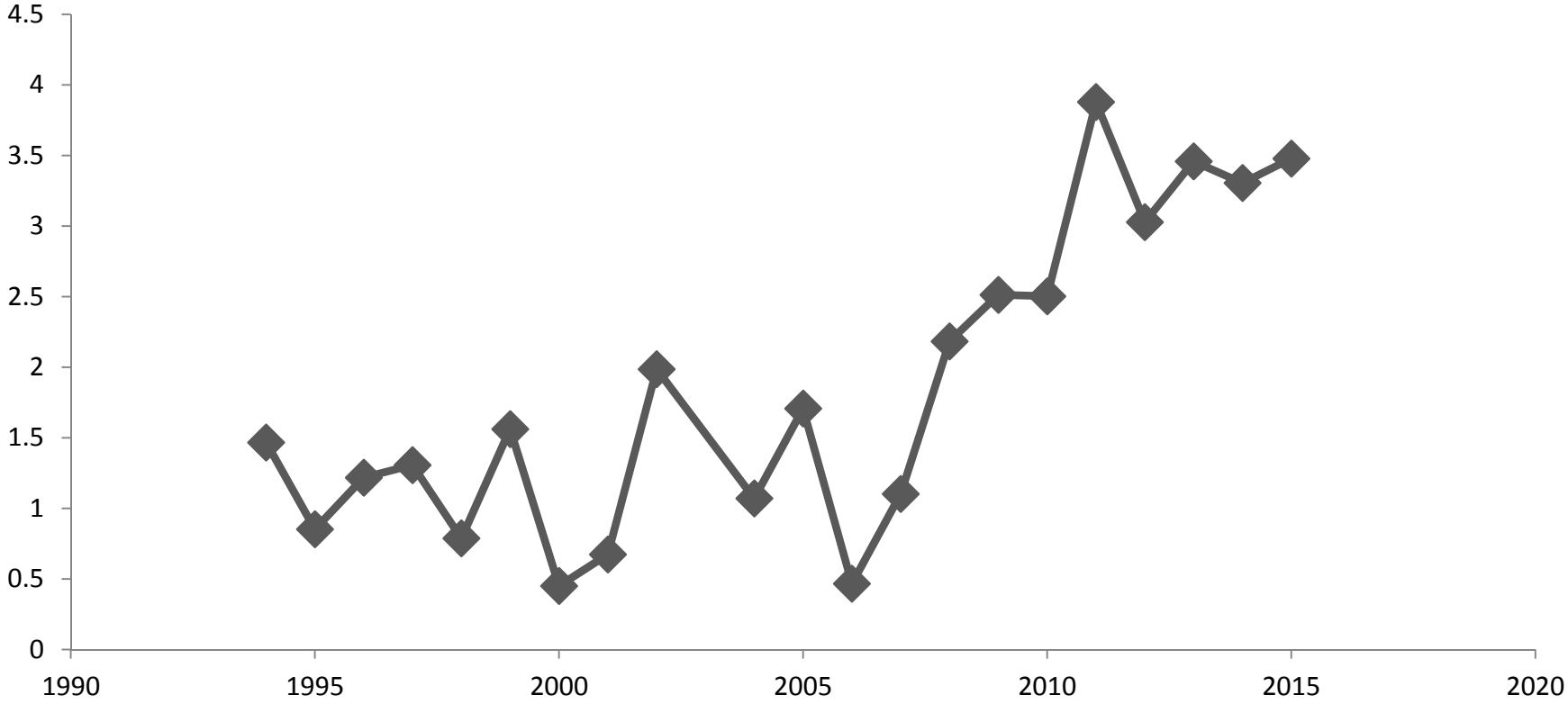


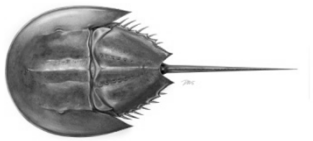
Horseshoe Crab Surveys Cont'd

Maryland

Horseshoe Crab Logmean Catch per Tow

Offshore Ocean City, Maryland

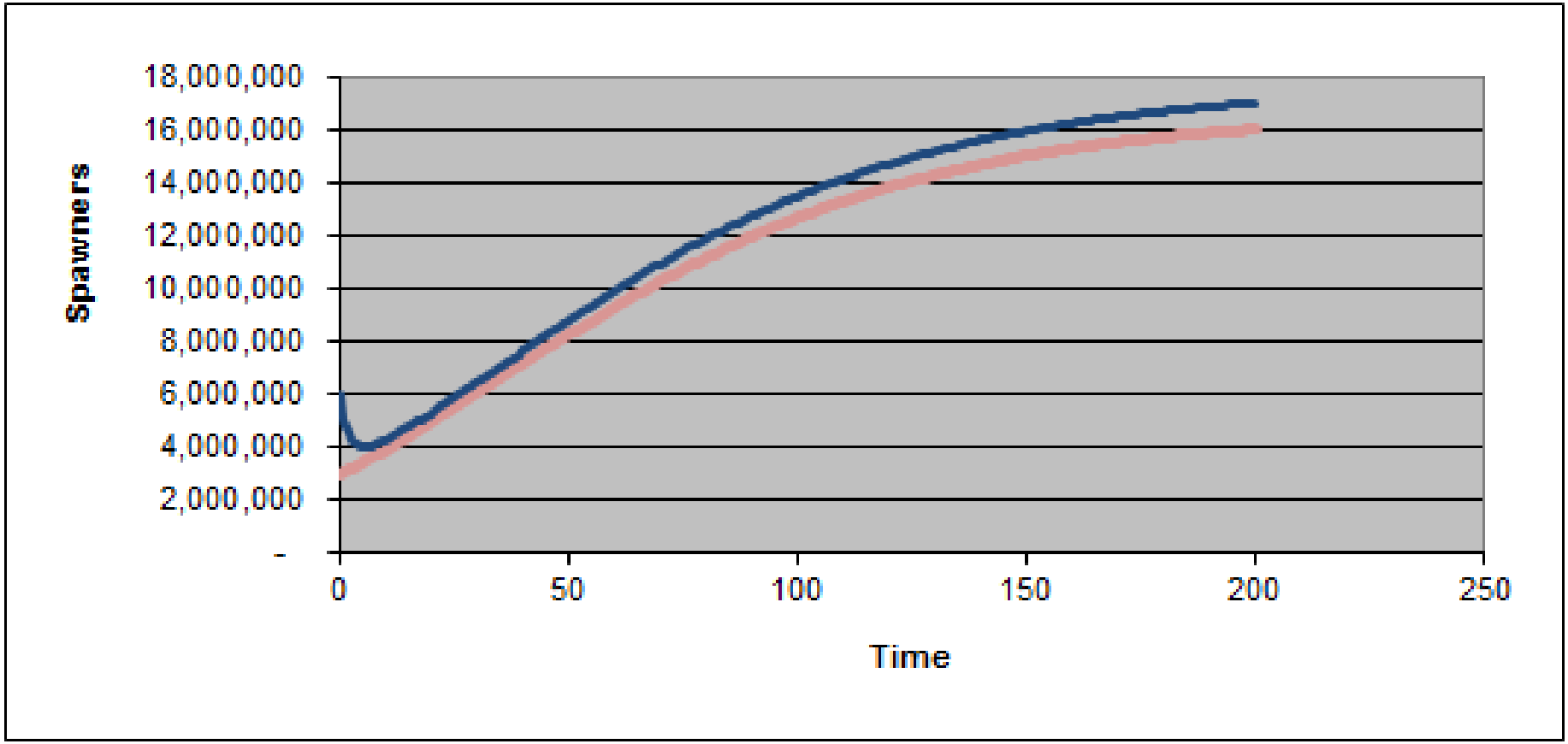




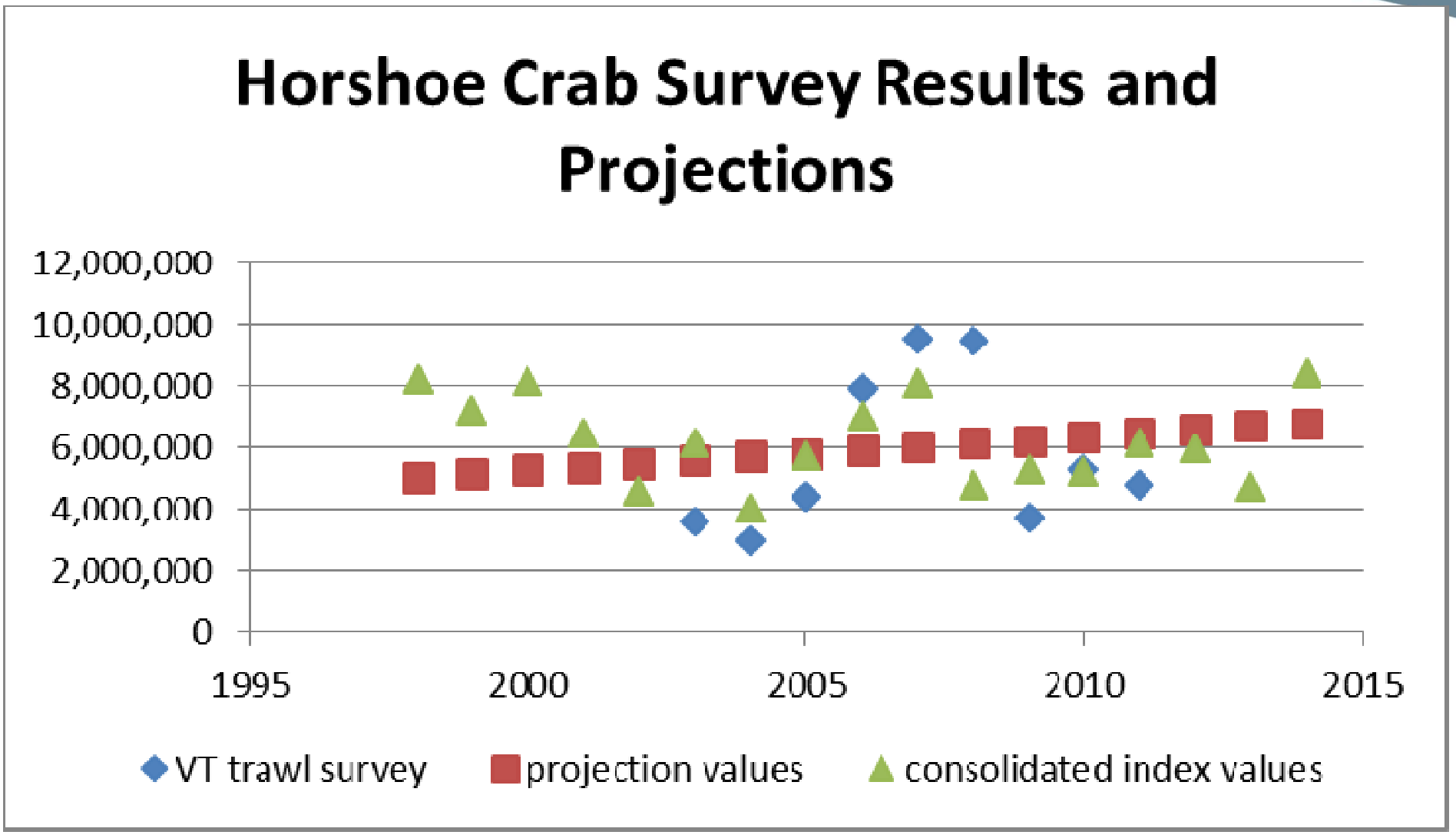
Horseshoe Crab Surveys Cont'd

Horseshoe Female Population Projection

- From 2007 paper by Sweka, Smith, Millard



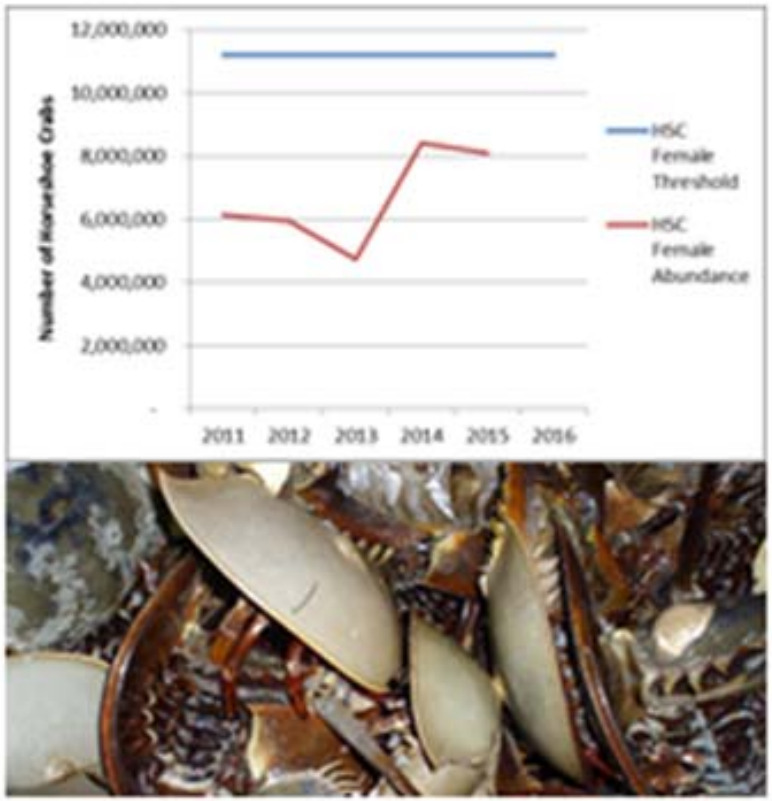
Horseshoe Crab Surveys Cont'd



Horseshoe Crab Surveys Cont'd

Species Updates
Horseshoe Crabs

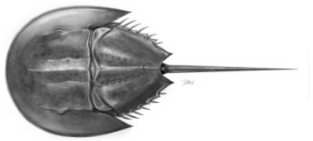
MARYLAND DEPARTMENT OF NATURAL RESOURCES



Red Knot Photo Courtesy of USFWS

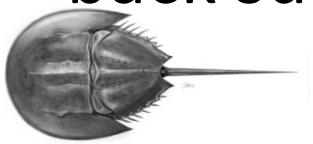
Shorebird Survey

- Shorebird stopover & winter population estimates have remained low but stable over the last few years (2011-2016)
- The proportion of red knots reaching adequate weight (180 grams) decreased in 2016.
- Surface densities of horseshoe crab eggs decreased (5,715 eggs/m^2).



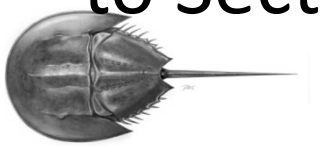
Alternative Bait Discussion

- Considered Board request from August 2016 Meeting
- Prospectus outline offered by RI was discussed
- Concerns raised over overall goal, objectives, and study design
  - A lot of opposition to using LaMonica Fine Foods product
- Considered MA survey- ingredients for bait bags and pots
  - A lot of unknowns in composition across the coast
- **Recommendation**: All states evaluate feasibility of conducting survey to get bait bag ingredients & report back survey results by Spring 2017

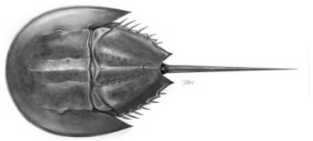


Update from USFWS on response to Red Knot ESA Listing

- USFWS is undergoing overhaul of recovery planning
  - New paradigm called Species Status Assessment (SSA).
- For new listings, SSA will be part of listing and carry forward into the recovery plan
  - Was not done for Red Knots; trying to adapt for Red Knots moving forward
- Critical habitat proposed rule expected in 2017; final rule in 2018
- ASMFC Management not subject to Section 7 (interagency consultation) review; but still subject to Section 9 ('incidental takes')



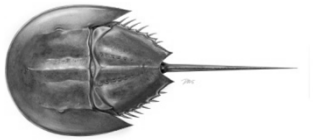
Questions?



2017 Horseshoe Crab Specifications for Delaware Bay Region

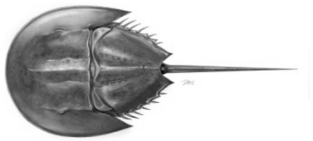
Presented to Horseshoe Crab Management Board

October 26, 2016



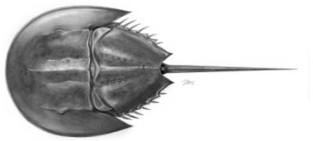
ARM Harvest Recommendations

- Model is based on estimates of red knot and horseshoe crab abundance
  - HSC abundance data from Composite Index
  - Shorebird Abundance from 2016 Mark-Recapture Survey
- ARM Model recommends harvest package 3; same as previous three years



ARM Optimum Harvest Packages

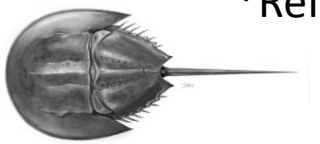
Harvest package	Male harvest (×1,000)	Female harvest (×1,000)
1	0	0
2	250	0
3	500	0
4	280	140
5	420	210



HSC Quota By State

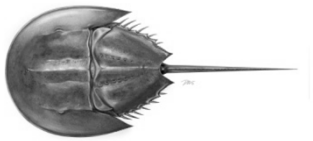
	Delaware Bay Origin HSC Quota		Total Quota	
State	*Male*	*Female*	*Male*	*Female*
Delaware	162,136	0	162,136	0
New Jersey	162,136	0	162,136	0
Maryland	141,112	0	255,980	0
Virginia	34,615*	0	81,331*	0

*Refers to harvest east of the COLREGS line.



Questions?

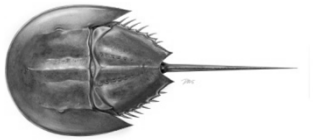
State	Total Quota	
	Male	Female
Delaware	162,136	0
New Jersey	162,136	0
Maryland	255,980	0
Virginia	81,331	0



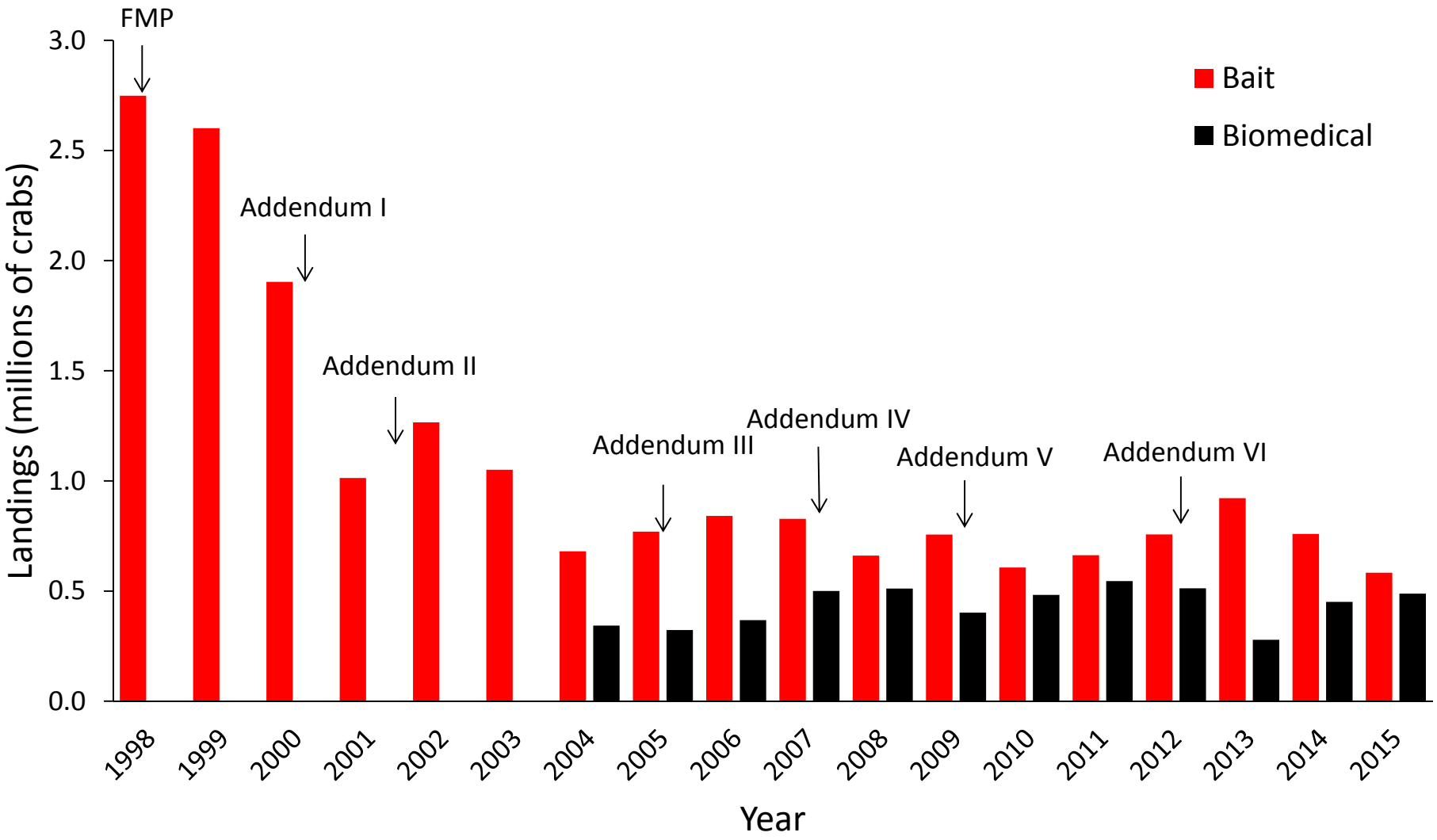
Horseshoe Crab 2016 FMP Review

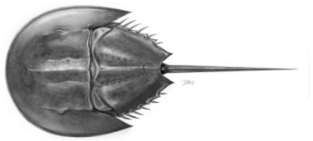
Presented to Horseshoe Crab Management Board

October 26, 2016



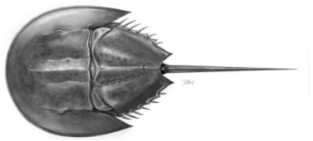
Annual Total Harvest





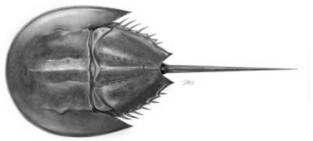
2015 Bait Fishery

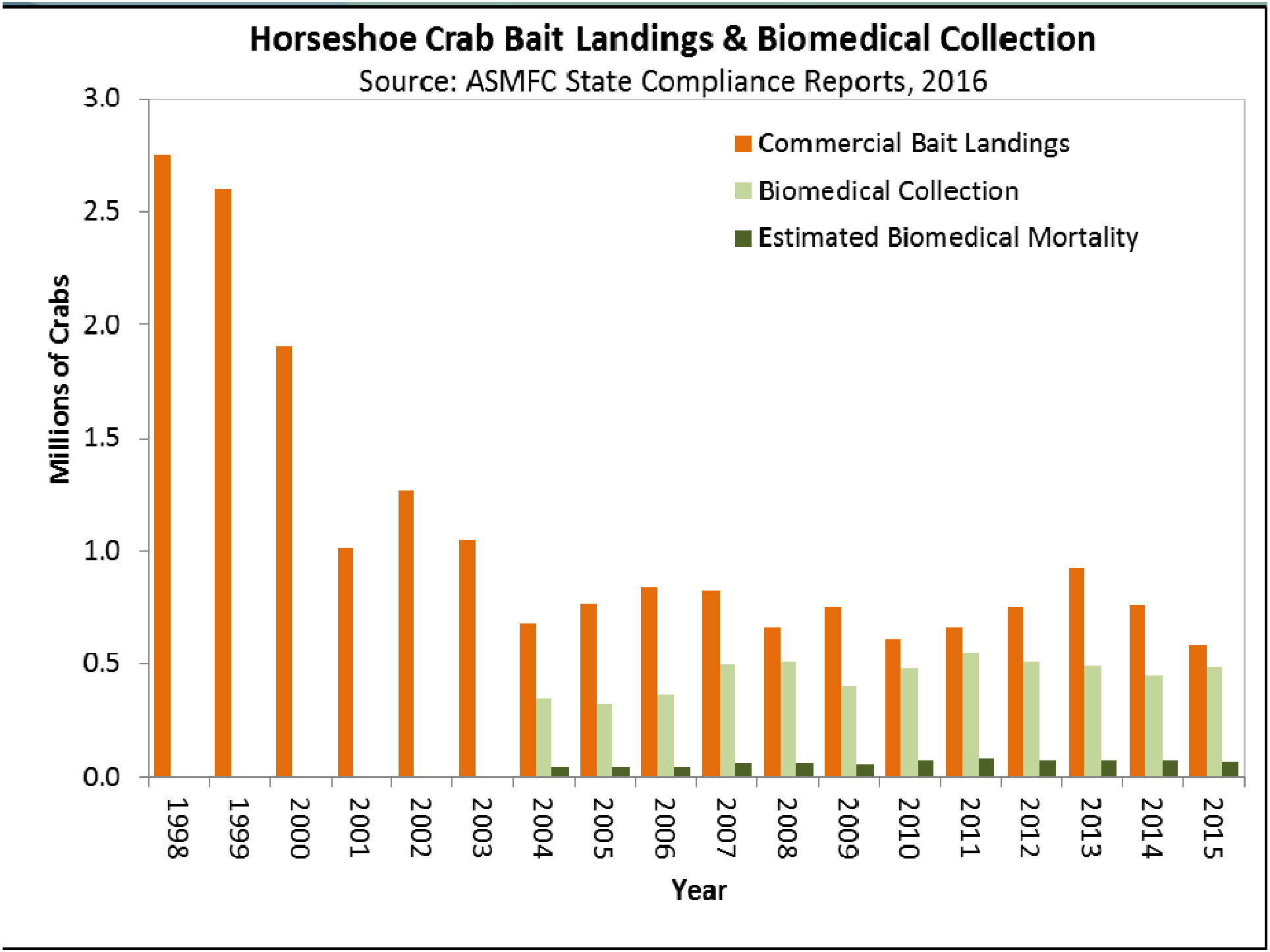
- **Total coastwide harvest was 583,208 crabs**
  - **Majority from DE,NY, and MA (combined for 69% of coastwide harvest)**
- **Decrease of 23% from 2014**
  - **DE-VA; GA-FL all decreased landings from 2014**
- **Approximately 36% of the coastwide quota (1.58 million lbs) was landed**



Biomedical Harvest

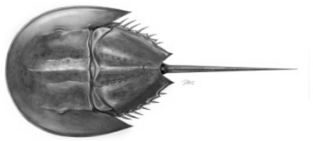
- **Reported number of crabs brought to biomedical facilities: 559,903**
  - **3% decrease from previous 5-year average**
- **Crabs used as bait and bled: 56,517**
  - **2% decrease from past 5-year average**
- **Biomedical-only mortality estimate: 70,223**




Horseshoe Crab Bait Landings & Biomedical Collection
Source: ASMFC State Compliance Reports, 2016
Commercial Bait Landings
Biomedical Collection
Estimated Biomedical Mortality
Millions of Crabs
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year

PRT Review

- Interest in reporting on the synthetic alternative LAL test
  - Not addressed this year due to time constraints
- Concerns on number of crabs unidentified by sex from biomedical bleeding
- Recommend continue seeking funding for VT trawl survey
- Find no issue with the requested size of quota transfer from GA to NC, but concerns expressed about it being an annual request
- PRT found all states management measures to be consistent with the FMP
  - DC did not submit a report

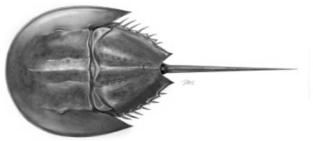


State Compliance

Additional Note:

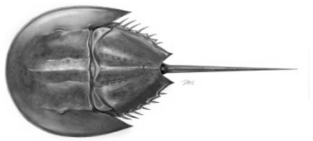
- **Improve reporting of numbers of males and females bled at biomedical facilities**

- **PRT finds all states in compliance with the requirements of FMP with the exception of DC**

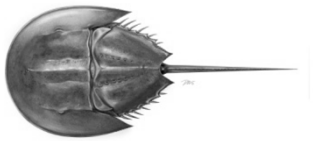


Request for *De minimis*

- **PRFC, SC, GA, and FL all qualify and request *de minimis* status for 2017**
- **NJ qualified but did not request**
- **PRT finds all states requesting *de minimis* status requirements**



Questions?



Board Action

- Consider accepting state compliance reports and approving the 2016 Horseshoe Crab FMP Review
- Approve *de minimis* requests from Potomac River Fisheries Commission, South Carolina, Georgia, and Florida