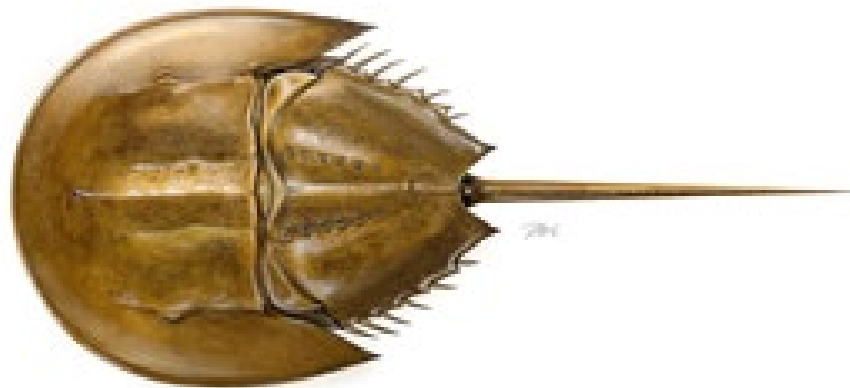


Update on Development of Draft Addendum VIII: PDT Recommendations



Horseshoe Crab Management Board

May 3, 2022

Overview



- Background
- Potential Management Changes
- PDT Recommendations
- Board Guidance
- Next Steps

Background



- Addendum VII (2012) established current ARM Framework for recommending optimal bait harvest for Delaware Bay based on HSC and red knot abundance
- Board accepted 2021 ARM Revision and Peer Review in January 2022
 - Addresses peer review critiques
 - Includes new data sources
 - New modeling software
- Board initiated Addendum VIII to consider use of ARM Revision in setting annual specifications for horseshoe crabs of Delaware Bay-origin

Potential Management Changes



Addendum VII codified the following parts of the ARM Framework:

1. Harvest packages
2. Management process
3. Revised Delaware Bay-origin % (λ)
4. State Allocations
5. Fallback option



PDT Recommendations

Draft Management Options



- **Option A: “Status Quo”**
 - Use original ARM as basis for harvest recommendations
 - True status quo is not possible given obsolete software
 - Annual HSC and red knot data would be used to select 1 of 5 harvest packages from a “lookup table”
- **Option B: Management using the Revised ARM**
 - Revised ARM Framework would be used to set the annual harvest specifications for horseshoe crabs of Delaware Bay origin
 - Adopt changes recommended in 2021 ARM revision and peer review

1. Harvest Packages



CURRENT

2.2.1 ARM Framework

- Selection of 5 possible optimal harvest packages depending on abundance of horseshoe crabs and red knots
- Maximum harvest of M and F crabs = 500,000 and 210,000

Package	Males	Females
1	0	0
2	250,000	0
3	500,000	0
4	280,000	140,000
5	420,000	210,000

Add. VII vs ARM Revision



Year	VA Tech Swept Area Estimates		Red knots	Optimal HSC Harvest (previous ARM)	
	Female HSC	Male HSC		Female	Male
2017	6,654,877	21,405,997	49,405	0	500,000
2018	7,555,622	19,346,403	45,221	0	500,000
2019	7,934,057	16,645,912	45,133	0	500,000
Year	CMSA Estimates		Red knots	Optimal HSC Harvest (revised ARM)	
	Female HSC	Male HSC		Female	Male
2017	10,967,100	31,664,430	49,405	154,483	500,000
2018	9,735,690	24,715,290	45,221	146,792	500,000
2019	9,357,400	21,897,920	45,133	144,803	500,000

1. Harvest Packages



RECOMMENDED

- Status quo maximum harvest of M and F crabs = 500,000 and 210,000
- Sex-specific harvest recommendations on continuous scale, but rounded down
 - Sub-options for rounding down to nearest 25,000 or 50,000
 - Necessary to protect confidential data

Year	Optimal HSC Harvest (revised ARM)		Rounded Down Harvest Recommendation	
	Female	Male	Female	Male
2017	154,483	500,000	150,000	500,000
2018	146,792	500,000	125,000	500,000
2019	144,803	500,000	125,000	500,000

2. Management Process



CURRENT

2.4 Management using the ARM Framework

- Annual specification process
 - “Double loop learning” with an annual and longer term cycles
 - Annual Cycle
 - e.g., when model is run and when Board decides harvest
 - Longer Term Cycle
 - E.g., 3-4 year plan, when to update or revise framework including stakeholder input, technical model updates, etc

2. Management Process



RECOMMENDED

- 1. Annual management process:** status quo, i.e., ARM Framework produces harvest recommendations for the upcoming fishing year.
- 2. Interim update process:** Every 3 years, update process where the model parameters (e.g., red knot survival and recruitment, horseshoe crab stock-recruitment relationship) are updated based on the annual routine data collected in the region
- 3. Revision process:** every 9 or 10 years (or sooner if desired by the Board), the ARM Framework should undergo a revision process similar to what occurred for the 2021 ARM Revision. 9-10 years allows two updates to occur, and encompasses one generation for horseshoe crabs.

3. Delaware Bay Origin Crabs



CURRENT

3a. Lambda

- Proportion of state harvest that is Delaware Bay Origin, based on genetic data as of 2012

State	Lambda, λ
NJ	1.0
DE	1.0
MD	0.51
VA	0.35

3. Delaware Bay Origin Crabs



RECOMMENDED

- Update lambda values for New Jersey, Delaware, Maryland, and Virginia from the ARM Revision
 - Recent genetic evidence used to estimate the proportion of states' landings, discards, and biomedical harvest that were DE Bay origin

State	Lambda
DE	1.0
NJ	1.0
MD	0.45
VA	0.20

4. State Allocations



CURRENT

3b. Weighting

- How optimal harvest is allocated among the states
- (Addendum VI quota*lambda)/total
- Impacted by DB-origin %
- VA is east of the COLREGS

State	Allocation weight
	w_i
	Genetics λ
NJ	32.4%
DE	32.4%
MD	28.2%
VA	7.0%

3c. Harvest Cap: MD and VA

- Max limit on total harvest to protect non-DB-origin crabs

MD Cap	VA Cap
170,653	60,998

3d. 2:1 male:female offset

4. State Allocations



RECOMMENDED

3b. Weighting

- Maintain status quo weighting with updated lambdas

3c. Harvest Cap: MD and VA

- Status quo

3d. 2:1 male:female offset

- Status quo

STATE	Allocation Weight
NJ	35%
DE	35%
MD	27%
VA	4%

Example State Allocations



Comparison of state allocations of DE Bay origin quota under old vs revised allocations (updated lambda values)

- Example recommended harvest of 500,000 males and 100,000 females of DE Bay origin

	Current DE Bay Allocations		Revised DE Bay Allocations	
STATE	Male	Female	Male	Female
NJ	162,136	32,427	173,014	34,603
DE	162,136	32,427	173,014	34,603
MD	141,112	28,222	132,864	26,573
VA	34,615	6,923	21,107	4,221

Example State Allocations



CURRENT

State	DE Bay Origin Quota		Total Quota (Add. 4 cap)	
	Male	Female	Male	Female
DE	162,136	32,427	162,136	32,427
NJ	162,136	32,427	162,136	32,427
MD	141,112	28,222	142,211	28,442
VA*	34,615	6,923	50,832	10,166
Total	500,000	100,000	517,315	103,463

REVISED

State	DE Bay Origin Quota		Total Quota (Add. 4 cap)	
	Male	Female	Male	Female
DE	173,014	34,603	173,014	34,603
NJ	173,014	34,603	173,014	34,603
MD	132,864	26,573	142,211	28,442
VA*	21,107	4,221	50,832	10,166
Total	500,000	100,000	539,071	107,814

Example State Allocations



CURRENT

State	DE Bay Origin Quota		Total Quota (Add. 4 cap)	
	Sexes combined	% Female	Sexes combined	% Female
DE	194,564	17%	194,564	17%
NJ	194,564	17%	194,564	17%
MD	169,335	17%	170,653	17%
VA	41,538	17%	60,998	17%
Total	600,000	17%	620,778	17%

REVISED

State	DE Bay Origin Quota		Total Quota (Add. 4 cap)	
	Sexes combined	% Female	Sexes combined	% Female
DE	207,617	17%	207,617	17%
NJ	207,617	17%	207,617	17%
MD	159,437	17%	170,653	17%
VA	25,328	17%	60,998	17%
Total	600,000	17%	646,885	17%

5. Fallback Option



CURRENT

3e. Plan B/Fallback Option

- Models are dependent on annual data
- If data is not available, alternative ways to set next year's harvest
 - Based upon Addendum VI quotas and management measures for New Jersey, Delaware, and Maryland, and Virginia coastal waters; or,
 - Based upon the previous year's ARM Framework harvest level and allocation for New Jersey, Delaware, and Maryland, and Virginia coastal waters

5. Fallback Option



RECOMMENDED

- Status quo alternative methods for setting harvest in absence of necessary data
 - CSMA should be able to handle more missing data than previously
- Update section to include new data sets required to run the revised ARM model

Board Guidance



1. Does the Board want to consider modifying state allocations of the optimized harvest?
2. Should any additional options be considered in the Draft Addendum?
3. Does the Board want to include management options to modify the FMP biomedical mortality threshold in Draft Addendum VIII?
4. Is the Board interested in including any additional issues in the Draft Addendum?

Next Steps

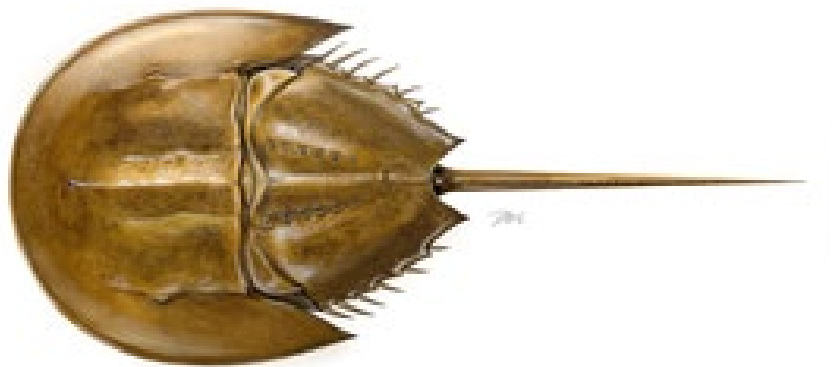


Date	Action
January 2022	Board initiated Draft Addendum VIII
May 2022	Consider PDT recommendations for Draft Addendum VIII
Summer 2022	PDT develops draft addendum document
August 2022	Board considers Draft Addendum VIII for public comment
August/ September 2022	Public hearings and comment period
October 2022	Board considers final approval of Draft Addendum VIII

Questions ?



Update on Board Task to Review Biomedical Mortality and Best Management Practices



Horseshoe Crab Management Board
May 3, 2022

Overview



- Board Task
- Background on Biomedical Mortality Threshold
- Review of Biomedical Data
- Background on Biomedical Best Management Practices
- Technical Committee Discussion
- Next Steps

October 2021 Board Task



- Review the threshold for biomedical use to develop biological based options for the threshold and to develop options for action when the threshold is exceeded. Also, review best management practices for handling biomedical catch and suggest options for updating and implementing BMPs.
 - PDT tasked TC with providing information and recommendations

Biomedical in the FMP



- **FMP (1998)**

- **FMP Goals:**

- “conserve and protect the horseshoe crab resource to maintain sustainable levels of spawning stock biomass to ensure its continued role in the ecology of the coastal ecosystem, while providing for continued use over time. Specifically, the goal includes management of horseshoe crab populations for continued use by...current and future generations of the fishing and non-fishing public (**including the biomedical industry, scientific and educational research**)”

- **Management Program**

- Horseshoe crab fishery for biomedical use is not subject to the potential limitations “because both the number of horseshoe crabs captured per year and the reported mortality are low”
 - States must issue a special permit or other specific authorization for biomedical harvests
 - Horseshoe crabs taken for biomedical purposes shall be returned to the same state or federal waters from which they were collected.
 - **“If horseshoe crab mortality associated with collecting, shipping, handling, or use by the biomedical industry exceeds 57,500 horseshoe crabs per year, the Commission would reevaluate potential restrictions on horseshoe crab harvest by the biomedical industry.**

Biomedical in the FMP



- **Addendum I (2000)**

- Management Board recommended NMFS close the harvest of horseshoe crabs in Federal waters within a 30 nautical mile radius of the mouth of Delaware Bay. The taking of horseshoe crabs for any purpose, **including biomedical**, would be prohibited in this area closure.

- *One exempted permit for biomedical for 10,000 crabs annually

- **Addendum III (2004)**

- Clarified that crabs harvested under a bait permit may be used for biomedical purposes (i.e. bled) and then returned back to the bait industry (encouraged as an opportunity to reduce overall mortality of horseshoe crabs)
- Required all states where horseshoe crabs are captured for biomedical use to monitor and report monthly and annual harvest of horseshoe crabs by biomedical facilities

- **Addendum IV (2006)**

- Maintains FMP provision that harvest and landing of horseshoe crabs for biomedical use are not subject to the restrictions placed on harvest and landing of crabs for bait use. This exemption is contingent upon relatively low mortality from the biomedical process including transport and bleeding.

States with Biomedical Collections



- Massachusetts – bait & biomedical; since 1999
- Rhode Island – since 2000
- New Jersey – since 2004
- Maryland – since 2001
- Virginia – 2007-2015
- South Carolina – since 1999

- *New York – bait only; 2004, and since 2015*
- *Delaware – bait only; 2016-2018*

Biomedical Mortality Rate



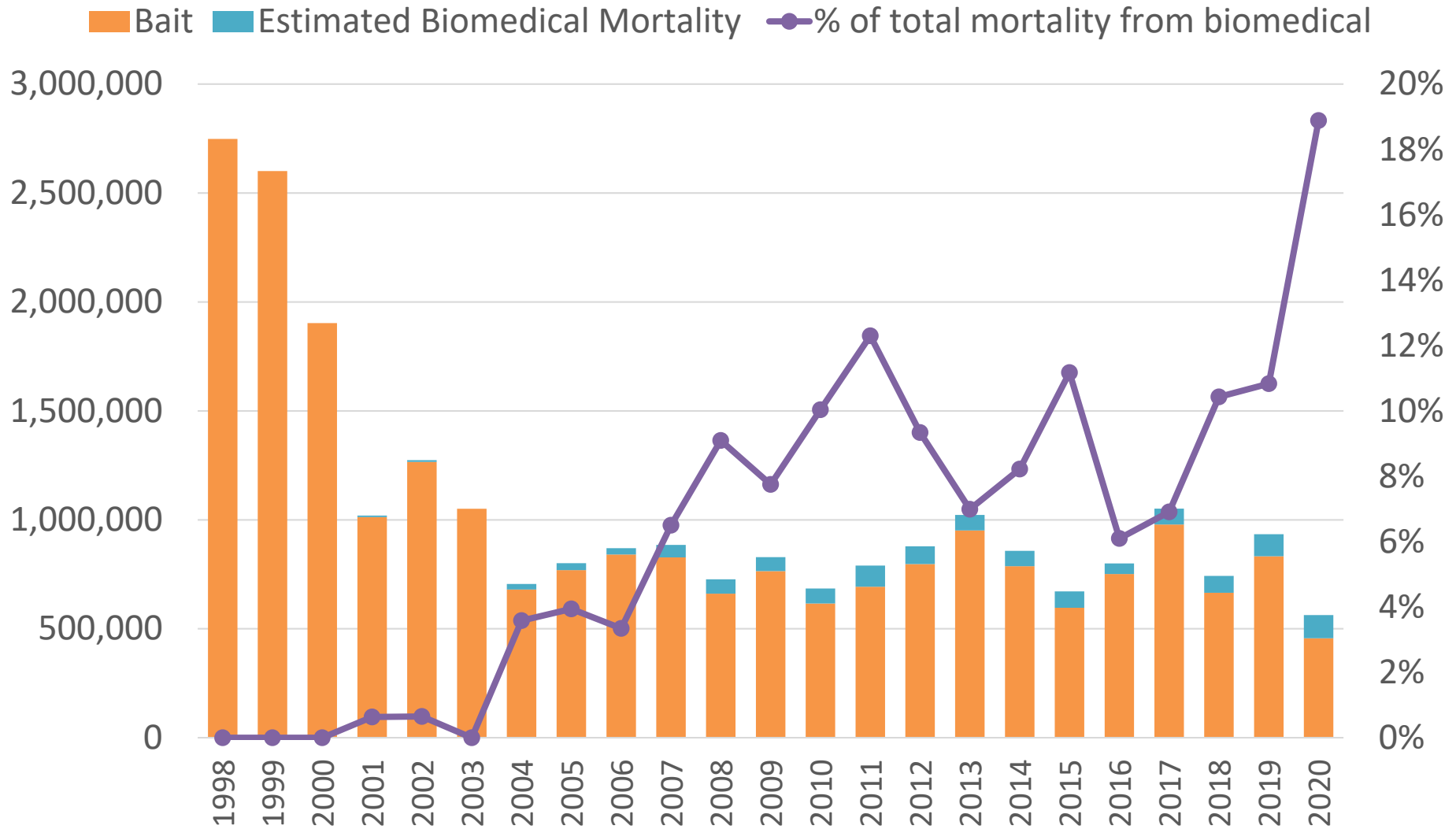
- **Assumed 15% mortality of bled crabs**
- 2019 Benchmark assessment literature review /meta-analysis supported this rate
 - 12 studies
 - calculated a biomedical mortality of 15% with a 95% confidence interval of 4-30%

Annual Total Mortality



Total Horseshoe Crab Mortality (Bait and Biomedical)

Source: State Compliance Reports



Biomedical + Bait as % of ASMFC Quota



	2014	2015	2016	2017	2018	2019	2020
ASMFC Coastwide Quota	1,587,274	1,587,274	1,587,274	1,587,274	1,587,274	1,587,274	1,587,274
Combined State Quotas	1,028,280	1,028,280	1,028,280	1,028,280	986,838	1,022,909	1,020,820
Bait Harvest	787,342	596,528	751,235	978,947	665,278	832,755	456,675
Biomedical Mortality	70,509	75,038	48,782	72,674	77,459	101,193	106,339
Total Mortality	857,851	671,566	800,017	1,051,621	742,737	933,948	563,014
Total Mortality as % of ASMFC Coastwide Quota	54%	42%	50%	66%	47%	59%	35%
Total Mortality as % of Combined State Quotas	83%	65%	78%	102%	75%	91%	55%

Biomedical in the ARM Framework



- Coastwide biomedical mortality included in CSMA model used in ARM to estimate HSC abundance
- For annual harvest recommendations, confidential Delaware Bay-specific biomedical data will be used to determine the harvest package

Best Management Practices



- BMP document produced by WG in 2011 with recommendations for each step from capture to return
 - Collection, Transport to Facility, Holding/Bleeding, Post-bleeding Holding, Return to Sea
- Recommended dual-use for bleeding and bait when possible
- BMPs are recommended but not required

TC Discussion



- In the 2019 stock assessment, coastwide biomedical data were considered as losses from the Delaware Bay population model
 - The levels of biomedical mortality through the terminal year of the assessment (2017) did not have a negative impact on the Delaware Bay stock abundance
- Results show current biomedical mortality levels are sustainable for the Delaware Bay stock
- Population/abundance estimates do not exist for other regions
 - Delaware Bay stock is relatively large compared to the other regional stocks
 - Other regions may be more at risk of impacts from biomedical mortality if they have smaller population sizes

TC Discussion



- Given lack of population estimates for the coast and regions except Delaware Bay, establishing a mortality threshold based on biological reference points is not possible on the coastwide level
- Data confidentiality precludes review of regional biomedical mortality
- TC recommended running population simulations for the Delaware Bay with different levels of biomedical mortality and biomedical sex ratios
 - This information could be used to evaluate potential biomedical thresholds for the coast using the Delaware Bay population as a proxy
 - **Caveat: impact of biomedical mortality will likely vary at the regional and state scales**

Next Steps



- The TC and SAS will meet to review ARM model population projections for the Delaware Bay under different levels of biomedical mortality
 - This is unlikely to produce technically sound methods for developing a coastwide biomedical mortality threshold because impacts are uncertain at the scale of the coast and other regions
- TC is compiling state information on biomedical permit requirements related to BMPs
- The PDT will provide recommendations to the Board at the next meeting

Questions?

