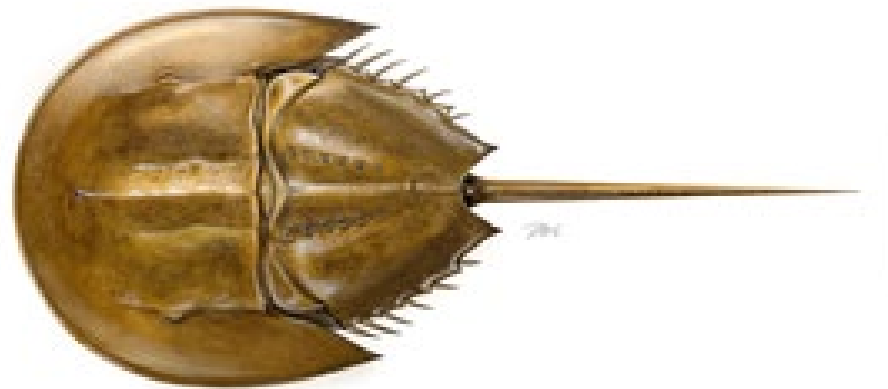


**Draft Addendum VIII on Implementing
Recommended Changes from the 2021 ARM
Revision and Peer Review Report**
for Board Consideration For Public Comment



Horseshoe Crab Management Board
August 3, 2022

Outline



1. Background
2. ARM Revision Components
3. Proposed Action Timeline
4. Proposed Management Options
5. Board Action
6. Next Steps

Background

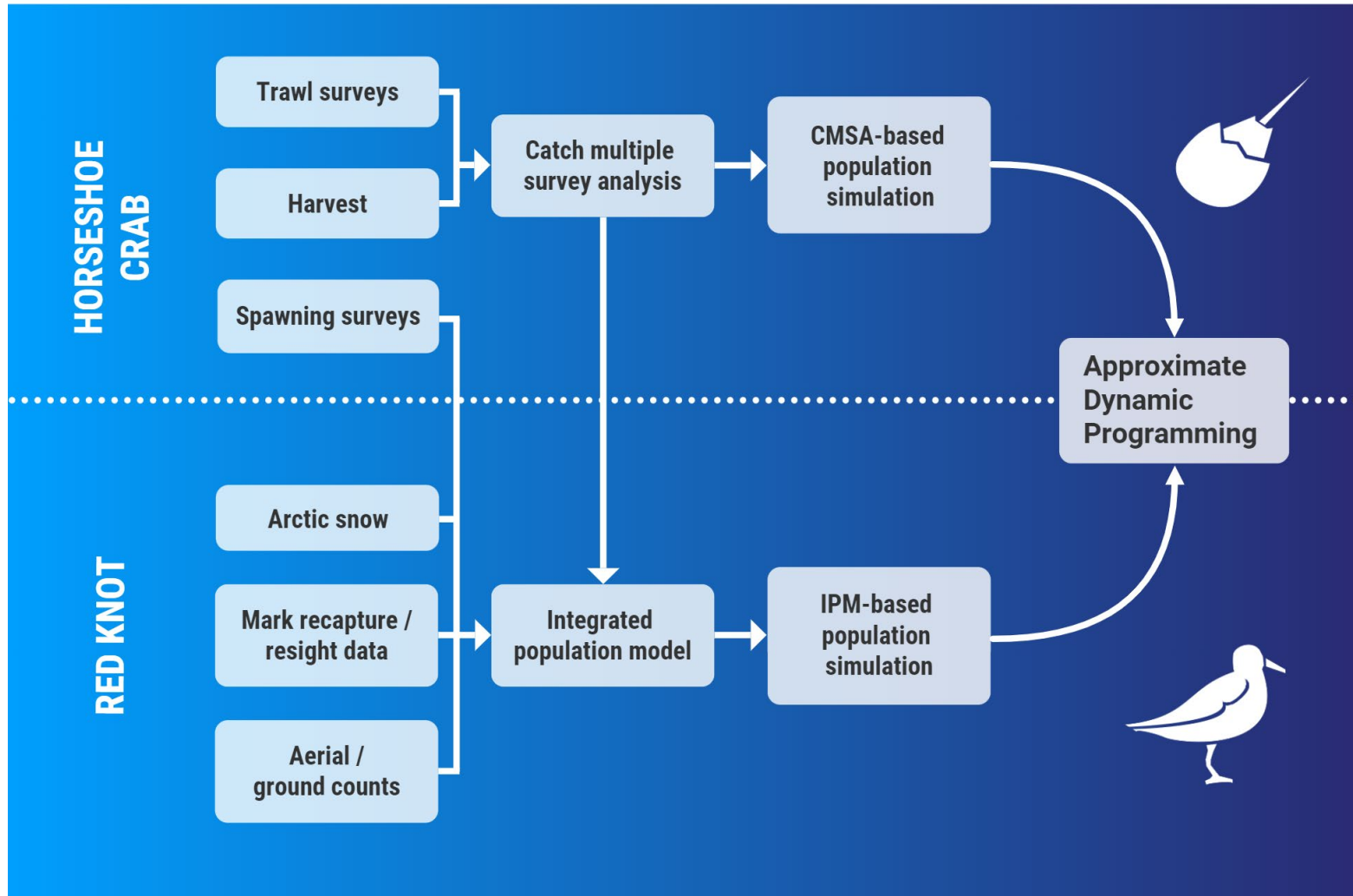


- Addendum VII (2012) established current ARM Framework for recommending optimal bait harvest for Delaware Bay based on HSC and red knot abundance
- Board accepted 2021 ARM Revision and Peer Review in January 2022
 - Addresses peer review critiques
 - Includes new data sources
 - New modeling software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

Revised ARM Conceptual Model



Conceptual Model of the ARM Framework for Horseshoe Crabs & Red Knots



Proposed Action Timeline



| Date | Action |
|--------------------|---|
| January 2022 | Board initiated Draft Addendum VIII |
| Feb-July 2021 | PDT met to develop addendum |
| August 2022 | Board meeting to consider Draft Addendum VIII for Public Comment |
| September 2022 | Public hearings and comment period |
| November 2022 | Board meeting to consider final approval of Draft Addendum VIII |

Draft Management Options



- **Option A: No Action**

- True status quo is not possible given obsolete software
- Management would revert back to provisions implemented under Addendum VI

- **Option B: Implement ARM Revision for setting bait harvest specifications for Delaware Bay-origin horseshoe crabs**

- 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

Option A



- No Action: management would revert back to Addendum VI

| Jurisdiction | Addendum VI ASMFC Quota |
|---------------------------|--------------------------------|
| NJ* | 100,000 |
| DE* | 100,000 |
| MD | 170,653 |
| VA** | 152,495 |
| DELAWARE BAY TOTAL | 523,148 |

Option A



- Addendum VI provisions:
 - prohibits directed harvest and landing of all horseshoe crabs in NJ and DE from January 1-June 7 & female crabs in New Jersey and Delaware from June 8-December 31
 - prohibits the landing of horseshoe crabs in Virginia from federal waters from January 1-June 7
 - no more than 40% of Virginia's annual quota may be harvested east of the COLREGS line
 - horseshoe crabs harvested east of COLREGS line and landed in Virginia must be comprised of a minimum male to female ratio of 2:1

Option B



- Adopt the updates to the ARM Framework recommended in the 2021 Revision and incorporate them into the process for setting specifications for bait harvest of Delaware Bay-origin horseshoe crabs
- Option B addresses aspects of ARM Framework established in Addendum VII:
 1. Harvest recommendations
 2. Adaptive management cycle
 3. Revised Delaware Bay-origin % (λ)
 4. State Allocations
 5. Fallback options

1. Harvest Recommendations



- Status quo maximum harvest of M and F crabs = 500,000 and 210,000
- Sex-specific harvest recommendations on continuous scale
- Sub-options for rounding down optimal harvest recommendation to protect confidential data
 - **Sub-Option B1:** Round down to nearest 25,000 horseshoe crabs
 - **Sub-Option B2:** Round down to nearest 50,000 horseshoe crabs

ARM Revision Harvest Recommendations



| 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 |

Example Harvest Recommendations



| Year | Optimal HSC Harvest (revised ARM) | |
|------|-----------------------------------|---------|
| | Female | Male |
| 2019 | 144,803 | 500,000 |

Sub-Option B1: Round down to nearest 25,000 crabs

| Year | Optimal HSC Harvest (revised ARM) | |
|------|-----------------------------------|---------|
| | Female | Male |
| 2019 | 125,000 | 500,000 |

Sub-Option B2: Round down to nearest 50,000 crabs

| Year | Optimal HSC Harvest (revised ARM) | |
|------|-----------------------------------|---------|
| | Female | Male |
| 2019 | 100,000 | 500,000 |

2. Management Process



- 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.

3. Delaware Bay Origin Crabs



- Updated 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 |

Lambda = Proportion of state harvest that is Delaware Bay Origin

3. Delaware Bay Origin Crabs



CURRENT

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

PROPOSED

| State | Lambda |
|--------------|---------------|
| DE | 1.0 |
| NJ | 1.0 |
| MD | 0.45 |
| VA | 0.20 |

4. State Allocations



- **Weighting**

- Maintain status quo weighting with updated lambdas

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

- **Harvest Cap: MD and VA**

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

| MD Cap | VA Cap |
|---------|--------|
| 170,653 | 60,998 |

- **2:1 male:female offset**

- When female harvest is zero, total male harvest allocation of MD and VA is increased at a 2:1 ratio

4. State Allocations



CURRENT

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

PROPOSED

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

Example Harvest Allocations



| Year | Optimal HSC Harvest (revised ARM) | |
|------|-----------------------------------|---------|
| | Female | Male |
| 2019 | 144,803 (100,000) | 500,000 |



| | Revised DE Bay Allocations | | |
|-------|----------------------------|--------|---------|
| STATE | Male | Female | Total |
| NJ | 173,014 | 34,603 | 207,617 |
| DE | 173,014 | 34,603 | 207,617 |
| MD | 132,864 | 26,573 | 159,437 |
| VA | 21,107 | 4,221 | 25,328 |

Example State Allocations



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

| State | DE Bay Origin Quota | | | Total Quota (Add. 6 cap) | | |
|--------------|---------------------|----------------|----------------|--------------------------|----------------|----------------|
| | Male | Female | Total | Male | Female | Total |
| DE | 173,014 | 34,603 | 207,617 | 173,014 | 34,603 | 207,617 |
| NJ | 173,014 | 34,603 | 207,617 | 173,014 | 34,603 | 207,617 |
| MD | 132,864 | 26,573 | 159,437 | 142,211 | 28,442 | 170,653 |
| VA* | 21,107 | 4,221 | 25,328 | 50,832 | 10,166 | 60,998 |
| Total | 500,000 | 100,000 | 600,000 | 539,071 | 107,814 | 646,885 |

5. Fallback Option



- Models are dependent on annual data
- If data is not available, two 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
- Updated to include new data sets required to run the revised ARM model

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 |
| September 2022 | Public hearings and comment period |
| November 2022 | Board considers final approval of Draft Addendum VIII |

Board Action

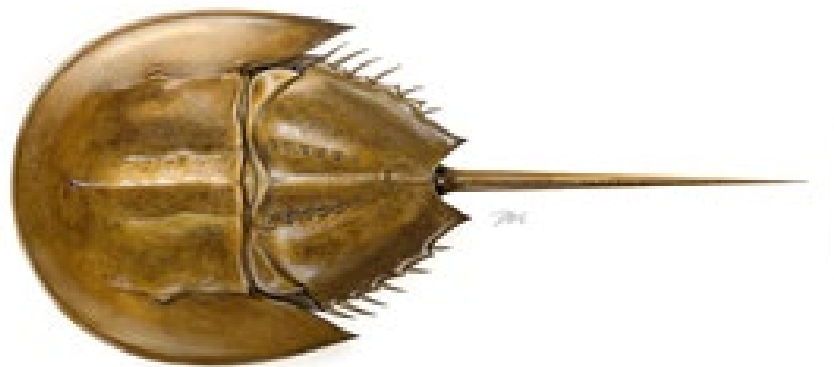


- Specify any changes to Draft Addendum VIII
- Consider approval of Draft Addendum VIII for public comment

Questions ?



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



**Horseshoe Crab Management Board
August 3, 2022**

Outline



1. Board Task
2. Background & Data
3. TC Discussion and Recommendations
4. AP Report
5. PDT Recommendation
6. Board Guidance

Board Task



- Review the threshold for biomedical use mortality to develop biological based options for the threshold and to develop options for action when the threshold is exceeded.
- Review best management practices for handling biomedical catch and suggest options for updating and implementing BMPs

Background on Mortality Threshold

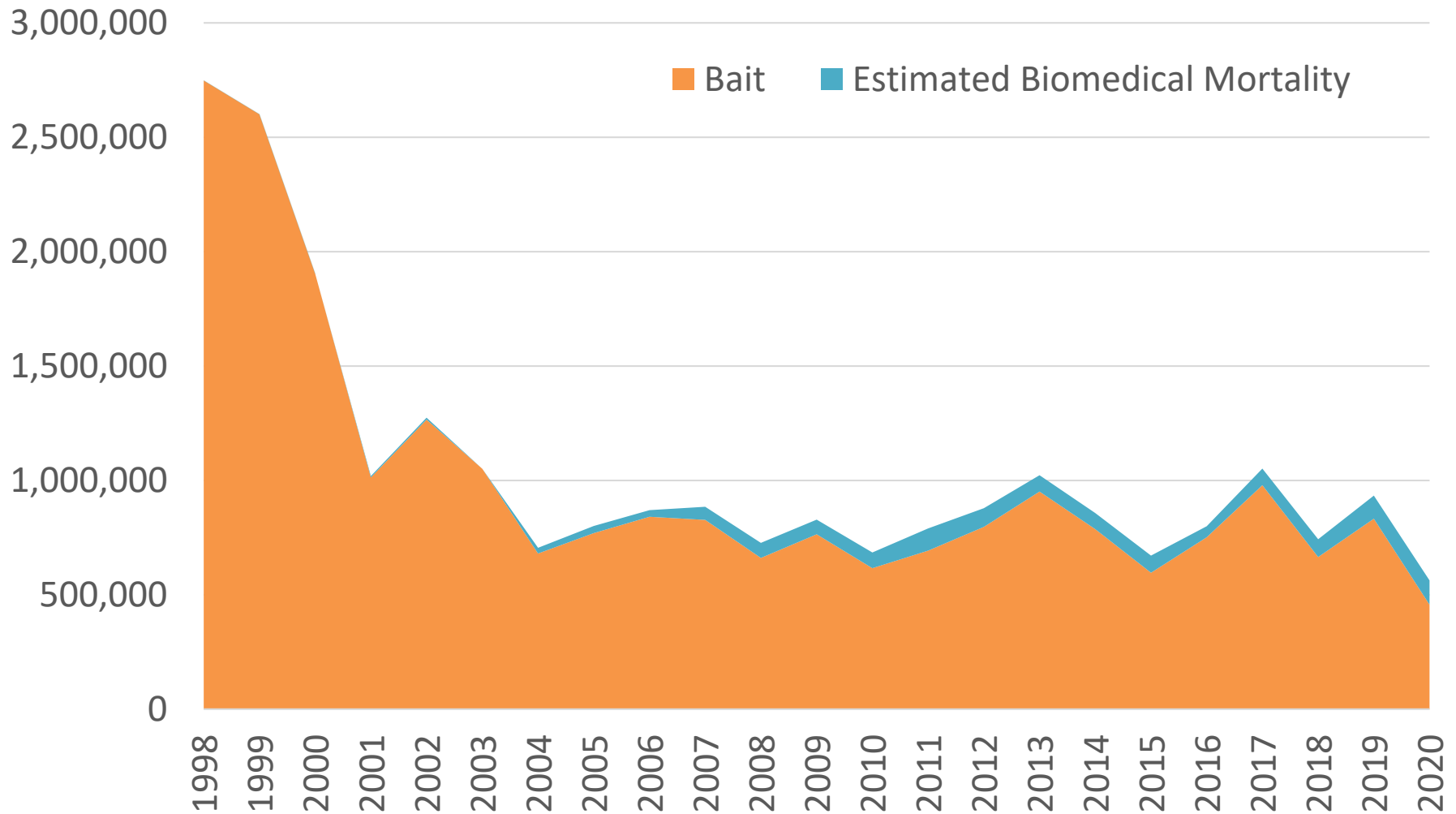


- 1998 FMP:
 - “If horseshoe crab mortality associated with collecting, shipping, handling, or use by the biomedical industry exceeds 57,500 horseshoe crabs per year, the Commission would reevaluate potential restrictions on horseshoe crab harvest by the biomedical industry.
 - Number was based on estimates of annual biomedical mortality at the time

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 (Bait + Biomedical) | 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 would be used to determine the harvest package if Addendum VIII

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
- BMPs are recommended in FMP but not required by ASMFC
 - FMP requires states to issue a special permit, or other specific authorization, for harvests for biomedical purposes, and return of horseshoe crabs taken for biomedical purposes to the same state or federal waters from which they were collected

TC Discussion



- Biomedical mortality threshold
 - DE Bay CSMA run with and without coastwide biomedical
 - negligible impact
 - Lack of biological reference points for coast = biological threshold not possible
 - Regional differences in stock status & impacts of biomedical mortality
 - Consider sex ratio of biomedical collections/mortality
 - Recommended population simulations
- Biomedical BMPs
 - TC members provided info on state permit requirements related to BMPs
 - Differences by state in regulations, permits, operations
 - Consider seasonality of collections

TC Recommendations



- Biomedical Mortality Threshold
 - **Not possible to recommend a scientifically based threshold for biomedical mortality**
 - No population estimate for coast, only DE Bay
- Best management practices
 - **TC recommends focus on BMPs for handling of horseshoe crabs for biomedical use**
 - Improving upon the BMPs and/or developing some standard requirements states could implement for biomedical operations may provide an avenue for reducing lethal and sub-lethal effects on horseshoe crabs

TC Recommendations



- **If the Board wishes to pursue modifying the BMPs or considering new requirements, the TC recommends forming a Work Group to collect additional information and develop recommendations.**

Advisory Panel Report



- AP met on July 11, 2022

Comments on Biomedical Mortality

- Some AP members think 15% estimated biomedical mortality rate is an overestimate.
- The Smith et al. 2020, paper was referenced as an example of long term effects of the biomedical process.
- One AP member is concerned that egg density on beaches remains low, and about post-handling effects of biomedical use on HSC, regardless of estimated mortality levels

Advisory Panel Report



Comments on Best Management Practices

- One member concerned vagueness of BMP language leaves too much room for interpretation
- Biomedical industry members counter that this is necessary due to variation in environment and practices along the coast.
- Concern was voiced about collection during spawning activity
 - Many States have specific regulations to protect spawning HSC IE: Lunar closures, quotas, late seasons.
- Biomedical industry is following relevant or applicable BMPs and doing everything reasonably possible to reduce stress, injury, and mortality.

Advisory Panel Report



- States have incorporated BMPs into codified regulation(s) or made them permit contingencies.
- Biomedical members suggest some minor language changes and the elimination of the recommendation to check salinity at release points.
- It was stated by the biomedical members that preservation of the species is a common goal.

PDT Recommendations



- **The PDT does not recommend using a biologically-based biomedical mortality threshold at this time.**
 - There is currently insufficient data to support a coastwide threshold based on biological reference points
 - Mortality thresholds would not be scientifically based
- The PDT recommends reviewing and discussing the best management practices to propose recommended updates
 - Work Group process

Board Guidance



- Does the Board want to form a Work Group?
- What would focus of Work Group be?

A large horseshoe crab is shown on a sandy beach. The crab is dark brown and has a prominent, rounded carapace. Its legs are visible, and it is casting a shadow on the sand. The background is a clear, light blue sky.

Questions?