

MEETING OVERVIEW

Horseshoe Crab Management Board

October 28, 2025

8:30 - 10:00 a.m.

Chair: Eric Reid (RI) Assumed Chairmanship: 2/25	Technical Committee Chair: Ethan Simpson (VA)	Law Enforcement Committee Rep: Nick Couch (DE)
Vice Chair: Carrie Kennedy (MD)	Advisory Panel Chair: Brett Hoffmeister (MA)	Previous Board Meeting: May 8, 2025
Voting Members: MA, RI, CT, NY, NJ, DE, MD, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS (15 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from May 2025

3. Public Comment – At the beginning of the meeting, public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance, the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Set Delaware Bay-origin Bait Harvest Specifications (8:45-9:15 a.m.) Final Action

Background

- In September 2025, the Delaware Bay Ecosystem TC (DBETC) and Adaptive Resource Management (ARM) Subcommittee met to review results of the horseshoe crab and red knot population abundance surveys in the Delaware Bay region (**Supplemental Materials**).
- The ARM model was run using fishery-independent surveys for horseshoe crabs, horseshoe crab removals, and the estimated population of red knots to provide a recommendation for harvest specifications for Delaware Bay states in 2026 (**Supplemental Materials**).
- The Board approved Draft Addendum IX in May 2025, which allows for male-only harvest specifications to be set for up to three years based on the ARM Framework.

Presentations

- Horseshoe Crab and Red Knot Abundance Estimates and 2025 ARM Model Results by J. Sweka

Board actions for consideration at this meeting

- Set specifications for Delaware Bay-origin horseshoe crab bait harvest

5. Update on Stakeholder Engagement Process Planning for Evaluating ARM Reward, Utility, and Harvest Policy Functions (9:15-9:35 a.m.)

Background

- In July 2024, the Commission held a stakeholder workshop on horseshoe crab management in the Delaware Bay region. One of the key recommendations produced was, “using current ASMFC processes, refine the ARM reward and utility functions with stakeholder input.”
- The Board tasked the ARM Subcommittee (Subcommittee) with reviewing the reward and utility functions of the ARM Framework and discussing what input from stakeholder groups would be needed to provide direction on changes. The ARM Subcommittee recommended initiating a stakeholder engagement process to address the workshop recommendation.
- The Commission has contracted Compass Resource Management as neutral third-party facilitators and analysts for this process, which will include participants from bait fisheries, biomedical groups, dealers, ecosystem, shorebird, and horseshoe crab conservation and science planning groups, and state and federal resource managers.

Presentations

- Update on Stakeholder Engagement Process Planning by C. Starks

6. Consider Approval of Fishery Management Plan Review and State Compliance for the 2024 Fishing Year (9:35-9:45 a.m.) Action

Background

- State Compliance Reports were due July 1, 2024.
- The Plan Review Team reviewed each state report and compiled the annual FMP Review (**Briefing Materials**).
- South Carolina, Georgia, and Florida have requested and meet the requirements of *de minimis* status.

Presentations

- FMP Review of the 2024 Fishing Year by C. Starks

Board actions for consideration at this meeting

- Approve FMP Review and State Compliance Reports
- Approve *de minimis* requests

7. Review and Populate Advisory Panel Membership (9:45-10:00 a.m.) Action

Background

- A consensus recommendation from the July 2024 stakeholder workshop was to evaluate the Horseshoe Crab Advisory Panel (AP) to determine if it has adequate representation across stakeholder groups. The current composition of the AP includes state-specific seats and two seats for non-traditional stakeholders.
- The Board agreed to solicit nominations for non-traditional stakeholder seats and formed a Work Group to review the AP membership and develop recommendations for Board consideration (**Briefing Materials**).
- The Work Group met in August and reviewed 14 nominations for non-traditional stakeholders and three nominations for commercial fishery stakeholders (**Briefing Materials**).

Presentations
• Board Work Group Recommendations on AP Composition by C. Starks
Board actions for consideration at this meeting
• Consider approval of AP nominations

8. Other Business/Adjourn (10:00 a.m.)



Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • asmfc.org

MEMORANDUM

TO: Horseshoe Crab Management Board

FROM: Delaware Bay Ecosystem Technical Committee and Adaptive Resource Management Subcommittee

DATE: October 10, 2025

RE: Delaware Bay Horseshoe Crab Harvest Recommendation for 2026

This memo describes the 2026 harvest recommendation for Delaware Bay Region horseshoe crabs using the methods from the Adaptive Resource Management (ARM) Framework (ASMFC 2022a). Since 2013, the horseshoe crab bait fisheries in the Delaware Bay Region (New Jersey, Delaware, Maryland, and Virginia) have been managed under the ARM Framework to set harvest levels with consideration of the needs of migratory shorebirds. The ARM was developed jointly by the Commission, US Fish and Wildlife Service, and US Geological Survey in recognition of the importance of horseshoe crab eggs to migratory shorebirds stopping over in the Delaware Bay Region. In particular, horseshoe crab eggs are an important food source for the *rufa* red knot, which is listed as threatened under the Endangered Species Act.

Under Addendum VIII (ASMFC 2022b), the 2022 ARM Revision is used to annually produce bait harvest recommendations for male and female horseshoe crabs of Delaware Bay-origin based on the abundance of horseshoe crabs and red knots. Per Addendum IX, male-only harvest can be set for one year or for up to three years (ASMFC 2025). The maximum number of male and female horseshoe crabs the ARM Framework can recommend is 500,000 males and 210,000 females.

1. Objective Statement

Manage harvest of horseshoe crabs in the Delaware Bay to maximize harvest but also to maintain ecosystem integrity, provide adequate stopover habitat for migrating shorebirds, and ensure that the abundance of horseshoe crabs is not limiting the red knot stopover population or slowing recovery.

2. Population estimates

Red knot abundance estimates used to make harvest recommendations under the ARM Revision are based on mark-resight total stopover population estimates (Figure 1; Lyons 2025). The 2025 red knot population estimate was 54,044 (95% CI: 47,926–61,928), an increase from

the 2024 estimate. However, to align the red knot population estimates with the horseshoe crab population estimates, the 2024 red knot population estimate of 46,127 (95% CI: 39,286–57,799) was used in making harvest recommendations for the 2026 harvest season.

In the ARM Revision, all quantifiable sources of mortality (i.e., bait harvest, coastwide biomedical mortality, and commercial dead discards; Figure 2 - Figure 3) were used in the catch multiple survey analysis (CMSA) to estimate male and female horseshoe crab population estimates. The Virginia Tech (VT) Trawl Survey estimates are used in the CMSA along with the New Jersey Ocean Trawl and the Delaware Fish and Wildlife Adult Trawl Surveys (ASMFC 2022a; Jiao et al. 2024; Figure 4 -Figure 5).

Horseshoe crabs are estimated in the Delaware Bay using a two-stage model (the catch multiple survey analysis) which requires estimates of newly mature and mature horseshoe crabs by sex from the VT Trawl Survey. Between 2019 and 2023, the VT Trawl Survey recorded very low numbers or zero newly mature female horseshoe crabs. Newly mature males did not show the same decline. The model cannot run with a zero data point for newly mature horseshoe crabs. Last year it was determined that newly mature females were being misclassified during sampling as *immature*, not mature, likely because the sampling of non-mature females to determine if eggs are present (indicating that they are newly mature versus immature) has been inconsistently applied between tows. Distinguishing the stages in male horseshoe crabs is straight-forward compared to female horseshoe crabs.

Following the methods from last year's ARM update, to re-calculate newly mature females for 2019-2024, the modeling team used a linear regression of newly mature males and females where females were lagged by one year to acknowledge that newly mature males are typically 9 years old and newly mature females are 10 years old. There was a strong positive relationship between these two population estimates (Figure 6), so the linear regression method can predict newly mature female population estimates for the years of 2019-2024 when newly mature female horseshoe crabs were not sampled as rigorously in the survey. No adjustments had to be made for the male horseshoe crab model.

Using the adjusted newly mature female populations methods in the CMSA model (assuming the coastwide biomedical mortality level), there were approximately 30.1 million (95% CI: 22-41.1) mature male and 19.4 million (95% CI: 13.8-27.2) mature female horseshoe crabs in the Delaware Bay Region in 2024 (Figure 7 - Figure 8).

3. Harvest Recommendation

Harvest recommendations for the 2026 fishing year made using the ARM Revision are based on CMSA estimates of horseshoe crab abundance and the red knot mark-resight abundance estimates. ARM harvest recommendations are based on a continuous scale rather than the discrete harvest packages in the previous ARM Framework. Therefore, a harvest number up to the maximum allowable harvest could be recommended, not just the fixed harvest packages. Harvest of females is decoupled from the harvest of males so that each is determined

separately. The maximum possible harvests for both females and males are maintained from the previous ARM Framework at 210,000 and 500,000, respectively.

The annual recommendation of allowable Delaware Bay horseshoe crab harvest is based on the current state of the system (abundances of both species in the previous calendar year) and the optimal harvest policy functions from the ARM Revision. Annual estimates of horseshoe crab and red knot abundances are used as input to the harvest policy functions, which then output the optimal horseshoe crab harvest to be implemented. As per Addendum VIII, if the optimal recommended harvest is less than the maximum, it is rounded down to the nearest 25,000 crabs to uphold biomedical data confidentiality. Under Addendum IX, the Board can set male harvest for one year or for up to three years (ASMFC 2025).

The harvest recommendation for 2026 based on the ARM Framework is 175,000 female and 500,000 male horseshoe crabs.

4. Quota Allocation

Allocation of allowable harvest to each state was conducted in accordance with the methodology in Addendum VIII (Table 1). Note that the total quotas for Maryland and Virginia are capped under Addendum VIII based on the female harvest recommendation. Additionally, if multi-year specifications were to be implemented in accordance with Addendum IX, an option is provided for state allocations with no female harvest included and a 2-to-1 offset for Maryland and Virginia (Table 2).

Table 1. Delaware Bay-origin and total horseshoe crab quota for 2026 by state. Virginia total quota only refers to the amount that can be harvested east of the COLREGS line. Total quotas for Maryland and Virginia are capped as established under Addendum VIII.

State	Delaware Bay-Origin Quota		Total Quota	
	Male	Female	Male	Female
Delaware	173,014	60,555	173,014	60,555
New Jersey	173,014	60,555	173,014	60,555
Maryland	132,865	46,503	126,410*	44,243*
Virginia	21,107	7,387	40,667*	20,331*
TOTAL	500,000	175,000	513,106	185,684

* Total quotas for Maryland and Virginia are capped as established under Addendum VIII.

Delaware Bay-origin and total horseshoe crab quota for 2026 by state with no female harvest and the 2-to-1 offset. Virginia total quota only refers to the amount that can be harvested east of the COLREGS line

State	Delaware Bay-Origin Quota		Total Quota	
	Male	Female	Male	Female
Delaware	173,014	-	173,014	-
New Jersey	173,014	-	173,014	-
Maryland	132,865	-	255,980	-
Virginia	21,107	-	81,331	-
TOTAL	500,000	0	683,339	0

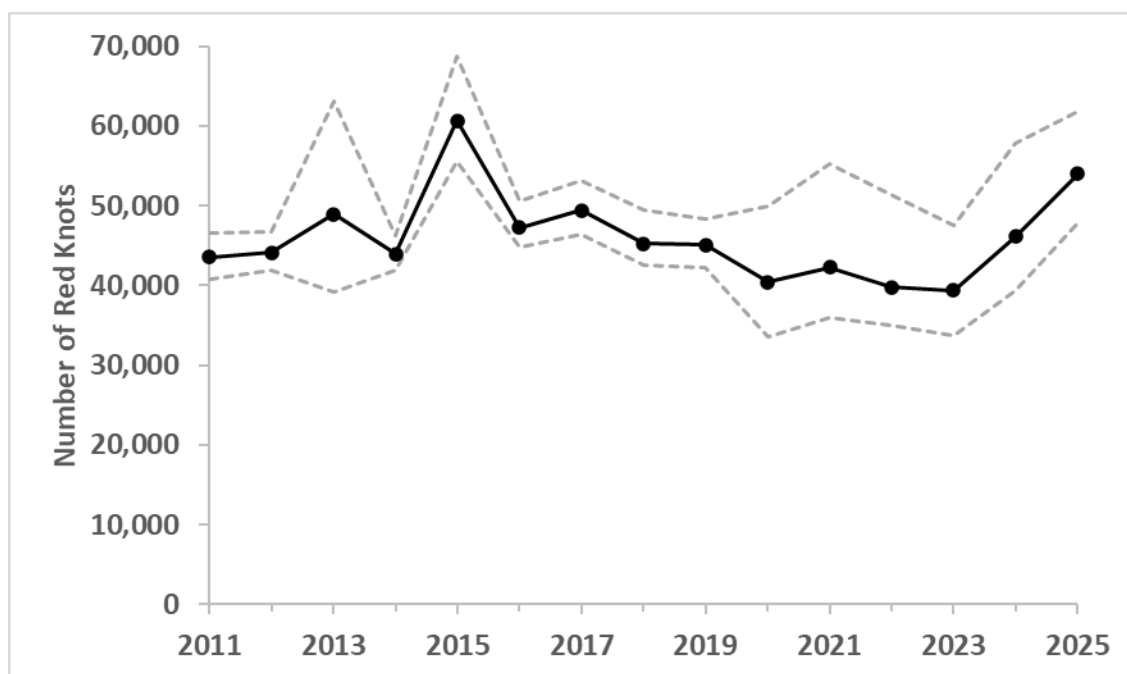


Figure 1. Mark-resight abundance estimates for the red knot stopover population with 95% confidence intervals, 2011-2025.

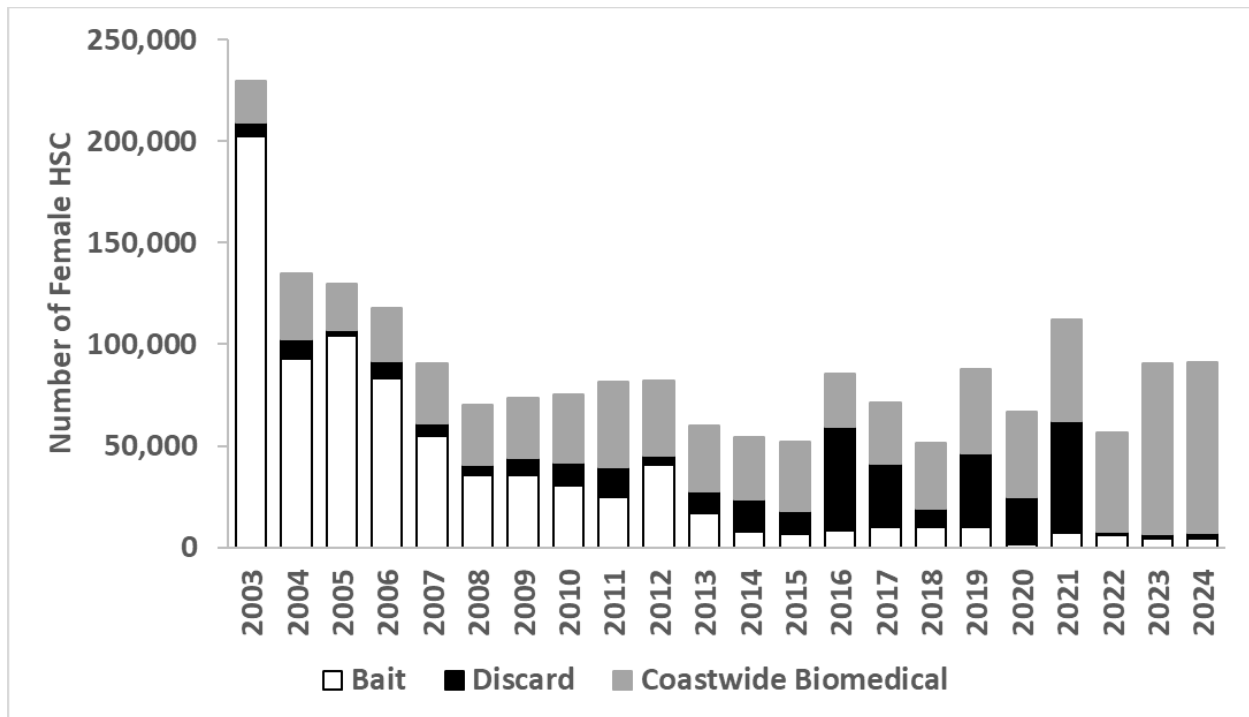


Figure 2. Total female horseshoe crab harvest by source in the Delaware Bay, 2003-2024.

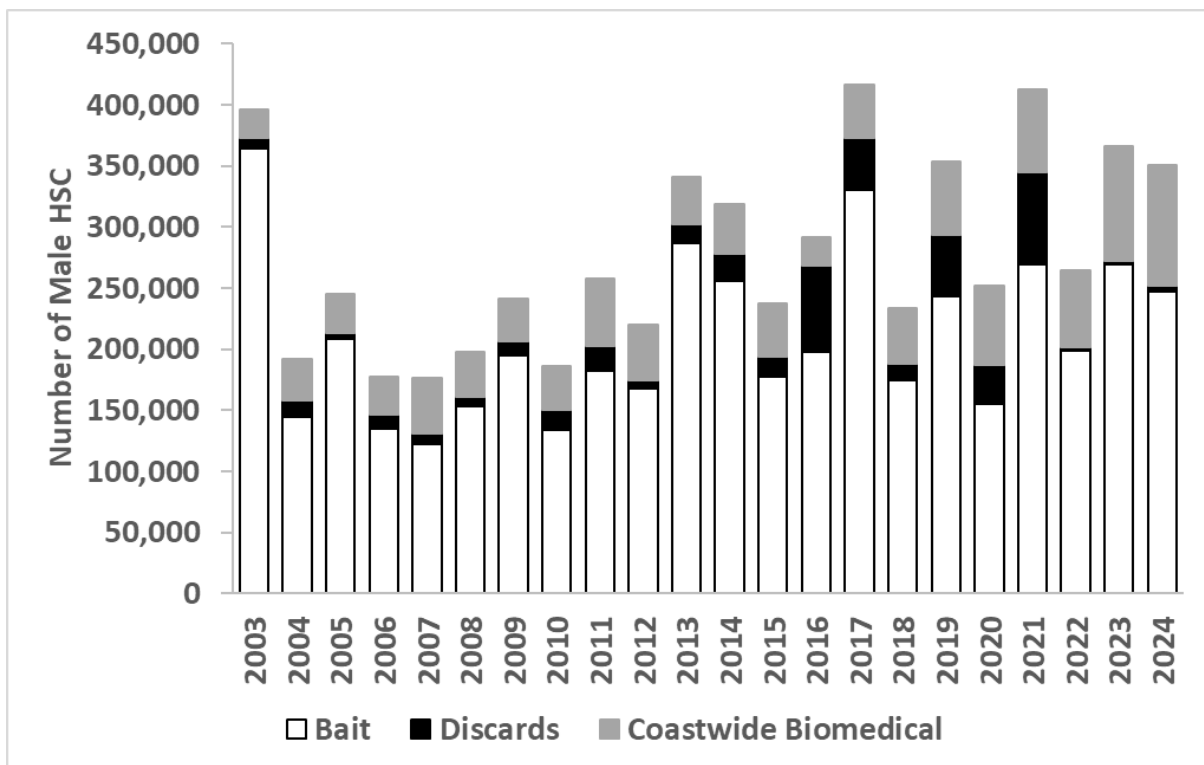


Figure 3. Total male horseshoe crab harvest by source in the Delaware Bay, 2003-2024.

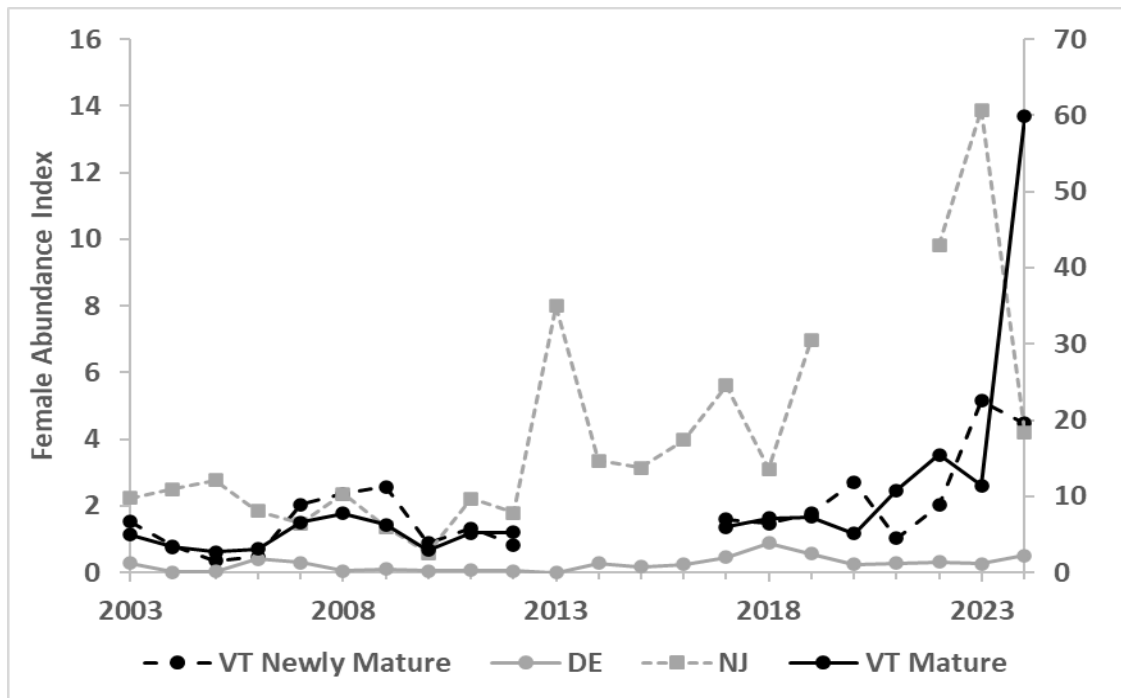


Figure 4. Female horseshoe crab abundance indices used in the CMSA. The Virginia Tech (VT) indices are in millions of newly mature and mature crabs while the Delaware Adult (DE Adult) and New Jersey Ocean Trawl (NJ OT) are in catch-per-tow. The axes for the VT Mature is on the right to account for changes in scale.

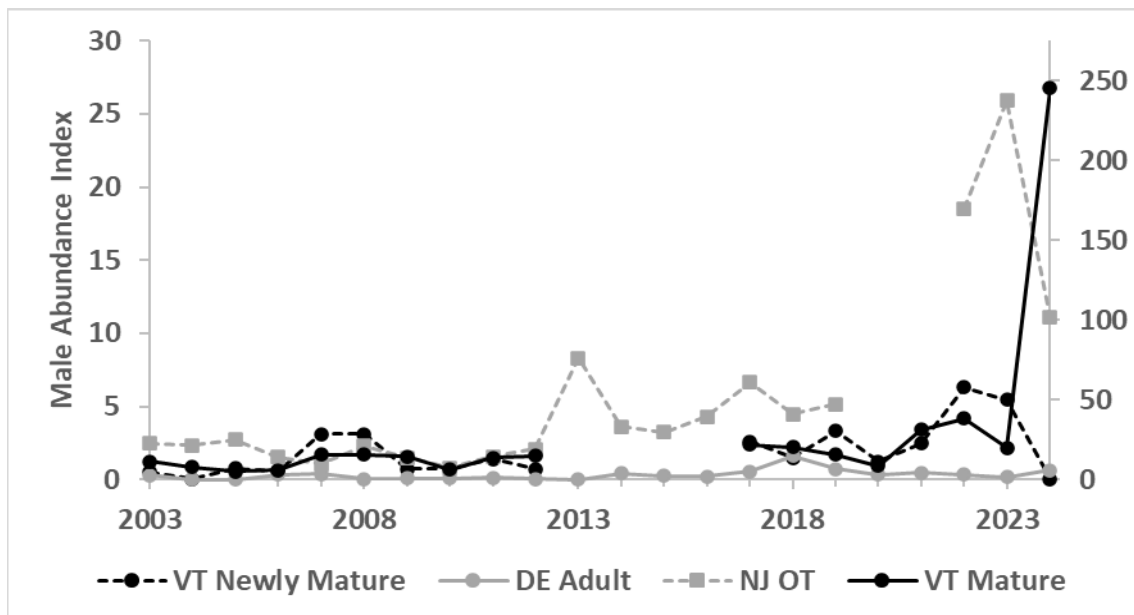


Figure 5. Male horseshoe crab abundance indices used in the CMSA. The Virginia Tech (VT) indices are in millions of newly mature and mature crabs while the Delaware Adult (DE Adult) and New Jersey Ocean Trawl (NJ OT) are in catch-per-tow. The axis for the VT mature index is on the right to account for changes in scale.

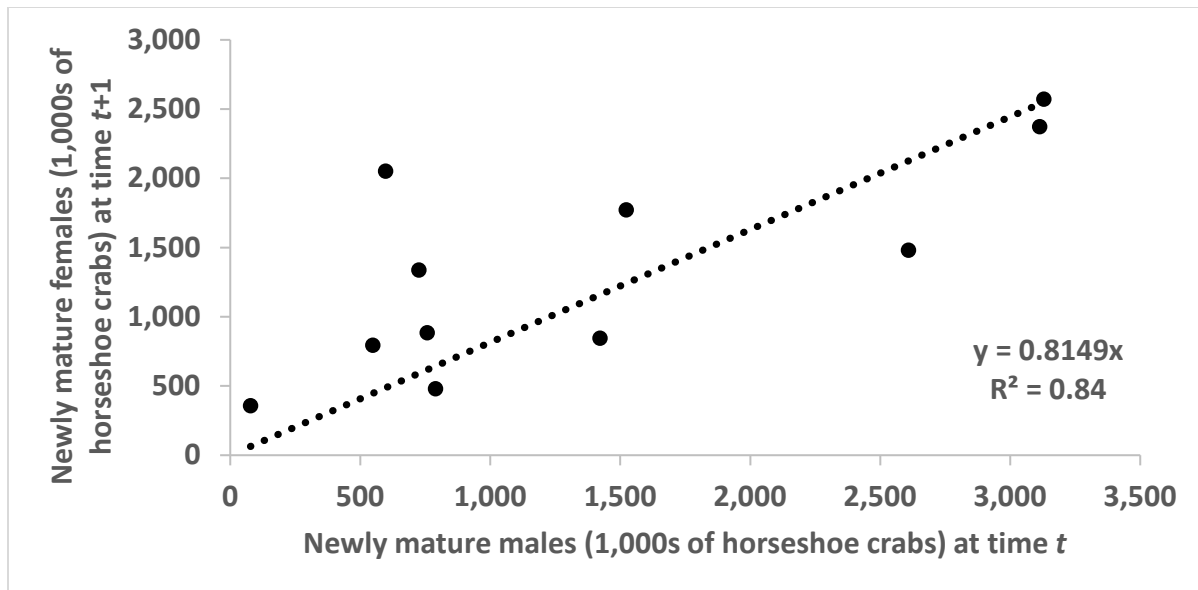


Figure 6. Linear regression between the population estimates of newly mature male to female horseshoe crabs, 2002-2018. The intercept has been fixed at 0.

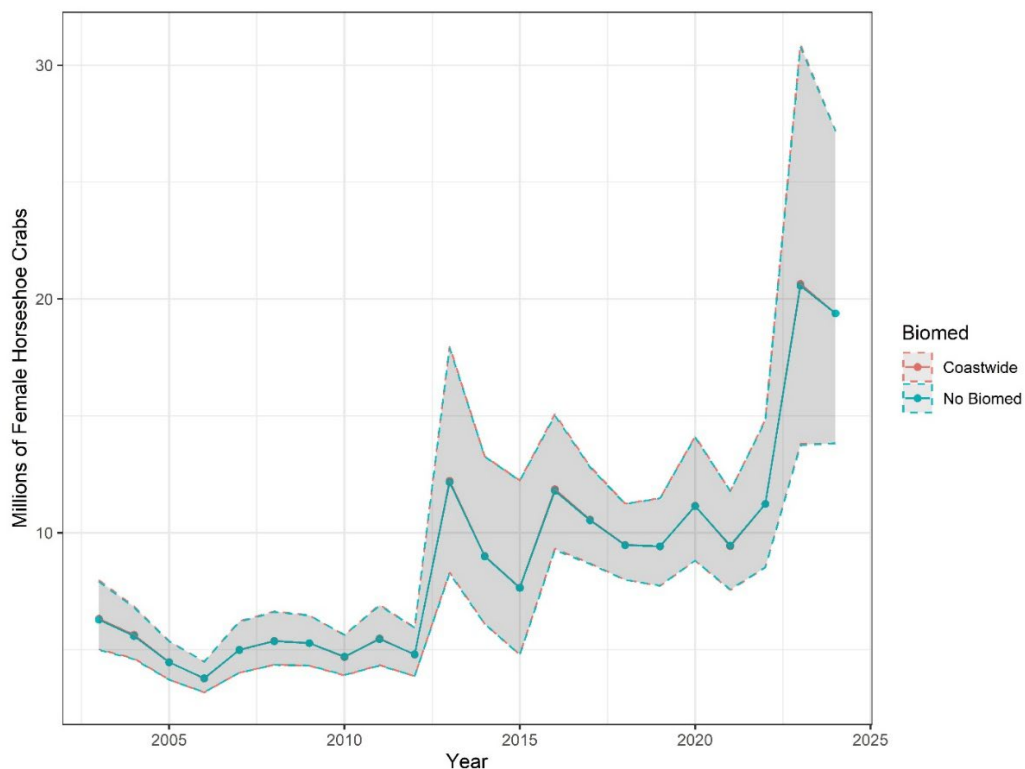


Figure 7. Population estimates from the CMSA for mature female horseshoe crabs with 95% confidence intervals. Delaware Bay biomedical data is confidential so population estimates using coastwide and zero biomedical data provide upper and lower bounds, although there is very little difference between the two and the time series overlap on the figures.

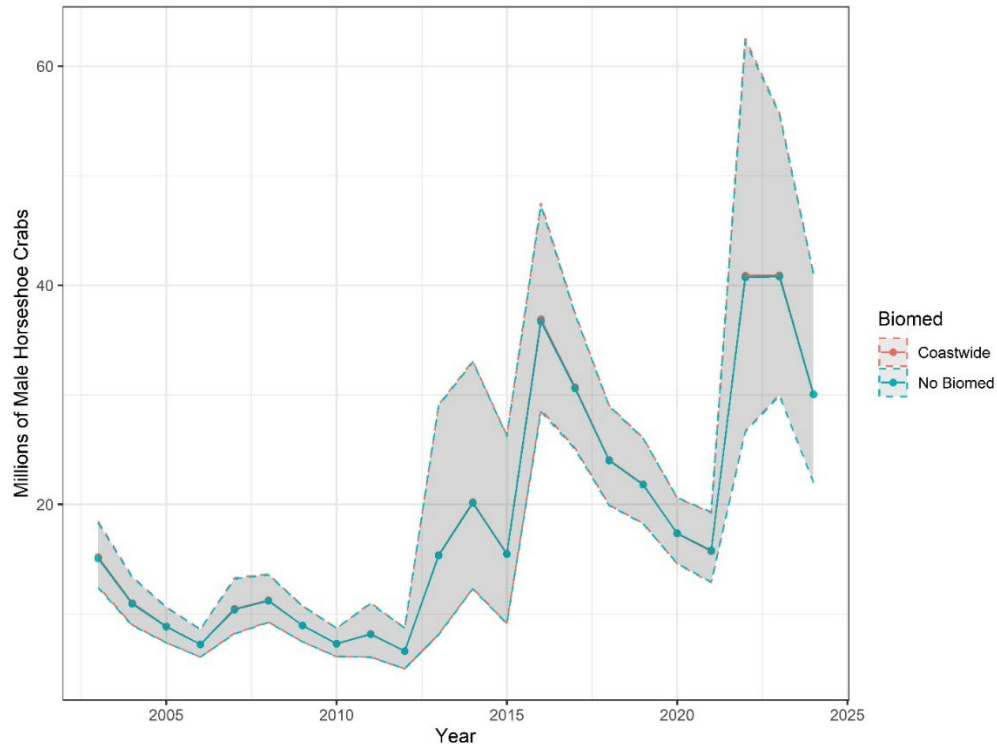


Figure 8. Population estimates from the CMSA for male horseshoe crabs with 95% confidence intervals. Delaware Bay biomedical data is confidential so population estimates using coastwide and zero biomedical data provide upper and lower bounds, although there is very little difference between the two and the time series overlap on the figures.

5. References

- ASMFC. 2022a. 2021 Revision to the Adaptive Resource Management Framework and Peer Review Report. Arlington, VA.
- ASMFC. 2022b. Addendum VIII to the Interstate Fishery Management Plan for Horseshoe Crabs. Arlington, VA.
- ASMFC. 2025. Addendum IX to the Fishery Management Plan for Horseshoe Crab. Arlington, VA.
- Jiao, Y., F. Ferretti, and E. Hallerman. 2024. Results of the 2023 Horseshoe Crab Trawl Survey: Report to the Atlantic States Marine Fisheries Commission Horseshoe Crab and Delaware Bay Ecology Technical Committees.
- Lyons, J. E. 2025. Stopover Population Estimate and Migration Ecology of Red Knots *C. c. rufa* at Delaware Bay, USA, 2025. Memorandum to the Delaware Bay ARM Working Group, Laurel, Maryland.



Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • asmfc.org

Horseshoe Crab Adaptive Resource Management Subcommittee & Delaware Bay Ecosystem Technical Committee

Call Summary

Tuesday, September 23, 2025

9:00 – 10:30 AM

Attendance:

Horseshoe Crab Adaptive Resource Management Subcommittee: John Sweka (Chair), Jim Lyons (Vice Chair), Jason Boucher, Margaret Conroy, Steve Doctor, Conor McGowan, Bryan Nuse, Wendy Walsh,

Delaware Bay Ecosystem Technical Committee: Wendy Walsh (Chair), Kat Christie, Steve Doctor, Danielle Dyson, Francesco Ferretti, Sarah Karpanty, Ethan Simpson, Yan Jiao, Jordan Zimmerman

Horseshoe Crab Technical Committee Members: Steve Doctor, Danielle Dyson, Kelli Mosca, Derek Perry, Ethan Simpson, Chris Wright, Jordan Zimmerman

ASMFC Staff: Caitlin Starks, Samara Nehemiah, Katie Drew

Additional Attendees: Steve Arnott, Andre Lai

The Adaptive Resource Management (ARM) Subcommittee and the Delaware Bay Ecosystem Technical Committee (DBETC) met via webinar to review the most recent population estimates for horseshoe crabs and red knots, the harvest recommendations from the ARM for the 2026 fishing year and supporting horseshoe crab and red knot data sets. Below are the agenda items and summary of the committee's discussion and decisions.

1. Survey Results for 2024 Horseshoe Crab (Andre Lai, Francesco Ferretti)

Andre Lai presented the Virginia Tech (VT) Trawl Survey results for 2024. In 2024, for the Delaware Bay Area (DBA) mean stratified catch-per-tow values for immature females and males remained stable, consistent with patterns observed since 2016. Catch-per-tow of mature females and males decreased from their 2023 values, becoming more similar to abundance levels seen in earlier years. There continues to be a significant correlation between stratified mean catches of mature males and mature females, and immature males and females.

In 2024, the number of newly mature males showed a slight increase, following a sharp decline in 2023 from the higher levels observed in 2021 and 2022. Catch-per-tow of newly mature females showed a substantial rebound in 2024 after having declined sharply from 2019 to near-zero by 2023. This may be due to the change to the sampling protocol for this demographic group. Shortly after the 2024 survey season began, an adjustment to the sampling protocol was

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made in regard to the identification of newly mature females, as recommended by the ARM Subcommittee and DBETC in early August 2024. The vessel captain stated that in the last three years, not all subsampled ambiguous newly mature females were probed with an awl to check for eggs. These tests occurred only when onboard logistics allowed, i.e., when the crew had sufficient time between one tow and the next. When probing could not be performed, the crew classified these crabs as female immatures. As such, it is possible that the low recorded catches of newly mature females in recent years were due to crew sampling error and may not be representative of their true abundance within the population.

Size-frequency distributions remain highly variable, and a trend of slight but detectable decreases over time has continued this year within the DBA. The rate of decrease is greatest for newly mature females, followed by mature females, mature males, and finally newly mature males. Overall, mature males were generally twice as common as mature females throughout the sampling period, although the mean-catch-per-tow sex ratio (M:F) for mature individuals increased substantially in 2023 and 2024.

Lower Delaware Bay was not sampled in 2024 due to poor weather conditions, crew health problems, and mechanical failure of the survey vessel late in the season. Sampling was also not completed in 2022 and 2023 due to rising costs and limited time.

The 2025 sampling season is currently underway.

2. Survey Results for 2024 Red Knots (Jim Lyons)

Jim Lyons presented the red knot stopover population estimate. The population estimate for red knots in 2024 is 54,044 birds (95% credible interval: 47,926 -61,928), which is an increase from 2023 (39,361 birds). There is broad overlap in the credible intervals for population estimates from 2020–2024, the population estimates are relatively stable. The 2025 red knot mark-resight data set included a total of 1,276 individual birds that were recorded at least once during mark-resight surveys at Delaware Bay in 2025, which is slightly lower than in 2024 (1,395) and the second lowest number of flagged individuals detected since 2011. Migration timing has remained consistent, with 50% of the population typically arriving by 18 May and no evidence of advancement since 2011. The majority of arrivals in 2024 occurred early in the season; by 21 May 2025, 84% of the stopover population was present, and only limited arrivals followed. The stopover population estimates in 2025 increased steadily from the beginning of the season and peaked around May 21. In 2025, departure probability was relatively low before May 21, then steadily increased to a peak near the end of the month, indicating steady turnover in the population after May 24. Stopover duration in 2025 was similar to 2024. Estimates from 2023-2025 suggest shorter stays than those from 2019–2021. The resight probability was relatively low for much of the season, and relatively low compared to most years since 2011.

DBETC and ARM Committee members asked why there are fewer individual tags being detected for red knots and whether something can be done to resolve this issue. It was noted that there has been a reallocation of flags from Delaware to New Jersey, and the issue of how to allocate

efforts across New Jersey and Delaware to improve resighting rates should be discussed at the Delaware Bay coordination meeting. It was also suggested that there should be an analysis of banding needs coastwide to ensure the needs of this model can continue to be met in the future.

3. Review of Supplementary Surveys for Horseshoe Crabs and Red Knots

a. NJ Ocean Trawl Survey (Danielle Dyson)

Danielle Dyson gave an overview of the NJ Ocean Trawl Survey. It was noted that no cruise occurred in October 2024. For April and August, the stratified arithmetic mean in numbers was 4.21 for females and 6.23 for males. This is consistent with the increasing trends in the male and female indices since 2010.

It was noted that there has been no sampling in 2025.

b. DE Bay 30 ft. Trawl Survey and Spawning Survey (Jordy Zimmerman)

Jordy Zimmerman reviewed the DE Bay 30ft Trawl Survey methods and sampling routine for horseshoe crabs. He noted no significant trends in the trawl survey indices. For the April-July index the 2024 geometric mean catch increased from 2023, and for all months it remained below the time series average similar to 2023. Staging of crabs caught in the surveys has occurred since 2017.

The spawning survey is used by the ARM for providing a sex ratio of males to females on the spawning beaches. Jordy noted that 13 of 240 sampling occasions (5%) were missed for 2024, which is a very low proportion for the time series. The abundance indices show positive trends over time and increased from 2021 to 2024. The Baywide female index shows a positive but not significant trend, while the Baywide male index shows a significant increasing trend. The proportion of females spawning in May was 70% for Delaware Beaches and 74% for New Jersey beaches. Peak spawning in 2024 occurred May 21 – May 25 (2nd lunar period) for both states.

c. Shorebird Monitoring

Kat Christie gave a summary of shorebird monitoring efforts in the Delaware Bay. She noted that to date most of the data from New Jersey have not yet been provided. Data collection has not been an issue on the Delaware side. However, only 7 red knot captures were made and 101 individuals resighted in 2025, which is well below average. The peak count was 25,667 red knots based on ground counts, and 16,335 based on the aerial counts. Aerial counts were lower than ground counts in 2025.

4. Review Results of ARM Model

The sections below summarize the committees' discussion on the ARM results. Details on the methods applied and the results themselves are provided in the memo to the Board from the ARM Subcommittee and DBETC dated October 10, 2025.

a. Results from 2021 ARM Framework Revision

Samara Nehemiah reviewed the annual process, results, and harvest recommendations for 2026 using the revised ARM Framework, which has been adopted for setting Delaware Bay specifications under Addendum VIII. The Virginia Tech Trawl Survey estimates are used in the CMSA along with the NJ Ocean Trawl and the DE Fish and Wildlife Adult Trawl (30') Surveys. All quantifiable sources of mortality (i.e., bait harvest, biomedical mortality, and commercial dead discards) were used in the CMSA to estimate male and female horseshoe crab population sizes. Public population estimates for horseshoe crabs were made using the coastwide biomedical data or no biomedical data, which provide upper and lower bounds. The exact harvest recommendation is based on the results using confidential biomedical data from the Delaware Bay region and cannot be publicly shared. The exact recommended male and female harvest levels are rounded down to the nearest 25,000 crabs to protect confidential data.

Using the CMSA model, there were approximately 30.1 million mature male and 19.4 million mature female horseshoe crabs in the Delaware Bay Region in 2024, assuming coastwide biomedical data. The Virginia Tech Trawl population estimates were 37.8 million male and 8.3 million female mature horseshoe crabs for comparison.

The 2024 red knot population estimate was 46,127 birds. The maximum possible harvest for both females and males are 210,000 and 500,000, respectively. The harvest recommendation based on the ARM Framework for 2026, using the gap-filling method recommended by the DBETC and ARM Committees, is 175,000 female and 500,000 male horseshoe crabs.

5. Board Recommendation

The ARM Subcommittee and DBETC recommend using the harvest recommendation from the revised ARM to set the Delaware Bay bait harvest specifications for 2026, or multi-year specifications for up to three years. This would result in harvest levels of 175,000 female and 500,000 male horseshoe crabs for 2026 only, or 500,000 males only for up to three years. The allocation methodology that would be used to distribute the Delaware Bay-origin quota amongst the states of New Jersey, Delaware, Maryland, and Virginia is specified in Addendum VIII.

6. Other Business

There was no additional discussion beyond the agenda items. No public comments were provided.