Atlantic States Marine Fisheries Commission

ADDENDUM IX TO THE HORSESHOE CRAB FISHERY MANAGEMENT PLAN FOR PUBLIC COMMENT

Multi-Year Specifications for Male-only Harvest in the Delaware Bay Region

May 2025

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

1.0 INTRODUCTION

The Atlantic States Marine Fisheries Commission's (ASMFC) Horseshoe Crab Management Board (Board) approved the Interstate Fishery Management Plan for Horseshoe Crabs (FMP) in October 1998. The goal of the FMP 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 researchers, migratory shorebirds, and other dependent fish and wildlife, including federally listed sea turtles. ASMFC maintains primary responsibility for horseshoe crabs in state and federal waters. The management unit for horseshoe crabs extends from Maine through the east coast of Florida. Horseshoe crabs are currently managed under the FMP and its eight addenda. The Delaware Bay region is the primary focus of this Draft Addendum. Bait harvest in the Delaware Bay region is managed using the Adaptive Resource Management (ARM) Framework. The ARM framework incorporates population models of horseshoe crabs and red knots and aims to balance harvest with maintaining the ecosystem and supporting shorebird migration.

In October 2024, the Board initiated Addendum IX to consider adding an additional specifications tool for the Delaware Bay region that would allow the Board to set specifications for male-only harvest for multiple years via the following motion:

> *Move to initiate an addendum to consider the ability to set multi-year specifications for male-only horseshoe crab harvest of Delaware Bay-origin Horseshoe Crab based on the ARM Framework or an alternative male-only harvest specification setting method.*

2.0 OVERVIEW

2.1 Statement of the Problem

The Board initiated Addendum IX in October 2024 to consider allowing for multi-year specifications for male-only harvest in the Delaware Bay region states of New Jersey, Delaware, Maryland, and Virginia. Since 2013, the first year the Adaptive Resource Management (ARM) Framework was used to set specifications for harvest of Delaware Bay-origin horseshoe crabs, the Board has maintained zero female harvest. When the 2021 ARM Framework Revision was adopted for management use in 2022 through Addendum VIII (ASMFC 2024), the possibility of female harvest elicited widespread public concern. Acknowledging these concerns, the Board has continued to establish zero female harvest annually despite the ARM Framework output including a limited amount of female harvest since 2022.

In July 2024, the Commission held a stakeholder workshop including representatives from environmental non-governmental organizations (NGOs), fishing industry, biomedical industry, bird and horseshoe crab scientists, and resource managers to generate recommendations for Board consideration regarding horseshoe crab management in the Delaware Bay region. A key consensus recommendation developed at the workshop was to continue running the ARM Framework but prohibit female horseshoe crab harvest while several additional

recommendations are considered and implemented. Multi-year specifications for male-only harvest in the Delaware Bay region states would alleviate concerns about female harvest while the Board considers possible changes to the Delaware Bay management program.

Additionally, it was recently identified that seasonal harvest restrictions established for the Delaware Bay states under Addenda IV-VI were not included in Addendum VII. Based on review of Board discussions during the development of Addendum VII, it appears the omission of the seasonal provisions, which prohibited the directed harvest of horseshoe crabs of Delaware Bay-origin from January 1 through June 7, was an oversight. Therefore, this Addendum also reestablishes the provisions of Addendum IV-VI that restrict directed harvest during the beginning of the year and the spawning season.

Addenda VII and VIII also include provisions that place a maximum limit on the total level of allowed harvest by Maryland and Virginia. The caps for each state were based on Addendum VI quota levels for Maryland and Virginia and are intended to provide protection to non-Delaware Bay-origin crabs when female harvest is allowed. The provision as written in Addendum VIII states that the harvest caps shall apply to these two states "except when the ARM Framework outputs an optimized harvest that prohibits harvest of female horseshoe crabs." If the ARM Framework output prohibits female horseshoe crab harvest, then Maryland and Virginia are allocated additional male harvest. This Addendum clarifies that the harvest caps do not apply if the Board voluntarily implements zero female harvest of Delaware-origin horseshoe crabs.

2.2 Background

In response to public concern regarding the horseshoe crab population and its ecological role in Delaware Bay, the Board adopted a multi-species approach to managing the commercial horseshoe crab bait fishery in the region. Addendum VII was approved in February 2012, implementing the Adaptive Resource Management (ARM) Framework for use during the 2013 fishing season and beyond. The Framework considers the abundance levels of horseshoe crabs and shorebirds (specifically, the rufa red knot) in determining the appropriate harvest level for the Delaware Bay states of New Jersey, Delaware, Maryland, and Virginia (east of the COLREGS). Since 2013, the Board has annually reviewed the maximum bait harvest levels output by the ARM model to specify harvest levels for the following year in New Jersey, Delaware, Maryland, and Virginia.

In 2021, a revision to the ARM Framework was completed and peer-reviewed. The revision updated and improved the ARM model with an additional decade of data on shorebirds and horseshoe crabs in the Delaware Bay region, and advancements in modeling software and techniques, including recommendations from the original peer review. Addendum VIII was approved in 2022 to allow the use of the 2021 Revision of the ARM Framework in setting annual bait harvest specifications for horseshoe crabs of Delaware Bay-origin.

During the public comment period on Addendum VIII, over 30,000 comments were submitted opposing the adoption of the ARM Revision in large part because the results of the revised

model run for the 2023 fishing year allowed for a limited amount of female horseshoe crab by the bait fishery for the first time since ARM implementation. In response to the widespread concern, the Board chose to implement zero female horseshoe crab harvest for the 2023 season, despite the ARM model output including limited female harvest. Given the apparent differences in stakeholder opinions on female harvest, in 2023, the Board conducted a survey of stakeholders including bait harvesters and dealers, biomedical fishery and industry participants, and environmental groups to better understand their diverse perspectives and values, and whether changes to horseshoe crab management for the Delaware Bay region should be considered.

The results of the survey confirmed that the various stakeholder groups hold divergent values and perspectives related to horseshoe crab management. Commercial industry participants indicated they still value the harvest of female horseshoe crabs, though it has not been permitted in the Delaware Bay region since 2012. Environmental researchers and advocates tended to value the protection of female horseshoe crabs and the ecological role of horseshoe crabs as a food source for shorebirds over the fishery. Considering these conflicting values, ASMFC held a stakeholder workshop in July 2024 with participants from all stakeholder groups to discuss management objectives for the Delaware Bay region horseshoe crab fishery[1].

The main purpose of the workshop was to increase understanding of various stakeholder perspectives and identify essential concerns and areas of common ground for horseshoe crab management. An important finding from the workshop was that participants from all stakeholder groups affirmed a preference for adaptive management over other approaches. However, it is clear there is a need to engage stakeholders in a process to evaluate and reconsider aspects of the ARM Framework to better address stakeholder concerns and values. Following the workshop recommendations, the Board agreed to move forward with considering potential changes to the ARM Framework with stakeholder input.

The workshop discussions also emphasized the need for an interim management approach while the Board gathers information from stakeholders and considers modifying the ARM Framework. Although the workshop participants agreed the ARM should continue to be used while additional recommendations are addressed, they expressed a desire for more certainty around future harvest levels. Specifically, the participants agreed it would be preferable to set the female harvest quota to zero for the time needed to address other recommendations. The management program does not currently allow for horseshoe crab bait harvest specifications to be set for multiple years. Draft Addendum IX aims to address the workshop recommendations by allowing for male-only harvest of Delaware Bay-origin horseshoe crabs to be established for multiple years based on the ARM Framework.

[1] The final report on the July 2024 Horseshoe Crab Management Objectives Workshop can be found here: https://asmfc.org/resources/management/species-board-proceedings/report-on-the-july-2024-horseshoe-crab-management-objectives-workshop/

3.0 MANAGEMENT PROGRAM

3.1 Multi-year Specifications

This section modifies Section 3.0 of Addendum VIII.

Addendum IX allows the Board to set harvest specifications based on the ARM Framework for male-only bait harvest of horseshoe crabs for the Delaware Bay states (New Jersey, Delaware, Maryland and Virginia) for multiple years at a time. The Board can choose to set specifications for up to three years. Multi-year specifications are only allowed for male-only harvest; if any female harvest is included, then specifications are only established for a single year.

The process for setting specifications is outlined in Figure 1. The Board reviews the output of the ARM Framework in the fall of a given year and set harvest limits for the following year, or years. For example, in fall 2025, the Board will review the 2025 ARM Framework output for 2026 harvest limits. The Board can then consider whether to adopt the ARM Framework output for males and females for the following fishing year or set different harvest limits, such as adopting zero female harvest instead of the ARM-recommended female harvest limit. If the Board does not allow any female harvest, then it can set specifications for male-only harvest for either the 2026 fishing year only, the 2026 and 2027 fishing years, or the 2026-2028 fishing years based on the 2025 ARM Framework output.

In years where multi-year male-only harvest specifications are implemented, in year one and two (interim years) of the specifications, the Board reviews updated data from the Delaware Bay horseshoe crab and shorebird surveys (i.e., the Virginia Tech Trawl Survey, horseshoe crab spawning surveys, red knot aerial and ground surveys) and responds if necessary. The full ARM process will not occur, meaning the Board will not review a new horseshoe crab population estimate nor an ARM Framework output in interim years, unless specifically requested by the Board. Following a multi-year specifications period, the ARM Framework is used to provide a new maximum harvest output, which is used to establish new harvest specifications for the following year or years; this includes the option to implement male-only harvest or female and male harvest (one-year specifications only).

This provision of Addendum IX is in place through 2031, and a new addendum is required to set multi-year specifications after 2031. The Board may choose to replace Addendum IX with another addendum or amendment to the FMP prior to 2031. If Addendum IX expires and the Board does not take management action to follow Addendum IX, then harvest specifications setting revert to the process established in Addendum VIII and specifications will be set annually based on the ARM Framework.

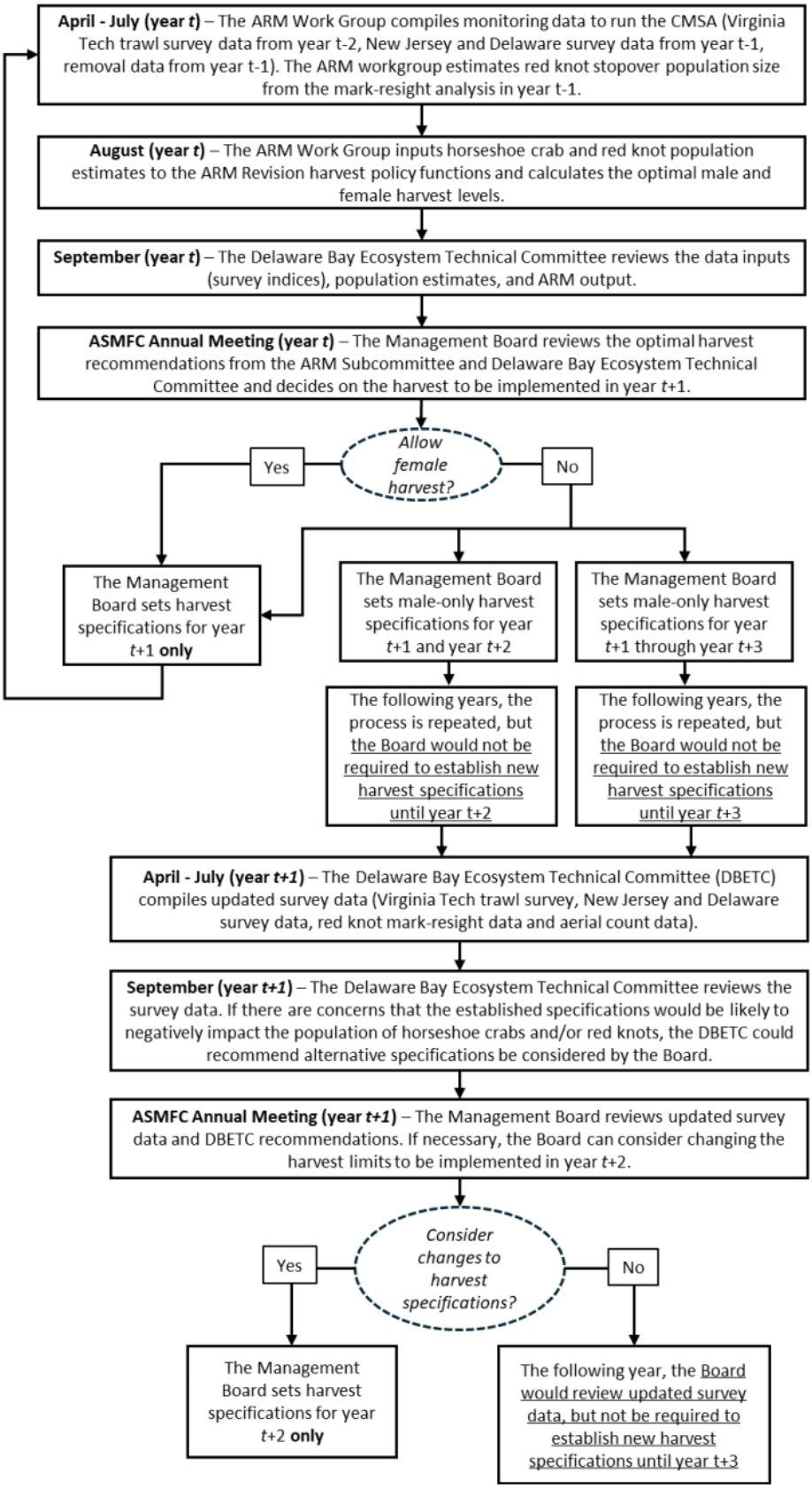

Figure 1. Multi-year specifications setting process for male-only horseshoe crab harvest.

In interim years of multi-year specifications, the male-only harvest limit is based on the male:female sex ratio of spawning horseshoe crabs on beaches observed in the bay-wide spawning survey. The target sex ratio is 3 males to 1 female and the threshold sex ratio is 2 males to 1 female[2]. If the sex ratio is greater than or equal to 3:1, the maximum harvest of 500,000 Delaware Bay origin males is permitted. If the sex ratio is between the target and threshold, the maximum allowable male harvest is reduced as the ratio decreases and would be zero if the sex ratio were to decrease to 2:1 or less (Figure 2). Maximum male harvest levels based on the spawner sex ratio are defined in Table 1.

Sex ratio data is collected and reported annually through the bay-wide horseshoe crab spawning survey. The average sex ratio on the spawning beaches was 4.2:1 from 1999 – 2019 (Figure 3). The lowest sex ratio over that period was 3.1 males to 1 female, and it has generally showed an increasing trend through time despite male-only harvest since 2013.

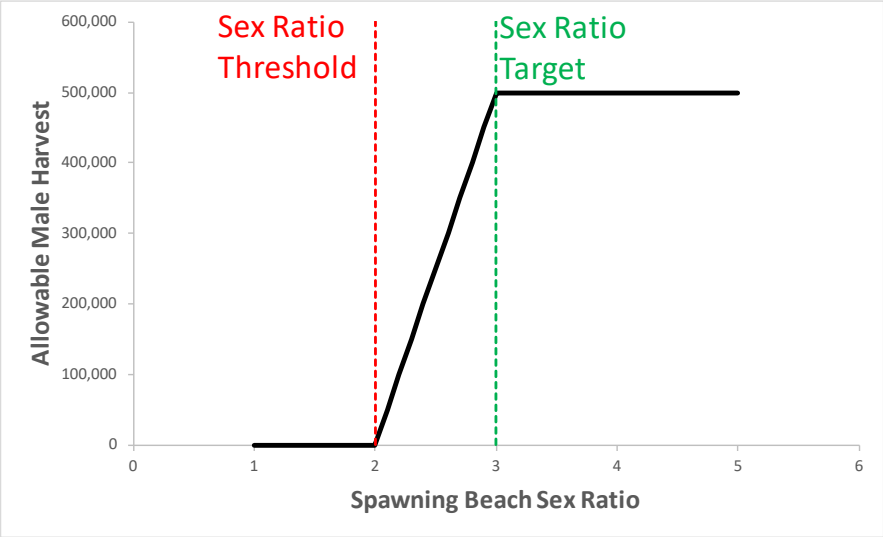

Figure 2. Harvest level of male horseshoe crabs as a function of the sex ratio (M:F) on spawning beaches.

[2] There is no direct link between male horseshoe crab abundance and red knot population dynamics. The only way male abundance could limit red knot population growth would be if the operational male:female sex ratio on the spawning beaches dropped to a point at which not all eggs were fertilized. Although satellite males (those that do not attach to a female) can fertilize as many eggs as attached males (Brockman et al. 2000), 96 – 100% of eggs are fertilized whether or not satellite males are present (Brockman 1990). Some males are not capable of amplexus (the mating position in which the male clasps the shell of the female) because of their condition (Brockman and Smith 2009) and females will tend not to nest unless they are in amplexus with a male. Therefore, an operational sex ratio skewed toward males is needed to ensure fertilization of eggs. If the spawning sex ratio should drop below 2:1, there is a chance of incomplete fertilization of the eggs deposited by females and future recruitment of horseshoe crabs could decline. As long as the sex ratio on the spawning beaches remains greater than 2:1, there is no biological mechanism for male abundance to limit red knot population growth. Given this effect of male crabs on the population dynamics of both species, a simple harvest control rule could be used to manage male-only harvest as a function of the spawning beach sex ratio.

Table 1. Maximum harvest level of male horseshoe crabs based on the sex ratio (M:F) on the Delaware Bay spawning beaches, as proposed under Sub-option 1B-2.

Observed Male:Female Sex Ratio	Maximum Allowable Male Harvest
≤2.0:1	0
2.1:1	50,000
2.2:1	100,000
2.3:1	150,000
2.4:1	200,000
2.5:1	250,000
2.6:1	300,000
2.7:1	350,000
2.8:1	400,000
2.9:1	450,000
≥3.0:1	500,000

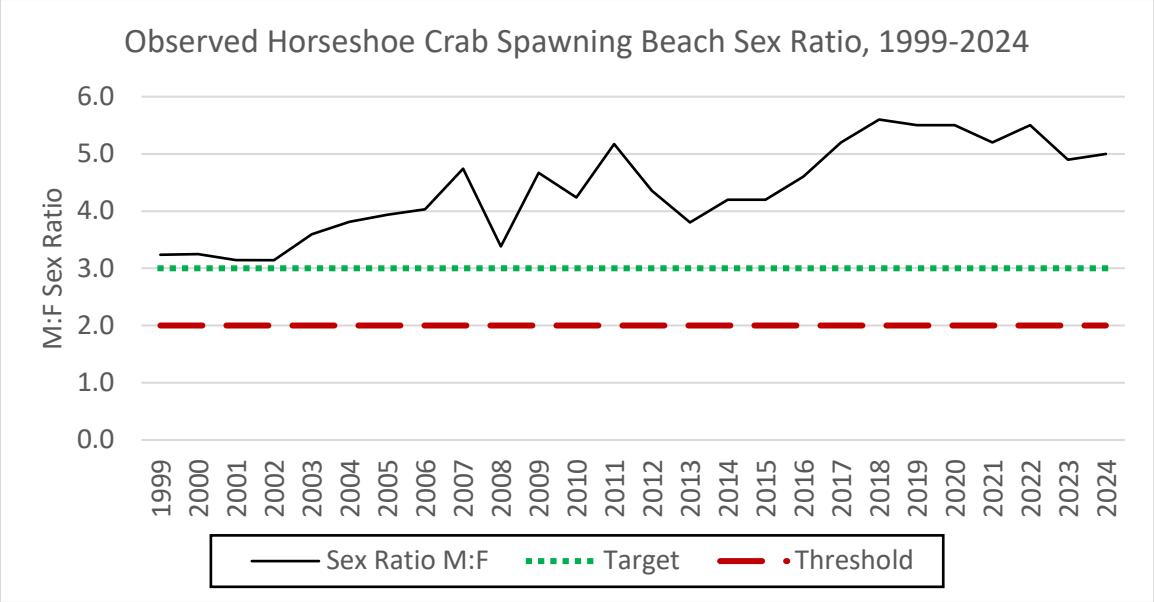

Figure 3. Average annual spawning sex ratio observed during Delaware Bay horseshoe crab spawning beach survey from 1999-2024.

3.2 Seasonal Harvest Restrictions

This section modifies harvest season provisions of Addendum III.

The directed harvest and landing of horseshoe crabs for bait in New Jersey, Delaware, and Maryland is prohibited from January 1 through June 7, and the landing of horseshoe crabs in Virginia from federal waters is prohibited from January 1 through June 7.

3.3 Application of Harvest Caps for Maryland and Virginia

This section modifies Section 3.0 of Addendum VIII.

The harvest cap for Maryland and Virginia established under Addendum VII is maintained. The harvest cap places a maximum limit on the total level of allowed harvest by Maryland and Virginia, providing protection to non-Delaware Bay-origin crabs. The cap is based on Addendum VI quota levels for Maryland and Virginia. Note that Virginia's quota only refers to the number of horseshoe crabs that can be harvested east of the COLREGS line.

MD Cap	VA Cap
170,653	60,998

These caps apply only when female harvest is implemented. The harvest caps for Maryland and Virginia do not apply whenever male-only harvest is implemented. In this situation, female horseshoe crab harvest in Maryland and Virginia are prohibited but a 2:1 offset of males:females applies and allows the total male harvest of Maryland and Virginia to rise above the cap level.

4.0 COMPLIANCE

Addendum IX is effective immediately and measures pertaining to the season closure in the Delaware Bay region must be implemented by January 1, 2026.

5.0 LITERATURE CITED

ASMFC. 2004. Addendum III to the Fishery Management Plan for Horseshoe Crab. Fishery Management Report of the Atlantic States Marine Fisheries Commission. Arlington, VA. 14 pp.

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