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Addendum III to the Interstate Fishery Management Plan For Horseshoe Crab

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Addendum III
to the
Atlantic States Marine Fisheries Commission
Fishery Management Plan for Horseshoe Crab

INTRODUCTION

The Horseshoe Crab Management Board approved the Horseshoe Crab FMP in October 1998. The goal of the FMP was "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; migratory shorebirds; and, other dependent fish and wildlife (including federally listed sea turtles)" (ASMFC 1998). The FMP outlined a comprehensive monitoring program that included mandatory monthly reporting, maintaining existing benthic sampling programs, establishing pilot programs to survey spawning horseshoe crabs and egg density, evaluating post-release mortality of horseshoe crabs used by the biomedical industry, and identifying potential horseshoe crab habitat in each state. It also maintained controls on the harvest of horseshoe crabs put in place by New Jersey, Delaware, and Maryland prior to the approval of the FMP. These measures were necessary to protect horseshoe crab spawning within and adjacent to the Delaware Bay, which is the epicenter of spawning activity along the Atlantic Coast. However, subsequent increased landings in other states largely negated these conservation efforts.

In April 2000, the Management Board approved Addendum I to the Horseshoe Crab FMP. This Addendum established a coastwide, state-by-state annual quota system to further reduce horseshoe crab landings. Through Addendum I the Board recommended to the federal government the creation of the Carl N. Schuster Jr. Horseshoe Crab Reserve, an area of nearly 1,500 square miles in federal waters off the mouth of Delaware Bay that is closed to horseshoe crab harvest. In May 2001, the Management Board approved Addendum II, which established criteria for voluntary quota transfers between states.

STATEMENT OF THE PROBLEM

Several new findings have surfaced since the Board first took management action in 1998 and again in 2000 and 2001. The U.S. Fish and Wildlife Service's (USFWS) Shorebird Technical Committee completed its report to the Management Board in June 2003, which included conclusions and recommendations for management and research. At its May 2003 meeting, the Horseshoe Crab Technical Committee recognized the need for change to the reporting requirements for biomedical companies and states. It also identified outdated state monitoring requirements and research needs in the FMP.

Horseshoe Crab-Shorebird Findings

An in-depth assessment of existing literature and research on shorebird populations, horseshoe crab populations, and their ecological interaction in the Delaware Bay lead the USFWS's Shorebird Technical Committee to several conclusions. The Shorebird Committee recognized that Delaware Bay is a critical stopover point for migratory shorebirds including the *rufa* red

knot (*Calidris canutus*) population, which, it concludes, has decreased since the 1980s. The Peer Review Panel generally agrees with that conclusion, but offered that further research and analysis should be conducted to more closely monitor the population.

The Shorebird Committee and Peer Review Panel's conclusions highlighted the importance of horseshoe crab eggs to migratory shorebirds. The Shorebird Committee found, "Stable isotope analysis indicates that red knots are highly dependent on horseshoe crab eggs." (USFWS 2003) The Peer Review Report stated, "crabs should be assumed to be critically important unless a viable alternative prey base is shown to exist." (USFWS 2003) The Peer Review Panel also indicated, "horseshoe crab eggs are only profitable to shorebirds if they occur in high surface density." (USFWS 2003) The Shorebird Committee determined that a lesser proportion of red knots are making minimal departure weights, which suggests that food resources in Delaware Bay may not be adequate.

New Jersey and Delaware took action to address concerns of the declining population of red knots. Both states aimed to alter their respective horseshoe crab management programs with the intent to increase horseshoe crab and egg abundance in and around Delaware Bay. The Delaware Bay population of horseshoe crabs may extend into Maryland waters, suggesting that harvest of crabs in Maryland could impact recruitment into the Bay. Several years ago Maryland voluntarily reduced its quota to 211,000, which is below the quota currently required by ASMFC.

Biomedical Industry Harvest

Section 4.2.3 Requirement
A subcommittee of the Horseshoe Crab Technical Committee reviewed the requirement in Section 4.2.3 of the FMP that "Horseshoe crabs taken for biomedical purposes shall be returned to the same state or federal waters from which they were collected". (ASMFC 1998) It found that the requirement might result in unnecessary mortality of horseshoe crabs. Some level of mortality occurs from harvest and transportation of crabs used for biomedical purposes. The Technical Committee concluded that this type of mortality could be avoided. If crabs harvested for bait were used by the biomedical companies and then returned to the bait industry, overall mortality would likely be reduced. However, there are cases where a state such as South Carolina has a biomedical industry but no bait industry. In such cases, the aforementioned system of transferring horseshoe crabs would not be applicable. It may be more appropriate for states to have the choice to maintain regulations as required in Section 4.2.3 of the FMP.

The subcommittee of the Technical Committee evaluated changing the regulation to allow bled crabs to enter the bait market. In this case, the harvested crabs would count against the quota of the state from which they were harvested. Massachusetts has since piloted this approach through regulation, allowing crabs harvested under bait harvest permits to be used for biomedical purposes and then released to the bait industry. It also allows crabs harvested from outside its waters to be used for biomedical purposes and then released to its bait industry. Massachusetts has established tight state control to monitor this process through a detailed tracking system.

Biomedical Company Survey

Surveys developed by the Biomedical Working Group were distributed to biomedical companies in 1999 and 2001. The surveys solicited information on the disposition and mortality of horseshoe crabs that were harvested for biomedical purposes. The Technical Committee updated the survey (See Appendix A) and recommended that it be distributed annually until an addendum was developed to make the information in the survey an annual compliance requirement. The Committee recognized that the threshold for biomedical-associated mortality (57,500 crabs; see Section 4.2.3) that triggers management action might soon be reached, making it important to gather this information from biomedical companies. Monitoring Component A of Section 3.5 of the FMP required states to collect limited information from the companies within their jurisdiction. A change in this monitoring requirement is necessary to reflect the information requested in the updated survey. This change is in addition to others in the Monitoring Program Changes section below.

Monitoring Program and Research Needs

At the direction of the Management Board, the Horseshoe Crab Technical Committee reviewed several state monitoring requirements and recommendations (Section 3.5) that were established in the 1998 FMP. The Technical Committee determined that the monitoring program needed updating. The Committee also pointed out that there are no monitoring requirements or recommendations directly related to migratory shorebird populations.

A research need that was not identified in the FMP (Section 6.1) is a methodology to identify the critical stage of horseshoe crab new recruits to the breeding population. This information is critical to the population model that has been chosen for the stock assessment. The Horseshoe Crab Stock Assessment and Technical Committees deemed this need the highest priority as part of the coastwide benthic sampling program. The Technical Committee highlighted another gap in research and data needs (Section 6.2)—the lack of information on juvenile habitat use. The Committee further identified changes needed in the Sections 6.1 and 6.2 of the FMP. The proposed changes of the monitoring program and research needs are identified below.

COMMERCIAL FISHERIES MANAGEMENT OPTIONS

Harvest Level Threshold

This addendum further reduces commercial harvest of horseshoe crabs for bait in and around the Delaware Bay. New Jersey and Delaware are restricted from harvesting greater than 150,000 horseshoe crabs each per year. Maryland is restricted from harvesting greater than its 2001 landings (170,653 horseshoe crabs) per year. All other states are restricted from harvesting greater than their respective quotas on bait landings as established by Addendum I.

Closed Season

This addendum establishes a closed season for bait harvest of horseshoe crabs in and around the Delaware during peak horseshoe crab spawning. New Jersey, Delaware and Maryland shall

prohibit the harvest and landing of horseshoe crabs for bait from May 1 through June 7, inclusive.

Exceptions (Biomedical Applications)

The Horseshoe Crab FMP requires that crabs taken for biomedical purposes (i.e. under a biomedical permit) be returned to the same state or federal waters from which they were collected. However, the FMP does not prohibit the use of crabs that are harvested for bait (i.e. under a bait permit) for biomedical purposes. Therefore, crabs harvested under a bait permit may be used for biomedical purposes (i.e. bled) and then returned back to the bait industry. Some states may have the opportunity to reduce overall mortality of horseshoe crabs if crabs are used by both industries. Massachusetts employs the transfer of crabs between industries for a portion of the crabs used by the biomedical company within its jurisdiction. This addendum encourages states, where appropriate, that have bait and biomedical fisheries to allow biomedical companies to use horseshoe crabs harvested under a bait permit for biomedical purposes and require the subsequent return of the horseshoe crabs to the bait market. Crabs used in this way must be reported and count against the state's bait quota.

The use of bled crabs for bait may decrease the effectiveness to attract the target species. States that consider requiring the transfer of bled crabs to the bait market are encouraged to investigate the effectiveness before making the transfer mandatory.

MONITORING PROGRAM CHANGES

The Technical Committee identified that the comprehensive monitoring program in the 1998 FMP (Section 3.5) needed modification. Work by states has been completed for several of the Components (i.e. C, D, E and F) in the FMP. The Components have been reorganized, modified, and expanded taking into account completed work, continued monitoring needs, and information gaps. The state monitoring program for Addendum III that will replace the program established by the 1998 FMP is as follows:

Monitoring Program Requirements

Component A_1 States are required to report monthly harvest (of any type) of horseshoe crabs. Annual reports must include numbers landed by sex and harvest method for a portion of the commercial catch.* Each state is encouraged to continue characterizing a portion of the commercial catch based on prosomal width by sex. States will be required to characterize a portion of the commercial catch based on maturity once an appropriate technique is developed and approved by the Technical Committee. The use and harvest of horseshoe crabs for scientific research, educational activities, and live trade should also be monitored and must be reported by all states.

* Any state with horseshoe crab landings less than 5 percent of the total coastwide landings is only required to report total crabs landed by month. In any year in which landings exceed 5 percent of the total, the full reporting requirement would be applied in the following year.

Component A_2 All states where horseshoe crabs are captured for biomedical use must monitor and report monthly and annual harvest of horseshoe crabs by biomedical facilities. All states must identify percent mortality up to the point of release (including harvest, shipping, handling, and bleeding mortality), harvest method, number or percent of males and females, disposition of bled crabs and condition of holding environment of bled crabs prior to release. Appendix A is a survey with suggested language and questions to solicit this information from biomedical companies. States are required to use that survey or some other means to obtain the required information.

Component A_3 States must identify spawning and nursery habitat if this requirement has not been completed. Such information must be provided in the annual report. States that have completed this work must report changes in spawning and nursery habitat over time. States must actively intervene to the extent of their authority to ensure that spawning and nursery habitat is conserved and the quality and productivity is maintained.

Monitoring Program Recommendations

It is recommended that states implement the monitoring components outlined below. The Horseshoe Crab Technical and Stock Assessment Committees identified the components as valuable to the stock assessment and for understanding the importance of horseshoe crab eggs to migratory shorebird populations. Because state fiscal and human resources are limited, the following components are recommendations. However, states must report the information, if it is obtained.

Monitoring of Horseshoe Crab Populations and Habitat

Component B_1 Continue working toward expanding the annual coastwide benthic trawl survey following methods described in Hata and Berkson (2003). As part of the survey, continue exploring methodologies for accurately identifying newly recruited females. Administer an ocean horseshoe crab tagging program associated with the survey. *B_1 is the highest priority monitoring component that is the collective responsibility of multiple states. Unique funding arrangements may be required to ensure continued implementation of the annual coastwide benthic trawl survey until long-term funding can be established.*

Component B_2 Continue existing state benthic sampling programs in Rhode Island, Massachusetts, Connecticut, New York, New Jersey, Delaware, Maryland, North Carolina, South Carolina, and Georgia. Benthic sampling programs should monitor and record weight, number, and prosomal width by sex of individuals collected. States that currently collect data from juvenile trawl surveys should include these data in annual monitoring reports. Juvenile sampling programs should record number and prosomal width.

Component B_3 Continue monitoring spawning populations based upon standardized and statistically robust methodologies. In Delaware Bay, continue the existing survey as described in Smith *et al.* (2002). In other locations, use the methodology described in Smith *et al.* (2002) as a model to develop a methodology based on unique conditions of the location.

Component B_4 A coordinated tagging program should be implemented by the Tagging Subcommittee based upon the draft coast-wide framework developed in 2003. States should continue to explore funding and implementation options to implement a coast-wide tagging program.

Joint Monitoring of Delaware Bay Horseshoe Crabs and Shorebirds

Component B_5 Continue existing state egg abundance surveys, particularly in the Delaware Bay region. Participate in a workshop of horseshoe crab and shorebird biologists to work toward formulating standardized and statistically robust methodologies (e.g., method of collection, survey time, location, method of counting), survey costs, and schedule for implementation of a Delaware Bay-wide horseshoe crab egg abundance survey to identify trends in annual egg abundance and availability to shorebirds. Target date for implementation is 2004.

Component B_6 Continue existing state shorebird monitoring programs. Participate in a USFWS Shorebird Technical Committee workshop to develop a Delaware Bay-wide framework for shorebird monitoring, based upon theoretical models and rigorous statistical review. Target date for initial workshop is Fall 2003, with implementation in 2004.

The Delaware Bay region, specifically, has associated with it several components: B_3, B_5 and B_6. New Jersey and Delaware should continue funding arrangements and partnerships with the federal government to ensure the continuity of these components. Other states are encouraged to administer such research programs and participate in workshops outlined in B_5 and B_6.

The comprehensive monitoring program outlined above should be initiated and continued over the long term to provide reliable data on horseshoe crab and migratory shorebird populations. The monitoring program will be reevaluated and potentially modified in the future.

If a state wants to be relieved of mandatory monitoring program components, the state has the option to prohibit all commercial bait harvest within its jurisdiction; however, monitoring requirements related to the biomedical industry (if one exists) are still required.

RESEARCH NEEDS CHANGES

The Technical Committee reviewed Section 6.0 of the FMP, Management Research Needs, to note progress and make additions in Addendum III. The methodology for a coastwide benthic sampling program has been established and the survey is ongoing (Section 6.1a). The first phase of a study of geographic subpopulations using genetic markers is complete and the results are currently being written (Section 6.1b). Progress has been made in investigating alternative bait sources by identifying the compound that attracts eel and conch to horseshoe crabs (Section 6.2a). Work is ongoing to determine the relationship between horseshoe crab egg abundance and shorebird survival, as well as to investigate weight gain and populations trends in migratory shorebirds (Sections 6.2b and 6.2c). Studies to determine the economic value of horseshoe crab-dependent industries and beach fidelity of horseshoe crabs have been completed (Sections 6.2d and 6.2f). Lastly, evaluation of the impacts of beach nourishment on horseshoe crab populations is ongoing (Section 6.2h).

In light of progress made and new informational needs, the Technical Committee identified several additions to Section 6.0. The Committee's additions are detailed below.

Section 6.1

- Insert "Develop an effective and efficient field protocol to identify critical life history stages. At a minimum, the protocol should identify horseshoe crabs that have spawned previously, those that are within one year of spawning for the first time, and those that are more than one year from spawning for the first time."

Section 6.2

- In addition to investigating, encouraging, and funding alternative bait sources, the Committee suggested focusing on alternative trap design (i.e. traps with bait bags).
- Add "Identify important juvenile habitat and extent of use."

COMPLIANCE

States must implement this Addendum no later than the following dates:

July 15, 2004:	States must submit state programs to implement Addendum III, including management and monitoring programs, for approval by the Management Board.
August 1, 2004:	States with approved management and monitoring programs shall begin implementing Addendum III.

LITERATURE CITED

Atlantic States Marine Fisheries Commission. 1998. Interstate Fishery Management Plan for Horseshoe Crab. FMR No. 32. 58pp.

Hata, D.N. and J.M. Berkson. 2003. Abundance of horseshoe crabs, *Limulus polyphemus*, in the Delaware Bay area. Fishery Bulletin 101(3): *In press*.

Smith, D.R., P.S. Pooler, B.L. Swan, S. Michels, W.R. Hall, P. Himchak, and M.J. Millard. 2002. Spatial and temporal distribution of horseshoe crab (*Limulus polyphemus*) spawning in Delaware Bay: implications for monitoring. Estuaries 25(1): 115-125.

U.S. Fisheries & Wildlife Service. 2003. Delaware Bay Shorebird-Horseshoe Crab Assessment: Conclusions and Recommendations to the Horseshoe Crab Management Board of the ASMFC. 12pp.

Appendix A

QUESTIONNAIRE TO LAL BIOMEDICAL INDUSTRY REGARDING HORSESHOE CRAB UTILIZATION

Company Name: _____

Respondent to Questionnaire: Name: _____

Title: _____

Please submit the following information. For each fisherman or vendor contracted to supply horseshoe crabs for your company's LAL production, please fill out a separate form. Also, if possible, please fill out a separate from for each year.

Name of Fisherman or Vendor*: _____

*If your company buys crabs directly from the fisherman listed above, please skip question 3.

Calendar Year For Which Answers Correspond To: 2001

1	Name of fishing vessel(s) (if applicable)?	
2	Vessel state(s) of residence (if applicable)?	
3	Number of fishermen that your vendor purchases horseshoe crabs from for your company's use (if applicable).	# of in-state fisherman: _____ # of out-of-state fisherman: _____ (specify by state in which HSCs were landed) _____ _____
4	Location where horseshoe crabs were collected (i.e. DE Bay beach, MD waters south of Ocean City, EEZ off Virginia waters)?	
5	Month(s) of year when horseshoe crabs were caught?	

6	Fishing gear utilized to collect horseshoe crabs?	Trawl: _____ Dredge: _____ Hand Harvest: _____ Other (specify): _____
7	Number or percent of horseshoe crabs culled at sea and reason for rejection (if applicable).	Due to injury: _____ Due to death: _____ Due to small size: _____ Other (specify): _____ Not applicable
8	Number or percent of horseshoe crabs culled at the dock by the vendor/your company and reason for rejection (if applicable).	Due to injury: _____ Due to death: _____ Due to small size: _____ Other (specify): _____ Not applicable
9	Number of horseshoe crabs transported to bleeding location?	
10	Number or percent of horseshoe crabs transported to bleeding location but not selected for bleeding, and reason for not being selected? (Rejected at bleeding location.)	Due to injury: _____ Due to death: _____ Due to small size: _____ Other (specify): _____

11	Disposition (number or percent) of horseshoe crabs transported to bleeding location but not bled?	Returned to water: _____ Entered bait market: _____ Other (specify): _____ Not Applicable: _____
12	Number or percent of male and female horseshoe crabs bled.	Male: _____ Female: _____
13	Disposition (number or percent) of bled horseshoe crabs.	Returned to water: _____ Entered bait market: _____ Other (specify): _____ *If any crabs were returned to water, please proceed to questions 14 and 15. *If no crabs were returned to the water, please proceed to the open-ended questions section.
14	Condition of holding environment for bled horseshoe crabs prior to release?	Average holding/transportation time: _____ Holding/transportation conditions -Refrigeration used (Y/N): _____ (if yes, what temperature?) -Moisture maintenance used (Y/N): _____ (if yes, what humidity?)
15	Location where horseshoe crabs were released following bleeding, if different from question 4 (be specific)?	

Open-ended Questions:

1) Do you believe that horseshoe crab regulations have impacted your ability to obtain sufficient numbers of horseshoe crabs for bleeding? If so, please explain.

2) Have the number of crabs bled in your facility *increased, remained stable, or decreased* over time? Please provide an approximate percentage and time frame if change has occurred.

3) Is your company willing to allow bled horseshoe crabs to enter the bait fishery? If no, why?

4) Any other comments or issues that you would like to raise.