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**TO:** Danielle Brzezinski, Horseshoe Crab FMP Coordinator  
**FROM:** Brenna Goggin, Environmental Advocate  
**SUBJECT:** Draft Addendum VII to the Horseshoe Crab Fishery Management Plan  
**DATE:** January 12, 2012

The Delaware Nature Society, a private, non-profit, membership organization with more than 6,000 members, fosters understanding, appreciation, and enjoyment of the natural world through education; preserves ecologically significant areas; and advocates stewardship of natural resources. The Society has commented extensively on previous Atlantic States Marine Fisheries Commission Horseshoe Crab regulations and appreciates the opportunity to comment on the Draft Addendum VII.

Management of horseshoe crabs is a multi-species issue. For two decades, the Delaware Nature Society has advocated for a holistic, regulatory approach that will protect and sustain the Delaware Bay ecosystem. Reductions in horseshoe crab harvesting quotas in recent years have begun to demonstrate an increase in crab populations. However, because it takes approximately 10 years for female horseshoe crabs to reach sexual maturity and produce eggs, a similar improvement has not yet been seen in red knot population numbers. Management strategies must continue to be implemented to maintain the critical shorebird-horseshoe crab connection.

The Delaware Bay beaches support the largest concentration of spawning horseshoe crabs along the Atlantic Coast, providing a critical food source and stopover location for migratory shorebirds. Without horseshoe crab eggs as a food source, shorebirds such as the red knot and the ruddy turnstone are unable to sufficiently replenish fat reserves which sustain them on their long migratory flights.

Faced with the potential extinction of species such as the red knot and the ruddy turnstone, the Delaware Nature Society believes Delaware, New Jersey, Maryland, and Virginia and the Atlantic States Marine Fisheries Commission must act aggressively and swiftly to prevent such an occurrence. The Delaware Nature Society has reviewed the options put forth in Addendum VII and has the following suggestions and concerns.

- Due to the lack of evidence supporting stabilization of red knot populations and the known lag time in the horseshoe crab life cycle, consideration should not be given to reverting management measures to Addendum III.
- The Delaware Nature Society supports the concept of the Adaptive Resource Management Framework (ARM); however, we have concerns about the lack of

- The Delaware Nature Society supports the concept of the Adaptive Resource Management Framework (ARM);, however, we have concerns about the lack of opportunity for public involvement. We request that as the ARM framework is developed, consideration be given to allowing public comment and hosting public hearings when the ARM subcommittee submits its recommendation for the horseshoe crab harvest package.
- If the ASFMC were to go with Option 3, allowing the ARM framework to decide the optimal harvest package, we request that the subcommittee implement a full bay-wide moratorium on the harvest of horseshoe crabs until such time as a more than adequate food supply from horseshoe crab eggs for migratory shorebirds and population viability for both shorebirds and horseshoe crabs is demonstrated. If the ARM subcommittee does not consider a full moratorium to be an option, then we strongly urge it to consider the Addendum VI harvest limits to be the maximum. At the very least the provisions in Addendum VI should remain in place until enough data is collected from the Delaware Bay region to prove that horseshoe crab and red knot populations have rebounded sufficiently.

Thank you for the opportunity to comment.



Danielle Brzezinski  
A.S.M.F.C.  
1050 N.Highland St., Suite 200A-N  
Arlington, VA 22201

Michael Litchko  
1203 Virginia ave  
Cape May, NJ 08204

Dear Danielle

These are my public comments for Horseshoe crabs.

Option 1)

The Board should take no action and revert back to Addendum 111.  
After 20 years of ASMFC taken action against the harvest of HS Crabs. The Commission only uses NJ data on populations of red Knots for the entire north America and omits the Red knots in the 14 other states on the East coast...There can never be Increase in Red Knots using only one state, in which 90% of the sand on NJ beaches and the beach dynamics have eroded away for the last 35 years of the data used by ASMFC.

Option 3)

The Board should NOT implement the Adaptive Resource Management Framework (ARMF).

1. The Science used in the ARMF plan. ( Niles 2008) Parts of the science were peer-reviewed by USF&WS in May 7. & June 2. 2003. They stated that survey data for estimating populations of red knots are NOT useful. The body mass of red knots are inherently flawed .To get the high weight gains they used nearly all female red knots and to show low weight gains

they used nearly all male red knots to show declines. The Science used in the ARM plan violates the Federal Law by using the inherently flawed and Not useful science from the peer-review and reused it in Niles 2008 science.

2. NJ beaches No longer exist where the horseshoe crab egg data was taken in the 80's and there is not much surface area of sand left in Delaware bay to put any amount of eggs in the ARMF plan. NJ has never replenished the surveyed beaches.

3. Delaware has its own population of red knots of around 33,000 that's the average red knot population for a single day, for the last ten years from its own state. This is twice the population of red knots that NJ states is the nation population.

Thank You,

BERNIE'S CONCHS, L.L.C.

P.O. Box 225  
Cheriton, VA 23316

Mr. Tom O'Connell, Chairman  
Horseshoe Crab Management Board  
Atlantic States Marine Fisheries Commission  
1050 N. Highland St., Suites 200 A-N  
Arlington, VA 22201

January 30, 2012

Re: Horseshoe Crab ARM Model/Draft Addendum VII

Dear Mr. O'Connell:

I am pleased to express my support for the implementation and ongoing evolution and improvement of the Commission's adaptive resource management (ARM) model for the management of the Delaware Bay horseshoe crab population. The ARM model will build upon the Commission's successful management of the Delaware Bay horseshoe crab population by explicitly accounting for ecological interactions with migratory shorebirds in an adaptive management framework. As the Commission prepares to implement the ARM, I would strongly encourage the Commission to incorporate appropriate tools, including  $\lambda$  and an adequate Delaware Bay Stock Allowance (DBSA) to manage Maryland and Virginia's horseshoe crab fisheries as mixed stock fisheries. These important tools will enable the Commission to effectively implement the ARM within this mixed-stock fishery while mitigating social and economic impacts within this regional fishery.

The Horseshoe Crab Advisory Panel's recommendations are well supported, and I am pleased to reiterate my support for their specific recommendations. Specifically, I support adoption of the following options for ARM implementation:

1. Lambda ( $\lambda$ ). I support the TC's earlier recommendation to set  $\lambda$  for Maryland at .51 and Virginia at .35, as interim values, based on genetic assignments. Although tagging data suggests these values are extremely conservative, they represent the best available information at this time. Future evaluations of tagging data should provide an improved understanding of the transitional probabilities of crabs moving between the spawning areas and may inform future  $\lambda$  values.  $\Lambda$  provides the ARM with an essential tool to manage the fisheries in Maryland and Virginia that are interacting primarily with populations that are spawning in their respective coastal embayments, and to a lesser degree with crabs spawning in Delaware Bay.

2. Weighting. ARM allocations among the four states should be weighted based on Addendum VI quotas. Addendum VI reflects the culmination of an extensive management history within this fishery, and best represents the current fishery within the region. Weighting the allocations based on Addendum VI quotas will minimize any disruptions associated with ARM implementation within the current fishery.
3. Harvest cap. I support capping harvest, on an interim basis, at Addendum VI quota levels in Delaware, Maryland and Virginia, provided that the Commission adopts a DBSA of 10%. In the alternative, if the Commission adopts a lower DBSA, I would encourage adoption of the 2:1 male to female offset provision considered in the document, in order to mitigate impacts associated with implementation.
4. Delaware Bay Stock Allowance (DBSA). The Commission could use two important tools, separately or in combination, to mitigate impacts within this highly constrained fishery. The Commission could set the DBSA at 10%, which would maintain the sexual composition of catch in Maryland and Virginia, or it could opt for a lower DBSA and offset the lost females with males at a 2:1 ratio in the two affected states. Setting the DBSA at 10% would result in removals of less than one percent of the estimated population of mature female horseshoe crabs in Delaware Bay. Either measure would mitigate impacts within the horseshoe crab fishery and the whelk fishery, which is dependent upon horseshoe crabs for bait. I would strongly encourage the Commission to use these tools to offset any economic impacts associated with ARM implementation in this fishery.
5. Contingency plans. I support including contingency measures in the addendum to ensure that the Board will have appropriate options if any of the surveys that are essential to the model are not funded in the future. At a minimum, I would recommend including Addendum VI options as a contingency, *inter alia*.

To the extent that the current removals in this fishery are approximately 75 percent below Fmsy values indicated in the 2009 stock assessment, further reductions in the fishery are not indicated biologically or ecologically. Nevertheless the ARM provides the Commission with a timely framework to manage the horseshoe crab fishery while explicitly accounting for ecological aspects of this important resource.

Based on the latest performance of the whelk fishery in Virginia in the 4<sup>th</sup> quarter of 2011, our fishermen generated 10.7 pounds of channeled whelk shellstock with an exvessel value of \$20.24 per female horseshoe crab utilized. We exhausted all of our horseshoe crab inventories in the last week of December, 2011 and the highly valuable whelk fishery is currently bait-limited. These recent performance metrics from Virginia's fishery provide the Commission with an upper limit of the exvessel impacts that can be anticipated within the whelk fishery in Virginia, depending on the extent to which the implementation is mitigated by the DBSA options. These metrics do not include any impacts beyond the exvessel level.

At the first opportunity to review the ARM model parameters, I would encourage the Board to review the female utility threshold, which is currently set at a knife-edge at 80% of carrying capacity. By adding utility incrementally, beginning at 65% of carrying capacity, the model would be more responsive to the comments of the ARM peer review, and would set more reasonable objectives. I would also recommend adding a slightly higher male-only management option, for 600,000 males, to provide more contrast in the management alternatives considered in the model.

The Commission deserves substantial credit for the ongoing recovery the Delaware Bay horseshoe crab population that continues to support a vibrant whelk fishery from Virginia through Massachusetts. Thank you for the opportunity to comment on this important addendum.

Sincerely,

Rick Robins



## State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION  
Endangered and Nongame Species Advisory Committee  
c/o Division of Fish and Wildlife-ENSP  
501 East State Street / MAIL CODE: 501-03  
Trenton, New Jersey 08625-0420

CHRIS CHRISTIE  
*Governor*

KIM GUADAGNO  
*Lt. Governor*

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Howard Geduldig  
Dr. Rick Lathrop  
Dr. Erica Miller  
Dr. David Mizrahi  
Jane Morton Galetto  
Dr. Dale Schweitzer  
James Shissias

BOB MARTIN  
*Commissioner*

January 31, 2012

Thomas O'Connell, Chairman  
Horseshoe Crab Management Board  
Atlantic States Marine Fisheries Commission  
1050 N. Highland St., Suite 200 A-N  
Arlington, VA 22201

Re: Comments – Draft Addendum VII to the Interstate Fisheries Management Plan for  
Horseshoe Crabs

Dear Chairman O'Connell:

I am writing on behalf of the NJ Division of Fish and Wildlife's, Endangered and Nongame Species Advisory Committee (ENSAC), of which I am the chair. This committee is the independent advisory body charged, pursuant to the New Jersey Endangered and Nongame Species Conservation Act (N.J.S.A. 23:2A et. seq.) with advising and assisting the New Jersey Department of Environmental Protection (NJDEP) in carrying out the intent of this legislation. Our committee includes biologists, academic representatives, resource managers, public health and veterinary medicine representatives, non-profit conservation organizations, and the public-at-large. We review land use and resource management issues, including NJDEP policies and decisions that affect nongame, threatened and endangered wildlife species in the State, and when appropriate, make recommendations. Among our principal functions is to provide scientific guidance and oversight for the research, monitoring and management activities of the Endangered and Nongame Species Program.

In accordance with N.J.S.A. 23:2B-21, which codifies New Jersey's moratorium on taking of horseshoe crabs, our committee is also charged with determining if the recovery of red knots and implementation of measures to ensure adequate supply of horseshoe crab eggs have been sufficient to begin allowing a limited harvest of horseshoe crabs in New Jersey waters.

I am providing the following comments on Draft Addendum VII to the Interstate Fisheries Management Plan for Horseshoe Crabs on behalf of the New Jersey Division of Fish and Wildlife's, Endangered and Nongame Species Advisory Committee (ENSAC):

**The ENSAC Committee supports Horseshoe Crab Management Board action to implement the Adaptive Resource Management (ARM) Model (Option 3).** The ARM model holds great promise to aid in recovery of the migratory shorebird stopover on the Delaware Bay and insure against future over-harvest of horseshoe crabs, especially females. We do not support reversion to Addendum III harvests as it would increase harvest and remove sex ratio restrictions on harvest that is protective of females. We do not support extension of Addendum VI harvests (status quo) because surface egg densities and female crab abundance have not substantively improved under this management regime, which has been in place since 2006 (Addendum IV).

**Option 3a. We support the Default Option (Lambda = 1 for NJ, DE, MD and VA) for determining proportions of Delaware Bay Origin Crabs in state harvests** until a larger sample of genetic data from ocean harvests in Maryland and Virginia can be systematically collected and the proportion of Delaware Bay Origin crabs in their harvests is more rigorously determined. Until that work is complete, the Management Board should, respectfully, adhere to the Interstate Fisheries Management Plan's self-stated precautionary principle and avoid risk of further impact to Delaware Bay breeding crabs.

**We do not support the use of tag return data for the calculation of Lambda in harvest allocation,** and we believe it is inadequate for this purpose at this time.

- Very few tag returns in MD and VA bias the calculation of Lambda (the proportion of Delaware Bay Origin crabs in harvests) to a low proportion.
- In addition, recoveries of MD and VA tags in MD and VA are assumed "Non-Delaware Bay Origin", this further reduces the Lambda value for these two states. However, it has not been acknowledged that most crabs tagged by MD and VA were collected by ocean trawl, and many are likely to be Delaware Bay Origin; this confounds the use of tag return data for calculating harvest allocation. This problem should be acknowledged, and tagging work altered to improve usefulness of these data, before tag return data are considered for use in calculating harvest allocation.

**Option 3b. We support the Weight Allocation values of Addendum VI.** These represent harvest quotas that states have come to rely on and are a more-than-equitable distribution of the ARM harvest quota, especially for Maryland which would receive the greatest proportion of the ARM quota if Default Lambda values are chosen. The choice of Reference Period Landings to weight the harvest allocation will reduce ARM harvest quotas to MD and VA and provide impetus for these states to insist on a Delaware Bay Stock Allowance and Offset, which we vigorously oppose.

**We do not support Weight Allocation values based on Estimated Abundance or Average Landings** because the Principal Investigators of the Virginia Tech Benthic Trawl Survey acknowledge that it was not designed to provide state-by-state population estimates, and weights based on average landings would penalize New Jersey for its risk-averse management.

**Option 3c. We support a cap on Maryland and Virginia harvests based on Addendum VI quotas.** This cap is equitable and is the current quota that the four states have come to rely on.

**Option 3d. We do not support a Delaware Bay Stock Allowance.** It is critical to increase egg densities to improve conditions for shorebirds. Harvest restrictions on female crabs in DE, MD and VA have, to date, failed to significantly increase egg and female spawning densities in Delaware Bay. Given that we cannot distinguish Delaware Bay from Non-Delaware Bay Origin crabs, the Delaware Bay Stock Allowance will continue harvests of females, preclude improvement of eggs and female crabs, and will confound evaluation of the ARM model if Option 3 (male only harvest) is implemented. The Stock Allowance is poorly justified and should be rejected.

**Option 3e. We do not support the inclusion of a 1:1 or 2:1 male to female Offset for MD and VA, respectively, for female crabs below the Addendum VI levels.** We cannot distinguish Non-Delaware from Delaware Bay Origin; this option allows increased harvest and is contradictory to concern expressed over damage to Non-Delaware Bay Origin crabs by allowing greater harvest.

**Option 3f. We support the use of the previous year's ARM harvest and allocation if data for NJ, DE, MD and VA are not available.**

The quickest possible recovery of horseshoe crab populations to levels necessary to support recovery of red knots and other shorebirds in Delaware Bay is of paramount importance and must be a primary focus of the policies implemented by Atlantic States Marine Fisheries Commission's Horseshoe Crab Management Board.

Thank you again for the opportunity to comment and for your anticipated consideration of these comments on this important policy matter.

Very truly yours,



Barbara Brummer, PhD, Chair  
Endangered and Nongame Species Advisory  
Committee

pc: Robert Martin, Commissioner, NJ Dept. of Environmental Protection  
David Chanda, Director, Division of Fish and Wildlife  
C. David Jenkins, Chief, Endangered and Nongame Species Program

**Draft Addendum VII**

**Frank Callahan** to: dbrzezinski

12/16/2011 12:20 PM

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History: This message has been replied to.

Dear Ms. Brzezinski:

We do not have the knowledge to suggest how protection of the horseshoe crabs should be managed. It is abundantly clear to us that regulations must be implemented which results in effective protection of the horseshoe crab population on which a huge birding population depend on for nourishment through the production of horseshoe crab eggs. We encourage laws and regulations which result in unquestionable protection of these species.

We strongly encourage and support a management plan which results in protection of the horseshoe crab and the shorebirds.

Thank you for listening to our plea!

Respectfully,

Frank & Kathy Callahan  
59 Mission Way  
Barnegat, NJ 08005  
609-660-1741

### Option 3: Implement Adaptive Resource Management (ARM) Framework

- Board receives ARM-recommended optimized harvest level
- Sub-options implement allocation of optimized harvest → all impact each other

	Alternatives
3a, Lambda	1) Tagging data NJ: 100% DE: 100% MD: 13% VA: 9% 2) Default NJ: 100% DE: 100% MD: 100% VA: 100% 3) Genetics data NJ: 100% DE: 100% MD: 51% VA: 35%
3b, Weighting	1) Reference period landings (historic harvest) 2) Current quotas (Add. VI) 3) Estimated abundance (Virginia Tech survey) 4) 2007-10 average landings
3c, Harvest cap	Yes or No? 1) Reference period landings (historic harvest) 2) Addendum I 3) Addendum III 4) Current quotas (Add. VI) 5) 2007-10 average landings
3d, Delaware Bay Stock Allowance	Yes or No? 1) 1% coastwide landings 2) 5% coastwide landings 3) 10% coastwide landings
3e, Delaware Bay Stock Allowance plus additional offset	Yes or No? 1) 1% coastwide landings 2) 5% coastwide landings 3) 10% coastwide landings
3f, Plan B	Yes or No? Other conditions for Board decision?

*I need to find Mike Getchko Represent the 34 HC crabbers in N.J. If anything we would like to have option 3.*

*Richard P...*

*Thank you Richard P...  
Fred Feffer*

**horseshoe crabs**

**Hollis Turner** to: dbrzezinski

12/19/2011 03:06 PM

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History: This message has been replied to.

Hello Danielle,

It has come to my attention that the current addendum restrictions on taking of horseshoe crabs in New Jersey, Delaware and Maryland waters is soon to expire. While I understand that the data shows an increase in their populations, it is also apparent that this current restriction has not been allowed to continue long enough. The populations of red knots and federally protected marine turtles have not increased. The addendum VI in its current form has been in place less than 5 years (with all addendums considered). Clearly this is not long enough. While their usage is largely for bait, it seems that their use in biomedical research might to be a driving force in allowing this addendum to expire. I would hope that those parties involved in the decision take into consideration that more time should be allowed for all populations to recover.

Ideally I would like to see a complete ban on harvesting of horseshoe crabs of both genders but realize that it is probably not realistic. Therefore, as a biologist and conservationist volunteering in the Barnegat Bay, I respectfully request that Option 2 "Status Quo" be chosen as the only option before this current plan expires.

Thank you,

Holly Turner  
Biology Department  
HCRHS

**Fwd: Hearing set on horseshoe crabs - cant attend but have public comments on killing red knots**

**jean public** to: dbrzezinski, info, letters, info, info, info, humanelines, info, info, info, INFO

01/14/2012 04:13 PM

Cc: info, americanvoices, COMMENTS, RUSH.HOLT, info, info

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History: This message has been replied to.

the red knot bird, a marvel of a bird that we are lucky to have in this world, flies thousands of miles. it relies on stopping in this specific area to eat horseshoe crabs. we have the ugly govts in va, del, nj etc allowing profiteers to take all the horseshoe crabs so when this little bird gets here, they have nothing to eat. they need that food.

first of all no commercial fish profiteer or amateur should be allowed to fish for horseshoe crabs sot hey can use those crabs for bait. use some other kind of fish for bait. ban all use of this fish by those commercial rapacious killers of fish.

secondly, stop the taking of crabs for ldl use. it is time that the other developed ldl, which costs more to make, is required to be used for testing. i have read the book "crab wars" and researched this issue so i am confident of what i say. the ldl profiteers are making big big money. the taxpayers of nj get absolutely NO DOLLARS OUT OF THIS TAKING OF LDL FROM THESE CRABS. THE TAXPAYERS OF NJ GET NOTHING FROM THIS INDUSTRY. MEANWHILE, NOBODY IS WATCHING WHAT THE LDL PROFITEERS TAKE IN HORSESHOE CRAB BLOODLETTING. THESE CORPORATE PROFITEERS TELL US THEY TAKE NOTHING, BUT WHO BELEIVES THAT WHEN THERE ARE MILLIONS OF DOLLARS BEING MADE FROM THE KILLING OF HORSESHOE CRABS. THERE IS SO MUCH TAKING GOING ON THAT THE HORSESHOE CRABS ARE GOING EXTINCT TOO.

WHEN WILL WE HAVE A SYSTEM IN NJ THAT IS NOT ALL ABOUT HOW MUCH MONEY YOU GIVE TO GOVT SO THE GOVT LETS YOU STEAL WHATEVER YOU WANT. THERE IS ZERO LAW ENFORCEMENT ON BOTH THESE COMMERCIAL RAPACIOUS TAKERS.THE NJ TAXPAYERS WHO OWN THOSE HORSESHOE CRABS GET NOTHING OUT OF THIS TAKING ALLOWED TO USERS.

LDL CAN BE MANUFACTURED WITHOUT THE CRABS. THE PROFITEERS DONT WANT TO DO IT BECAUSE IT COSTS THEM A LITTLE MORE MONEY. ITS TIME TO TELL TH EM TO DO THAT. WE NEED TO SAVE OUR ENVIRONMENT.

THIS IS MY COMMENT ON THIS ISSUE. TELL ALL THE STATES TO BAN ALL TAKING OF HORSESHOE CRABS. ITS TIME TO TELL THE LDL PROFITEERS TO USE THE SYNTHETIC LDL.  
JEAN PUBLIC

Article Title:

Hearing set on horseshoe crabs

To view the contents on [www.app.com](http://www.app.com), go to:

<http://www.app.com/apps/pbcs.dll/article?AID=/201112152123/NJSPORTS06/312150117>

Message:

horseshoe crab being used up by profiteers so the red knot has nothing to eat .

## HSC Draft Addendum VII

Jay Sanders to: dbrzezinski

Cc: jjjsand

01/05/2012 06:27 PM

HSC abundance in the Delaware Bay Region is rebuilding and the plight of the red knot remains unchanged. It would appear then that if years of HSC harvest limits and moratoriums have not helped increase the population of red knots (shore birds) there must be other more pressing issues causing the red knot decline. Summer, winter habitat loss, environmental pollution, climate change...something other than HSC egg abundance alone. This being stated the recommended ARM HSC harvest for New Jersey should be set at the pre-moratorium figure of 600,000 HSC under Addendum VII. Thank you, James Sanders

Public comment on the Atlantic States Marine Fisheries Commission's "Draft Addendum VII to the Interstate Fishery Management Plan for Horseshoe Crabs: Adaptive Resource Management Framework."

The Wetlands Institute  
January 22, 2012

Introduction

The Wetlands Institute is a 501(c) (3) organization located on the Cape May peninsula (southernmost point in New Jersey). Our Board members, staff, members, and volunteers are dedicated to promoting stewardship, understanding, and appreciation of coastal and wetlands ecosystems through our programs in research, conservation, and education. Horseshoe crabs (*Limulus polyphemus*) have long been a focus of our activities. Since 1991, the Wetlands Institute has brought scientists and volunteer citizens together to help conduct censuses of the breeding horseshoe crab population of the Delaware Bay, under a 1990 Delaware Sea Grant Program. These census are central to our understanding and responsible management of this ancient marine organism.

Context of the Problem

As the Commission recognizes, the status of Delaware Bay-origin horseshoe crab populations has repercussions reaching well beyond the abundance of one species. For example, gastrointestinal analyses of federally-endangered loggerhead sea turtles indicate that horseshoe crabs are an important food source for turtles inhabiting Delaware Bay, as well as Chesapeake Bay (Keinath and Musick, 1991).

In addition, the Delaware Bayshore region was recently recognized by the National Audubon Society as a Globally Significant Important Bird Area (IBA) (New Jersey Audubon, 2011). This designation is due, in part, to the region's importance as a stopover for migratory shore birds, some of which are imperiled. These birds rely on an abundance of horseshoe crab eggs as a primary food source during their northward migrations each spring. The flagship species for this ecological link, the Red Knot (*Calidris canutus rufa*), was added to the list of Federal candidate species in 2006. It is expected that a "Proposed Rule / Proposed Critical Habitat will be published in the Federal Register by late 2012 for public comment" (<http://www.fws.gov/northeast/njfieldoffice/Endangered/redknot.html>).

*Task 1.9* in the Atlantic States Marine Fisheries Commission (ASMFC) 2011 Action Plan states that the Commission will "evaluate interactions and minimize impacts on protected species." The ASMFC should consider the Red Knot a federally protected species since it is likely that it will become federally protected during the later phases of applying Addendum VII to the Interstate Fishery Management Plan for Horseshoe Crabs.

Although the relationship between Red Knots and horseshoe crabs is "imperfectly known," Niles et al, 2007, suggest that reduced availability of horseshoe crab eggs directly impacts the ability for Red Knots to gain the mass necessary to successfully reproduce in their Arctic nesting grounds (Niles et al., 2007). Unfortunately, horseshoe crab egg density estimates on Delaware Bay beaches indicate that there are much fewer eggs available each spring than are necessary to begin recovering the Red Knot population. This is largely due to the fact that horseshoe crab numbers remain historically low (Niles et al., 2009).

McGowan et al., 2011, also suggest that there is a link between red knot mass and annual survival; and that “managing horseshoe crab resources in Delaware Bay has the potential to improve red knot populations”. It is the ASMFC’s responsibility to make management decisions that will improve horseshoe crab populations and, subsequently, begin to rebuild Red Knot populations.

Despite the ecological and economic importance of horseshoe crabs, scientists did not know much about its population status until relatively recently. Even in the August 2011 ASMFC Stock Status Overview, horseshoe crab populations were defined as being in “unknown” condition. ASMFC 2011 Action Plan *Task 1.5* states that the Commission will “manage responsibly when facing uncertainty.”

#### Wetlands Institute’s Position

Due to the uncertainty concerning the fate of ecologically linked, and at-risk, species like horseshoe crabs, marine sea turtles, Red Knots and other migratory shorebirds, we implore the Commission to implement an Addendum VII to the Interstate Fisheries Management Plan for Horseshoe Crabs that is responsible, risk-averse, and focuses on the long-term sustainable recovery of horseshoe crab populations within their entire range.

Such an approach requires that there should not be an allowable harvest of Delaware Bay-origin horseshoe crabs under any circumstances until their populations rebound to historic levels. Horseshoe crabs occupy a critical niche in both the ecology of Delaware Bay and human pharmacology. They provide incalculable services and their population decline has catastrophic implications. Every feasible action to protect this at-risk species should be taken.

#### Responses to questions for public comment:

##### *1) Should the Board take no action and have management measures revert back to Addendum III?*

Addendum III does not limit Virginia harvest east of the COLREGS line, resulting in over 91,000 more crabs being harvested each year (ASMFC, 2011). In addition, Addendum III allows for a longer harvest season which would make enforcement of regulations more difficult. Reverting back to Addendum III is a relatively risk-inclined option, and should not be supported by the ASMFC according to the ASMFC’s 2011 Action Plan which encourages responsible management “when facing uncertainty”. (Uncertainty regarding the status of horseshoe crab populations was established by the ASMFC 2011 Stock Status Overview, which defines the status of horseshoe crab populations as “unknown”.)

##### *2) Should the Board take action and extend the status quo management measures under Addendum VI?*

Since 2004, the total annual harvest of horseshoe crabs has not decreased (Niles et al, 2011, as per the National Marine Fisheries Service’s Commercial Fishery Landings Database 2009). As a result, horseshoe crab egg density estimates on Delaware Bay beaches are well under the target density needed to rebuild the Red Knot population, which, over the past fifteen years, has declined dramatically (McGowan et al. 2011, Niles et al 2009). It is likely that the Red Knot will become a Federally-listed species by the end of 2012. According to the ASMFC’s 2011 Action Plan, efforts should be made to “evaluate [species] interactions and minimize impacts on protected species”. A recent study from McGowan et al. 2011 suggests that “managing horseshoe crab resources in Delaware Bay has the

potential to improve Red Knot populations”. While Addendum VI (status quo) was an improvement to Addendum III, stricter regulations are necessary to recover horseshoe crab populations and, subsequently, begin to rebuild migratory shorebird populations. Thus, it seems necessary to increase the status quo harvest restrictions on horseshoe crabs.

3) *Should the Board take action and implement the Adaptive Resource Management Framework?*

We support implementation of the Adaptive Resource Management (ARM) Framework, but using the most cautious criteria. Under the ARM Framework, it is possible to further protect horseshoe crabs and the species directly impacted by their prominence. With advancing technological capabilities, ecological model-based management should become increasingly sophisticated and reliable. However, it is our responsibility to manage natural resources using extreme caution, especially when managing “unknown,” not to mention imperiled, conditions.

In addition, according to the ASMFC 2011 Action Plan *Task 2.1.1*, efforts should be made to “develop quantitative assessments for species of unknown stock status” with the intention of establishing a known stock status condition. If there are insufficient data available to implement the ARM Framework in any year, then extreme caution should be applied to that year’s harvest allowance.

*If so,*

a. *How much of each state’s harvest is comprised of Delaware Bay-origin crabs, Lambda  $\lambda$ ?*

The ASMFC is tasked with managing responsibly when facing uncertainty. Proposed Lambda values based on tagging data are limited in the amount of information they reliably provide for determining the degree of population mixing along the coast because “much of the tagging and recapture data fall within [the] parameters” that exclude them from being used in analysis (ASMFC, 2011).

We concluded that using genetic markers to determine Lambda may be more reliable than using tagging data because there are fewer restrictive parameters to limit the use of the results. However, the Delaware Bay Ecosystem Technical Committee, who performed the genetic analysis, noted that low levels of genetic mixing can “maintain genetic similarity” (ASMFC, 2011). So, it is fair to assume that the Lambda values based on genetic analysis represent a Lambda value that is still below the actual value.

It would be more responsible to begin the ARM Framework using the risk-averse options for Lambda, which are the Default values of 1.0 for New Jersey, Delaware, Maryland, and Virginia. As the ARM Framework develops and scientists learn more about these populations, Lambda values might be adjusted.

b. *On what basis should the total recommended ARM harvest output be divided among the four states of New Jersey, Delaware, Maryland, and Virginia (weight allocation- $w_i$ )?*

Four weighing systems are being considered for apportioning harvest output, which are based on: 1) the average landings over the past four years; 2) estimated abundance levels; 3) current management quotas; and 4) historic harvest levels (Reference Period Landings, RPLs).

Using the past four years’ average landing to determine harvest output per state would result in a distorted weight allocation because New Jersey has claimed 0 % of harvest output over the past four years, which might result in added pressure on other states’ resources.

Current estimated abundance levels are determined using the Virginia Tech Horseshoe Crab Trawl Survey, which is “not specifically designed” to estimate harvest output per state (ASMFC, 2011). In addition, using this measure might put added pressure on Delaware Bay-origin crabs because the estimate does not take Lambda into account, thereby effectively devaluing Delaware Bay-origin crabs.

Historically, Delaware Bay had a thriving horseshoe crab fishery. Using historical, unregulated levels (RPLs) of horseshoe crab harvest to determine current harvest allocation might put too much pressure on a currently vulnerable and valuable Delaware Bay-origin population.

Current management quotas were established based on an at-risk population and place a greater value on protecting Delaware Bay-origin crabs. This option should be used to apportion harvest output as it takes into consideration the importance of protecting horseshoe crabs and is based on current knowledge. It should be a goal of the ASMFC to restore horseshoe crab populations to their historic levels by responsibly managing the at-risk fishery.

- c. Should there be an overall cap placed on Maryland and Virginia’s harvest to protect non-Delaware Bay-origin horseshoe crabs (harvest cap)?*

As referenced in “Draft Addendum VII to the Interstate Fishery Management Plan for Horseshoe Crabs,” New York and Massachusetts had to adjust their regulations on horseshoe crab harvest in 2008 as a result of increased harvest pressure due to stricter harvest restrictions in Delaware Bay. With stricter regulations placed on harvesting Delaware Bay-origin horseshoe crabs, it is fair to assume that there will be pressure to offset those losses by increasing harvest of horseshoe crabs elsewhere, especially Maryland and Virginia. Preemptive actions should be implemented to protect non-Delaware Bay-origin crabs from exploitation.

- d. Should there be an allowable harvest of Delaware Bay-origin horseshoe crabs for Maryland and Virginia if the ARM-recommended harvest option requires a moratorium on one or both genders (Delaware Bay Stock Allowance)?*

There should not be an allowable harvest of Delaware Bay-origin horseshoe crabs under any circumstances until their populations rebound to historic levels. Horseshoe crabs occupy a critical niche in both the ecology of Delaware Bay and human pharmacology. They provide incalculable services and their population decline has catastrophic implications. Every feasible action to protect this at-risk species should be taken. We hope the ASMFC will implement a fisheries management plan for horseshoe crabs that is responsible, risk-averse, and focuses on the long-term sustainable recovery of horseshoe crab populations within their entire range.

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# RE: ASMFC Horseshoe crab Addendum VII (public comment)

Ms. Chesky (Danielle);

There are two main points to my comment:

- Use of **best available science** is the standard by which FMPs should be framed.
- Even though other viable options were available and should have been offered as alternatives, the ASMFC Amendment VII only offered unpalatable options. (See end-note)

Let me elaborate on these two points.

## Use of **best available science**:

In the past, horseshoe crabs have been managed as a response to special interest pressure. That was management by *political science*. Although political science and the application of organizational psychology may be the appropriate scientific methodology by which to allocate percentages of available resources (TAC) among the segments of society (i.e. environmentalists, recreational users, biomedical and other commercial users), and a methodology by which State by State allocations of available harvest should be determined because of historic usage patterns, it is clearly NOT the appropriate science by which MSY and TAC should be determined.

Since the *physical* and *mathematical* sciences (statistical analysis of data) are by far the more appropriate sciences to use for determining TAC, option 1 of Addendum VII should be rejected because the use of it would be to ignore all recent advancements in data collection and application of the methodologies of the sciences to the horseshoe crab/red knot management process

Option 2 and all of its sub-options have the same problem as Option 1. They are all based on "gut feelings" and not founded in any science.... Therefore Option 2 should be summarily rejected.

Therefore, since it is the only option that utilizes the .... *any science whatsoever*..... ,

## I advocate using **Option 3**

=====  
(Aside☺)Using *best available science* (statistical analysis of data sets) may lead us down a path of continued (and possibly increased) harvest despite a declining population of red knots. This presents a dilemma to ASMFC in that this outcome is not acceptable to the environmentalist entrenched on the sub-committees. Since ASMFC is by definition a political organization, with environmentalists in control of significant portions of its horseshoe crab related subcommittees, implementation of Option 3 will most likely cause consternation among those on the subcommittees tasked with analyzing the incoming stream of data and making rational decisions. (Expecting rational decisions to be made by agenda driven persons is an oxymoronic expectation that can't be satisfied by implementing any option.....)

What follows are my comments on the several sub-options within Option 3 that were printed in the draft:

### Option 3a: (determination of lambda)

The fact that this is proposed as an option is an indication that, the scientists on the subcommittees of ASMFC were not able to determine the answer to a simple question that is well within their ability to answer. The question ... "What are the most accurate values of lambdas?" Why can't

# RE: ASMFC Horseshoe crab Addendum VII (public comment)

they answer this?..... Answer: The politics and pressures exerted by special interest members entrenched in the ASMFC subcommittees demand that inaccurate values of lambdas be offered as alternative options. (Golly what a mess you've got on those subcommittees!!)

Obviously, we should **NOT** use **option 3a.2** because it ignores **all** available data. It fixes all four states' harvest as coming entirely from the Delaware Bay Stock even though all gathered data indicates otherwise. By ignoring the data, it immediately disqualifies itself as a scientifically based option. The fact that it is even listed as an option by the subcommittee is testament to the fact that ASMFC is by definition a political organization reacting to special interest group pressures. ASMFC has most likely included 3a2 as a choice because it was a capitulation by the scientific members of the subcommittee to the pressure of the other non-scientific members. That is truly an indication of a FAILURE by the scientists on the committee, and domination of the subcommittees by non-scientific agenda driven members.

Options 3a1 and 3a3 are therefore the only two options for the determination of lambdas that are the outcome of any scientific discipline.

**Option 3a1** is based on the statistical analysis of tagging data. Although *statistics analysis* is a precise discipline of mathematics, the methodology employed in the gathering data can skew the analysis and reduce the accuracy of the results. I am referring to the fact that the fishermen who are returning the tags are not unbiased; and their bias may affect their actions. Each has the opportunity to NOT to return tags from animals tagged in the Delaware Bay region thereby skewing the resulting analysis showing a higher percentage of their total harvest is coming from NON-Delaware Bay stocks. Although I have no information that this is happening, it is a possibility and therefore has the potential to reduce the accuracy of lambdas based on tagging programs and tag return data.

**Option 3a3** on the other hand, determines lambdas based on genetic analysis of randomly taken samples of the harvest. This removes the possibility of data skewing by the harvesters and leaves in only in the hands of the genetic testers. Since these testers are most likely un-biased, the accuracy of their data has a higher accuracy than that of biased tag returners. Thus, this process is the most accurate of the sub-options offered.

**Therefore, on the basis of using the best (most accurate) available science,.....**

**I advocate the use of option 3a3.**

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## **Option 3b: (weighting allocation values)**

Options 3b2 and 3b4 are each based on the quotas and landings that were significantly affected by past political compromises and agenda driven moratoriums. To use either of these options is to continue to use allocations that had no basis in science.

**Therefore, I recommend that ASMFC reject 3b2 and 3b4.**

Basing allocation on a *resource availability index* (option 3b3) is the most scientifically valid option offered. However, the *availability index* (percentage of the stock available to a state's fishermen) upon which the allocation is based must be determined accurately and fairly. The problem is that, option 3b3 of Addendum VII only allows the use of data from the Virginia Trawl survey even though this survey not designed to accurately determine that index. This survey (incorrectly) considers that the delineation lines between the states' availability zones run due east from the intersections of the states'.

Because the State of New Jersey contains a large peninsula separating the Delaware Bay from the Atlantic Ocean, by using the VT trawl survey method of determining state zones, NJ receives no credit for the fact that many of the crabs "available" to it. They are being credited to Delaware, yet lie in areas that are closer to New Jersey (Cape May) than to Delaware. Therefore, although the VT survey

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yields valid results for its designed purpose, its methodology is severely flawed in determining resource *availability index* for crabs available to NJ and Delaware harvesters.

**Therefore, I recommend that ASMFC reject 3b3** because it contains the restriction of using the VT survey in its current configuration. (As an alternative, If option 3b3 is implemented, I propose that you modify the output from the VT survey to create a *resource availability index* representing the percentage of the total resource that lies within a 20-mile radius of each State's shoreline.)

However, allocations are more often a result of political compromises rather than scientifically based statistical analysis. *Historical claims* are a fact of life and a valid consideration when determining the weighting of allocation values.

Since Alternative 3b1 represents a hybrid of actual availability (i.e. historical harvest = a combination of availability & demand) It is the option that represents a merging of political science (historical claims) and physical sciences (availability)..

**If no additional "b" options were available, I would advocate using option 3b1 as the basis for weighting the allocations among the four states. However, other options are available. (see End Note)**

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### **Option 3c: (overall cap on MD and VA harvest)**

The placing of a cap on harvest from stocks of unknown size has NO basis in science. Its only validity would be to prevent additional utilization of a resource until stock assessments are completed. However, since no stock assessments are in progress, that (valid) basis does not exist. Therefore, placing a cap on harvest is acting on voo-doo science much like Chicken Little and the falling sky ..... (May GOD save us from acting so foolishly.....)

I recognize that it is foolish NOT to place a cap on what is obviously a resource of finite size. However, the fact that nobody is working on generating an assessment to determine the size of these non- Delaware Bay stocks, places the blame for this foolish action on the stock assessors' procrastination. To impose a cap without a stock assessment is to encourage a continuation of their procrastination (foolishness). Employing *the science of psychology* is the only way to encourage an end to the assessors' procrastination, Thus we should allow "non-responsible" action (no cap) to continue until the assessors do their job and show (with data analysis) that a cap is necessary....

**Therefore: on this option, I advocate 3c:NO** i.e. NO cap until a stock assessment is done and a cap can be established based on MSY (just as the Magnuson Act mandates)

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### **Option 3d (2 state allowance of deviation from ARM output recommendations)**

The development of an FMP must be based on science. To allow states to ignore that basis, and deviate from what the scientific model advises would be to ignore the principle of managing by best available science. The science of Biology (genetic analysis option 3a3) is what I advocated should be relied on to show which stocks are being harvested. Since the ARM output is specific to the DB stocks, a state must be able to show (by genetic analysis) that they are not harvesting an excess of DB stocks. If a state can change its harvest techniques in such a way as to avoid DB stocks, the genetic analysis will indicate that. But I repeat, a state should NOT be permitted to harvest more than their allowance of DB stocks.....

# RE: ASMFC Horseshoe crab Addendum VII (public comment)

Since bycatch is inevitable, EVERY state should be allowed the typical bycatch allowance of 5% for non-directed species (in this case... crabs from the DB stock).

Therefore, I advocate **3d:YES:5%**

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## Option 3e (2 for 1 male: female exchange allowance)

The ARM considers males and females to be separate manageable stocks. Since the ARM sets allowable harvest levels of male and female crabs separately based on a *scientific method of analysis of real* data, to allow deviance from the model output is to circumvent the science and data used by the model. If the swap option is acceptable, then the model will (should) indicate such by showing the appropriate linkage between the stocks. Clearly, if management plans are to be based on *best available science*, swaps of resources (male for female) should not be considered unless the equivalence is shown to be valid by scientific data (example: when considering forage actions of predator species, 3 mullet may contain the equivalent nutritional resource of 1 herring.) Although from the conch fisherman's point of view, a female HSC is worth (at least) 2 males, from the resource and the ARM model point of view, it is clearly not true that 2 males are equivalent to 1 female.

To offer this as an alternative for consideration by the public is another indication that special interest groups (conchers) have infiltrated the technical committees. ASMFC's tech committees need to keep proper perspectives. They are working on a horseshoe crab FMP that is based on science. If they get lost in the process, soon they will be considering swapping 1 female for \$5.00 cash money to its "research (slush) fund"... (It makes just as much sense as swapping 2 males for 1 female when the ARM model treats them as different resources)

I therefore advocate: **3e:NO** (No deviance from ARM model outputs.)

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## END NOTE :

The glaring flaw in the Addendum VII draft is that for New Jersey fishermen, there are other, more preferable, viable options, yet only in the fine print of page 9, where it said "... *or an (additional) option that is within the range of options presented below.*" was it hinted that they were available as choices. At the New Jersey hearing, the coordinator indicated to the public that **only** comments pertaining to the printed options were appropriate.

The situation was similar to the one in this example:

A man standing in the middle of the street is creating a safety hazard to passing motorists.

Should the police officer observing this situation:

- A. Shoot the man in the head and drag him from the street.
- B. Shoot the man in the heart and drag him from the street.

Reasonable persons recognize the problem in the example immediately. The officer needs to remove the man from the street, but neither of the two options offered are acceptable means to accomplish this. There are other options available; however, the question does not allow consideration of those options.

The situation presented at the New Jersey public hearing was similar to the example. Clearly, the ASMFC needs to move forward to modify its FMP, and to correct a coast wide problem created by New Jersey's unilateral moratorium that has caused excessive pressure to harvest non-DB stocks of crabs.

## RE: ASMFC Horseshoe crab Addendum VII (public comment)

Closely aligned with AMSFC's goal, is the goal of NJ harvesters to end the moratorium by making a case to their Legislative leaders that the current non-scientific based harvest moratorium is not aligned with ASMFC's coast wide plan and is causing a loss of potential New Jersey economic activity to other states.

NJ harvesters would clearly desire ASMFC to implement option 3b4 to support their argument. However, if ASMFC implements option 3b4, and NJ ends its moratorium, since the state gets no allocation under option 3b4, the fishermen would have shot themselves in the head by advocating for option 3b4 (no allocation). On the other hand, by supporting any of the other options (3b1, 2 or 3) that have NJ receiving a future allocation, there is no support for an ending of the New Jersey moratorium because the birding interests think that NJ's moratorium is "saving" the un-harvested allocation of crabs for the birds. In this scenario, the harvesters would have shot themselves in the heart by supporting option 3b 1, 2 or 3 and lost their only hope of making a case to end the state's moratorium.

Addendum VII offered New Jersey's harvesters a NO-WIN situation! All options that Addendum VII offers are ...BAD for New Jersey harvesters..... They amount to: "shooting themselves in the head" ... by reallocating NJ's share to other states with no hope of ever getting it back, or .... "Shooting themselves in the heart" by removing the incentive to end NJ's moratorium ..... The option that New Jersey's harvesters clearly were looking for was "*an (additional) option that is within the range of options presented*" (quote from Addendum VII Draft; pg 9).

Therefore, I propose this composite option:

### Option 3b5.....

- A) Implement option 3b4 UNTIL New Jersey lifts its harvest moratorium...
- B) Implement option 3b1,2 or 3 AFTER New Jersey ends its harvest moratorium....

ASMFC did not offer option 3b5 as a (printed) choice. ASMFC gave New Jersey fishermen: Shoot yourself in the head ...or... Shoot yourself in the heart. The hearing officer did NOT explain that the phrase..."*or an option that is within the range of options presented* ....." appeared on page 9 of the draft. (Is it any wonder that the fishermen in attendance "passed" when he explained to them that their comments should be restricted to ... "*only the options listed !*" ?)

## Conclusion:

I think it would be wise for ASMFC to implement option 3b5 (above). This allows pressure to be put on New Jersey to end its unilateral, non-ASMFC aligned moratorium, and to rejoin a coordinated ASMFC management plan based on a science based model (ARM) once that moratorium is ended.....

The Old Fisherman.....

Walter Chew <"(((>< ... .. .  
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**MEMORANDUM**

February 1, 2012

To: Horseshoe Crab Management Board  
From: Danielle Chesky, FMP Coordinator  
RE: Public Comment on Draft Addendum VII to the Horseshoe Crab FMP

The following pages represent the comment received by ASMFC by January 31, 2012 on Draft Addendum VII to the Horseshoe Crab Fishery Management Plan.

A total of 49 comments have been received. Of those comments 41 were individual comment and 8 comments were from organizations.

Four public hearings were held, one each in New Jersey, Delaware, Maryland, and Virginia. Approximately 32 individuals, not including staff, were estimated to have attended all of the hearings combined.

The following table is provided to give the management board an overview of the support for specific options contained in the document. Support for an option was only indicated in the table if the commenter specifically stated preference for one or more of the options in the document.

**Draft Addendum VII to Horseshoe Crab FMP, Public Comment Summary**

	Option 1 No action	Option 2 Maintain status quo	Option 3-ARM Implementation						
			No additional preference	3a-Lambda	3b-Weighting	3c-Harvest Cap	3d-Stock Allowance, no offset	3e-Stock Allowance 2:1 male offset	3f-Plan B
<b>Written</b>	1	No preference on sunset: 2	1	Genetics: 37 Default: 36	RPLs: 1 Add VI: 4	Yes, Add VI: 37 Yes, no preference: 1 No: 1	Yes, 5%: 1 Yes, 10%: 1 No: 37	Yes: 1 No: 38	Yes: 3
<b>Hearings</b>									
<b>NJ</b>				Genetics: 4	RPLs: 2 Add VI: 1 Av. Land: 1	Yes, RPLs: 1 Yes, Add VI: 5	No: 4	No: 4	Yes: 4
<b>DE</b>	1		1						
<b>MD</b>		5 year sunset (if no 10% DBSA): 4		Between tagging and genetic: 4	Add VI: 4	Yes, Add VI: 4	Yes, 10%: 4	No: 4	Yes: 4
<b>VA</b>		No preference: 1		Genetics: 1	Add VI: 1	Yes, Add VI: 1	Yes, 10%: 1	Yes: 1	Yes: 2

The following is a summary of additional comments that were given in the written comments:

- No commercial fish profiteer or amateur should be allowed to fish for horseshoe crabs so they can use those crabs for bait.
- Management of horseshoe crabs is a multi-species issue.
- Horseshoe crab abundance in the Delaware Bay Region is rebuilding and the plight of the red knot remains unchanged.
- The populations of red knots and federally protected marine turtles have not increased.
- Lambda provides the ARM with an essential tool to manage the fisheries in Maryland and Virginia that are interacting primarily with populations that are spawning in their respective coastal embayments, and to a lesser degree with crabs spawning in Delaware Bay.
- I support capping harvest, on an interim basis, at Addendum VI quota levels in Delaware, Maryland, and Virginia, provided that the Commission adopts a DBSA of 10%.
- Setting the DBSA at 10% would result in removals of less than one percent of the estimated population of mature female horseshoe crabs in Delaware Bay.
- We exhausted all of our horseshoe crab inventories in the last week of December, 2011 and the highly valuable whelk fishery is currently bait-limited.
- At the very least the provisions in Addendum VI should remain in place until enough data is collected from the Delaware Bay region to prove that horseshoe crab and red knot populations have rebounded sufficiently.
- The ASMFC should consider the Red Knot a federally protected species since it is likely that it will become federally protected during the later phases of applying Addendum VII to the Interstate Fishery Management Plan for Horseshoe Crabs.
- Such an approach [to management] requires that there should not be an allowable harvest of Delaware Bay-origin horseshoe crabs under any circumstances until their populations rebound to historic levels.
- Weights based on average landings would penalize New Jersey for its risk-averse management.
- Harvest restrictions on females [sic] crabs in Delaware, Maryland and Virginia have, to date, failed to significantly increase egg and female spawning densities in Delaware Bay.
- Using *best available science* (statistical analysis of data sets) may lead us down a path of continued (and possibly increased) harvest despite a declining population of red knots.
- Clearly, the ASMFC needs to move forward to modify its FMP, and to correct a coast wide problem created by New Jersey's unilateral moratorium that has caused excessive pressure to harvest non-DB stocks of crabs.
- I propose this compromise option:  
Option 3b5
  - A) Implement 3b4 [weighting by average landings] UNTIL New Jersey lifts its harvest moratorium...
  - B) Implement 3b1, 2, or 3 [other weighting options] AFTER New Jersey ends its harvest moratorium...

Other comments not specific to the Draft Addendum VII options but in reference to implementation of the ARM Framework

- At the first opportunity to review the ARM model parameters, I would encourage the Board to review the female utility threshold, which is current set at a knife-edge at 80% of carrying capacity. By adding utility incrementally, beginning at 65% of carrying capacity, the model would be more responsive to the comments of the ARM peer review, and would set more reasonable objectives.
- I would also recommend adding a slightly higher male-only management option, for 600,000 males, to provide more contrast in the management alternatives considered in the model.
- The ARM model currently assumes all horseshoe crab mortality is represented but it does not account for mortality related to lysate bleeding, bycatch, and illegal harvest. All mortality should be forthrightly reported and included in the ARM model.

### **Public Hearing Summary**

#### **Maryland Public Hearing Summary Horseshoe Crab Draft Addendum VII Ocean Pines, Maryland (4 Attendees, 1 DNR staff) December 21, 2011**

##### **Summary**

All members of the public present at the meeting supported Option 3, implementation of the ARM Framework, as long as the Delaware Bay Stock Allowance was set at 10% or at a level to maintain the current level of female horseshoe crab harvest. Participants also agreed that setting lambda values at 1.0 (Default) or 0.51 (Genetics) for Maryland was too high, given what they have seen in the fishery. Two individuals felt the value was somewhere between 0.13 (Tagging) and 0.51 (Genetics), and one individual believed the value was right around 0.13 (Tagging). All individuals agreed that the weighting ( $W_i$ ) should be set at Addendum VI levels and that a harvest cap set at Addendum VI levels would be appropriate until information is available to support raising the cap. All individuals were against allowing a 2:1 male:female offset with the Delaware Bay Stock Allowance (3e) and highly advised against increasing the cap to allow for this offset. All individuals supported a Plan B for management (3f), should data not be available. Most were in agreement that Addendum VI management should be put back into place as the Plan B, although they did encourage the consultation of the technical committees. Finally, all members agreed that if the 10% Delaware Bay Stock Allowance to maintain current levels of female harvest was not possible, then Option 2 should be implemented to continue Addendum VI management measures. The group agreed on a five year sunset clause.

##### **Option 3, Implement ARM Framework**

Fishermen are seeing higher numbers of crabs of all sizes both inside the bay and out in the ocean waters, yet the red knots do not seem to be responding. Implementation of the ARM Framework will allow the relationship between horseshoe crabs and red knots to be specifically modeled and put into management with the various models that include no and full dependence of red knots on horseshoe crabs.

### **Lambda, 3a**

Horseshoe crabs for Maryland and Virginia are differently morphologically than crabs from Delaware Bay. The level of Delaware Bay crabs in the offshore trawls is nowhere's near 50% of the total catch.

### **Weighting, 3b**

The current approach to management has provided for increased horseshoe crab populations, so let's keep a good thing going.

### **Harvest Cap, 3c**

No fisherman necessarily wants to say no to a higher limit, but stability and a reliable catch in the future is more important than a few more crabs for one year. Maintain the caps so that the population continues to climb. The cap should be looked at during the next stock assessment or ARM review.

### **Delaware Bay Stock Allowance, 3d**

A 10% stock allowance would allow a small number of females to still be caught. The current management measures have allowed the populations to increase so far, so keep that same trend.

### **Delaware Bay Stock Allowance with 2:1 male:female offset, 3e**

Increasing the cap to allow more crabs to be caught may be alright for one or a few years, but we have seen increases from the current management measures and do not want to stop that increase. This is a bad idea and should not be included in the next set of management measures.

### **Plan B management option, 3f**

Addendum VI measures have worked over the last five years, so that's what should be the default if the ARM Framework can't output an optimized harvest. The technical committee should be involved in looking at the data, whether through what the states collect or going out on the boats with the fishermen to look at the health of the stock.

### **Option 2, Continue Addendum VI measures**

If the Delaware Bay Stock Allowance can't be at the 10% or current female harvest level, then Addendum VI measures should be continued with a five year sunset clause. That doesn't prevent the Board from looking at changing management measures during those five years but provides some level of stability for the industry. The measures have been working so far so should keep it going.

## **New Jersey Public Hearing Summary Horseshoe Crab Draft Addendum VII Galloway, New Jersey (25 Attendees, 5 DEP staff) January 5, 2012**

### Summary

All members of the public present at the meeting supported Option 3, implementation of the ARM Framework. All individuals who spoke supported using the lambda values based on the genetics data. The weighting option elicited three different opinions: Reference Period Landings, Addendum VI, and Average Landings. There was concern about using Average

Landings, as it would remove all of New Jersey's allocation. At the same time, there was concern that any allocation that would go to New Jersey would be lost, at least in the short term, due to the moratorium on bait harvest. All individuals who spoke favored a harvest cap, and although most supported using Addendum VI levels as the basis for cap, one individual said either Addendum VI or the Reference Period Landings level would be appropriate. No individuals who spoke favored a Delaware Bay Stock Allowance, whether with a 1:1 or a 2:1 offset of males. Finally, all speakers supported a back up or Plan B, although one individual suggested that rather than having the options set, that the Board consult its technical and advisory committees before making a decision.

### **Option 3, Implement ARM Framework**

The ARM Framework still has numerous problems with its models and multi-species modeling and management is not well established yet. Despite these concerns, the ARM Framework is the best way forward to use science in management.

One individual commented that neither horseshoe crabs nor shorebirds are increasing, especially as evidenced by the lack of increases in egg densities on the beaches. The ARM Framework maximizes the protection of the female horseshoe crabs and speed the recovery of both species. Another individual commented that the horseshoe crabs are increasing quite a bit and that younger generations of horseshoe crabs are showing up in the nets.

One other individual expressed frustration that the biomedical industry and whatever mortality or impacts associated with it, were not included in the ARM Framework.

### **Lambda, 3a**

All individuals who spoke (4) supported the use of the genetics values for lambda.

### **Weighting, 3b**

Although New Jersey is currently under a moratorium, its landings shouldn't be reallocated to other states.

Multiple individuals spoke against using the average landings for weighting, as that would remove New Jersey's allocation in the future.

Two individuals favored Reference Period Landings, as this standard gives New Jersey its traditional proportion of landings prior to any management or the moratorium.

One individual favored using quotas based on Addendum VI levels, as this reflected the current distribution of crabs among the four states.

One individual spoke in favor of average landings.

### **Harvest Cap, 3c**

All individuals spoke in favor of placing a cap on the harvest limits of Maryland and Virginia, in order to protect the other populations.

Most (4) favored basing the cap on Addendum VI levels to maintain the current supply level.

One of these individuals preferred either Addendum VI or the Reference Period Landing levels.

### **Delaware Bay Stock Allowance, 3d**

No individuals spoke in favor of a Delaware Bay Stock Allowance option, whether 3d or 3e.

One individual cited the need to maintain as near-perfect implementation of the ARM-recommended harvest as possible, in order to evaluate the impacts of management on the population.

### **Delaware Bay Stock Allowance with 2:1 male:female offset, 3e**

No individuals spoke in favor of a Delaware Bay Stock Allowance option, whether 3d or 3e. One individual cited the need to maintain as near-perfect implementation of the ARM-recommended harvest as possible, in order to evaluate the impacts of management on the population.

### **Plan B management option, 3f**

All individuals spoke in favor of having some sort of back-up plan for management should the data to run the ARM model not be available.

One individual recommended not locking the Board into one default or the other but rather to consult the Delaware Bay Ecosystem Technical Committee along with the Shorebird and Horseshoe Crab Advisory Panels on what is the best science available to inform the decision.

## **Delaware Public Hearing Summary Horseshoe Crab Draft Addendum VII Dover, Delaware (1 Attendees, 1 DNREC staff) January 6, 2012**

### Summary

The individual who attended expressed apprehension with the options. The individual expressed concern that Delaware has been unable to domestically support its eel fishery with harvest of some females. The individual supported Option 1, No action, for the sole reason that it would immediately allow some harvest of females by Delaware. The individual expressed support for the state of Delaware implementing more measures to limit the female harvest if Option 1 was selected, as the entire harvest could potentially be females. The individual acknowledged that, although Option 1 served these interests in the short-term, Option 3 (ARM Implementation) would likely be a better option to support the Delaware fishery in the long-term. The individual did not offer comments on any of the specific options for allocation, but did offer that there was no opinion on the Delaware Bay Stock Allowance, due to the fact that those crabs may not be able to Delaware fishermen for purchase. The current year has shown a very large limit on bait availability. Without assurances that the supply would be available to Delaware, there may be no benefit to allowing females to be harvested in Maryland and Virginia.

## **Virginia Public Hearing Summary Horseshoe Crab Draft Addendum VII Newport News, Virginia (2 Attendees, 2 VMRC staff) January 10, 2012**

### Summary

One commenter supported continuing with the current management measures (Option 2), although no feedback was given on whether or not to include a sunset clause. The other commenter supported implementing the ARM Framework (Option 3). Both attendees supported having a backup plan, if needed.

### **Option 2, Continue Status Quo**

The attendee commented that the current regulations in place have not been given enough time to assess the impacts of them. In addition, the attendee indicated that the harvest practices of the directed horseshoe crab fishery in Virginia have changed, with vessels fishing more in Chesapeake Bay as well as fishing closer in to shore, where crabs from Delaware Bay are less likely to occur. The commenter also indicated that a full female moratorium would be a bad idea and a waste of resources. The commenter indicated that females will come up in the dredge damaged and to throw them over the side would waste the resource, as it would not be helpful to the industry or the shorebirds. Additionally, the commenter noted that the current management requirements, which include a 2:1 male:female ratio east of the COLREGS, requires harvesters to put back females currently and avoids the waste that would be involved with limiting females.

### **Option 3, Implement ARM Framework**

The commenter supporting the ARM Framework cited the amount of work and effort that had gone into creating the framework and the models. Through future development efforts of the ARM, the commenter encouraged the Board to include an additional Harvest Output option of 600,000 male crabs. The commenter also suggested that the utility of female horseshoe crabs be changed from a knife-edge to graduated utility function that adds utility beginning at 65% of carrying capacity (currently knife-edge utility function set at 80% carrying capacity).

The commenter also called for mitigating the social impacts of the decisions of the management.

### **Lambda, 3a**

The commenter supported basing lambda on the genetics data, as an appropriate start.

### **Weighting, 3b**

The commenter supported basing the weighting on Addendum VI levels, as these are where the current fishery stands.

### **Harvest Cap, 3c**

The commenter did not specify a preference on the harvest cap.

### **Delaware Bay Stock Allowance, 3d**

The commenter spoke in favor of a Delaware Bay Stock Allowance to maintain the status quo harvest of females in Virginia and Maryland.

### **Delaware Bay Stock Allowance with 2:1 male:female offset, 3e**

The commenter spoke in favor of the 2:1 male:female offset should the number of females be decreased from the current levels allowed under the plan, in order to offset the impacts of the measure.

### **Plan B management option, 3f**

Both attendees spoke in favor of having a back-up plan but did not offer any additional detail or preference

## Delaware Bay Ecosystem Technical Committee Report

January 10, 2012

### **Participants**

#### *Delaware Bay Ecosystem Technical Committee Members*

Jeff Brust (NJ), Chair  
Greg Breese (FWS), Vice Chair  
Jordan Zimmerman (DE)  
Dr. Jim Frawer (Virginia Tech)  
Kevin Kalasz (DE)  
Joe Grist (VA)  
Dr. Mandy Dey (NJ)

#### *Additional participants*

Dr. Sarah Karpanty (Virginia Tech), Shorebird Advisory Panel Chair  
Dr. James Cooper (NC), Horseshoe Crab Advisory Panel Chair  
Dr. John Sweka (FWS)  
Danielle Chesky (ASMFC)

The Delaware Bay Ecosystem Technical Committee (TC) met via conference call on January 10, 2012, to review the Draft Addendum VII to the Horseshoe Crab Fishery Management Plan. The TC agreed that the best option for management of the horseshoe crab bait fishery was to move forward with implementing the Adaptive Resource Management (ARM) Framework, Option 3. The TC agreed that Option 1 (no action) was less risk averse than implementation of the ARM Framework, and thus should not be the recommended option. The TC noted that Option 2 (status quo) may be more or less risk averse than the ARM Framework but does not allow for adjustments to the management program based on the best available scientific information and increased understanding of population dynamics and its response to management gained from implementing the ARM Framework. The TC also emphasized that the ARM Framework is currently ready to implement, and delaying implementation would not likely bring any substantial changes without feedback from implementation. The TC also supported the idea of the ARM Framework, in contrast to continuing the status quo (Option 2) or previous management (Option 1), and implementing a scientific-based harvest level, rather than allowing a certain portion of the previous, unregulated harvest levels. In addition the TC expressed appreciation for the amount of time and effort that had been put into the building of the ARM Framework by the state and federal partners. For these reasons, the TC recommends implementing the ARM Framework, Option 3. The TC noted that, should the Board decide to continue the status quo (Option 2), that a sunset clause of one year be included, in order to provoke considering implementation of the ARM Framework as soon as possible under the proposed options. **Overall, the TC agrees the ARM Framework was the preferred option because it has the best scientific support, allows for harvest changes as populations change, and will result in better understanding by reducing uncertainty over time.**

### *Option 3a, Lambda*

The TC could not reach consensus on the appropriate lambda value. The default values (1.0 for all states) are the most conservative option for the Delaware Bay stock, but this option is not based on scientific evidence and, if incorrect, could lead to increased exploitation of the southern region population. Lambda values based on genetic analysis are scientifically derived, but the data were not collected specifically to address the question at hand, and the accuracy of the results is therefore uncertain. **The majority of the committee recommends setting lambda values no lower than those values based on the genetics data for Maryland and Virginia. However, one member of the committee who could not participate on the conference call expressed concern that the true values could be lower than the genetics values. There was consensus among all TC members that a directed genetics and/or tagging study would be beneficial to directly estimate lambda values.**

### *Option 3b, Weighting allocation*

In its previous report, the TC did not recommend any values for weighting but deferred, citing the policy basis of the question. In its discussion on the call, the TC suggested against using average landings, due to the lack of fairness and lack of representation of the fishery with this option. This option would allocate no quota to New Jersey and thus shift harvest to the other states since all of the harvest would still be allocated. The TC also recommended against basing the weighting on the abundance estimates from the Virginia Tech Trawl Survey, as the survey was not intended to divide its trawls among the states. The TC suggested that using current management measures reflects past policy and management decisions. The TC also emphasized that should a state decide to be more conservative than the ARM Framework or ASMFC plan specifies, the “extra” crabs should not be reallocated among the remaining states. If needed, Addendum II allows for transfer of quota after review by the TC, which would give states flexibility as long as it did not compromise the goals of the plan. **The TC recommends basing the weighting allocation on Addendum VI levels.**

### *Option 3c, Harvest cap*

The TC again pointed out that the harvest cap has the greatest ability to impact how many crabs are harvested out of the mid-Atlantic and is only a consideration should the Board select lambda values for Maryland and Virginia that are less than 1.0. Selecting a cap based on Addendum VI quota levels best reflects past management decisions to be risk averse in allocating among the states. A cap based on Reference Period Landings or Addendum I would be ineffective at limiting harvest. Addendum III's levels would be more risk averse than RPL or Addendum I levels, but would not reflect more recent management decisions. The use of recent average landings would penalize states that had chosen to be more conservative than ASMFC requirements, which would be inconsistent with promoting state decision-making. **Thus, the TC continues to recommend the implementation of a harvest cap based on Addendum VI levels.**

### *Option 3d and 3e, Delaware Bay Stock Allowance, with or without 2:1 male:female offset*

The TC noted that the ARM Framework last recommended Harvest Package #3, which is a 500,000 male-only harvest. In its last report, the TC did not recommend any option for the Delaware Bay Stock Allowance, deferring it to the Board as a policy decision. However, Draft Addendum VII includes an option that attempts to maintain the status quo level of harvest. TC participants on the conference call felt that the ARM Framework should be implemented as intended and allow the adaptive aspects of the model to work as designed. Participants noted that to implement the ARM Framework, only to include deviations that allow the status quo

harvest to continue, would undermine the purpose, intent, and work behind the ARM Framework. A Delaware Bay Stock Allowance would compromise the predictive ability of the framework, and allowing even a small level of bycatch would turn into a female quota. However, one TC member who could not be present for the conference call felt that implementation of the DBSA would not be excessively detrimental to implementation of the framework. **Thus, the majority of the TC recommends against implementation of the Delaware Bay Stock Allowance, but consensus was not achieved.**

The use of a 2:1 male:female offset, although it may lead to more perfect implementation of the ARM Framework under some circumstances, would further convolute the implementation of the framework and move away from the ARM structure. In addition these options potentially decrease the transparency of the model and its impacts to the public, due to their complexity. **Thus the TC recommends against implementation of the 2:1 male offset.**

*Option 3f, Plan B for management*

The TC agreed that there should be a mechanism for a contingency plan in management rather than leaving a potential management loophole that would need to be rectified with an emergency measure or a hastily-formulated addendum. However, the TC agreed that the Board should consult the TC and the Shorebird and Horseshoe Crab Advisory Panels prior to making any decision. The TC also believed that limiting the choices to previous management measures under Addendum VI or the past year's ARM-recommended measures would be a premature decision. The best option will likely depend upon many factors, including: how long the ARM Framework has been in effect, how much the ARM Framework recommendations have deviated from Add VI, how has the ARM Framework recommendation has changed over the years, and how likely it is the monitoring will be resumed in future years. **Thus, the TC suggests the following language for Option 3f, which would allow the TC and Advisory Panels to consider the most recent data available to make an informed recommendation to the Board for their consideration.**

*Replace paragraph 3 under Option 3f with the following:*

The absence of these annually-collected data sets would inhibit the use of the ARM Framework.

If these data were not available for the summer harvest decision, the Delaware Bay Ecosystem Technical Committee, or relevant technical committee, along with the Horseshoe Crab and Shorebird Advisory Panels would review the best available scientific information and provide recommendations to the Board. The Board would review the recommendations and, via Board action, set the next season's harvest.

## Conclusion

In summary, the TC supported implementation of the ARM Framework (Option 3) but expressed concern about the impacts of deviating from the ARM Framework. The TC felt that selecting certain options would undermine the predictive ability of the models, thus decreasing the utility of the ARM Framework in management.

1) *Lambda,  $\lambda$*

**The majority of the TC recommended lambda values between the genetics data and the default conservation values. The full committee agreed that directed genetics and/or tagging studies would be useful to directly estimate lambda values.**

2) *Allocation weights,  $w_i$*

**The TC recommended basing the allocation weights on the Addendum VI quota levels.**

3) *Harvest cap for Maryland and Virginia*

**The TC recommended basing a harvest cap for Maryland and Virginia on Addendum VI quota levels, should the Board select lambda values for Maryland and Virginia that are less than 1.0.**

4) *Delaware Bay Stock Allowance (DBSA)*

**The majority of the TC recommended implementing the ARM optimized harvest recommendation without deviations from the ARM Framework recommendation.**

5) *Delaware Bay Stock Allowance with 2:1 male:female offset.*

**The TC recommended implementing the ARM optimized harvest recommendation with no 2:1 offset of male crabs.**

6) *Plan B for management*

**The TC recommended that should the necessary annual data to run the ARM model not be available, the Board consult the Delaware Bay Ecosystem Technical Committee and/or appropriate technical committees, Shorebird Advisory Panel, and Horseshoe Crab Advisory Panel to review the available data and recommend a management approach.**

## Horseshoe Crab Advisory Panel Report

November 29, 2011

### **Participants**

Dr. James Cooper (NC), Chair  
Dr. Mick Dawson (MA)  
Rick Robins (VA)  
Benjie Swan (NJ)  
Jay Harrington (MA)  
Danielle Chesky (ASMFC)

The Horseshoe Crab Advisory Panel (AP) met via conference call on November 29, 2011, to review the Draft Addendum VII to the Horseshoe Crab Fishery Management Plan. The AP agreed that the best option for management of the horseshoe crab bait fishery was to move forward with implementing the Adaptive Resource Management (ARM) Framework, Option 3, as it provides a sound, scientifically-based recommendation for harvest of horseshoe crabs while still considering the needs of the red knots. The AP had previously reviewed suboptions 3a-d under Option 3 in May 2011 and noted that the situation in the industry had changed in 2011. The market became extremely bait-limited, causing shortages during and especially at the end of the year. Even without these changes in the bait industry in 2011, the AP expressed frustration that the addendum process does not necessarily include economic information on the options.

Thus, the AP worked to include some information on what potential economic impacts that may result from the addendum in this report. Bernie's Conchs, LLC, is the major purchaser of conchs from Virginia Beach to the eastern shore of Maryland. The company provided 2011 fourth quarter information on the use of horseshoe crabs for bait and the resulting ex-vessel value paid to fishermen for the conchs caught using the horseshoe crabs. From October 1 through December 31, 2011, Bernie's Conchs, LLC, purchased 394,805 pounds of conch shellstock at a price of \$750,129. For these harvests, 37,059 female horseshoe crab equivalents, or 74,118 male horseshoe crab equivalents (2:1 ratio) were used. Thus, each female horseshoe crab equivalent (or 2 male horseshoe crab equivalents) yielded, on average, 10.7 pounds of conch shellstock with an ex-vessel value of \$20.24, based on the shellstock purchase price of \$1.90 per pound.

With these potential economic impacts accompanied by the observed changes in the 2011 bait market, the AP emphasized that the implementation of a Delaware Bay Stock Allowance option, can have major impacts on the industry. Using the most recent 2011 data provided by Bernie's Conchs, LLC, eliminating female harvest in Virginia could have a potential economic impact of over \$200,000 on the ex-vessel value of conch shellstock that could be produced with that amount of bait. Using the same data, the potential impact of eliminating female harvest in Maryland could reduce the ex-vessel value for conch shellstock possible from that bait by \$860,000. The AP recognized these options represent a slight departure from the ARM recommendations but also noted that the impacts of New Jersey's moratorium would have a higher impact on deviating from perfect ARM implementation in terms of total number of crabs. Although there was no consensus to support a 2:1 offset in males, it would, under some circumstances, improve the implementation of the ARM Framework, notwithstanding New

Jersey's moratorium on harvest. In terms of specific options for Suboptions 3a to 3c, the AP did not have any changes in recommendations from its May meeting. The recommendations are pasted below for reference.

*Option 3a, Lambda*

**The consensus recommendation from the AP is that the lambda values fall between the values based on the tagging data (Option 1) and those based on the genetics data (Option 3). The AP recommends that the Board consider these two sets of values as ends for a slot for determining the lambda values for use in future management.**

*Option 3b, Weighting allocation*

**Thus, the majority recommends that the Board base the proportional allocation of the ARM harvest on Addendum VI quota allocations; the minority recommends that the Board based the proportional allocation of the ARM harvest on RPLs.**

*Option 3c, Harvest cap*

**The AP agrees with the DBETC and recommends a harvest cap based on Addendum VI quota allocations to cap the non-Delaware Bay harvest of Maryland and Virginia. Further, the AP recommends that the Board include review of the harvest cap and its level as a high priority in the normal course of double-loop review process of the ARM model.**

*Option 3d, Delaware Bay Stock Allowance*

The AP recognized the importance of having a scientifically-based harvest level for horseshoe crabs that also considers the needs of red knots. In order to provide the Board with additional economic information, the AP included data from Bernie's Conchs, LLC, on the ex-vessel value of the conch harvest, which uses horseshoe crabs as bait. These data indicated that prohibiting female harvest in Maryland and Virginia would have a potential economic impact of over \$1 million in relation to the ex-vessel value of the conch shellstock. These estimates do not include the value of the horseshoe crab harvest or the processed whelk products.

Maintaining the female harvest at status quo levels amounts to less than 80,000 crabs in total harvested by Maryland and Virginia, of which less than half are of Delaware Bay origin (assuming lambda values set at 0.51 for Maryland and 0.35 for Virginia). The most recent estimates available for the Delaware Bay population indicate a population level over 8 million crabs (2010 Virginia Tech survey). In addition, the stock assessment in 2009, which passed peer review, suggested a female population of over 9 million crabs (ASMFC 2009). In comparing these overall population estimates to the recommended levels of the Delaware Bay Stock Allowance, sustaining the current female catch is minimal. **Thus, the AP recommends that the Board allow a level of Delaware Bay Stock Allowance to maintain current female quotas in Maryland and Virginia.**

*Option 3e, Delaware Bay Stock Allowance with additional 2:1 male:female offset*

The AP recognizes the tremendous amount of political measure to continue to reduce the female harvest of Delaware Bay crabs, which has over time shifted the harvest to be male-biased. New Jersey's moratorium further impacts the bait market and implementation of the ARM model. **The majority of the AP recommends that, should female harvest be limited or prohibited,**

**the Board include a 2:1 male:female offset, allowing a larger harvest of males and a potentially more-perfect implementation of the ARM harvest. The minority recommends against the 2:1 offset being automatically invoked. The minority noted that the ARM model, as implemented under this addendum, provides the Board with the flexibility to review the ARM model's total impact and account for additional needs on a case-by-case basis.**

*Option 3f, Plan B for management*

The AP agreed that the Board should consider the best available scientific information, should the specific data needed for the ARM Framework not be available. **Thus, the AP recommends that a contingency plan for management be included in the addendum, and the Board use its resources to consider which option would be most appropriate.**

Conclusion

In summary, the AP supports the implementation of the scientifically-based ARM Framework and harvest output. The ARM Framework is a tool for the Board to use in its management of horseshoe crabs and incorporates multiple review processes to assess its full impacts. The AP highlights the potential economic impacts without a Delaware Bay Stock Allowance option, which compared to the current estimated population levels, is a minimal adjustment. The economic impacts, using the 2011 fourth-quarter values of conch shellstock ex-vessel value and the amount of bait that would be lost by prohibiting female harvest in Maryland and Virginia, could amount to over \$1 million, not including the loss of the ex-vessel harvest value of the horseshoe crabs or of the processed whelk products. For future work on the ARM Framework, the AP recommends that the Board consider adding additional harvest packages, such as a 600,000-male only harvest, and incorporate reassessment of the allocation options into the double-loop review process. The AP emphasized the importance of continually reviewing and updating the ARM Framework and harvest options through the review process.

1) *Lambda,  $\lambda$*

**The AP recommends lambda values set between the values obtained from the tagging data and values obtained from the genetics data.**

2) *Allocation weights,  $w_i$*

**The AP did not have consensus on which option to weight the harvest. The majority favored using the Addendum VI levels; a minority opinion favored using the reference period landings. There was no support for using the average landings.**

3) *Harvest cap for Maryland and Virginia*

**The AP agrees with the DBETC and recommends a harvest cap based on Addendum VI quota allocations to cap the non-Delaware Bay harvest of Maryland and Virginia. Further, the AP recommends that the Board include review of the harvest cap and its level as a high priority in the normal course of double-loop review process of the ARM model.**

4) *Delaware Bay Stock Allowance (DBSA)*

**The AP recommends that the Board allow a level of Delaware Bay Stock Allowance to maintain current female quotas in Maryland and Virginia.**

5) *Delaware Bay Stock Allowance with 2:1 male:female offset.*

**The majority of the AP recommends that, should female harvest be limited or prohibited, the Board include a 2:1 male:female offset, allowing a larger harvest of males and a more perfect implementation of the ARM harvest. The minority recommends against the offset, noting that flexibility to modify the harvest already exists within the ARM Framework implementation.**

6) *Plan B for management*

**The AP recommends that a contingency plan for management be included in the addendum and the Board use its resources to consider which option would be most appropriate.**