Atlantic States Marine Fisheries Commission

Horseshoe Crab Management Board

May 3, 2023
1:00 – 3:00 p.m.
Hybrid Meeting

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1.	Welcome/Call to Order *(J. Clark)*	1:00 p.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from November 2022	1:00 p.m.
3.	Public Comment	1:05 p.m.
4.	Consider Work Group Report on Biomedical Best Management Practices *(C. Starks)* **Action**	1:15 p.m.
5.	Review Potential Processes and Resources Required for Evaluating Management Objectives for the Delaware Bay Bait Fishery *(C. Starks)* **Possible Action**	2:15 p.m.
6.	Other Business/Adjourn	3:00 p.m.

The meeting will be held at The Westin Crystal City (1800 Richmond Highway, Arlington, VA; 703.486.1111) and via webinar; click here for details.

MEETING OVERVIEW

Horseshoe Crab Management Board Meeting
May 3, 2023
1:00 – 3:00 p.m.
Hybrid Meeting

Chair: John Clark (DE) Assumed Chairmanship: 1/22	Horseshoe Crab Technical Committee Chair: Vacant	
Vice Chair: Justin Davis (CT)	Horseshoe Crab Advisory Panel Chair: Brett Hoffmeister (MA)	Law Enforcement Committee Representative: Nick Couch (DE)
Delaware Bay Ecosystem Technical Committee Chair: Wendy Walsh (FWS)	Adaptive Resource Management Subcommittee Chair: Dr. John Sweka (FWS)	Previous Board Meeting: November 10, 2022
Voting Members: MA, RI, CT, NY, NJ, DE, MD, DC, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS (16 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from November 2022

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

4. Work Group Report on Biomedical Best Management Practices (1:15-2:15 p.m.) Action

Background

- In November 2022, the Board formed a work group to review the best management practices (BMPs) for handling biomedical collections. The work group includes technical committee and advisory panel members with expertise in horseshoe crab biology, ecology, and biomedical processing.
- The work group met multiple times to recommended updates to the BMPs originally developed in 2011 (**Briefing Materials**).
- The work group provided additional recommendations for Board consideration related to the biomedical fishery and industry (**Supplemental Materials**).

Presentations

- Work Group Report on Biomedical Best Management Practices by C. Starks

Board actions for consideration at this meeting

- Approve updated Best Management Practices

5. Review Potential Processes and Resources Required for Evaluating Management Objectives for the Delaware Bay Bait Fishery (2:15-3:00 p.m.) Possible Action

Background

- At its November 2022 meeting, after adopting changes to the Adaptive Resource Management (ARM) Framework, the Board discussed the possibility of forming a work group to evaluate the current goals and objectives for the management of Delaware Bay horseshoe crab.
- Staff has provided a list of potential approaches for evaluating management objectives, and the resources required for each option (**Briefing Materials**).

Presentations

- Potential Processes for Evaluating Management Objectives for the Delaware Bay Bait Fishery by C. Starks

Board actions for consideration at this meeting

- Consider forming a work group to address management objectives for the Delaware Bay bait fishery

6. Other Business/Adjourn

Horseshoe Crab

Activity level: Low

Committee Overlap Score: Low

Committee Task List

- TC – July 1st: Annual compliance reports due
- ARM & DBETC – Fall: Annual ARM model to set Delaware Bay specifications, review red knot and VT trawl survey results

TC Members: Katie Rodrigue (RI), Jeff Brunson (SC), Derek Perry (MA), Deb Pacileo (CT), Catherine Ziegler (NY), Samantha Macquesten (NJ), Jordan Zimmerman (DE), Steve Doctor (MD), Ingrid Braun (PRFC), Adam Kenyon (VA), Jeffrey Dobbs (NC), Eddie Leonard (GA), Claire Crowley (FL), Chris Wright (NMFS), Joanna Burger (Rutgers), Mike Millard (USFWS), Kristen Anstead (ASMFC), Caitlin Starks (ASMFC)

Delaware Bay Ecosystem TC Members: Wendy Walsh (USFWS, Chair), Samantha MacQuesten (NJ), Henrietta Bellman (DE, Vice Chair), Jordan Zimmerman (DE), Steve Doctor (MD), Adam Kenyon (VA), Jim Fraser (VA Tech), Eric Hallerman (VA Tech), Mike Millard (USFWS), Kristen Anstead (ASMFC), Caitlin Starks (ASMFC)

ARM Subcommittee Members: John Sweka (USFWS, Chair), Linda Barry (NJ), Henrietta Bellman (DE), Jason Boucher (DE), Steve Doctor (MD), Wendy Walsh (USFWS), Conor McGowan (USGS/Auburn), David Smith (USGS), Jim Lyons (USGS, ARM Vice Chair), Jim Nichols (USGS), Kristen Anstead (ASMFC), Caitlin Starks (ASMFC)

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

HORSESHOE CRAB MANAGEMENT BOARD

The Ocean Place Resort
Long Branch, New Jersey
Hybrid Meeting

November 10, 2022

These minutes are draft and subject to approval by the Horseshoe Crab Management Board.
The Board will review the minutes during its next meeting.

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INDEX OF MOTIONS

1. **Move to approve Agenda** by Consent (Page 1).

2. **Move to approve Proceedings of August 3, 2022** by Consent (Page 1).

3. **Main Motion**
Move to implement Option B: Implement the ARM revision for setting bait harvest specifications for DE-Bay origin horseshoe crabs and Sub option B1: round down continuous optimal harvest specifications to the nearest 25,000 crabs, with the intent to allow the 2:1 offset for MD and VA if the Board sets female harvest at zero during specification setting (Page 20). Motion by Shanna Madsen; second by Mike Luisi.

Motion to Amend
Move to amend to replace Sub Option B1 with Sub Option B2 (Page 21). Motion by Rick Jacobson; second by Justin Davis. Motion failed (2 in favor, 11 opposed, 2 abstentions) (Page 22).

Main Motion
Move to implement Option B: Implement the ARM revision for setting bait harvest specifications for DE-Bay origin horseshoe crabs and Sub option B1: round down continuous optimal harvest specifications to the nearest 25,000 crabs, with the intent to allow the 2:1 offset for MD and VA if the Board sets female harvest at zero during specification setting. Motion carried (14 in favor, 1 abstention) (Page 22).

4. **Move to approve Addendum VIII as modified today with an implementation date effective today** (Page 22). Motion by Justin Davis; second by Shanna Madsen. Motion approved unanimously (Page 23).

5. **Move to accept the 2023 Adaptive Resource Management harvest specifications with 475,000 males and no female harvest on Delaware Bay-origin crabs. In addition, the 2:1 offset will be added to MD's and VA's allocations due to no female harvest** (Page 23). Motion by Shanna Madsen; second by Mike Luisi. Motion carried with 1 abstention (Page 26).

6. **Move to approve the nominations to the work group to review best management practices for handling biomedical collections** (Page 26). Motion by Emerson Hasbrouck; second by Conor McManus. Motion carried by unanimous consent (Page 26).

7. **Move to approve the FMP Review, state compliance reports, and *de minimis* requests for South Carolina, Georgia, and Florida for the 2021 fishing year** (Page 28). Motion by Mike Luisi; second by Jim Gilmore. Motion carried by unanimous consent (Page 28).

8. **Motion to adjourn** by Consent (Page 29).

ATTENDANCE

Board Members

Dan McKiernan, MA (AA)
Raymond Kane, MA (GA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
Conor McManus, RI, proxy for J. McNamee (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Justin Davis, CT (AA)
Bill Hyatt, CT (GA)
Sen. Craig Miner, CT (LA)
Jim Gilmore, NY (AA)
Emerson Hasbrouck, NY (GA)
Joe Cimino, NJ (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Sen. Gopal (LA)
John Clark, DE (AA)
Roy Miller, DE (GA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Mike Luisi, MD, proxy for L. Fegley AA (Acting)
Robert Brown, MD, proxy for R. Dize (GA)
Dave Sikorski, MD, proxy for Del. Stein (LA)
Shanna Madsen, VA, proxy for J. Green (AA)
Chris Batsavage, NC, proxy for K. Rawls (AA)
Jerry Mannen, NC (GA)
Chris McDonough, SC, proxy for Sen. Cromer (LA)
Doug Haymans, GA (AA)
Spud Woodward, GA (GA)
Erika Burgess, FL, proxy for J. McCawley (AA)
Gary Jennings, FL (GA)
Marty Gary, PRFC
Chris Wright, NMFS
Rick Jacobson, US FWS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Brett Hoffmeister, Advisory Panel Chair

Staff

Robert Beal
Toni Kerns
Madeline Musante
Tina Berger
Kristen Anstead
Tracey Bauer
Emilie Franke
Chris Jacobs
Jeff Kipp
Adam Lee
Heather Power
Caitlin Starks
Geoff White

Guests

Fred Akers, Gr. Egg Harbor
Max Appelman, NMFS
Linda Barry, NJ DEP
Meredith Bartron, US FWS
Alan Bianchi, NC DENR
Nora Blair, Charles River Labs
Sarah Blick, ACCI USA
Jason Boucher, NOAA
Colleen Bouffard, CT DEEP
Jeff Brunson, SC DNR
Jeff Brust, NJ DEP
Nicole Caudell, MD DNR
Zach Cockrum, NWF
Margaret Conroy, DE DFW
James Cooper
Heather Corbett, NJ DEP
Abigail Costigan, Stonybrook
Stephen Cottrell
Deborah Cramer
Jolie Crunelle, RIT
Jessica Daher, NJ DEP
Steve Doctor, MD DNR
Tim Dillingham, Littoral Society
Jeffrey Dobbs, NC DENR
Roman Dudus
Chiara Eisner, NPR
Jacob Espittia, FL FWC
Catherine Fede, NYS DEC
Cynthia Ferrio, NOAA
Brad Floyd, SC DNR
Tony Friedrich, SGA
Matt Gates, CT DEEP
Pat Geer, VMRC
Lewis Gillingham, VMRC
Shirley Goffigon
Jamie Green, VA, (AA)
Zoe Grueskin
Brooke Handley, Gr. Egg Harbor
Harry Hornick, MD DNR

These minutes are draft and subject to approval by the Horseshoe Crab Management Board.
The Board will review the minutes during its next meeting.

Guests (continued)

Margaret Keane
Michael Kendrick, SC DNR
Carrie Kennedy, MD DNR
Adam Kenyon, VMRC
John Kravchak
Rob LaFrance, Quinnipiac Univ
Christina Lecker, Fuji Film
Benjamin Levitan, EarthJustice
Susan Linder, HSC Recovery
Danni Logue
Samantha MacQuesten, NJ DEP
John Maniscalco, NYS DEC
Tobias Matts, ACCI USA
Patrick McGrath, VIMS
Dayna Mercadante, NJ Leg.
Lindsey McNamara, Littoral Soc.
David Meservey, Chatham, MA
Mike Millard
Kyle Miller, FL FWC
Steve Minkkinen, US FWS
Tina Moore, NC DENR
Kelli Mosca, CT DEEP
Brandon Muffley, MAFMC
Kirby Rootes-Murdy, USGS
Brian Neilan, NJ DEP
Josh Newhard, US FWS
Derek Perry, MA DMF
Zoe Read, WHYY
Allen Reneau, Fuji Film)
Samantha Robinson, DE DFW
Jason Rock, NC DENR
Brandi Salmon, NC DMF
Daniel Sasson, SC DNR
Chris Scott, NYS DEC
Anna Schields, DE DFW
McLean Seward, NC DENR
Ethan Simpson, VMRC
Dave Smith, USGS
Somers Smott, VMRC
Brian Sparrow, Fuji Film
Renee St. Amand, CT DEP
David Stormer, DE DFW
Alex Su
Toni Tablante, Littoral Soc
Beth Versak, MD DNR
Wendy Walsh, US FWS
Kristoffer Whitney, RIT
Angel Willey, MD DNR
Faith Zerbe, DE Riverkeeper
Jordan Zimmerman, DE DFW
Erik Zlokovitz, MD DNR

The Horseshoe Crab Management Board of the Atlantic States Marine Fisheries Commission convened in The Monmouth I Room in The Ocean Place Resort via hybrid meeting, in-person and webinar; Thursday, November 10, 2022, and was called to order at 9:00 a.m. by Chair John Clark.

CALL TO ORDER

CHAIR JOHN CLARK: Good morning, everybody, and welcome to the Horseshoe Crab Board. The Board is now in session. I am your Chair, John Clark, I'm the Administrative Commissioner from the first state, Delaware, and I'm joined up here at the front by our Advisory Panel Chair, Brett Hoffmeister, and ASMFCs dynamic duo of Horseshoe Crabs.

The Plan Coordinator, Caitlin Starks, and Assessment Scientist, Kristen Anstead, and between them they'll be able to cover so many of the things that we're going to be talking about today.

APPROVAL OF AGENDA

CHAIR CLARK: Let's move on to Item 2, which is Board Consent. First on the agenda there is going to be a slight rearrangement. It will just make things work better in the flow.

We're going to go to Agenda Item 5, which is to Review the Results of the ARM Model. That way we'll have all the description of what's going on with the ARM, before we consider Addendum VIII. But we will not be taking action on Item 5. The action will be taken in order, so we'll be taking action on Addendum VIII, and then we will be going to Item 5, which is to set the specifications and taking action on that. Just a slight rearrangement.

Having said all that, are there any further revisions to the agenda? Seeing none, the revised agenda is accepted by consent.

APPROVAL OF PROCEEDINGS

CHAIR CLARK: Proceedings from the August 2022 meeting, Are there any revisions or comments about the proceedings? Seeing none; those are also approved by consent.

PUBLIC COMMENT

CHAIR CLARK: We move on to Item Number 3, Public Comment.

Is there any public comment for items not on the agenda? I've been told, no there is not.

ADAPTIVE RESOURCE MANAGEMENT MODEL RESULTS

CHAIR CLARK: I just want to make clear that we are not going to be allowing further comment on Draft Addendum VIII or on the ARM Model. We had plentiful opportunity to comment on the Draft beginning with the August board meeting, and through the many hearings, and during the open comment period.

The number of comments received, as everybody saw, was huge. The Board appreciates the effort, thought and passion shown in those comments, and will fully consider those comments. They will all be getting summarized by Caitlin during the addendum process here. We will be carefully considering those when we make our decisions. I just wanted to make that clear.

CHAIR CLARK: Okay, having said all that now, we move on to our next item, which will then be Item 5, the presentation for Item 5, and I'll turn it over to Kristen for that. Thanks.

REVIEW HORSESHOE CRAB AND RED KNOT ABUNDANCE ESTIMATES AND ARM MODEL RESULTS

DR. KRISTEN ANSTEAD: Thank you, good morning. I'm Kristen Anstead. I'm the Commission's Stock Assessment Scientist on Horseshoe Crab. Today I'll be presenting the Delaware Bay harvest recommendations from the ARM Subcommittee, and the Delaware Bay Ecosystem TC.

Since the implementation of the ARM Framework, the Delaware Bay Ecosystem Technical Committee, the TC, and the Adaptive Resource Management Subcommittee, the ARM, have met annually to

review the data on horseshoe crab and red knots, and make a harvest recommendation to the Board.

As a reminder, both of these committees are made up of Horseshoe Crab biologists, shorebird biologists, state and federal representatives, and stock assessment scientists. Both committees have approximately a 50/50 split of shorebird and horseshoe crab representation, although there has been some turnover in the last couple months, and we will be repopulating those committees.

This year is a little different, because we're currently operating under Addendum VII, which is the old ARM. That is how I'm going to refer to it throughout this presentation is the old ARM as the 2012 ARM. But we're also considering Addendum VIII, which is the revised ARM or the new ARM.

At our annual meeting of the Delaware Bay Ecosystem TC and ARM Subcommittee, we considered both of these methods, and discussed the recommendation for the Board. Also, I'm going to spend a little bit more time on the details today than I normally do, because of the immense public interest in the science and the process around the ARM revision. First, let's talk about the old ARM.

Up here in the italics are the objective statement for the ARM. This was developed through lengthy discussions with the Technical Committees, mangers and stakeholders during the development of the original ARM Framework. To achieve this objective, which is to manage horseshoe crabs in the Delaware Bay Region, to maximize harvest, but also maintain ecosystem integrity, and provide adequate stopover habitat for migrating shorebirds.

To achieve this the ARM Model was developed, where the harvest of female horseshoe crab is decreased or prohibited when the red knots and female horseshoe crab abundances are low, and the male harvest would be decreased or prohibited when horseshoe crab population sex ratio limits the population growth.

The original ARM had a couple population thresholds for both species, which I'll go over in the following slides, and the horseshoe crab population was estimated from the Virginia Tech Trawl Survey, and the red knot population was estimated from mark/resight model using tagging data. There were five harvest packages that could be recommended for the Board's consideration on an annual basis. Here are the original five harvest packages. The need for these five to three packages is due to modeling limitations at the time. We couldn't have continued packages where they were all available options for both sexes up to the maximum allowable harvest by sex. We had Harvest Package 1, which is full moratorium for both sexes for all states in the region. Harvest Package 2 and 3 with low and high, male only harvest for when the populations were below their thresholds, and Package 4 and 5 were low and high harvest packages for both sexes when the threshold was met.

Again, female harvest was always an option in the original ARM and the two of the five possible harvest packages included female harvest. The maximum harvest allowed, so for example of 210,000 for females, was agreed upon by the Committee deliberations during the development of the original ARM.

Let's talk a little bit about the thresholds in the old ARM Framework. The ARM Model recommends female harvest only when the abundance of red knots reaches 81,900 birds, and that was the value related to historic abundance of red knots in the region, and/or when the abundance of female horseshoe crab reaches 80 percent of a carrying capacity.

That was 11.2 million female horseshoe crabs, assuming a carrying capacity of 14 million. Stakeholders at the time of the original ARM Framework agreed that if the female population grew to 80 percent of that carrying capacity, that harvest would not be considered a limiting factor for the red knot population growth.

The carrying capacity was based on a paper by Sweka et al. in 2007. It was an age structured model based on life history parameters, and at the

time it was the best science available. On an annual basis the ARM Model is used to select the harvest packages out of those five packages, to implement for the next year, given the current state of how many horseshoe crabs are in the system, and how many red knots are in the system.

For red knots, the red line is that 81,900 threshold, the population threshold for red knots. The blue line are the mark/resight estimates. Those are the ones we use in the ARM Framework, and you can see their error bars. There is a little bit more error in the last two years, and that is due to sampling around COVID. There were some reduced teams, but the survey was still fully in operation, you can just see a little bit more error.

The green line are the aerial and ground count. We don't use that as an input to the ARM Framework, but the committees annually look at several data streams in their deliberations, and so that is just included on the graph. Red knot abundance estimates from the mark/resight estimates in the spring of 2022 was 39,800 red knots.

The data and the methods around the estimation can be found in the meeting materials. They are provided by Jim Lyons from the USGS. For red knots, the population estimate in 2022 was slightly lower than 2021, as was the amount of time that the birds spent on average in the region. Okay, for horseshoe crab the old ARM used the Virginia Tech Trawl Survey to estimate population abundance.

The top graph is females. You can see the population threshold was 11.2 on that graph, and the bottom graph is males. The survey was not funded for a few years there in the middle, and those years are indicated by the dash line. Index was developed from other surveys in the region to make up data for those years, so you have a continuous time series. You can also see that in the terminal year 2021, that the females have exceeded their population threshold. I just for one minute want to talk about the different stages, and how we use that in ARM Framework.

The Virginia Tech Trawl Survey collects data on three stages, so immature or juveniles. For females that would be about ages 0-8. We have newly mature horseshoe crabs, which are around 9, and those are horseshoe crabs that are newly mature in the fall, and will participate in peak spawning the following spring, and provide eggs for the birds.

Then we have the mature stage, which is 10 plus for females, so everything else. Each year on the annual time step that newly mature becomes mature horseshoe crabs. When we're doing the ARM Framework, we're adding the newly mature and mature together from the fall, because that is what is going to provide a stopover for the birds in the following year.

Because that survey operates in the fall, we take away half a year of natural mortality before we use that population estimate in the ARM Framework. There were 15.5 million females and 44.9 million males in the Virginia Tech Trawl Survey in 2021. We subtracted a half a year of natural mortality, and so going into the ARM Framework for the old ARM this year, there was 13.5 million females and 39.1 million males.

As you probably know, this is the first year that the population estimates in the Virginia Tech Trawl have exceeded the threshold. Since its implementation, the ARM has recommended Harvest Package 3, which is that 500,000 male-only harvest, because both female horseshoe crabs and red knots were below their threshold.

Using the old ARM Framework and agreed upon objectives, thresholds and harvest packages, the harvest recommendation for 2023 would be Harvest Package 5, maximum female harvest, because that threshold was exceeded. Even though the red knots have not reached the population threshold, the female harvest is recommended, because the population is above their threshold, and unlikely to be the limiting factor at that point.

This is an example of the harvest allocation between the states using that Harvest Package 5. Not all the states in the Delaware Bay are felt to be

100 percent Delaware Bay origin, so I won't belabor this slide, but you have your Delaware Bay origin that is coming from the maximum harvest, Harvest Package 5, how it's divvied up between the states, and then Maryland and Virginia's crabs are not 100 percent Delaware Bay origin, so their quotas are slightly adjusted.

Plus, that has more to do with Caitlin's presentation, so we can save some of the questions on allocation for later. Let's talk about the new ARM. Who asked for this? Why was the ARM revised? The ARM Subcommittee was tasked with revising the ARM Framework to incorporate new data. We have ten years of data since the previous ARM was developed, as well as move the model to a different software platform.

The old ARM is run in an obsolete platform and we can't update it anymore, so it had to be moved to a different place, if we wanted to continue to use the ARM Framework. Additionally, this is a routine part of stock assessments, to update a model and data on a 3, 5, 10-year time series, depending on the species life history. It is fairly normal and part of our process to redo stock assessments on this time scale. During the ARM revision the committees added to the previous objective statement so that the same objective statement.

But we have added the additional part in red, to ensure that the abundance of horseshoe crab is not limiting the red knot stopover population or slowing recovery. This was implicit in the original ARM, but we made it explicit in our objective statement as we continue to revise this model. The red knots are estimated the same way in the new ARM, so from the mark/resight estimates.

The horseshoe crab is now estimated from a catch survey model. The Catch Survey Model uses and heavily relies on the Virginia Tech Trawl Survey, as well as two other surveys in the region that provide additional information on abundance at natural mortality, and it accounts for all sources of quantifiable removals, so biomedical mortality of commercial dead discards from other fisheries.

This is considered an improvement over the previous methods, since we are now using a population model instead of a swept area population estimate. Because we can do more modeling now, we have continuous harvest packages, so anywhere between, for example for females 0 and 210,000 females can be selected, depending on their abundance.

Additionally, the males in the female harvest are no longer linked to each other, so each sex of horseshoe crab, the quota can be recommended based fully on their own population. Also, we have incorporated biomedical data, which was a specific task from the Board when we went to do this revision, which should account for that mortality in the model. We have done that.

But the Delaware Bay specific biomedical data is confidential, so we have developed a model, both using coastwide data, no biomedical data, but we make our harvest recommendation based on that confidential run. You'll see ranges here in my following slides. These are the horseshoe crab population estimates coming out of the Catch Survey Model.

The females are on the top and the male horseshoe crabs are on the bottom, and you see the two runs here. One with the coastwide biomedical and one with no biomedical data. The Delaware Bay specific is confidential, but the harvest recommendations are made on that run. What I'm showing you is the upper and lower bounds of what that population is, based on that confidential data.

You can see they overlap for the most part, because the biomedical, the coastwide harvest as well as no harvest is on a much smaller scale than the millions of the population estimates. Between the two runs, females are between 6 and 6.1 million mature crabs in 2021, and the males are between 15.9 and 16 million. That real value using the confidential data is somewhere between there.

Why is this so different from Virginia Tech Trawl? As I'm sure you recall, the Virginia Tech Trawl we had our highest value in the entire time series in

2021. Well, they are different for a couple of reasons. I'll go through those. But what I'm showing here on the top graph is the newly mature and the mature females on the bottom, this is just females. We're going to talk about females for a minute, and I split them out by sex. First of all, the two methods are just different.

The Virginia Tech Trawl, the total abundance that they are coming up with their estimate annually is from extrapolating that mean catch per tow to the entire Delaware Bay Region, versus the Catch Survey Model, which is a population model. They're different methods. Additionally, Virginia Tech Trawl is conducted in the fall, so the Catch Survey Model lags that forward to match the timing of the other surveys and the removals.

The 2020 Virginia Tech datapoint is being used to inform the 2021. The Catch Survey Model is about a year behind the Virginia Tech Trawl. That very high datapoint actually isn't even in the Catch Survey Model yet. The terminal year of 2021 is using the 2020 Virginia Tech Trawl data. Thirdly, the Catch Survey Population Estimate is highly influenced by that stage abundance data that I talked about in the Virginia Tech Trawl.

The model is having a hard time reconciling those low values that started in 2019 of the newly mature, which is the top graph. You can see a dramatic drop in 2019, with the very high values of the mature. That is a one-year timestep, so where are those crabs coming from? That is one reason the model is estimating that population to be lower.

It's sitting so closely to the newly mature it can't make sense out of the very high values of where those crabs are coming from. It's probably underestimating the population. The committees have discussed this. We talked about this at our meeting. What is going on with this newly mature stage? We have three hypotheses about what could be happening.

One, maybe we have a catchability issue that for some reason newly mature, mature are not happening in the same place as they used to. We have assumed thus far that we're catching them at the same rate during the same time and space. Maybe something has changed and the newly mature is hanging out somewhere else during the time of the survey.

Also, could there be a recruitment failure. That is another possibility. If in 2019, when they suddenly disappeared, that would mean in 2010, so nine years previous, there was a recruitment failure. I think that is probably an appealing hypothesis for some, because that was time of higher harvest before the ARM was implemented.

That is still kind of hard to reconcile with these really high mature values. They still have to come from somewhere. How do we believe these really high values, which are really low, which is the stage before? It's still hard to make that make sense, but it's still a possibility. Thirdly, it could be an identification issue.

There is a lot of nuances in staging the crabs. While the survey had trained technicians onboard, you know there are staffing changes. Could there suddenly be an issue identifying these, and they are being misclassified, either as mature and contributing to those large numbers, but they're actually newly mature, or maybe they're being classified as juveniles. We haven't decided which we think is the best explanation yet for what is happening for these newly mature. It does matter, because you can see its influence on the Catch Survey Model. We have a couple lines of evidence we can look at going forward. NEAMAP stages the crabs. We can look to them. They don't catch them at as high a rate as Virginia Tech, so it would be informative, but probably not a data input into the model. But we can look at it.

What is the ratio of newly mature to mature? Are they also finding that these crabs are disappearing, or is there just something happening in the Virginia Tech Trawl specifically? Delaware Adult Trawl has also started staging crabs. I have about four, five years of data from that. That is another place we can look.

We have ways going forward to try to figure this out, and try to resolve this in the model. Just as a reminder, using the new ARM this is how many red knots we have going in this year, how many female horseshoe crabs and how many males. These are the harvest policy functions for the revised ARM.

First, we have the males in blue. This is showing the optimal harvest for 10,000 simulation runs. On the X axis for the males, you have a male abundance, and then you can see that curved line that goes from 0 harvest up to the 500,000, and it asymptotes there at the top. If you follow the 15,000, which is approximately how many males we had in 2021. You can see that it's pretty much intersecting with about 500,000.

You would expect most likely your male harvest recommendation is going to be around that 500,000, maximum, maybe slightly lower, if you haven't quite reached the total flattening out point. For females it's a little different. We have our light yellow, which is zero recommended female harvest, up to the 210, maximum in the dark red. That gradient moves across the graph. You can see that harvest gradually ramps up.

On the X axis you have the red knot population, and on the Y, you have the female horseshoe crab population. The blob in the middle is where most of our simulated runs end up. You can see there aren't a lot of cases in our simulations where we end up at maximum harvest, or at 0 harvest, because the female population has been so high for a few years that we're not seeing female populations in our entire time series in around like 2 million or anything like that.

Most of the runs end up in this blob. If you follow our birds in 2021, which was about 42,000 to the million females. You can anticipate that the harvest is probably going to be somewhere around that 100,000 range. Why is this different from how female harvest is handled in the old ARM? Specifically, the 11.2 million, where you saw before it was no harvest, and now in the revised ARM there is a little bit of female harvest.

This was a criticism from the original Peer Review, as well as structure decision making experts, that the threshold was not properly handled in the old ARM Framework. For one, there was concern among the Peer Review, as well as the ARM Committee that the recommendations would go from Harvest Package 3, a female moratorium, to maximum female harvest, if that threshold was exceeded, and that is exactly what we saw this year. We were concerned about that, because basically the ARM was functioning like a Harvest Control Rule. Below this level no harvest, above this level maximum harvest. That's because from a modeling perspective 210,000 horseshoe crabs is not a significant number, compared to 11.2 million. It's almost always going to go to maximum harvest once you exceed the threshold, and that was concerning. Additionally, the modeling perspective that threshold was considered too prescriptive.

You're telling the model the answer already. You don't need to do adaptive management, or have a complicated model. Say zero females below this level, 210 above this level. You don't need all that to do that, so it's too prescriptive to have that constraint in the model that says you can only harvest females above or below this.

The way that we handled it from a modeling perspective was to gradually give females as the population increases. As you saw in this graph, there is a gradient, so a little bit of females at a lower population level and you slowly ramp up. But there is almost no scenario where we now hit that 210. You would have to have about 30 million females to get up to that, versus 11.2 that we see in the old ARM Framework.

That was considered to be more in line with structured decision making, and that was advice we got from structured decision-making modelers that are not specific to this field. It was just that that was not the proper way to handle it in the old ARM. Okay, so the harvest recommendation coming out of the new ARM.

There were two options and a designate, B1 and B2, and they were both rounding conventions to

protect the biomedical data. If you use B1 you would have 475,000 male-harvest recommended for 2023, and 125,000 females. If the males were recommended from the new ARM to be 500,000, we don't round down.

You know by looking at this that the male population using confidential data is somewhere between 476 and 499. If it hits that 500,000, we don't round down. If you round down to the nearest 50,000, you can see that the optimal harvest is there. It is likely that this rounding in the final harvest recommendation overwhelms the effect of additional uncertainty incorporated in the horseshoe crab model.

When we got that 6 million estimate coming out of the Catch Survey Model when compared to the 15.5 million coming out of Virginia Tech. We were less concerned about it, one because it will be more conservative. Our estimate is likely an underestimate, and will result in lower harvest. But also, because that blob that you saw on that colorful graph, most of the harvest falls around a similar level from many levels of female horseshoe crabs.

You are not moving the needle as much. If we put in 15.5 million, that harvest recommendation still will not jump to 210, it's going to be lower than it was in the old model. The difference between 6 million and 15.5 million, while it sounds like a lot, the way that we have gradually tuned that harvest makes it a less dramatic harvest recommendation.

Finally, my last slide, is after the ARM Committee has reviewed all of that, and talked about what's going on between the two models, as well as the newly mature horseshoe crab. We had consensus among the committees that the harvest recommendations from the new ARM were preferred over the old ARM for those reasons. I'll do my best to answer any questions.

CHAIR CLARK: Thank you, Kristen, for that brilliant and thorough summary of the two different models. That really is great for informing discussion about the Addendum. But before we do that, that is a lot to digest there. Does anybody have questions? I see Bill Hyatt.

MR. WILLIAM HYATT: This is a question for Kristen. Earlier in your presentation you mentioned 11.2 million crabs as not only where you are trying to get, but you mentioned it as a level that is not limiting. That was determined to be not limiting for the red knot performance. You also talked throughout your presentation on the estimates from the Virginia Tech Trawl, the Catch Survey Method, how they differed.

How the Catch Survey Method was an improvement, and that the numbers of female estimate are around 6 million now, based upon the 2021 analysis. Is it safe to say that regards to number of females, we're in the ballpark of halfway to the number that need to be out there, in order to be nonlimiting to the red knot? Is that sort of a safe way to look at the gestalt of all this?

DR. ANSTEAD: We no longer have that 11.2 threshold. My short answer is no, actually. That 11.2 threshold was based on that Sweka paper from 2007. It was the best, but it borrowed information from New Hampshire for some of the life history parameters from the literature.

We have data in the region now, so we no longer have a threshold in our revised ARM. But we have a projected equilibrium point of the model, and it is lower than the 11.2. But 11.2 isn't in the model anymore, so we're not comparing that 6 million against anything. Does that answer your question?

MR. HYATT: Not entirely. The 11.2 million, I was looking at it not so much as a threshold, but as something that had been sort of determined through the process as, here is the number to achieve, in order to not be limiting to the red knot population. I guess my follow up question would be, what number would you describe of female horseshoe crabs would be not limiting? If that number hasn't been determined yet, I wonder if there is an effort underway to determine that number, or if it's practical to actually determine that number.

DR. ANSTEAD: It's a great question, and it has come up. We have our projection now that goes out to kind of an equilibrium point. It was lower. I believe it was closer to an 8 million, but we're not measuring necessarily against that anymore. The 11.2 wasn't a magical number, it was just the best number we had at the time. We have not updated that analysis to have a revised carrying capacity.

CHAIR CLARK: Does that answer it for you, Bill?

MR. HYATT: Yes, it answers the question, although conceptually I think that given whatever you're dealing with, trying to recover threatened or endangered species, the objective one way or another is to try to get to a point where you are no longer limiting. That is just a conceptual approach to that aspect of conservation biology that, you know I feel probably should be part of this process.

CHAIR CLARK: Next question is from Mike Luisi.

MR. MICHAEL LUISI: This may come later with Caitlin's presentation, but I'm just wondering. The ARM recommendation is from both male and female harvest. But if states that prosecute this fishery choose to not, they don't want to harvest females. What options do we have from there?

This may be coming later, so maybe I could hold back, I can ask the question again after Caitlin's presentation. But I'm just wondering what options we have, if our industry, they don't want to prosecute the female crab. I'll leave it there and see what you think is best, Mr. Chairman.

CHAIR CLARK: Okay thanks, Mike. That will definitely be coming up, but Kristen does have some response to that.

DR. ANSTEAD: I just want to say, from a modeling perspective. You all don't harvest females. That doesn't matter to us as an ARM Committee. This is the optimal harvest of what you could harvest up to these limits to feel confident that you're not impacting the red knot population. If you don't harvest it, anywhere from 0 to that is within the bounds of the science, the best science we have available.

CHAIR CLARK: I see Rick Jacobson.

MR. RICK JACOBSON: I don't want to go too far down a rabbit hole, but having read Addendum VIII several times, and trying to understand one of the caveats within it. I saw that there is an exception for Maryland and Virginia, and that exception is there is, there is an action by the Board when there could be a harvest of female horseshoe crabs, to not allow the harvest of female horseshoe crabs.

There is a two-to-one offset for Maryland and Virginia, where they may take two male horseshoe crabs for each female horseshoe crab they would have been allowed as a quota. What was unclear from that, but what I think I understood, was that the quotas assigned to Virginia and Maryland included harvest of female horseshoe crabs, both in the Bay and outside of the Bay, and that the additional compensatory male harvest would be attributed to the quota outside of the Bay, not inside the Bay. Is that correct, or am I misinterpreting?

MS. CAITLIN STARKS: I believe there was no spatial restriction on where that additional male quota could come from. But this is definitely more related to the Addendum VIII conversation, I think.

CHAIR CLARK: Thanks, do we have any other questions? I see Shanna.

MS. SHANNA MADSEN: Thank you, Dr. Anstead, for your presentation. I had a question regarding the Catch Survey Model. I think you noted that it might be underestimating the populations, since we're not really capturing those newly matured crabs, and the model is kind of struggling with the fact that we are capturing a high number of mature crabs.

Is there any scenario, and you kind of went through the different scenarios of why that might be happening, catchability, et. cetera. Is there any scenario where the committee might believe that we're overestimating the population with the

Capture/Remodel, or are we really just underestimating right now?

DR. ANSTEAD: In the graph where I plotted the two, you can see that sometimes the Catch Survey Model estimates more than the Virginia Tech Trawl Survey, and sometimes it does less. That's because it's taking more things into consideration. If we have a high primiparous, it will show up in a higher newly mature and mature the next year. It's not going to always match the Virginia Tech Trawl.

That is one reason why we think the method is better, is because it's using the Virginia Tech Trawl, specifically for scaling. But these additional bursts of data are helping to better inform an estimate. I suspect that we're underestimating it in the last couple years, because of this issue with the newly mature. But it's the best data we have, so maybe it's nailing it. I suspect that it's underestimating it, because we have a catchability issue or maybe a misidentification issue. But let's not rule out the third, and look at more data to find out.

CHAIR ANSTEAD: Thank you, Kristen. Does that answer your question, Shanna?

MS. MADSEN: It does, thank you.

CHAIR CLARK: Okay, are there any further questions? I see Joe Cimino, and then Jim Gilmore.

MR. JOE CIMINO: No, just a comment. It made me think about what was presented, and thank you, Kristen for that. Just we went through our Climate Scenario Planning Workshop, and this is one of the big concerns right, is like if things are changing, then we need to be ready for that for our surveys.

You know I hope that this group is looking ahead, and thinking of what this might mean. You know, is the timing changing and are we missing things? How do we move forward there? It's going to be an important question for all of our surveys. The Virginia Tech Trawl Survey in particular has always been a priority of ASMFC and New Jersey DEP, and we will continue to be, so thank you.

CHAIR CLARK: Thanks, Joe. Jim.

MR. JAMES J. GILMORE: Yes, and just to comment also, just following what Joe said. After going through the material, I had several questions, Kristen. But your presentation was outstanding, and you answered every one of them. Good job, thank you.

CONSIDER ADDENDUM VIII ON IMPLEMENTATION OF RECOMMENDED CHANGES FROM 2021 ARM REVISION AND PEER REVIEW REPORT FOR FINAL APPROVAL

CHAIR CLARK: Indeed, that was a wonderful summary there, Kristen. Okay, if we don't have any further questions for Kristen. Now we move back to Agenda Item 4, which is to Consider Draft Addendum VIII for Approval. For that I'll kick it over to Caitlin to bring us up to speed.

MS. STARKS: Thank you, Mr. Chair. I'll be going through the Addendum VIII Options, Public Comments and Advisory Panel input on the Addendum. I'll start off with some background leading up to this meeting, the timeline for the action's development. Proposed management options, and then again cover public comments and AP report will be given by Brett Hoffmeister, our AP Chair, and then I'll wrap up with Actions for Board to Consider today and Next Steps.

To provide some context for today's discussion. Again, our current management program for horseshoe crab bait harvest of Delaware Bay origin was established by Addendum VII to the horseshoe crab FMP in 2012. Addendum VII implemented the use of the Adaptive Resource Management or ARM Framework, for recommending the bait harvest quotas for the Delaware Bay Region space, based on abundance of both horseshoe crabs and red knots.

As we've discussed, ARM underwent a revision, which was endorsed by the Peer Review Panel, and in January of this year the Board accepted the ARM revision and Peer Review for management use. At that same meeting the Board also initiated this

Addendum, Draft Addendum VIII, which considers using that revised ARM in setting the annual specifications for horseshoe crab of Delaware Bay origin, and that is what we're discussing today.

PUBLIC COMMENT SUMMARY

MS. STARKS: After the January meeting, the PDT has worked on this Addendum document. The Board approved it for public comment in August. Then we held state public hearings and received written comments in August and September. That leads us to today to have the Board consider final approval of the draft Addendum. Now, I'll just review the proposed options. Draft Addendum VIII includes two main management options.

Option A is no action, and Option B would be to use the revised ARM for management to set the bait harvest specifications for the Delaware Bay. Option A is no action, because true status quo will not be possible in future years, and this is because the software that was used to run and update the original ARM model is obsolete.

Since that model can no longer be updated, that means we cannot continue doing adaptive resource management with it, as it was established in Addendum VII. As a result, the no action option would result in the management program reverting back to the provisions of Addendum VI, and I'll go over those shortly. Alternatively, Option B would adopt the changes that were recommended in the 2021 ARM Revision and Peer Review.

This means that the updated data and model would be used to produce annual harvest recommendations for the Delaware Bay origin horseshoe crab. The general structure of how the ARM optimal harvest recommendation is allocated among the four Delaware Bay states would effectually remain the same. I'll also go into detail on that shortly. Under Option A, if no action is taken, management would revert back to the provisions of Addendum VI, and that means the quotas for the four states of New Jersey through Virginia would go back to those shown on the table. Additionally, beyond the quotas, these are the other provisions of Addendum VI that would go back into effect if no action is taken. First, the directed harvest and landing of all horseshoe crabs in New Jersey and Delaware would be prohibited from January 1st through June 7th, and harvest of female horseshoe crabs in New Jersey and Delaware would be prohibited year-round.

Additionally, from January 1st through June 7th, directed harvest and landing of horseshoe crabs in Maryland, and landing of horseshoe crabs in Virginia from federal waters would also be prohibited. No more than 40% of Virginia's annual quota would be allowed to be harvested east of the COLREGS line, and horseshoe crabs that are harvested east of the COLREGS line and landed in Virginia, must be comprised of a minimum male to female ratio of two-to-one.

To highlight the important points here. Under Option A, New Jersey and Delaware would not be allowed any female harvest. But this action would not affect New Jersey's voluntary moratorium on all horseshoe crab harvest. For Maryland, the quota of 170,653 crabs is not restrictive by sex, and there are no spatial restrictions on where that quota can come from.

In the Addendum VI provisions however, all harvest would be prohibited from January 1st through June 7th. Then for Virginia, again only 40 percent of that total quota can come from east of the COLREGS Line, and there is no harvest from federal waters allowed from January 1st through June 7th.

Action B in the Addendum would again, adopt the changes to the ARM recommended in the 2021 Revision and Peer Review, and going forward we would use that revised ARM to annually recommend and set the specifications for bait harvest of Delaware Bay origin horseshoe crab. Option B addresses each of these aspects that were established in Addendum VII, related to how the harvest specifications are set or recommended, which include the harvest recommendations that come out of the ARM, the adaptive management cycle.

The percent of each state's harvest that is considered to be of Delaware Bay origin. The state allocation of the overall Delaware Bay quota, and then fallback options for setting specifications. I'm going to walk through each of these one by one, and review what's in the Addendum. For the annual harvest recommendations, Addendum VIII proposes that the revised ARM Framework would be used to annually recommend optimal harvest levels for males and females.

The maximum number of males and females that can be recommended by the ARM would not change, and they remain at 500,000 males and 210.000 females. However, where the original ARM recommended one of those five harvest packages, the revised ARM recommends sex-specific harvest levels on a continuous scale.

There are two sub-options here which would result in the optimal harvest output for each sex being rounded down to either the nearest 25,000 or 50,000 horseshoe crabs. Again, rounding that harvest recommendation to some degree is necessary to protect confidential data that are input into the model. Rounding the output from the ARM would prevent anyone from being able to back calculate those confidential data. Sub-Option B1 would round down to the nearest 25,000 crab, and would generally result in a harvest recommendation that is closer to what the optimal harvest is that comes out of the ARM, before rounding for confidentiality. Then Option B2 would round down to the nearest 50,000. That would result in a more conservative harvest recommendation. One clarification is that if the ARM were to recommend the maximum amount of either males or females, rounding would not be necessary to protect those confidential data, because it's already being limited by that maximum.

This is an example of the harvest recommendations produced by the revised ARM for 2019 through 2021. These are relevant to the future years, but I just want to show you what they look like. The table shows that female and male horseshoe crab population estimates, the red knot stopover population estimate, and then the resulting harvest recommendation for each of those years if we use the revised ARM.

As a note, these are using coastwide biomedical mortality data, rather than Delaware Bay specific confidential data. These are not confidential numbers, but they are likely a slight overestimate of what we would get if we used confidential biomedical from Delaware Bay specific.

In each of these years the revised ARM would have recommended the maximum, or just short of the maximum amount of male harvest, and a varying amount of female harvest, ranking from around 150,000 to 127,000 pounds. On this next slide is an example of how rounding those options, so rounding options in the addendum would be applied to the recommended harvest that comes out of the ARM using the 2020 number as an example.

In the uppermost table is the 2020 ARM recommendation for optimal male and female harvest, and then the next table shows the harvest that Sub-Option B1 would result in, so 125,000 females and 500,000 males. In the last table the female harvest would be rounded down to 100,000 crabs rather than 125,000.

I'll just throw these out shortly, these are for comparison the harvest packages that were used in Addendum VII. The second item under Option B in Addendum VIII is the management process for the ARM Framework. Option B would establish the three-level process, which includes an annual management process, an interim update process and a revision process.

The annual management process is essentially exactly the same as what we're currently doing under Addendum VII, and that is that annually the ARM Framework would be used to produce a harvest recommendation for the upcoming fishing year. The interim update process would be that every three years the model parameters, including things like the red knot survival and recruitment rates and horseshoe crab population parameters

would be updated based on the most recent years of data from the Delaware Bay Region.

Then the third level would be a more intensive revision process occurring every 9-10 years, in which the ARM Framework would undergo a revision similar to what we did in 2021. This timeline was chosen because it allows for two interim updates to occur, and it also encompasses an entire generation for horseshoe crabs. The third issue under Option B is the proportion of harvest in each state that is of Delaware Bay origin, and this value is called Lambda. Option B would update these Lambda values for each of the states, based on the most recent genetic data, which was recommended in the ARM Revision and Peer Review. This would result in decrease a set of proportions of Maryland and Virginia's harvest that is assumed to be of Delaware Bay origin, whereas Delaware, New Jersey remain unchanged. I'll go over the details here, but these Lambda values do affect the state-by-state allocations of the overall Delaware Bay quota.

For comparison here, the current Lambda values used in the original ARM and Addendum VII on the left, compared to the proposed updated Lambda values on the right. The fourth issue under Option B is the methodology for calculating the state allocations of the total Delaware Bay harvest. In Option B the allocation methodology from Addendum VII is basically the same, with the exception of those updated Lambda values.

Changing those Lambda values does result in new allocation weights for each state, specifically the new state allocations of the Delaware Bay harvest limit would be those shown in the table on the top right, compared to the allocations in Addendum VII, the new allocations for New Jersey and Delaware slightly increase, and the allocations for Maryland and Virginia slightly decrease.

I'll show a comparison of those in a second. I do want to note here that with all of these numbers we're only talking about Virginia's quota for crabs harvested east of the COLREGS Line, and that's what is considered to include Delaware Bay origin crabs. The other two aspects of state allocations that were in Addendum VII and carried forward in Addendum VIII under Option B are the Harvest Cap Provision and the two to one male/female offset provision.

These are remaining status quo from Addendum VII. The Harvest Cap for Maryland and Virginia limits the total level of allowed harvest by those two states, in order to provide protection to crabs that are not of Delaware Bay origin. The caps are shown in the bottom table, and those were based on the Addendum VI quota levels for Maryland and Virginia.

These caps do not apply when the ARM Framework recommends zero female harvest of horseshoe crabs. As a result, these caps have never been applied to Virginia and Maryland to date. The two-to-one offset is only relevant when the ARM recommends zero female horseshoe crab harvest.

When the recommended harvest is zero, then this provision allowed a two-to-one offset of males to females for Maryland and Virginia male harvest allocation to increase, making up for those females that were not allowed. These are the current state allocations resulting from the old Lambda values, and then on the right the new Lambda values and the resulting state allocations.

On this slide I am going to walk through an example of how the total Delaware Bay quota is allocated if the harvest quota recommendation, after it's rounded down, gets split up amongst the states. In this example, I'm showing a breakdown among the four states if we're using 500,000 males and 100,000 females.

Once again, this is just the Delaware Bay portion of these state quotas. Then on this slide you can see both the Delaware Bay origin quotas on the left in the blue, and the total of quotas that include the non-Delaware Bay origin crabs on the right in the orange, for each state using the revised allocation. Delaware and New Jersey are the same on both sides, blue and orange, because 100 percent of their harvest is considered to be of Delaware Bay

origin, whereas Maryland and Virginia's overall quotas, which are shown in the red plots are greater than their Delaware Bay only quotas, and that's counting for those additional crabs and their harvest that are not of Delaware Bay origin.

In this example, the harvest caps for Maryland and Virginia are being applied, because there is female harvest recommended from the ARM. Because of that, the total quota for Maryland is 170,653 crabs, and the total for Virginia east of the COLREGS Line is 60,998. These are equal to the quotas again that were in Addendum VI for Virginia and Maryland.

The last item under Option B is the fallback option for how harvest specifications would be set if the ARM cannot provide a harvest recommendation in a given year. This is basically the same as what's in Addendum VII, which is that if in a given year the model and ARM there is not enough data, or some other issue that causes it to not be able to produce a harvest recommendation.

The next year's harvest could be set either based on the Addendum VI quotas, and management measures for the four Delaware Bay states, or based on the previous year's ARM Framework harvest level and allocation to the four states. Beyond that language the Addendum VIII does update this section to reflect new datasets that are required for running the revised ARM Model.

Now I'm going to transition into the summary of public comments that we received on Draft Addendum VIII. The public comment period started in mid-August and ended on September 30th, 2022. During that period, we had four public hearings that we held, one in person and three on webinars. Across those four hearings there were 59 public attendees, and in total during the comment period we received 34,613 written public comments.

Of those 34,000 comments, these included 24 letters from organizations, 245 comments from individual industry stakeholders and members of the public, as well as 8 form letters that were submitted by a total of 33,932 individuals. For our purposes, 3 or more comments that have the same language or state support for a single organization's comments are considered a form letter.

However, if a comment includes additional comments or rationale related to a potential management action beyond what is in the original letter, then it is considered to be an individual comment. That is just how we count those. During the four public hearings we had 18 comments that were provided in person. I want to spend a moment here explaining how these comments were categorized, because there is some nuance to this. Many of the comments we got did not say explicitly which management option they supported.

In some cases, there was a need to interpret some comments. For example, comments that made statements to the effect of, I strongly oppose the use of the 2021 ARM for setting horseshoe crab harvest regulations, or ASMFC should reject or abandon Addendum VIII, or I oppose the proposal to increase the harvest of horseshoe crab or oppose Addendum VIII.

These comments were interpreted as being in support of Option A, because the opposition to the revised ARM Framework was made clear. Support of Option B was usually stated fairly clearly in the comments, but in some cases, interpretation had to be made. For example, in comments that stated their support for the revised ARM Framework, but also stated they did not want to see any female harvest allowed, we put that under support for Option B, given the caveat that the Board could still restrict female harvest through specifications if the ARM is adopted.

Lastly, we had to mark some comments as not stating sport for a particular option at all. This was done when a comment advocated for something that was outside the scope of possibilities in the draft addendum option. For example, if a comment said something to the effect of wanting the Board to retain the current ARM Framework, or comments that advocated for a complete horseshoe crab moratorium, for example.

That was categorized as no option selected. This is a breakdown of the comments, and which options were preferred. As you can see in the table here, support for Option A was expressed in the majority of the comments, both were in and delivered at hearings. Three comments, one written and two at hearings, were in support of Option B to adopt the ARM revision for setting specifications.

Of those two comments included a preferred sub-option. One favored each of those sub-options, B1 and B2. Then there was a chunk of comments that could not be classified as being clearly in support of either option. Within the comments that supported Option A, the most common reason that they supported it was that they opposed any female horseshoe crab harvesting allowed for the Delaware Bay.

A few of the comments that supported Option A did acknowledge the fact that Option A would allow for female harvest for Maryland and Virginia, but the large majority of them did not. The other comments did not agree with the fact that the ARM revision does not have the same population threshold for horseshoe crab and red knots that were in the original ARM Framework, which had to be exceeded to allow female harvest.

Many comments expressed their concern about the red knot population and recovery as their reason for supporting Option A, and some also expressed concern about the horseshoe crab population, and concern that allowing female horseshoe crab harvest could have cascading impacts on the ecosystem.

There were also a number of comments that criticized the revised ARM for various reasons, including statements that the model's relationship in the ARM between horseshoe crabs and red knots was weak. That the horseshoe crab population model does not properly account for uncertainty. Some comments took issues with the data that were used in the ARM revision, stating that the ARM did not use the egg density data in the models, and some disagreeing with the equal weighting of the three horseshoe crab surveys that go into the population model.

Other comments stated that they did not feel there was sufficient stakeholder input in the revision process, and many comments were critical of the fact that the models were not available for the public to review during the comment period. Comments from organizations in support of Option B generally expressed a desire from individuals and organizations to use science-based management, and some supported the new ARM Framework's ability to make updates and improvements to the modeling approach in the data. One of the organization comment letters did state support for the ARM as the best management approach, but they did caveat their support with a request to not allow female harvest for a period of ten years, in order to allow another generation of horseshoe crabs to mature, and to allow the population to stabilize at the projected equilibrium in the ARM Model.

There was also support for prioritizing the research that was recommended in the ARM Framework Revision and Peer Review, including additional data collection to support the inclusion of egg density information in the model, and research to better understand the effects of climate change on spawning and breeding habitat for horseshoe crabs and red knots.

As I mentioned earlier, some of the comments submitted did not support either of the proposed management options. Instead, some asked for a complete moratorium on female harvest, or in some comments a full moratorium on all horseshoe crab harvest. There were some comments that expressed concerns with the sublethal impacts of mortality associated with biomedical collections.

Some others said that the eel and whelk fisheries, which use horseshoe crab as bait are not in good condition, and those fisheries should be limited. A number of comments expressed a desire for more holistic ecosystem-based management approach for the Delaware Bay resources.

ADVISORY PANEL REPORT

MS. STARKS: Now I'm going to hand the microphone over to Brett Hoffmeister, our AP Chair for the AP report.

MR. BRETT HOFFMEISTER: Thank you, Caitlin. The AP met virtually on October 13. Seven advisors attended the meeting. The ASMFC staff provided a summary of Addendum VIII, and of course the option to revert to Addendum VI. A summary of metrics concerning the public comments was also reviewed, and we had general discussion, basically agreeing that management should adapt to use the best available science.

The horseshoe crab populations have improved under ARM management. The data that was presented is out of Virginia Tech. That said, the AP also wants to acknowledge the public comment in opposition of Addendum VIII. I think the general comments and general feeling from the AP was that the ARM process is obviously much more complex than it's often described, and that the oversimplification in some of these form letters may not be an accurate description of the model, or the good work that has been done.

But clearly, the spirit of public comment reflects a desire to protect female horseshoe crabs for the benefit of the crabs and ecosystem and the red knot. We wanted to point out that the ARM, the original ARM and the revised ARM have that purpose in mind. This is consistent with that desire.

Reverting back to Addendum VI would decrease bait quotas in some areas, and allow female harvest in others. Also reverting back to Addendum VI, set quotas based on historical landings independent of other data, and exclusive of the most recent data. Reducing the bait harvest in the Delaware Bay area could mean additional pressure in the northeast, so there were some comments regarding the balloon effect, something that we have seen in Massachusetts on a small scale, and even in a larger scale, as females from Massachusetts find their way south. There was a genuine concern there. Just a reminder to the AP that the states do have the ability to implement stricter controls, if they desire to do so. The AP was amenable to a modest harvest of females supported by the data, but also not averse to the Board conservatively limiting female harvest. We are sensitive to the public comment, but I think we really want to see science drive the decision making here.

The AP recognizes the importance of horseshoe crabs in the ecosystem, the economy and the fishing community. There are multiple stakeholders here. That said, the AP members present unanimously supported Addendum VIII, Option B with no sub-option as a preference. This being the best science-based management option available.

There was a little bit of discussion after the meeting had broken, maybe days later, and a couple of points that needed to be made by the AP, or wanted to be made by the Ap that coastal development is really a major factor affecting beach habitat for both red knots and the horseshoe crabs. There was comment that perhaps the Virginia Tech Survey should run tows earlier in the year, to capture some of the large number of juveniles that, as some of the fishing leaders are seeing, they may not be reflected in the assessments.

I wanted to point out that there is a lot of additional key aspects of red knot decline, as a disturbance of birds and habitat from relentless coastal development. These things must be kept in mind when discussing horseshoe crab harvest impacts, and supporting the management recommendations. There are a lot of things at play here. That's all.

CHAIR CLARK: Thank you, Brett, thank you, Caitlin, for those excellent summaries of public comment, and the explanation of the Addendum. Caitlin, you have a couple more slides, right?

MS. STARKS: Just one, Mr. Chair. This slide is just to set the Board up for their discussion today. First the Board will need to select a management program from the proposed options, and finally consider approval of Draft Addendum VIII to the

horseshoe crab FMP. With that I can take any questions.

CHAIR CLARK: As Caitlin did such an excellent summary of the public comment. There has been a heck of a lot of public comment, and there is a lot of questions raised. Before we get into discussion of the Addendum let's take some questions. Bill Hyatt.

MR. HYATT: This is a follow up a little bit to the question that Rick asked earlier. I'm still struggling with understanding fully the two to one tradeoff that is in the Addendum. I'm going to ask kind of a hypothetical, and maybe that will help me understand. As I understand it, if the ARM Model calls for female harvest, there is a two-to-one tradeoff that comes into play. My question is, if the ARM calls for female harvest, but the Board then decides on a male only quota. Does that two-to-one come into play at all? I hope I've asked that clearly.

CHAIR CLARK: Okay, Bill. Toni will address that.

MS. TONI KERNS: Thank you, Mr. Chair, I was hoping this would not come up. Caitlin and I did a little homework, and went back and looked at the minutes from all of the board meetings leading up to the approval of the ARM, when the two-to-one offset was originally discussed, because as you saw in Caitlin's presentation earlier, it does say that two to-one-offset is for when the ARM sets the female harvest at zero. That is pretty specific language. When you go back and read the minutes, it was very clear that that offset was to provide to make up for the lack of those larger females, and to give additional males to make up for it. It did not talk about the ARM setting at zero. It was just about providing that offset there.

To us, the intention was there to allow for that, but the language in the document is very specific to the ARM. It would be the Board's decision of whether or not you think the intention was there, or do you want to stick with the language that is in the Addendum? We will leave it to you all.

CHAIR CLARK: Thank you, Toni, Bill, did you have a follow up?

MR. HYATT: Yes, just a follow up. The cleanest way would be to accommodate for that within the actual, if we were to set a male-only quota could be to just incorporate that into the decision over what number to pick.

CHAIR CLARK: You got the answer you needed, Toni, to respond?

MS. KERNS: Just needed to check one thing before I responded. Yes, you could just add additional male quota to the harvest allowance that you're giving.

MR. HYATT: Thank you, that definitely helps.

CHAIR CLARK: Joe, you had a question? Joe Cimino.

MR. CIMINO: I will get to a question for Caitlin. Thank you to both Caitlin and Brett for those great presentations. I think this gets to this conflated issue, what Bill was just talking about. There is a challenge in that. I know Mike, it certainly is for you. This erroneous assumption that what a model suggests is safe harvest and then actual management action, right.

I mean this is now in the New York Times erroneously is, and is an ASMFC proposal when its just a model suggestion. I'm very troubled by that wording that we got in there, and I hope that we can remedy that, because what we actually set as harvest is what impacts the resource, and what should impact the two-to-one ratio.

I just wanted to put that on the record. Then second, you know this is something that has always bothered me with weakfish as well. We have genetic work that distributes the catch of Florida's weakfish catch between sand seatrout and weakfish, and we have the catch composition here in the Lambda.

But we don't have a timeframe for how often that should be updated. Luckily genetic work is getting cheaper, easier and much more accurate. I really

think we should also consider a timeframe for how often we update that work for the Lambda. I guess it wasn't a question. Thank you.

CHAIR CLARK: Further questions? Looking around the Board. Shanna Madsen.

MS. MADSEN: Thank you for both of your presentations. My question is for Caitlin. Caitlin, I think it was pretty clear, but I just kind of want you to correct me if I'm wrong. Essentially, if this Board selects Option A, we would revert back to Addendum VI, which would allow female harvest in Maryland with no spatial regulations. However, in Virginia it would allow female harvest, but with those spatial regulations outside of the COLREGS Line. Essentially before us today are two decisions, either Option A or Option B, and both of those options allow female harvest.

MS. STARKS: That's correct, Shanna. As you stated, Maryland quota would go back to 170,653 horseshoe crabs, and that could be male or female. It is not restricted by sex, and it's not restricted by area. For Virginia female harvest would be allowed. The way that works is the total quota for Virginia would be 152,495 horseshoe crabs, and then 60,998 can come from east of the COLREGS Line, and the crabs that come from east of the COLREGS Line have to have a sex ratio of two to one.

CHAIR CLARK: Okay, and the next question we have is from Mike Luisi.

MR. LUISI: Yes, this might be a little more than a question, but just a comment as well. You know I guess the thing, and I asked this before, but I'm going to bring it up again. I feel like we're challenged by this new information, in the fact that there is going to be a pretty dramatic industry impact, because the model is telling us we can harvest females, but if we choose to not harvest females, there is going to be a pretty large reduction in our bait harvest.

I'm looking to staff, looking to you, Mr. Chairman, other members around the table. I mean we've been successful in what we've done, given the quotas that we've had. I just find it challenging that if we decide not to harvest the females, but the model is telling us we're allowed to, then we don't get that two-to-one ratio, and we have to cut back on our bait harvest, which is going to be impactful to the industry.

It's going to be hard for me to go home and say, guys you have the opportunity to harvest females, based on the pressure that we're under to not harvest females. If you choose not to, you're going to lose 80,000 crabs. I just wish there was some way out of the box that we could just kind of maintain what we have. I feel like we've been pretty successful, and I'll just offer that as a comment, and see if there are any thoughts around the table as to how we can just kind of keep doing what we're doing. I don't know.

CHAIR CLARK: I think that was an issue kind of brought up by Bill's question. Toni, do you want to respond to that?

MS. KERNS: I was just going to say, I think what I believe Bill is alluding to, and what I was trying to point to, is that the ARM is giving you a recommendation for quota. It doesn't mean the Board has to set it at exactly what the ARM is recommending. Therefore, you could provide a value that gives you that offset. Originally, in the underlying intention of what the Board was trying to do when they originally put together the offset, it was just provided for that. When the Board is not harvesting any females at all, then you're giving that extra male to make up for it. The Board could set a higher quota, that is possible. Then there is also always the possibility of transfers as well.

CHAIR CLARK: That is a much simpler solution. Mike, you want to follow on this?

MR. LUISI: I just wanted to say, I apologize, I had to step away from the table for a minute, and I might have missed Bill. Between walking from here up, it takes about ten minutes to get up to your room in this place. I had to step away for a second, so I apologize if I missed that. Toni, thank you for that summary.

CHAIR CLARK: Mike, and I think that is very helpful to Maryland's situation. Shanna, you had a follow up question?

MS. MADSEN: I think I'm good, Mr. Chair, I was just trying to help Mr. Luisi out.

CHAIR CLARK: Thank you. Rick Jacobson.

MR. JACOBSON: I actually wanted to follow up on Shanna's earlier question. I just want to be clear. If we were to vote for Option A, we would revert to Addendum VI. The total quota of females that could be harvested from Delaware Bay approaches 200,000.

MS. STARKS: I'm going to pull up the slide so that you can see it more clearly.

MR. JACOBSON: If it's the same slide I'm thinking of, I'm not sure it's clearer to me.

MS. STARKS: Under Option A, these are the quotas that would go back into effect for each state. For New Jersey and Delaware there is 100,000 crabs allocated each. Maryland gets 170,000. But not all of those would necessarily come from the Delaware Bay, as their Lambda value is about half. Then for Virginia, the 60,998 are east of the COLREGS Line, so some of those could be from Delaware Bay.

MR. JACOBSON: Am I interpreting that as, if the Lambda is 50 for Maryland, 85,326 could come from Delaware Bay, and there is no restriction on sex, they could all be females, so 85,000 potential females, and from Virginia 40 percent of 71,000, so another 28,000. Something in the neighborhood of 100,000 females could come from Delaware Bay.

MS. STARKS: Yes, something like that.

MR. JACOBSON: Yes, it was rough math, but thank you.

CHAIR CLARK: Do we have any further questions? Kristen, if I could just bring up, based on the huge amount of comments we received. But some of them were very detailed, and in particular the two scientists that sent detailed critiques of the ARM, and then just more recently another paper about egg density. Could you just let us know what the ARM Subcommittee, their considerations about those type of detailed comments?

DR. ANSTEAD: Sure, thank you. The inclusion or exclusion of the egg density surveys has been debated by the ARM since its inception. During the old ARM, the ARM Subcommittee chose not to use that data, because the surveys that were operating were using different methods. We couldn't make it be one time series, and it was a challenge.

Also, the ARM manages for the horseshoe crabs, and that abundance is related to egg density. We manage the crabs, so it's easier to use the abundance indices as the direct measure of horseshoe crab. With that said, when we do a new stock assessment, we always ask for more data. What do you have? Give us everything and we'll look at it. No egg density data was submitted for our consideration.

I did have a conversation with the author of the egg density paper that recently came out, Smith, and we talked about the data. But we didn't have it in hand. It has since been published, and we did extract that time series out of the paper to compare it to what we have from Virginia Tech Trawl, from the Catch Survey Model, and our model goes from 2003 to 2021. The trend is quite similar, actually, in the egg density survey. They kind of all track each other.

During that time series they all start out kind of low, and they increase through the terminal year. We could put the egg density survey in the catch survey model, which I have done, and you get similar results. It's probably isn't sufficient to some, because it doesn't go farther back in time. But unfortunately, I can't go further back in time. I would love to go further back in time with the model, before the pressure was of horseshoe crab. But our data starts in 2003.

CHAIR CLARK: Thanks, Kristen, and once again the amazing amount of work and modeling done by the

ARM Subcommittee. You know there are all these other factors came up, and just one other comment that I saw coming up a bunch. I believe in one of the critiques showed the weak linkage between horseshoe crab population and the red knot population, and what is happening there, because the model seems to show that even if there were no horseshoe crabs, red knots could still increase.

DR. ANSTEAD: That is correct. Our model shows a very weak, but significant link between horseshoe crab abundance and red knot survival. That is using the data from the region. We can't make it be a stronger link. We believe that these two populations are linked, and we have modeled it that way. But if more years of data come out, and that relationship falls apart. We do have to rethink some of the ARM.

But this is the best data we have in hand. In the original ARM and this ARM there was always these different possibilities of these populations are not linked, that they are linked in a weak way or they are linked in a strong way. We're just using the data that we have, and that's how it came out. There are probably other factors that we're not able to model at this time. Hopefully, in a decade it will be better.

CHAIR CLARK: As we know, the strong correlation possibly seen earlier in the time series could have been done due to other factors, other than the fact of a direct linkage there. But thank you very much for those explanations. If there are no further questions about the public comment. Joe Cimino.

MR. CIMINO: I just have a comment on that. What we see between the relationship of these two species is kind of, and I think maybe even at one point in time described by Fish and Wildlife Service as a phenomenon. Previous to the '80s, we're not sure that this linkage was there. It's a molluscivore that is highly dependent on horseshoe crab eggs now in the Delaware Bay.

But we all acknowledge that things are changing, and so that relationship may be changing as well. Fortunately, we're able to start tagging these birds in a way we want. You know we have to understand their usage of the Delaware Bay. Now the importance of horseshoe crab eggs isn't going to change. But if the usage of the Delaware Bay by these birds' changes, then we might lose that relationship.

CHAIR CLARK: Thanks, Joe, and again, it was more just because that was such a theme that came up, just good to address it a bit here. I guess before we go on to deliberation of our management actions regarding Draft Addendum VIII, are there any further questions? Not seeing any. If it's the will of the Board, perhaps we would start. I'm sorry, we have a question coming from online from Chris McDonough. Go ahead, Chris.

MR. CHRIS McDONOUGH: This is more of a comment, just kind of learning from the model and the relative scale in looking at, you know what the models are and the estimated harvest levels, and what population levels that the model is outputting. You know the estimated natural mortality, 0.3, 30 percent.

Those harvest levels represent a fraction of what even natural mortality is. You know at the level, I understand the linkages, what may or may not be there between red knot populations and horseshoe crab abundance. But the processes that are going on in that, I always have problems with the connection between the red knot and the horseshoe crab population in these models.

Because those connections are very tenuous, and small things in the model could change that a lot. I guess that is my comment is that given the way the population estimates come out, just a natural mortality alone just swallows up what could possibly be harvested through bait, through biomedical, whatever, all that stuff.

CHAIR CLARK: Thanks, Chris. Kristen, do you want to add anything to that?

DR. ANSTEAD: No, just that he is correct that we're talking about very different scales here, and that's why the model has responded the way it has. You

would have been in this situation either way. The old ARM also recommends female harvest, that when you're talking about a population, whether it's 6 million or 15 million mature females, removing 100,000 isn't going to register the same way that natural mortality does. He's correct.

CHAIR CLARK: Okay, well let me just check again. Is there anybody else online that has a question? We don't have any further questions.

BOARD DISCUSSION AND CONSIDERATION OF APPROVAL OF DRAFT ADDENDUM VIII

CHAIR CLARK: In that case, as I was saying. Now we move into Board Discussion and Consideration of Approval of Draft Addendum VIII. Perhaps, are you ready for further discussion, Shanna, or do you want to make a motion? Okay, let's move right to a motion, and then we can get the discussion going. Go ahead, Shanna.

MS. MADSEN: I think it always helps for us to have a motion on the table for us to incite a bit of discussion. If I get a second, I'll go ahead and give you why I am making this motion. **My motion is, move to implement Option B, which is implementing the ARM revision for setting bait harvest specifications for Delaware Bay origin horseshoe crabs.**

With that Sub-option B1, which is rounding down the continuous optimal harvest specifications to the nearest 25,000 crabs. Additionally, I would like to add to the end of that motion, with the intent to allow the 2-1 offset allowance for Maryland and Virginia, if the Board sets female horseshoe crab harvest at zero.

CHAIR CLARK: Thanks Shanna, and we have a second from Mike Luisi. We'll just give it a second here to get the motion up there. That was a very comprehensive motion. I think you pretty much covered all the issues, didn't you there, Shanna? Is that your motion?

MS. MADSEN: That is my motion.

CHAIR CLARK: Okay, we have a motion, we have a second and let me throw it back to you, Shanna to talk about the motion.

MS. MADSEN: You know the intent of the original ARM was really born from a desire to protect female horseshoe crabs for the benefit of the species, as well as the benefit of the ecosystem and red knot. The point was really to be responsive to changes in that ecosystem, through evidence-based science. You know over the past decade, I think we've heard from our experts that we've collected more complete datasets on shorebirds and horseshoe crabs, and we've advanced our modeling techniques.

This updated ARM really does fulfill the original intent and goals of the ARM overall. I think, you know Dr. Anstead asked earlier, who asked for this? Well, we asked for this. We asked for this update, we asked for the science, and we asked for our technical experts to include both shorebirds and horseshoe crab experts, to give us the best available science.

I know that later motions are going to address the input that we've received from the public, and that can be done when we set our specifications. But what I want to say today is, if we reject the ARM itself, we are essentially rejecting one of our very first original ecosystem modeling approaches, and really the recommendations from our experts and the best available science.

CHAIR CLARK: Mike, as the seconder would you like to add anything?

MR. LUISI: Shanna got a lot better sleep than I did last night, so no, I'll say ditto to what Shanna said. But I think this motion allows for the minimal impact to the industry, based on decisions regarding female harvest. I appreciate the interest for that. I'll leave it there.

CHAIR CLARK: Shanna, Toni has a follow up, just to perfect the motion.

MS. MADSEN: Yes, Toni asked for a quick perfection. Essentially just to say, to allow the 2-1 offset allowance for Maryland, Virginia if the Board sets female horseshoe crabs harvest at 0 during specification setting.

CHAIR CLARK: Thanks, Shanna, and since the motion was already made and seconded, is there any objection from the Board to adding that wording? I see none. Okay, is there any further discussion of the motion? I see Joe Cimino and then Bill Hyatt.

MR. CIMINO: I had the honor of sitting in your seat as we got through this process, and like Shanna touted that this was, you know the ARM Framework was early adoption of multispecies management. But what we learned through the Peer Review was that we weren't actually doing anything. This is our first attempt at adaptive management, and so I'm fully supportive of this motion. We will hopefully have further discussions about what that means to all the stakeholders, but for right now on this particular motion, I'm in full support.

CHAIR CLARK: Bill.

MR. HYATT: Yes, and I will also speak in support of the motion, you know for all the reasons that Shanna and Mike mentioned, with a little caveat, and that is that I'm not convinced that the addition of the 2-1 offset makes things simpler or easier, or fair for anybody in this process. But I believe that we'll be able to play it out in the specifications part of the discussion. It could just be a function of me still not understanding that completely. I'm hoping to have opportunity to talk to my colleagues across the table at some point, as the meeting progresses.

CHAIR CLARK: Next we have Rick Jacobson.

MR. JACOBSON: I look to the Chair for point of order as I wade into this**. In order to just extend the conversation beyond Sub-option B1, I would like to offer a motion to amend for purposes of discussion. The motion as previously stated and adopted, replacing Sub-option B1 with Sub-option B2.**

CHAIR CLARK: Okay, we have a motion to amend from Rick Jacobson, do we have a second for the motion to amend? We have Justin Davis is seconding the amendment, and so Rick, would you like to further discuss?

MR. JACOBSON: Yes, thank you. We at the U.S. Fish and Wildlife Service are committed to the recovery of rufa red knot, and the sustainable management approach to crabs. We're similarly committed to managing the recovery of red knots, and sustainable use of horseshoe crabs using the best available science. We believe that the ARM model represents the best available science.

We're also committed to public transparency, including sharing and providing access to the ARM model. Ultimately, we will seek avenues to forestall the horseshoe crab harvest from Delaware Bay, until such time as the public has ample opportunity to explore the ARM model, the model code, and as indicated in our minority report from the fall of 2021. We continue to encourage ASMFC to engage stakeholders, to consider adjustments to the levels of risk tolerance that are embedded within the ARM framework. Ultimately, we are committed to the recovery of rufa red knot, and taken a precautionary approach, and we feel Sub-option B2 would better achieve those ends.

CHAIR CLARK: As the seconder, Justin, would you like to add anything? Okay. Nothing there. Just before we get further in discussion of the Amendment. You both, Caitlin and Kristen, the round down options, both of them achieve the confidentiality requirements we have for the data, correct.

MS. STARKS: Correct.

CHAIR CLARK: Now we have an amendment to the motion on the floor, is there any discussion of the amended motion? I'm not seeing any hands; do we have any online? Okay, no hands online, oh, we have Shanna Madsen.

MS. MADSEN: I won't be supporting this motion to amend, simply because the option is really just a

round down option in order to protect confidentiality. I believe that the intent of what we're doing here is to get the specification setting where the Bay states will likely be discussing not having female harvest. The conservation measures will come in during specification setting, and that is why I left the motion as is, with the 25,000 round down.

CHAIR CLARK: Any further discussion? Not seeing any, then I think we'll call the question. Okay, I was planning to have a caucus. I'm the only one here from Delaware, so I'll see what I can connect with here. Okay, so why don't we take, would three minutes, given the situation. Can we put a three-minute timer up there? Does anybody else need a caucus break. How about after. **Let's call the question now. We are voting on the amended motion. All in favor, please raise your hand. We have Fish and Wildlife Service, right?**

MS. KERNS: I'll say it, Fish and Wildlife Service and NOAA Fisheries.

CHAIR CLARK: All opposed, please raise your hand.

MS. KERNS: Rhode Island, Massachusetts, Connecticut, New York, Georgia, North Carolina, Virginia, Potomac River Fisheries Commission, Maryland, Delaware. May I clarify on the record? Chris, are you voting, McDonough? I don't see your hand up right now.

MR. McDONOUGH: Yes, I am. I have it clicked up, but it indicated yes voting up.

MS. KERNS: If you click it again, I think your hand will actually be up then. Now your hand is up, now it's down, just letting you know. South Carolina is also against.

MR. McDONOUGH: Yes.

CHAIR CLARK: What is our final tally? Oh, I'm sorry, do we have any extensions? New Jersey is abstaining. Do we have any null votes? No nulls. Okay, motion fails 2 in favor, 11 opposed, 1 abstention and 0 null. That means.

MS. ERIKA BURGESS: Mr. Chair.

CHAIR CLARK: Yes, Ma'am.

MS. BURGESS: Florida abstains on that vote as well on the webinar. Thank you.

CHAIR CLARK: **Okay, so it's 2 abstentions on the vote to amend.**

CHAIR CLARK: Okay, so we are now back to the Main Motion, and do we need any time to caucus on the main motion? I'm not seeing any need for that. Why don't we go right to the vote. All in favor, please raise your hands.

MS. KERNS: I have NOAA Fisheries, Delaware, Rhode Island, Massachusetts, Connecticut, New York, New Jersey, Fish and Wildlife Service, Georgia, North Carolina, Virginia, Potomac River Fisheries Commission, Maryland, South Carolina.

CHAIR CLARK: Okay, do we have any abstentions? I'm sorry, it's been a long day already. Do we have any votes in opposition? Seeing none. Do we have any abstentions?

MS. KERNS: Florida.

CHAIR CLARK: Okay, and do we have any null votes? Okay, seeing none of those. The motion passes, 14 in favor, 0 opposed, 1 abstention and 0 null. All right, so that is now our accepted motion. Now we'll need a motion to approve the addendum as modified this morning. I have Justin Davis as the maker of the motion to approve the Addendum, and Shanna Madsen as the seconder of the motion. Justin, would you please read the motion. Also, do we have a seconder? Oh, Shanna that's right, sorry about that. Go right ahead, Justin.

DR. JUSTIN DAVIS: I move to approve Addendum VIII as modified today with an implementation date effective today.

CHAIR CLARK: Okay, we have the motion to approve the Addendum, it's been seconded. Why don't we do this the easy way this time. Is there

any opposition to this motion? Okay, not hearing any or seeing any. We don't have any opposition online; nobody needs to abstain?

MS. KERNS: I have one hand raised. Tom Fote. Tom, is that in opposition?

MR. THOMAS P. FOTE: I just want to make a comment before we vote, because it's been such a controversial subject. I just wanted to state, I wish I could be there today, my back wouldn't basically allow me. But I think we always have to use the best science available, and this is much better science than we had before, and I truly support this motion.

CHAIR CLARK: Okay, thank you, Tom, and other than that we had no opposition to the motion. The motion is approved as written. We have now approved the Addendum. Before we move on to the specification setting process, would we like to take a short caucus break? Why don't we make it five minutes? Can everybody be back here at 10:55?

(Whereupon a recess was taken.)

SET SPECIFICATIONS FOR 2023

CHAIR CLARK: Okay, I think the Board is all here now, so why don't we move on and I'll turn it over to Caitlin to discuss the specifications for 2023**.**

MS. STARKS: I think we need to pull up a table from the last Power Point. It's Slide Number 39 in the last Power Point.

CHAIR CLARK: We're getting there. Okay, now we're there.

MS. STARKS: The Board today will be determining what the specifications will be for the 2023 fishing year, based on the ARM, which was adopted through Addendum VIII just now. The decision before the Board is simply to set the specifications for the Delaware Bay states of New Jersey through Virginia. As we've discussed, the Board can use the ARM recommendation or make some modifications to those state quotas.

CHAIR CLARK: Thanks, are there any questions, or do we want to go right to a motion here? Seeing no questions, I believe Shanna has a motion. Hold on one second, Shanna. Emerson, did you have a question?

MR. EMERSON C. HASBROUCK: Yes, Mr. Chairman, thank you. I'm not quite following those two tables, unless one is mislabeled, because they both say round down to the nearest 25,000.

CHAIR CLARK: Problem solved.

MS. STARKS: This is the only relevant table for your consideration. This is what is recommended from the ARM for the 2023 fishing year.

CHAIR CLARK: Okay, so now hopefully everything is clear now. This is the specifications for 2023, and I'm going to turn it to Shanna Madsen who has a motion for us.

MS. MADSEN: I know they've got a motion prepared, so I'm just going to wait and read it off. My motion is, move to accept the 2023 ARM harvest specification with 475,000 males and no female harvest on Delaware Bay-origin crabs. In addition, the 2:1 offset will be added to Maryland and Virginia's allocation due to the Board selecting no female harvest.

CHAIR CLARK: Do we have a second? Mike Luisi. Discussion of the motion, Adam Nowalsky.

MR. ADAM NOWALSKY: A question on the application of the offset and language that is in the Addendum that we approved. Some quick math I think I did on my end was, Maryland and Virginia are about 30 percent of the quota. We're talking about 30 percent of 125,000 female crabs, about 37,500.

We're doing a 2-1 offset, so we're looking at adding about 75,000 male crabs back, for a total harvest of around 550. That is my back of the envelope math.

But in the Addendum, there was language that said the maximum possible harvest for both females and males are maintained at 210,000 and 500,000 respectively. With the language that was in the Addendum, can we get to the 550,000 male crabs, if my math was correct, or are we constrained that we're actually still capping it at 500,000?

CHAIR CLARK: You and your quick math, Adam. Let me turn it over to Toni.

MS. KERNS: The short answer is yes, Adam. It's the same as we had been doing under the old ARM, where for several years we had 0 females and 500 males only crabs. But then you put the 2-1 offset in there and it puts you above that 500 male only crabs. We're working in the same method that we had before, and Caitlin will add one more piece.

MS. STARKS: For your consideration on the screen there is a table here that shows what the Delaware Bay origin quota is, as recommended by the ARM. If you are only looking at 475,000 males, and then on the other half of the table shows what the quotas for Maryland and Virginia would be with the offset applied.

CHAIR CLARK: Okay, are there further comments/questions on this? Bill Hyatt.

MR. HYATT: All I want to do is speak in support of the motion. Should I do that now, or are we still handling questions?

CHAIR CLARK: Go right ahead, Bill, you use big support.

MR. HYATT: Yes, I want to speak in support of this motion, particularly the elimination of the female harvest. I think that the Addendum and the ARM Framework that we approved before does a great job of representing the best available science. It provides us with valuable guidance to this group on what we can do.

But it's our job to decide what we should do. I think in light of a number of considerations, this motion represents exactly that, what this body should do. It takes into consideration the low to nonexistent numbers of newly mature female horseshoe crabs and the uncertainty that Kristen so well described around that.

It takes into consideration sort of a lack of any really convincing argument for a need to significantly improve the harvest of the crabs, and in particular any argument of a need to approve the harvest of female crabs. It's really responsive to the amount of input that we've gotten from the public. For all those reasons, I think this represents a good example of what this group can do, and is exactly what we should be doing at this point.

CHAIR CLARK: Are there other comments? Shanna.

MS. MADSEN: Just really quickly, and I actually think Bill did an excellent job. You know I didn't get to give my justification for making this motion, but what Bill summarized is my exact intent here. You know the Bay states got together and had a discussion about whether or not we felt comfortable harvesting female horseshoe crabs, in lieu of all of the comments that we received. You know we came to this decision together. I think this Board did an excellent job of really deliberating over that, and recognizing that these two parts of the process are separate in that way. We can accept the best available science for management, and make the decisions regarding what we are going to do with the harvest after that point. I really appreciate Bill's comments, and Joe Cimino's comments previously to that affect. I hope to see this motion go forward today.

CHAIR CLARK: We have Tom Fote has a comment.

MR. FOTE: I had a lot of meetings with legislators over the last couple of months, and other people concerned about it and I said, we have to use the best science. But again, the Board will make the decision on what they feel is right. This motion I think makes that decision the right one, just as I said to all those people out there that's what would happen. Thank you, and I really want to also say, I really appreciate all the science that went into this,

all the work by the Technical Committee, and it just really always amazes me. Thank you.

CHAIR CLARK: Thanks, Tom, Mike Luisi.

MR. LUISI: I'll just say I certainly support the motion, and in discussions with our industry over the last few months. You know years ago they made some considerable sacrifices to the way that they operated by moving to male only over a period of time. They've evolved, and understand and realize that the female horseshoe crab and the importance of it.

The controversy that surrounds it is not something to, you don't want to poke the bear. I guess that might be the way to put it out there bluntly. I appreciate the motion before us. I think this gets us back to status quo, if you want to call it that. I certainly support it, so thank you.

CHAIR CLARK: We have Justin Davis and then Joe Cimino.

DR. DAVIS: I'll also speak in support of the motion. Kind of what Shanna was alluding to; I think this decision point is really about risk tolerance. Certainly, with what we do at the Commission, the scientific process and decisions about risk are linked, but they are not one and the same. You know science can provide us advice, it can tell us where we're at, it can give us probabilities of different outcomes if we take different actions.

But ultimately, it's up to the Board to decide how risky or not we want to be with the decisions we make. I just think what we're doing here is in keeping with, you know other recent decisions this Commission has made to be risk averse. When I think about striped bass, the decisions we made in the rebuilding plan. We chose to use a low recruitment assumption, even though we didn't need to do that, which led to more conservative estimates of appropriate fishing mortality.

The debate we had about menhaden this week, we chose a TAC that was really conservative. We didn't have to do that, we could have chosen one with a 50 percent probability of exceeding F, but we chose one that was really conservative. I think this decision is in keeping with decisions this Commission has made in recent history to be conservative, to be precautionary when we're setting targets. For that reason, I support this motion.

CHAIR CLARK: Joe Cimino and then Rick Jacobson.

MR. CIMINO: To paraphrase Mike Luisi, I think everybody around this table got more sleep than I did, and ditto all the great comments. Two things, one, I hope we are seeing the fruits of our labor here, and an increasing trend for female horseshoe crab abundance in the Delaware Bay.

But we're, I think a long way if ever, in my opinion, considering female horseshoe crab harvest. I would be remiss not to give my thanks to the group, but I think you all know I had a chance to share and just appreciate all the hard work, and for Dr. John Sweka as well. Just thank you to all of you.

CHAIR CLARK: Thanks, Joe, Rick.

MR. JACOBSON: I want to speak in favor of the motion as well. I do believe that the ARM does represent the best available science, and we're committed to utilizing the best available science. I also applaud the members of this Board for supporting an Amendment that looks beyond simply the recommendations of the ARM, and recognizes the public interest in the issue. I'll also be continuing to press the Board to continue to explore the human dimension elements of the model, and the risk tolerance factors that are within it.

I also would like to acknowledge our colleagues of the U.S. Geological Survey for their collaboration in the construction of the model, and also their diligent efforts to make the model code available to the public. Taking this action will provide the additional time necessary for the public to gain the confidence in the model code in this period. Thank you very much, and I look forward to voting in favor of the motion.

CHAIR CLARK: Are there any further comments? Seeing none; it's time to call the question. Let me just see first if we can do this the easy way. Is there any opposition to the motion? I should have asked. Does anybody need time to caucus? I'm not seeing any hands on that, not seeing any hands in opposition.

In that case, are there any abstentions from the motion? We have one abstention, but otherwise the motion is passed by unanimous consent.

REVIEW AND POPULATE A WORKGROUP TO REVIEW THE BEST MANAGEMENT PRACTICES FOR HANDLING BIOMEDICAL COLLECTIONS

CHAIR CLARK: Fantastic, we've got the Addendum approved and the specifications for 2023 set, and you might think that was it, but wait, there's more. Now, I'm going to turn it back over to Caitlin to cover Agenda Item 6, which is Review and Populate a Workgroup to review the best management practices for handling Biomedical Collections. Take it away, Caitlin.

MS. STARKS: This should be brief and relatively straightforward. At the last meeting the Board decided to form this workgroup, and that is what I'm going to be discussing today. At that August meeting, the Board agreed to form a workgroup to review the best management practices for handling biomedical catch, and suggest options for updating and implementing the BMPs.

This was based on a recommendation from the Plan Development Team that no action was needed related to the biomedical mortality threshold that is currently in the FMP, but that the Board could continue to annually review estimated biomedical mortality levels, and form this workgroup to address the BMPs. The original Best Management Practices document was produced by a workgroup in 2011, and it contains recommendations for best management practices from each step of the biomedical process from capture to returning those crabs to the ocean. These BMPs are recommendations, but they are not implemented as requirements by ASMFC.

There are some states that do require some of those self-management practices as part of their permitting process. The nominations that I received to serve on the management workgroup include these names here. We have Katie Rodrigue from Rhode Island, Derek Perry from Massachusetts, Sam MacQuesten from New Jersey, Brett Hoffmeister from Associates of Cape Cod, Nora Blair from Charles River Labs, Benjie Swan from Limuli Labs, and Dr. Daniel Sasson from South Carolina DNR.

This group represents something similar to the original workgroup, with representation from both the biological and ecological technical side, as well as the understanding of the biomedical process side. With that today, the Board can consider approving the nominations to the Biomedical Workgroup.

CHAIR CLARK: Do we need a motion to do so, Caitlin? Yes. Just to make it clean, why don't we go ahead and get a motion to approve the workgroup. Does anybody want to offer that? We have Emerson Hasbrouck, and seconded by Conor McManus. Is there any discussion? Emerson.

MR. HASBROUCK: Do you need me to read that into the record?

CHAIR CLARK: Great point, yes, please do.

MR. HASBROUCK: Move to approve the nominations to the work group to review best management practices for handling biomedical collections.

CHAIR CLARK: **Thank you, and is there any discussion of the motion? Seeing none; is there any opposition to the motion? Are there any abstentions from the motion? Nothing, okay, good, so the motion is approved, passed by unanimous consent**. Mike Luisi.

MR. LUISI: Yes, just a quick question, Mr. Chairman. This jumped up on me faster than I thought it was going to. I didn't realize we were going to be approving this today. I believe one of my members

of my staff were interested in participating. What would the process be, once I confirm that, if somebody wanted to be added to the group? I just want to confirm it before I recommend a nomination, so I just sent out a quick note.

But it just kind of jumped up on me pretty fast here, and I just want to see what the process would be. I just got a confirmation that Steve Doctor from Maryland DNR would like to serve as part of this working group. I don't know if we can add him. Is it to late to do that, since we already approved it?

CHAIR CLARK: Well yes, why don't we just do it. Is there any objection to adding Steve Doctor of Maryland DNR to the Workgroup. Okay, we're being told we don't need a motion, so there is no objection to adding Steve, and the good Doctor will be added to the workgroup.

MR. LUISI: Excellent, and he'll be very happy. Thank you very much.

CONSIDER THE FISHERY MANAGEMENT PLAN REVIEW AND STATE COMPLIANCE FOR THE 2021 FISHING YEAR

CHAIR CLARK: Excellent, now we move on to Item Number 7, which is Consider the Fishery Management Plan Review and State Compliance for the 2021 Fishing Year, and that is Caitlin again.

MS. STARKS: Quickly I just want to note that the document that went out in materials will be updated following the meeting, because I have received some additional data from the states. I just wanted to make that note. This is going to be short and sweet. This is the management history for horseshoe crab at the Commission.

We can add Addendum VIII to this list as of today. Then on this figure, I am just showing the annual values of the reported horseshoe crab bait harvest, biomedical questions and estimated biomedical mortality in millions of crabs. As you can see, bait harvest and biomedical collections are slightly higher in 2021 compared to 2020.

For bait harvest in 2021, the total number of crabs reported was 741,684 crabs, and this number is the most up-to-date, and does include the landings from Connecticut that came in recently. After this meeting I'll update the FMP Review Document to reflect this change. The 2021 landings represented 63 percent increase from the 2020 landings, but it is still well below the Commission's coastwide quota for horseshoe crabs, which is 1.59 million crabs.

The states of Massachusetts, Delaware, New York and Maryland made up for 84 percent of the total coastwide bait harvest, and each of those states represents 24 percent, 23 percent, 21 percent, and 15 percent respectively. This is a note. The increase in landings seen in 2021 was likely due to 2020 landings being very low, as a result of COVID.

The 2021 landings are more similar to 2019. In 2021 the number of crabs collected for the sole purpose of LAL production in the biomedical industry was 697,025 crabs. This represents a 3 percent increase from the 2020 value. The estimated mortality from biomedical was 112,104 crabs.

As a reminder, this includes the observed mortalities that are reported, plus 15 percent of the total crabs that are bled. In 2021 the biomedical mortality represents about 13 percent of the total directed mortality, which is bait harvest plus biomedical mortality. That's about 836,000 crabs.

That total mortality is an increase from 2020, considering that bait harvest was much higher in 2021 than 2020. This next graph shows the total coastwide mortality of horseshoe crabs by year, broken out by bait and biomedical mortality. The orange area on the graph is the bait harvest, and the blue area is the estimated biomedical mortality. This is just to give you a sense of the relative magnitude of each of those to sources of mortality. I did want to make a note that the COVID-19 pandemic still had some impacts on sampling in 2021, not as much though as in 2020. But in 2021 the Long Island Sound Trawl Survey and the New Jersey Benthic Trawl Survey were not completed because of COVID restrictions. For de minimis

status, states can qualify for this if their combined average bait landings for the last two years are less than 1 percent of the coastwide bait landings for the same two-year period.

In 2021 South Carolina, Georgia and Florida requested and meet the de minimis criteria. The PRTs recommendations, based on their review of the Annual Compliance Report are first, it's always recommended for the last several years, the PRT recommends that the Commission continue to prioritize finding long term funding for the Virginia Tech Trawl Survey, as that is a critical data source that we need throughout the management program.

The PRT also recommends working towards getting annual estimates of horseshoe crab discard removals for the coast. With regard to state compliance, the PRT found that with the exception of the surveys that were affected by COVID, as well as a late compliance report, all states and jurisdictions appear to be in compliance with the requirements of the FMP. The PRT recommended approval of the Compliance Reports, de minimis request, and the FMP review for the 2021 fishing year. That's all I have.

CHAIR CLARK: Before we go to a motion on the Plan Review, does anybody have any questions for Caitlin? Seeing none; can we get a motion? Mike Luisi.

MR. LUISI: Yes, I'll be happy to make that motion, Mr. Chairman. I've got something I can read.

CHAIR CLARK: Please, go right ahead, Mike.

MR. LUISI: Okay. Move to approve the FMP Review, state compliance reports, and de minimis requests for South Carolina, Georgia, and Florida for the 2021 fishing year.

CHAIR CLARK: Motion by Mike Luisi, we have a second from Jim Gilmore. Any comments? Okay, seeing no hands**. Is there any opposition to approving this motion? Okay, and nothing online, so motion is approved, and the Plan Review and State Compliance for 2021 fishing year is therefore approved by unanimous consent.**

OTHER BUSINESS

CHAIR CLARK: I believe that brings us up to our last item, which is Other Business. I don't believe there was any. Oh, we have Shanna would like to bring something up.

MS. MADSEN: I'll make this Other Business brief. I don't know if it helps to have my other business in motion form or not, but essentially, we've talked a lot today about the goals and objectives of the fishery and the ecosystem, and protecting red knots for Delaware Bay origin crabs.

I think it's time that we potentially sit down and start to have some facilitated workshops with stakeholders and managers and scientists, to try to help better inform future goals and objectives and modeling approaches. I will say that I envision this to be a lot like the Ecosystem Management Objectives Workshop that were held for Atlantic Menhaden. There were really great, a cooperative approach with our managers, stakeholders and scientists, to really start to talk about what our goals and objectives are for both the fishery and the ecosystem. I think that our discussions today have led me to believe that we should start to do that as soon as possible. I know that might mean an amendment to the Action Plan, or something like that. But I do believe that this is important enough that we should discuss it today.

CHAIR CLARK: Thanks, Shanna. Bob, you have a response to that?

EXECUTIVE DIRECTOR ROBERT E. BEAL: Well not a response, just maybe a little bit different course. You know some of the examples that Shanna mentioned, the menhaden work and others, were pretty expensive and very involved. As Shanna mentioned, we probably would need to do an addition to the Action Plan, which is fine to do this.

But it might be best if the staff does some work and kind of maps out some possible courses moving

forward, sort of a different levels of workload, and different options for workshops and cost associated with those options and that sort of thing. We can bring that back in February, and then the Board can sort of dig in to how involved do you want this to be?

You know I think it's a good idea to do it, but there is a workload component. You know, do we want to have the sort of Cadillac version or the cheap Ugo version, or whatever that old car was that the doors fell off. You know I think it's probably worth doing some staff exploration as the first step.

CHAIR CLARK: I like billing it as the Cadillac or the Ugo version, but Shanna, does that meet your expectations?

MS. MADSEN: Yes, I'm completely comfortable with that, Bob. I think it makes sense to go back, reevaluate workload, and look at what funds might be available. I just kind of wanted to point the Ecosystem Workshop as kind of maybe a framework, because I think it really did help us a lot in moving forward.

CHAIR CLARK: I saw Rick and then Joe.

MR. JACOBSON: I just wanted to echo Shanna's comments and her suggestion. I think that is the perfect path forward for us. I'm totally happy with Bob's approach to going and looking at various options to achieve those objectives. I'm very supportive, thank you.

CHAIR CLARK: Thanks, Rick, Joe.

MR. CIMINO: Yes, I agree that discussions need to happen. I'm just kind of curious, Bob, on the timing. You know if you thought this would be available at the first 2023 meeting, but the Horseshoe Crab Board had no reason to meet. Could we cover this at another Board?

EXECUTIVE DIRECTOR BEAL: I'll kind of turn it back on the Board. When do you want it? We can pull together a list of options and different scenarios, sort of different process options for the February meeting. But if that's the only thing the Board needs to tackle, we can postpone it for awhile if the Board is comfortable with that. It's really up to this group.

CHAIR CLARK: Any further discussion of that? I mean could this be something done, like the suggestions be sent out by e-mail also?

EXECUTIVE DIRECTOR BEAL: We can send them out. I think it might be worth Board discussion to select the option. There are different levels of work and cost and those sorts of things, and that may be hard to resolve over e-mail. But we can share the options over e-mail, and then have a future conversation at the Board.

CHAIR CLARK: Okay, thanks, Bob. Mike, before we get to you, we have Chris Wright on the webinar that would like to make a comment.

MR. CHRIS WRIGHT: I was just thinking if we don't want to wait, we could always have a conference call. You know we've had webinars like that before. In between boards, if needed.

EXECUTIVE DIRECTOR BEAL: Toni would like to respond, but I'm going to do it. One option is if the Best Management Practices Workgroup that was just formed, that their output will be available at the spring meeting, I think is the current plan. We could just do all of these at the spring meeting, if the Board is comfortable waiting that long.

CHAIR CLARK: Is that okay with the Board? I'm seeing thumbs up here, and Shanna has got a big thumb up there. Mike, did you have any further comments you wanted to make, Mike? Okay. I think in that case we've resolved that item, have we? All right, I'm not seeing any.

ADJOURNMENT

CHAIR CLARK: Before we adjourn, I would just like to take this opportunity again to thank the ASMFC staff.

Caitlin's phenomenal job of getting us through all the hearings, the massive amount of public comment. Thanks to the public for their just passion and interest in this issue. I also wanted to just make special notice. This new ARM is just such an advance in modeling. Special thanks to Kristen, and I know Joe mentioned John Sweka.

The two of them did phenomenal work on this. The entire ARM Subcommittee, the Technical Committee. This has really been an achievement, and ASMFC is rightly proud of this. I just wanted to say that. With that, if there is nothing else, this Board will stand adjourned. Thank you, everybody.

(Whereupon the meeting adjourned at 11:30 a.m. on Thursday, November 10, 2022)

April 9, 2023

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Horseshoe Crab Recovery Coalition Comments: Proposed Work Group Recommendations on Biomedical Best Management Practices

Executive Summary

In October 2011, the Atlantic States Marine Fisheries Commission's Horseshoe Crab Biomedical ad hoc working group met to codify best practices governing the bleeding of horseshoe crabs in the production of LAL. Despite more than a decade of scientific advances and a deepening understanding of the impacts of bleeding on horseshoe crabs, the BMPs have not been meaningfully revised since that time.

The goal of the Horseshoe Crab Recovery Coalition (HCRC) is a phaseout of the biomedical harvest replaced by widespread adoption of an already available synthetic alternative for endotoxin testing. Multiple laboratories have demonstrated recombinant test reagents to be equally effective and provide the reliability of a renewable resource rather than relying on the unsustainable practice of bleeding wild animals.

Until the phaseout becomes complete, the coalition is proposing revisions to the BMPs to address the following deficiencies:

- They are not mandatory or specific and there is little or no regulatory oversight.
- Key data are not available to NGOs and the public-at-large.
- The process is optimized for the blood product and not for the health of the crabs.
- There is no consequence to killing horseshoe crabs: in fact, the Atlantic States Marine Fisheries Commission and the U.S. Fish and Wildlife Service encourage bleeding of bait crabs as a "conservation measure." However, states like Massachusetts use this loophole to purchase bait crabs from other states that are bled and enter the bait market in that state through a so-called rent-a-crab program.
- Finally, there is no adaptive process to reduce the impacts of biomedical bleeding and no assessment of metrics to reduce crab mortality.

The HCRC's newly proposed BMPs are designed to address these deficiencies through a variety of measures including:

- Calling for reduction in the mortality of bled crabs to less than 5 percent and total mortality from the entire capture-to-release process of less than 7 percent.

- Reform the practice of storing crabs in ponds or pens prior to bleeding. Under normal conditions, holding time should be limited to less than 24 hours, and bled crabs should be released within 24 hours after the bleeding process.
- Selecting only healthy and undamaged crabs for bleeding.
- Improved reporting and Increased transparency in reporting the number and sex of the crabs selected for bleeding, as well as those that are rejected.
- Developing a coastwide system of marking bled crabs to avoid rebleeding in the same year.
- Discontinuing the bleeding of bait crabs, which is currently practiced in Massachusetts.
- Regular auditing by regulatory agencies to ensure compliance with the revised BMPs.
- Increasing the number of horseshoe crabs that actually spawn.

The coalition believes its best practice proposal is aligned with United Nations Sustainability Development Goals for Biodiversity and will help to ensure the health of U.S. horseshoe crab populations until the phaseout of the biomedical harvest is complete.

The following pages provide more detail on our proposal and how it should be implemented and monitored.

Signed by members of the Horseshoe Crab Recovery Coalition

American Littoral Society
Center for Biological Diversity
Connecticut Audubon
Delaware Audubon
The Delaware River Keeper
The Forest Keeper
Georgia Audubon
Maryland Ornithological Society
Mass Audubon
National Audubon Society
New Jersey Audubon
North Carolina Wildlife Federation
One Hundred Miles
Revive and Restore
The Safina Center
Shark River Cleanup Coalition
Southeast Massachusetts Pine Barrens Alliance
The Wetlands Institute
Wild Cumberland

Background/History

The Horseshoe Crab Biomedical *ad-hoc* Working Group (WG) met on October 3, 2011 to discuss the biomedical process and begin building a biomedical best management practices document, as tasked by the Horseshoe Crab Management Board at its August 4, 2011, meeting. The meeting opened with a brief background on the biomedical industry, its impacts, and the board's task, followed by a period of public comment. The WG received written public comment from the Horseshoe Crab Conservation Association of Massachusetts, and Amanda Dey of New Jersey. Discussion by the WG was conducted in a closed-door setting, in anticipation that potential confidential and proprietary information may be discussed. The WG produced a report presenting the biomedical process broken down by steps, with the best management practices (BMPs) that are associated with each step. Some areas for improvement, through training and other methods,

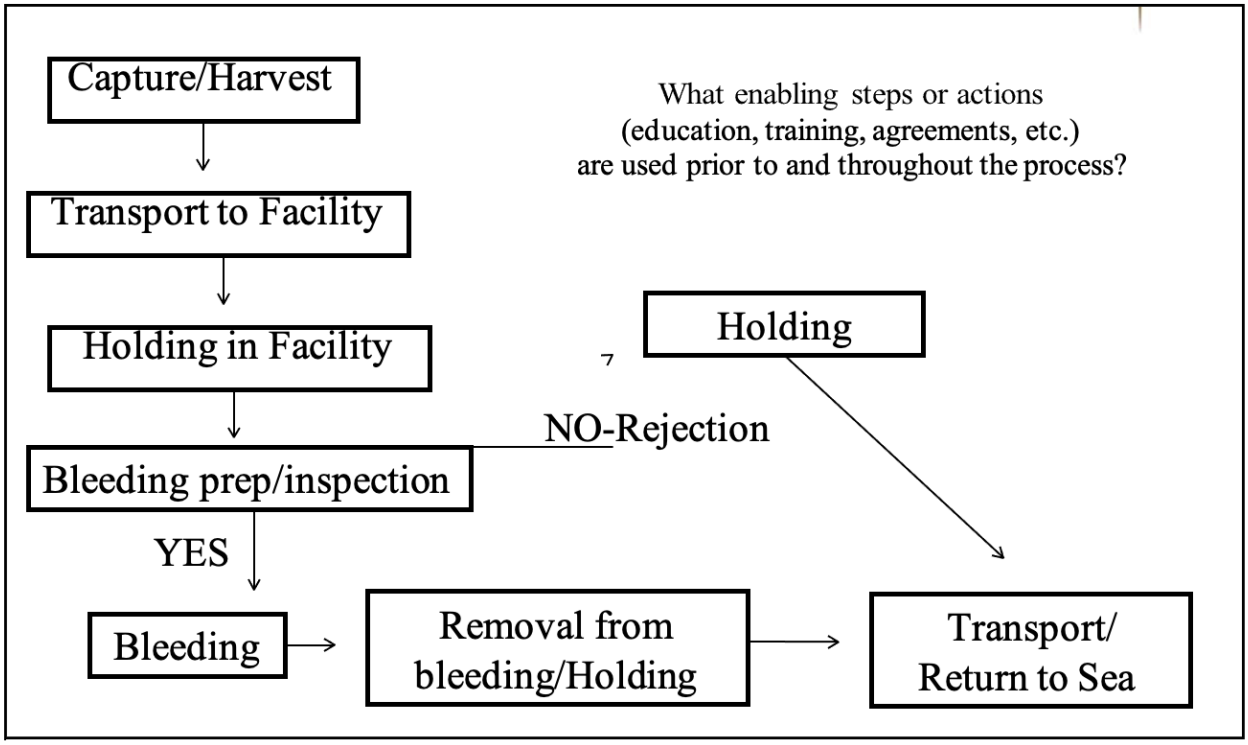
were identified. Additionally, the group felt that future discussions would likely be necessary as practices continue to evolve.

These recommendations were never formally adopted as required standards and have not been revised since 2011. The Horseshoe Crab Recovery Coalition recommends the following revised BMPs be adopted.

The following comments follow the format of the original BMP but are updated reflecting recommendations from scientists involved with the Horseshoe Crab Recovery Coalition.

Development of Biomedical Best Management Practices

In 2011, the WG based its discussion of BMPs on the following step chart. The scope of discussion for the BMPs was limited to the collection, bleeding, and release of crabs collected solely for biomedical purposes. However, the WG recognized that these same practices must also be used when collecting crabs that will ultimately go to the bait industry to ensure a quality product for the biomedical and bait industries.



HCRC Recommended Updated BMPs

By 2027, biomedical facilities will reduce the mortality of bled crabs to ≤ 5 percent, and total capture-to-release mortality of all biomedical crabs collected to ≤ 7 percent (including culled at sea, culled at dock, dead on arrival at lab, bled and unbled mortality in lab, dead on release). This more accurately captures the impact of biomedical industry collection and use of horseshoe crabs.

Registered fishers will play a key role in collecting data on number, sex, and status (condition) of crabs during collection and transport, after bleeding, and upon release at sea.

Capture/Collection:

- Biomedical collection in the Carl Shuster Reserve is discontinued.
- For targeted horseshoe crab trawl tows (biomedical-only and combined bait and biomedical collection), use reasonable tow times to reduce injury and stress, recommended at 15 minutes bottom time (winches locked).

For hand collection of horseshoe crabs, crabs should not be stacked in the bottom of a boat (stacked upside down and left uncovered in direct sun); holding containers must be used to reduce stress, direct sunlight (high temperatures) and desiccation. Proper care and handling of horseshoe crabs must be exercised while collecting, sorting, and placing crabs in holding containers.

Proper care, handling, holding:

- At all times, crabs should be picked up with two hands by the carapace.
- Crabs should never be held by the telson.
- Crabs should never be tossed or thrown.
- Crabs are always be placed right side up (legs down) in holding containers and stacked no more than 3 crabs deep.
- Crabs are to be inspected for standardized markings that indicate whether an individual was bled in the current collection year; release such crabs immediately.
- Holding containers must be well aerated and light in color to reduce heat inside the container.
- Crabs are to be kept cool, moist, and shielded from direct sunlight.
- Released crabs are placed right side up in shallow water (hand collection) or individually into deeper water (trawl/dredge collection); do not throw, toss, or dump crabs *en masse*.
- Healthy crabs are stacked in holding containers, no more than 3 crabs deep to reduce stress and injury during transport to biomedical facility.
- Data to be collected by registered fishers during collection:
    - Sort and record the number, sex, and status of crabs:
        - Healthy crabs: to be transported to biomedical facility.

        - Released crabs: juveniles, dead, injured, unsuitable for bleeding and reason (due to small size, too slow, too old/dull shell).
    - A record of crabs collected, culled at sea and culled at dock are required for annual capture-to-release biomedical harvest reports (ASFMC Addendum III).
    - Avoid exposure to direct sun, extreme temperatures as well as rapid temperature changes; containers with horseshoe crabs are to be kept covered with wet cloth to protect against direct sunlight.
- Night harvesting is recommended during periods of excessive heat (≥75 degrees Fahrenheit)
- Upon landing, if crabs are sorted and released at dock ("culled at dock") before transport to bleeding facility, collectors should follow the above handling and recording procedures.
- Biomedical staff will educate collectors in proper holding, handling, and careful sorting and transport techniques and release site requirements. Rigorous sorting, and release at capture site, of crabs unsuitable for bleeding will reduce the number and mortality of such crabs transported and unnecessarily held at bleeding facilities.
- All collectors and their employees are provided a written copy of procedures and sign a training document to indicate they understand the required procedures.
- Specify collection requirements, best management procedures, and expectations of collectors and their designees/employees in written contracts. Annually audit horseshoe crab collectors on implementation of best management procedures (collection, handling, holding, transport) of horseshoe crabs to biomedical facilities.

Transport to Biomedical Facility

- Transport crabs in enclosed box trucks to maintain a cool temperature and moisture, reduce desiccation (exposure to wind) and exposure to sun.
- Before and during transport, maintain temperature between approximately ambient water temperature at time of collection and 10ºF below the ambient water temperature.
- Maintain good ventilation while stacked in holding containers. Limit number of horseshoe crabs stacked in any container to no more than 3 crabs deep, with crabs placed right-side up, legs down to minimize stress and damage to other horseshoe crabs.
- Transport to bleeding facility immediately after landing; do not hold crabs overnight. Institute the ability of biomedical labs to accept delivery and secure crabs indoors (in environmentally controlled conditions) outside of normal business hours.
- Minimize travel time.
- Keep bins and horseshoe crabs covered (e.g., wet cloth) to protect against desiccation.
- Secure containers in the transport vehicle.

Holding at Facility/Preparation for bleeding/Bleeding

- Limit holding time, under normal circumstances, at the facility to less than 24 hours.
- Minimize exposure to fresh water.

- Follow above procedures for proper care and handling when sorting horseshoe crabs and moving them between bins and within the facility; at all times, crabs in containers are kept indoors, moist, and out of direct sun.
- Inspect crabs for health and damage, selecting only undamaged and healthy crabs for bleeding (do not bleed injured, juvenile, too small, too slow, too old/dull shell).
- Crabs to be bled are placed in containers right-side up, feet touching bottom and not stacked (only one crab deep) to reduce stress. Maintain this condition during sorting or in holding bins throughout the bleeding process, including post-bleeding holding period.
- Record the number, sex, and status (healthy, slow, dead) of bled crabs required for annual capture-to-release biomedical harvest reports (required by ASFMC Add. III).
- Maintain same level of care for rejected crabs (unbled) while being held until release at sea. Crabs rejected for bleeding should be placed in containers right-side up, stacked no more than 3 crabs deep, and released immediately to a waiting collector/delivery person for transport and release. Do not delay the release of unbled crabs until bled crabs are ready for transport and release.
- As with bled crabs, record the number and sex of crabs rejected for bleeding (unbled) and reason (injured, too slow, too small, too old/dull shell). Report the sex and number of unbled crabs and cause for rejection for annual capture-to-release biomedical harvest reports.
- If not medically necessary for a sterile bleed (by heart puncture), discontinue the use of sharp knives to hack epibionts from the carapace of crabs. This practice causes stress and injury that may be unnecessary.
- Maintain clean, sanitary conditions during bleeding.
- Avoid bleeding crabs more than once per year.
- Develop a coastwide system of marking crabs (not USFWS tags) such that all collectors can easily identify by sight, and immediately release, crabs already bled in the current collection year.
- If crabs are marked to avoid re-bleeding, ensure that the mark is residual and not harmful to the crab.
- Upon arrival at the facility, all crabs to be bled will be measured and weighed.
- Measurements will include inter-ocular distance (OID) and Prosomal width (PW), and total blood volume (ml) will be estimated for each crab using 25 percent of wet weight [(1)]; the blood volume extracted (ml) will not exceed 30 percent of an individual crab's total blood volume.

Bleeding

- Given a higher mortality from bleeding during the breeding period, the process for Horseshoe crabs collected and bled during the breeding period [(2)] (the period while not in the wintering area) must be restricted in the following ways.
    - Only males may be bled from April – July; females bled in this period have mortality rates as high as 29% [(2)]
    - Bleed females August to October, after main breeding period.

- An 18-gauge sterile needle will be used. This should be inserted through the membrane in the hinge to extract a predetermined amount of blood from each crab (not to exceed 30% of total blood volume of an individual). If less blood is collected from the crab, suction will not be used.
- The bleeding lab will report (for each crab)
    - Total estimated blood volume (ml) and hemolymph (ml) extracted (not to exceed 30 percent of total blood volume).
    - Type of needle used.
    - Discontinue practices of timed bleeding periods and discontinue allowing crabs to bleed until rate slows.
- Perform internal audits to maintain quality control over written procedures.
- Perform weekly audits of metrics: number and sex of bled crabs and mortality during pre-bleeding, bleeding, and post-bleeding processes.
    - Total mortalities of bled crabs (intake to discharge from biomedical facility) that exceeds 15 percent will be cause for temporary suspension of bleeding activities until deficient handling/holding/bleeding practices are identified and corrected.
    - If deficiencies are corrected but mortality/injury are not reduced to 15 percent or less, reduce amount of blood drawn per crab to 25 percent or less of total blood volume (ml).
    - If mortality cannot be brought to 15 percent or less within two (2) weeks following initial suspension of bleeding activity, the permit/license to bleed crabs may be suspended until the biomedical facility develops changes to procedures that reduce bled crab mortality to 15 percent or less and prove the efficacy of new procedures to an independent assessor (not related to biomedical industry or fisheries agencies).
- Biomedical facilities will account and report the number and sex of unbled crabs and their status (dead, injured, too slow, too small, too old) in annual capture-to-release biomedical harvest reports. To date, the number of unbled crabs have not been required to be reported in annual biomedical harvest figures; unbled crabs range in number from 12,331 to 63,324 per year (avg. 31,238/year); 2004 to 2019 [(3)].

<u>Post-Bleeding Holding</u>

- Recognizing that the horseshoe crabs are now stressed from the bleeding process, maintain the same level of care.
- Minimize holding time in biomedical facility to less than 24-hours post-bleeding.
- When returning crabs to the water, if not being returned to the area of capture, ensure that conditions (salinity, water temperature, etc.) are similar to those found at the harvest site.
- While in holding, keep horseshoe crabs in the dark to minimize movement and injury.
- Keep horseshoe crabs well-ventilated, moist, and allocate only a suitable number of crabs to holding containers – no stacking, allow crabs to rest on bottom of container to reduce post-bleeding stress and injury.

- Crabs placed into containers for transport and release at sea should be right side up and stacked no more than 3 crabs deep.
- Crabs should not be out of salt water for more than 24 hours.
- All crabs must be processed in less than 24 hours and placed back in saltwater holding tanks after processing.

Return to Sea

- Whenever feasible, crabs should be returned to capture location within 36 hours or less from time of capture.
- Use same care in handling and transport when crabs are returned to the water.
- Include return written instructions and requirements within contract with collectors, if applicable
- Periodically audit horseshoe crab collectors on implementation of BMPs for returning crabs to sea.

Summary of Data to be collected by registered fishers during collection, before transport to biomedical facility, and post-bleeding before release at sea:

Monitoring disposition of all crabs collected for biomedical use: To ensure thorough monitoring, all crabs collected for biomedical use must be tracked from the time of capture until release (bled or not bled).

1. This will be done by registered fishermen only, who will report the following:
    a) The location of the catch.
    b) The number of crabs caught.
    c) The number and sex of injured, killed, rejected for bleeding that are released at sea and released at dock, the number of healthy crabs transported to biomedical facility.
    d) After capture, all crabs judged suitable for bleeding will be marked, the fishermen will mark the crab and will report the health of crabs at marking and at release.
    e) The number and condition of crabs transported and delivered to bleeding labs
    f) The disposition of each crab after bleeding including:
        i. The number, sex, and relative health of the crab at the dock (healthy, injured, slow, dead)
        ii. The number, sex, and relative health of crabs at release to sea (same as above)
    g) The time from first capture to release.
2. An oversight (peer group) will monitor the data collected for each segment of the crab's movement from initial collection to release. The data will be reported to a mutually agreed upon group or agency who will release mortality and injuries data for each state within two weeks of the end of each quarter.

Thresholds for allowable mortality and injury at each stage will be determine by the oversight (peer review) group. The group shall be composed of experts who have demonstrated expertise in

the ecology of horseshoe crabs and shall not contain experts representing any commercial interests.

Overarching practices for all steps

- Generate written procedures for all handlers of horseshoe crabs, covering all steps in the process from collection to release.
- Keep horseshoe crabs cool, moist, and covered, avoiding direct sunlight.
- Establish a dialogue among collectors, the biomedical company, and the state regulatory agency to address concerns and challenges.
- Have a written contract between collectors and the biomedical company, outlining practices and expectations.
- Perform audits of the various steps in the biomedical use process and contractors/employees throughout the process
- Ensure proper monitoring and recording of mortality and injury at each step in the chain of custody.

Other concerns: bleeding of bait crabs

- Dual use of bait horseshoe crabs for biomedical practices should be prohibited.
- Eels and whelk fisheries are depleted, and HSC bait harvest should decline on its own, but not if bait fishermen can sell crabs to the biomedical industry.
- The bleeding of bait crabs will prop up an unnecessary bait harvest and institutionalize the death of hundreds of thousands of crabs/years rather than moving the biomedical industry toward a less lethal, more sustainable industry.
- Bait crabs from a given state or region are now sold to other states/regions for bleeding and entry into the purchaser's bait market (e.g., MA rent-a-crab, see Addendum III) or may be returned to the fisher – either way their fate is unknown. This practice undermines conservation efforts (*e.g.*, in Del. Bay Region) and rewards states/regions that continue to overfish their HSC populations (e.g., NY & New England Regions).
    - (Action: disallow sale of bait crabs outside the region of landing, e.g., bait crabs harvested in the Del. Bay region can only be sold to states within the Del. Bay Region – NJ, DE, MD, VA).
- Biomedical reps. claim that bait crabs receive the same level of care as biomedical-only crabs (i.e., only passively bled). This is doubtful. The biomedical industry is secretive, there is no oversight, facilities do not assess in-house mortality or allow independent assessment of mortality or best management practices. There is no reason to trust that the biomedical industry is not bleeding bait crabs to death.
- The biomedical industry has dismissed all biomedical mortality studies to date on the basis that the studies "did not follow industry best management practices." Industry BMPs were adopted in 2011 after most biomedical mortality studies were conducted. The 2011 BMPs are non-specific and non-measurable, and each biomedical facility is alleged to use additional unpublished practices. If industry BMPs are not measurable and

unknown, they cannot be reasonably replicated in biomedical mortality studies – this is an industry gambit.

- Starting in 2018, the number of bait crabs bled has not been reported in annual bait or biomedical harvest figures. This decreases public information and transparency of these two industries. The bleeding of bait crabs will prop up an unnecessary bait industry.

Review of Bleeding Mortality reports

Given recent findings and the wide variation in testing conditions and mortality results in bleeding studies, a formal peer review of the published studies needs to be undertaken. Publication of such a report could reduce some of the conflicting views currently expressed by various interests. Such a report could also frame future research avenues.

Summary

This report recommends revised BMPs for the various steps throughout the biomedical process, from harvest to release. The Horseshoe Crab Recovery Coalition continues to advocate for phaseout of the biomedical harvest replaced by widespread adoption of a equivalent synthetic alternatives for endotoxin testing. Until that time, we believe these BMP recommendations will help to reduce horseshoe crab mortality and protect this iconic species.

Literature Cited:

(1) Hurton, L, J. Berkson, and S. Smith. 2005. Estimation of total hemolymph volume in the horseshoe crab *Limulus polyphemus*. Mar. Fresh. Behav. Physiol. 79A:493-494.

(2) A.S. Leschen* and S.J. Correia. 2010. Mortality in female horseshoe crabs (Limulus polyphemus) from biomedical bleeding and handling: implications for fisheries management, Marine and Freshwater Behavior and Physiology Vol. 43, No. 2, 135–147

(3) ASMFC, Review of the Interstate Fishery Management Plan, Horseshoe Crab, Fishing years 2004 to 2017. http://www.asmfc.org/species/horseshoe-crab.

From:	Mary Pickett
To:	Comments
Subject:	[External] Horseshoe crabs and Delaware Bay
Date:	Saturday, January 21, 2023 10:19:13 AM

Horseshoe crabs are the foundation of so many species survival including the migratory birds. It is shameful that you are even considering allowing the harvest of female horseshoe crabs. Your purpose is to manage and help with species survival and that includes strict regulations on harvesting the female horseshoe crabs. Reread the research including paper published in the Environmental and Resource Economics which recommends that with a 12 year moratorium on crab bait harvests, this species could recover along with giving migratory birds including the red knot a fighting chance for recovery. So, please consider your actions carefully as so many species from the horseshoe crabs, fish, and birds depend on your decision.
Sincerely,
Mary Rose Pickett
Toledo, Ohio
419-297-3061

Sent from my iPhone

Best Management Practices for Handling Horseshoe Crabs for Biomedical Purposes

May 2023

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

DRAFT FOR BOARD CONSIDERATION

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Summary

The Atlantic States Marine Fisheries Commission (Commission) has maintained primary management authority for horseshoe crabs in state and federal waters since it adopted the Interstate Fishery Management Plan for Horseshoe Crabs (FMP) in 1998. The goal of the FMP includes management of horseshoe crab populations for continued use by current and future generations of the fishing industry and non-fishing public, including the biomedical industry, scientific and educational researchers, migratory shorebirds, and other dependent fish and wildlife. The Commission also assesses the horseshoe crab population through periodic stock assessments; the most recent assessment was the Horseshoe Crab Stock Assessment and Peer Review Report completed in 2019[1].

In 2022, the Horseshoe Crab Management Board (Board) appointed a work group to review and update the best management practices (BMPs) for handling biomedical catch, given over a decade has passed since the BMPs were originally developed. The work group included technical committee and advisory panel members with expertise in horseshoe crab biology, ecology, and biomedical processing. The purpose of the BMPs is to recommend broadly applicable industry standards that are expected to minimize mortality and injury of horseshoe crabs associated with the biomedical process. This document includes the modified BMPs, as recommended by the work group. It also provides background on the horseshoe crab biomedical fishery, information on current regulations in the Commission's Horseshoe Crab Fishery Management Plan (FMP) related to biomedical collections, descriptions of general processes used to collect and transport horseshoe crabs for biomedical purposes, and research

[1] Horseshoe crab stock assessment reports and information can be found on the Commission's webpage here: http://www.asmfc.org/species/horseshoe-crab#stock

recommendations that could further inform the BMPs and potentially further reduce mortality or injury of biomedical horseshoe crabs.

Background

Coastwide, horseshoe crabs are harvested for use as bait, and are an important resource for research and human health. In 1964, researchers discovered that horseshoe crab blood coagulates in the presence of very small quantities of bacterial endotoxin. By 1979, the U.S. Food and Drug Administration (FDA) issued draft guidelines for the use of *Limulus amebocyte lysate* (LAL), the product derived from horseshoe crab blood, as a test for detecting pathogens in patients, medical devices, and injectable drugs. The LAL test is the compendial standard[2] currently used domestically and internationally for screening injectable and indwelling medical products for endotoxin contamination. Vaccines, IV fluids, medications, artificial joints, and internal devices (e.g., stents, pacemakers, catheters) are just some examples of products tested. LAL is also used in medical research for human health and most recently, it has been approved for use as a clinical diagnosis of invasive fungal infections in patients.

To manufacture LAL, horseshoe crabs are collected by fishermen and provided to biomedical companies, which take a portion of their blood. The blood is then separated, and the proteins within the white blood cells are processed for more precise results. There are currently five FDA-licensed LAL manufacturers along the Atlantic Coast that process horseshoe crab blood for use in manufacturing LAL: Associates of Cape Cod Inc.; Lonza, Limuli Laboratories; FujiFilm Wako Chemicals; and Charles River Microbial Solutions. Horseshoe crabs are currently collected for biomedical purposes in Massachusetts, Rhode Island, New Jersey, Maryland, Virginia, and South Carolina.

As required for the reporting for biomedical horseshoe crabs, both the total number of horseshoe crabs collected and the number bled are reported. The number of bled horseshoe crabs has averaged 92.6% of the total number collected for the years since 2011 when the BMP document was developed. Some crabs are not bled due to damage, health (slow movements) and mortality. Horseshoe crabs collected solely for biomedical use are required to be released alive, however, there is a low level of mortality associated with biomedical processing. The overall biomedical mortality reported by the Commission includes any horseshoe crabs that are observed dead between the point of capture and release, plus the estimated number of horseshoe crabs that die from the biomedical bleeding process. Biomedical companies are required to record and report numbers of horseshoe crabs that are observed dead between the

[2] "Compendial standard" refers to a pharmaceutical standard of the United States Pharmacopeia, or other international pharmacopeia, meaning it is the official quality standard to be used for all pharmaceutical products sold in the U.S. or international marketplace. Testing and compliance to these standards is a basic requirement for global manufacturing, release, and distribution of pharmaceutical products.

point of capture and release, however, there are differences in how this information is collected by different biomedical collectors, companies, and facilities. Since this reporting began in 2004, the observed number of biomedical mortalities per year has averaged about 1.5% of the total number of horseshoe crabs collected for biomedical purposes coastwide (ASMFC 2022). The estimated mortality rate is 15% of all horseshoe crabs processed and released alive by the biomedical industry, which was determined through a review of all available literature on mortality, including studies that were not representative of standard biomedical handling practices, nor the practices described in the 2011 BMPs. This mortality rate has been reassessed and maintained in recent stock assessments (ASMFC 2019). Some states also have a dual use program where horseshoe crabs destined for the bait market can be loaned to a biomedical facility to be bled, before being returned to the bait market. These horseshoe crabs are not subject to the reporting described above; instead, they are counted against the state's bait quota as they have a 100% mortality rate.

The relative mortality of horseshoe crabs from the biomedical fishery is small when compared to the bait fishery. The number of horseshoe crabs harvested for bait on an annual basis typically accounts for over 85% of the total fishing mortality (bait fishery harvest plus estimated and observed biomedical mortality). Additionally, the Commission does not have regulatory authority over biomedical companies; they are subject to regulation by the FDA. Nevertheless, the Board strives to minimize the impact of biomedical collections on Atlantic horseshoe crab populations. In 2011, an *ad-hoc* work group drafted a BMP document including BMPs for the various steps throughout the biomedical process, from harvest to release. Many of the practices identified as BMPs had been historically used by the biomedical companies to sustain the horseshoe crab population and ensure a steady and reliable product supply to the pharmaceutical market. The work group recommended biomedical facilities follow the BMPs and monitor their suppliers. Recognizing the potential for future changes in the industry and the status of the resource, the WG also recommended meetings be held periodically to identify opportunities for improvements and minimize mortality.

In 2022, the Board formed a new work group to review and update the 2011 BMPs for handling biomedical catch. Over several meetings in early 2023, the work group evaluated each of the BMPs and identified areas that are out of date or could be improved with additional information. This document reflects the recommendations of the 2023 work group. Its purpose is to establish broadly applicable industry standards that are expected to minimize mortality and injury of horseshoe crabs associated with the biomedical process. This document also serves to educate the public about the biomedical industry, processes, and practices.

Horseshoe Crab Biomedical Regulations

Biomedical LAL manufacturers are regulated by the FDA and are permitted to obtain horseshoe crabs for blood collection by individual states. Collections of horseshoe crabs for biomedical use are subject to state regulations, separate from those placed on harvest and landing of horseshoe crabs for bait. The Commission's Horseshoe Crab FMP and subsequent Addenda include some regulations that states must comply with related to the biomedical collection of horseshoe crabs, which are summarized below.

FMP Requirements:

Interstate Fishery Management Plan for Horseshoe Crab (ASMFC 1998):

- States must issue a special permit, or other specific authorization, for harvests[3] for biomedical purposes.
- Horseshoe crabs taken for biomedical purposes shall be returned to the same state or federal waters from which they were collected.
- If horseshoe crabs are captured for biomedical use, all states must monitor and report monthly and annual harvest of horseshoe crabs by biomedical facilities (i.e., numbers), identify percent of mortality up to the point of release (including harvest, shipping[4], handling, and bleeding mortality), and certify that harvested horseshoe crabs are being used by biomedical facilities and not for other purposes.

Addendum III (ASMFC 2004):

- All states where horseshoe crabs are captured for biomedical use must monitor and report monthly and annual harvest of horseshoe crabs by biomedical facilities. All states must identify percent mortality up to the point of release (including harvest, shipping, handling and bleeding mortality), harvest method, number or percent of males and females, disposition of bled crabs, and condition of holding environment of bled crabs prior to release.

[3] The FMP refers to the collection of horseshoe crabs for biomedical purposes as "harvest." However, for the purposes of this document the term "collection" will be used because it more accurately represents the practices of the industry.

[4] The FMP refers to the transport of horseshoe crabs for biomedical purposes from where they are collected to a biomedical facility as "shipping." However, in this document the term "transport" is used because it more accurately represents the practices of the industry.

Best Management Practices for Handling Biomedical Collections

The following presents the biomedical process broken down into steps (Figure 1), with the best management practices associated with each step, as well as overarching practices applicable to all steps.

The general steps in the process are collection, transport to facility, holding at facility, inspection, blood collection, transport for return to sea, and release. “Collection” refers to removing horseshoe crabs from their natural environment, using methods such as trawl netting, or by hand from shore or shallow water. Some states use the practice of in-water holding, which involves keeping horseshoe crabs in coastal ponds or pens between capture and transport to the facility for blood collection. “Transport” refers to moving horseshoe crabs from the point of collection, landing, or holding to a biomedical facility, typically in containers by truck. “Holding at Facility” and “Blood Collection” refers to keeping the horseshoe crabs at the facility until they are inspected and then collecting blood from horseshoe crabs that pass inspection. Once blood is collected, the horseshoe crabs are held at the facility (along with those that were rejected) until they can be transported to the same state or federal waters from which they were collected and released.

The BMPs presented in this document represent standard practices used by the licensed manufacturers, and serve as recommendations for the best handling practices to minimize mortality and injury of horseshoe crabs. They are geared toward collections of horseshoe crabs for biomedical purposes, however these practices may be utilized by LAL manufacturers participating in a dual use program. The Work Group recommends that states review the BMP recommendations periodically to continue to minimize rates of mortality and injury of horseshoe crabs collected for biomedical purposes. The work group recognized the potential for changes in industry practices, increased knowledge related to the impacts associated with the various aspects of the biomedical process, and other factors that could affect the BMPs. Therefore, periodic review of the BMPs will be necessary to ensure their positive impact into the future.

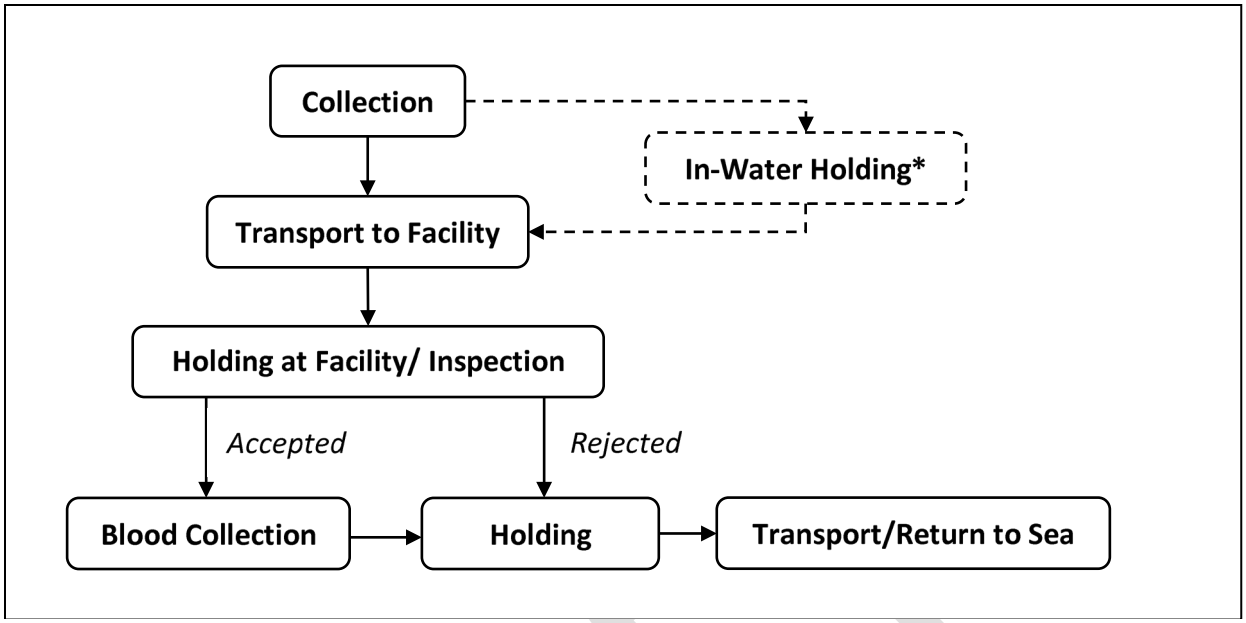

Figure 1. Diagram illustrating the general flow of horseshoe crabs through the biomedical process, from collection until return. *In-water holding is not utilized in all states.

Overarching practices for all steps

- Keep horseshoe crabs cool and moist, and minimize exposure to direct sunlight and anoxic conditions
- Avoid prolonged exposure of gills to fresh water
- Establish a dialogue among collectors, the biomedical company, and the state regulatory agency to address concerns and challenges
- Have a written agreement between collectors and the biomedical company, outlining practices and expectations
- Perform reviews of the various steps and contractors/employees throughout the process
- Ensure proper monitoring and recording of mortality at each step in the chain of custody
- Return horseshoe crabs taken for biomedical purposes to the same state or federal waters from which they were collected
- Avoid keeping horseshoe crabs out of the water for longer than 36 hours in total

Collection

- Minimize tow times for targeted horseshoe crab trawl tows,
- Handle horseshoe crabs carefully to minimize injury (e.g., avoid dropping/tossing horseshoe crabs, etc.)
- Minimize exposure to direct sun, avoid extreme temperatures and rapid temperature changes
- Night collection is recommended, especially during periods of excessive heat, when permitted by state regulation

- Sort out and return immediately to the water individuals that do not appear to be healthy (damaged, slow movement), soft shelled, or undersize horseshoe crabs (based on state regulations)
- Educate collectors in BMPs
- Specify expectations of collectors in written agreements
- Periodically observe horseshoe crab collectors' adherence to BMPs
- Horseshoe crabs marked as having been bled during the calendar year should be immediately released

In-Water Holding

- Minimize holding time
- Avoid overcrowding
- Monitor water conditions (e.g., temperature, dissolved oxygen, salinity) and minimize exposure to stressful conditions
- Follow state guidelines on holding conditions, where applicable

Transport to Facility

- Limit number of horseshoe crabs to a suitable number dependent on container size and shape to minimize damage to horseshoe crabs
- Minimize travel time
- Keep transport containers protected against direct sunlight and heat
- Secure containers in transport vehicle

Holding at Facility/ Blood Collection

- Minimize holding time at the facility, ideally to less than 24 hours
- Follow written procedures for proper care and handling when sorting horseshoe crabs and moving them between bins and within the facility
- Inspect horseshoe crabs for health and damage, selecting only undamaged and healthy individuals for blood collection
- Maintain clean, sanitary conditions during blood collection
- Maintain same level of care for rejected horseshoe crabs while they are being held until release back to state or federal waters
- Avoid collecting blood from individual horseshoe crabs more than once per year (e.g., by marking, tagging, etc.)
- If horseshoe crabs are marked, ensure that the mark is residual and not harmful
- Cease blood collection once blood flow rate slows
- Do not use suction to collect blood
- Perform internal audits to maintain quality control over written procedures

Post-Blood Collection Holding

- Maintain the same level of care that is used prior to blood collection
- Return to the state or federal waters from where they were collected as soon as possible, following state guidance when applicable

- Keep horseshoe crabs in low-light areas to minimize movement and injury

Return to Sea

- Use same care in handling and transporting horseshoe crabs being returned to the water
- Include written instructions and requirements for return within agreements with collectors, if applicable
- Periodically observe horseshoe crab collectors on implementation of BMPs and/or other criteria

Research Recommendations

The Work Group compiled the following list of research recommendations, which would enhance the understanding of impacts of the biomedical process on horseshoe crab populations. The work group recommends future experimental research related to biomedical practices using horseshoe crabs adhere to the applicable BMPs to more accurately reflect industry practices.

- *Study survival rates of horseshoe crabs collected for biomedical purposes over time when kept in in-water holding ponds or pens*
    - *Compare survival of horseshoe crabs at different holding durations to determine standard maximum holding times for different systems and water conditions*
- *Study the impacts of biomedical collection processes on spawning of horseshoe crabs, including the differential impacts of various collection and holding methods*
- *Compare mortality rates across different collection methods*
- *Estimate horseshoe crab discard mortality associated with trawling collection methods*
- *Review and summarize the findings of current literature on horseshoe crab mortality associated with blood collection, and compare across experiments that more closely reflect BMPs and do not reflect BMPs*
- *Quantify mortality rates of horseshoe crabs post-blood collection, applying the BMPs and other standard biomedical industry practices*
- *Study conditions that minimize movement and injury of horseshoe crabs during biomedical processes (e.g., light, density, etc.)*

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Atlantic States Marine Fisheries Commission

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Horseshoe Crab Biomedical Best Management Practices Work Group Meeting Summary

Webinar
January 4, 2023

Work Group Members: Benjie Swan (Limuli Labs), Brett Hoffmeister (Associates of Cape Cod), Daniel Sasson (SC DNR), Derek Perry (MA DMF), Katie Rodrigue (RI DEM), Nora Blair (Charles River Labs), Samantha MacQuesten (NJ DEP), Steve Doctor (MD DNR)

ASMFC Staff: Caitlin Starks

Public: Robert LaFrance, Susan Linder, Ben Levitan (Earthjustice)

In November 2022, the Horseshoe Crab Management Board formed a work group to review and update the best management practices (BMPs) for handling biomedical catch, which were originally developed in 2011. The work group (WG) includes technical committee and advisory panel members with expertise in horseshoe crab biology, ecology, and biomedical processing.

The WG met on January 4, 2023, to begin working on the Board task. Staff reviewed the task, and the WG raised issues with the BMPs that should be discussed. Daniel Sasson raised the issue that across the states with biomedical collections, there are different practices that are used. For example, in SC they only allow collection by hand, and then use holding ponds for crabs between collection and transport to the bleeding facility. For that reason, it is worth considering where the BMPs could be made more general. Derek Perry also mentioned that MA rarely used trawling as a biomedical collection method until this year, so it would be worth thinking about methods that are not used now but may be in the future. The group suggested that the section of BMPs related to collection should include sub-headers with BMPs that are specific to certain collection methods.

The group also suggested adding a new section for "penning or holding" to come before the "holding at facility" section. While the group saw value in adding more detail to the BMPs, one member reminded the group that the BMPs were originally developed to document industry practices, not to regulate industry. Practices have evolved over time, and there are a wide variety of methods for harvest, transportation, etc., and therefore the BMPs should tend to be more general. The group agreed it would be helpful to document and describe what general methods are used in each state. The WG noted that when summarizing practiced by state there could be some issues with proprietary information, so summaries should be general.

Derek suggested that the product of the WG should include recommendations for some broad-based regulations that could serve as baselines for biomedical practices coastwide. This would

set limits to ensure that the minimum standards accepted by the industry continue to be followed. He also suggested the group develop a list of research recommendations that would help inform improvements to BMPs in the future. Daniel noted that there are some research papers available the group could refer to that could inform BMPs related to how long crabs can be held in ponds, density, and water quality.

The WG had a discussion about the marking of crabs after they are bled with the purpose of avoiding bleeding crabs more than once in a season. In most places crabs are marked. In MD they use a tool to make a dent (but not perforate) the shell. MA uses waterproof paint applied at the bleeding facility, and rotates through four different marks each year. It was noted that the bleeding season seems to be getting longer so there is some uncertainty about whether the paint mark will continue to last through the season. Associates of Cape Cod did a small study in conjunction with Massachusetts DMF by marking a small number of crabs and placing them in an aquarium tank; this study demonstrated the mark was visible after several months when applied correctly. In addition, observations in the LAL manufacturing plant have showed evidence of marks from previous years showing up the next year. For SC the group was not sure if all crabs are marked after bleeding, but Nora Blair indicated that Charles River Labs' current practice is to mark crabs after bleeding. In the past some facilities have used scarring of the membrane to try and assess if the crab was previously bled.

Not all members of the WG agreed that the language in the BMPs on marking crabs should state that crabs "should" be marked. One person preferred that the language to remain as is, and say "if crabs are marked." It was noted that marking crabs can add additional time before returning crabs to sea, and in some areas may be unnecessary due to the large population. In tagging studies done by Limuli Labs they found they were not re-catching crabs that had already been bled that year, presumably due to the large number of crabs in the Delaware Bay area. The group suggested adding examples of marking methods to the BMPs.

The WG also began to discuss whether the BMPs should address the seasonality of collection, or collecting crabs from spawning beaches. Some members were concerned about harvest and penning during spawning season because it could limit the reproduction potential of the population. Others thought that this issue might be outside the scope of the document, which they argued was to reduce mortality and keep crabs healthy from when they are collected for biomedical purposes to when they are returned to the sea.

On the BMP related to appropriate tow times for trawling, the WG agreed that specifying a tow time was not necessary because there are other variables, like the number of crabs, that would affect what tow times are best. The WG suggested changing the language to encourage "minimizing" tow times.

The WG discussed the BMP related to "proper handling" of crabs. Some members thought there should be a more specific description of what "proper handing" entails. Others were concerned that defining it too narrowly could create unnecessary problems for the industry when practices differ. The group agreed to continue this discussion at its next meeting.

The following tasks were assigned to WG members to prepare for the next meeting:

- WG members will provide descriptions from each state on general biomedical practices used (e.g., collection methods, holding practices, seasonality, time out of the water, transport methods, release practices, etc.)
- Daniel will provide literature on handling for group to review, and literature on holding crabs and water quality
- All WG members will bring specific suggestions for changes to BMPs for next meeting, as well as research recommendations
- WG members will identify BMPs that could apply coastwide as baseline regulations for the group to consider

The WG will meet next month to continue work on this Board task.

Atlantic States Marine Fisheries Commission

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Horseshoe Crab Biomedical Best Management Practices Work Group Meeting Summary

Webinar
March 13, 2023

Work Group Members: Benjie Swan (Limuli Labs), Brett Hoffmeister (Associates of Cape Cod), Daniel Sasson (SC DNR), Derek Perry (MA DMF), Katie Rodrigue (RI DEM), Nora Blair (Charles River Labs), Samantha MacQuesten (NJ DEP), Steve Doctor (MD DNR)

ASMFC Staff: Caitlin Starks

Public: Melissa Chaplin (USFWS), Kristoffer Whitney (), Glen Fernandes, John Martin, Susan Linder, Ben Levitan (Earthjustice)

The Biomedical Best Management Practices Work Group (BMP WG) met on March 13th via webinar to continue addressing the Board task to review and update the Biomedical BMPs. The WG reviewed a draft document including the recommended modifications to the BMPs. First, the WG discussed the background information that should be provided in the document. WG members suggested that there should be a brief description of the biomedical industry's history and average observed mortality rates to provide context. They also agreed that there should be an explanation of the document's purpose and audience.

The WG also reviewed a draft diagram to include in the document. The diagram illustrates the flow of horseshoe crabs from the point of collection, to the biomedical facilities, to their point of return to the ocean during the biomedical process. The goal is to clarify the steps in the process to which each of the BMPs are relevant. The WG suggested changes to make the diagram as accurate as possible, while also including processes used across different regions.

The WG discussed recommendations for research and management. They agreed to include a number of research recommendations in the document that could increase knowledge of the impacts of the biomedical industry on horseshoe crab populations. The WG considered adding a recommendation to the states about how to make use of the BMPs. They agreed that the goal of the BMPs is to minimize mortality and injury of horseshoe crabs, but considering the variation in practices across the states, some members do not think it is appropriate to suggest the BMPs be implemented as requirements. The WG agreed that it should recommend the states periodically review the BMPs to continue to reduce the impacts of biomedical collections.

Two public attendees made comments at the end of the meeting. Ben Levitan from EarthJustice commented that the work group should recommend that the states should make material publicly available on which states allow biomedical collections of horseshoe crabs, as well as

their permit requirements for the biomedical industry. He also stated that if the document produced by the WG includes observed mortality rates, it must be made clear what practices are being used that result in those rates. Regarding the research recommendations, he commented that if studies on biomedical mortality rates are reviewed to reevaluate the number used to estimate the mortality bled crabs, there would need to be full transparency and public input on the studies that are used.

Susan Linder commented that she appreciates that this WG is considering how to improve the BMPs to decrease mortality, and also appreciates that the public were able to listen in. She said it has been helpful to listen to these conversations to better understand the biomedical process and clear up misconceptions that some may have about it.

Staff will revise the document based on the WG's recommendations. The WG will meet again in several weeks to finalize the draft document for the Board's consideration at its May 2023 meeting.

Atlantic States Marine Fisheries Commission

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Horseshoe Crab Biomedical Best Management Practices Work Group Meeting Summary

Webinar
April 4, 2023

Work Group Members: Benjie Swan (Limuli Labs), Brett Hoffmeister (Associates of Cape Cod), Daniel Sasson (SC DNR), Derek Perry (MA DMF), Katie Rodrigue (RI DEM), Nora Blair (Charles River Labs), Samantha MacQuesten (NJ DEP), Steve Doctor (MD DNR)

ASMFC Staff: Caitlin Starks, Toni Kerns

Public: Melissa Chaplin (USFWS), Kristoffer Whitney , Susan Linder, Ben Levitan (Earthjustice), John Sweka (USFWS), Allen Burgenson (Lonza), Christina Lecker (Wako Chemicals USA Inc.), Jim Cooper, David Mizrahi (NJ Audubon)

The Biomedical Best Management Practices Work Group (BMP WG) met on April 4th via webinar to continue addressing the Board task to review and update the Biomedical BMPs. Staff began the meeting by reviewing the work group ground rules and process for allowing the public to make comments during the meeting. The WG reviewed suggested edits to the draft BMP document it has developed over the last several months. The draft document includes a summary, a background section to provide context for the biomedical industry BMPs and purpose of the document, a description of the general flow of horseshoe crabs through the biomedical blood collection process, research recommendations, and a recommendations section geared toward management.

The WG did not complete its review of the draft document at this meeting, but did review the summary and background sections. The WG discussed adding data on the horseshoe crab population, and the relative numbers of crabs collected for biomedical use. There was disagreement among group members on the level of detail to provide on this topic, but ultimately a compromise was reached by agreeing to add a reference to the most recent stock assessment to provide population information, and a direct link to the stock assessment publications on the Commission's website. The group also agreed it would be helpful to note that this review of the BMPs is occurring due to the amount of time that has passed since the BMPs were originally developed, and not as a result of an issue with the BMPs. The group also wanted the background section to clarify that fishing practices within each state have generally dictated the collections methods that can be used for biomedical crabs.

There was also a discussion on the dual use of horseshoe crabs originating from the bait fishery for biomedical blood collection. The group decided the BMP document should mention this practice only occurs in some states. Because dual-use crabs are counted against the bait fishery

quota and have a mortality rate of 100%, the document should clarify that the BMPs are not relevant to dual-use horseshoe crabs.

One member of the public commented that he disagreed with comments suggesting that the BMP document should address how shorebirds are impacted by the biomedical collection of horseshoe crabs. He noted that the purpose of the BMPs is to reduce the mortality and injury of horseshoe crabs during the biomedical process, and that comments about broader impacts to other species are outside the scope of the document and should be disregarded.

Staff will provide edits to the document to address the concerns raised by the WG. The WG will meet again in April to continue reviewing the document and finalize it for the Board's consideration at its May 2023 meeting.

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MEMORANDUM

TO: **Horseshoe Crab Management Board**

FROM: **Caitlin Starks, Senior FMP Coordinator**

DATE: **April 17, 2023**

SUBJECT: **Options for Evaluating Delaware Bay Horseshoe Crab Fishery Management Objectives**

Background

At its November 2022 meeting, after adopting changes to the Adaptive Resource Management (ARM) Framework, the Horseshoe Crab Management Board (Board) discussed the possibility of forming a work group to evaluate the current goals and objectives for the management of Delaware Bay horseshoe crab. The 2021 ARM Revision established the following objective statement:

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

The Board requested a list of potential approaches for evaluating management objectives, and the resources required for each option be presented in May. The three options listed below range from low to high resource requirements and include a general description, anticipated timeline and personnel needs, and major budget line items associated with each approach. Any of the options may require an amendment to the Commission's Action Plan.

Each of these processes would provide the Board more information on which to base the decision about whether to consider changes to the Delaware Bay horseshoe crab management program. For all of these approaches the Board would need to provide guidance on the scope of issues to be addressed. All of the options would inform possible revisions to the management goals and objectives and ARM Framework. If the Board were to pursue changes to the management program based on the information provided through their selected approach, an addendum or amendment to the fishery management plan would likely be necessary.

Options for Evaluating Goals and Objectives

1. Stakeholder Survey (Low Resource Requirements)

Description: A Board Work Group (WG) would be convened to develop a survey to evaluate the current goals and objectives for Delaware Bay horseshoe crab management. WG members would include a subset of Board members from the Delaware Bay region. Additionally,

individuals would be identified by the WG to provide information on the stock, the fishery, ecosystem services, and biomedical use to the WG during their deliberations. These individuals would represent the various stakeholder interests including horseshoe crab bait fishermen, conservation organizations, shorebird and horseshoe crab ecologists, biomedical industry representatives, etc. ASMFC staff would present the results of the survey to the Board.

Timeline: ~4-6 months

Personnel Needs: ASMFC Staff, 5-6 Board members

Major Budget Items: WG meeting(s)

2. Board Work Group (Medium Resource Requirements)

Description: A Board WG would be formed to identify possible goals and objectives for both the fishery and horseshoe crab's role in the ecosystem for the Horseshoe Crab Board to consider. WG members would include one Board member from each of the Delaware Bay states, one non-Delaware Bay state, and a federal representative. The product would be a WG report that outlines potential objectives (e.g., sustain a horseshoe crab fishery, maximize red knot forage) and a range of possible management strategies to address the objectives. The WG could seek information from stakeholder groups (e.g. horseshoe crab bait fishermen, conservation organizations, shorebird and horseshoe crab ecologists, biomedical industry representatives, etc) to address issues outlined in the statement of the problem.

Timeline: 6-9 months

Personnel Needs: ASMFC Staff, Board and Advisory Panel members, technical and stakeholder representatives

Major Budget Items: In-person WG meetings

3. Ecosystem Management Objectives Workshop, Similar to Atlantic Menhaden Process (High Resource Requirements)

Description: This approach would involve one or a series of facilitated workshops with stakeholders, managers, and scientists, to identify possible goals and objectives for both the fishery and horseshoe crab's role in the ecosystem for the Horseshoe Crab Board to consider. Participants in the workshop would include one Board member from each of the Delaware Bay states, one non-Delaware Bay state, and one federal representative, as well as one representative each from the following groups: biomedical industry, bait industry (harvester), non-governmental organizations, technical committee (horseshoe crab expertise), technical committee (shorebird expertise), bait dealer or fisherman that uses horseshoe crab for bait. The workshop report would outline potential objectives (e.g., sustain a horseshoe crab fishery, maximize red knot forage) and potential performance measures for those objectives (e.g., meeting or exceeding reference points, historic distribution maintained). The workshop could potentially discuss a system for prioritizing competing objectives, if applicable.

Timeline: 9-12 months

Personnel Needs: ASMFC Staff, Board and Advisory Panel members, technical and stakeholder representatives, workshop chair (e.g., a previous ARM peer review panel member) and/or a hired facilitator

Major Budget Items: In-person stakeholder workshop(s), workshop facilitator