

Atlantic States Marine Fisheries Commission

Horseshoe Crab Management Board

*October 24, 2012
1:30 – 2:30 p.m.
Philadelphia, Pennsylvania*

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 (*D. Simpson*) 1:30 p.m.
2. Board Consent 1:35 p.m.
 - Approval of Agenda
 - Approval of Proceedings from May 3, 2012
3. Public Comment 1:40 p.m.
4. Delaware Bay Ecosystem Technical Committee Reports (*J. Brust*) **Action** 1:50 p.m.
 - ARM Framework Harvest Output Recommendations for 2013
 - Shorebird and Horseshoe Crab Survey Reports Summary
5. Other Business/Adjourn 2:25 p.m.

The meeting will be held at the Radisson Plaza Warwick Hotel, 220 S. 17th Street, Philadelphia, PA; 215-735-6000

Healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015

MEETING OVERVIEW

Horseshoe Crab Management Board Meeting

Wednesday, October 24, 2012

1:30 – 2:30 p.m.

Philadelphia, PA

Chair: David Simpson (CT) Assumed Chairmanship: 5/12	Horseshoe Crab Technical Committee Chair: Penny Howell (CT)	Law Enforcement Committee Representative: Vacant
Vice Chair: Jim Gilmore (NY)	Horseshoe Crab Advisory Panel Chair: Dr. Jim Cooper (SC)	Previous Board Meeting: May 3, 2012
Shorebird Advisory Panel Chair: Dr. Sarah Karpanty (VA)	Delaware Bay Ecosystem Technical Committee Chair: Jeff Brust (NJ)	
Voting Members: NH, MA, RI, CT, NY, NJ, DE, MD, DC, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS (17 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from May 3, 2012

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. Delaware Bay Ecosystem Technical Committee Reports (1:50-2:25 p.m.) Action
<p>Background</p> <ul style="list-style-type: none"> • The Delaware Bay Ecosystem Technical Committee Reviewed the ARM Framework Harvest Output, provided by the ARM Subcommittee at its September 2012 meeting. • The Harvest Output recommends the optimal harvest, based on horseshoe crab and red knot abundances, for implementation of the ARM Framework in the 2013 season. Harvest Package 3 (500,000 males; 0 females) was recommended (Briefing CD). • The Delaware Bay Ecosystem Technical Committee also reviewed the various horseshoe crab and shorebird surveys and reports to provide the Management Board with a more holistic view of the Delaware Bay
<p>Presentations</p> <ul style="list-style-type: none"> • Review of ARM Framework Harvest Output recommendation by J. Brust. • Review of horseshoe and shorebird survey reports summary by J. Brust
<p>Board actions for consideration at this meeting</p> <ul style="list-style-type: none"> • Approve the ARM Framework Harvest Output for management in 2013.

5. Other Business/Adjourn

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PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

HORSESHOE CRAB MANAGEMENT BOARD

Crowne Plaza Hotel - Old Town
Alexandria, Virginia
May 3, 2012

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

INDEX OF MOTIONS

1. **Approval of Agenda** by Consent (Page 1).
2. **Approval of Proceedings of February 9, 2012** by Consent (Page 1).
3. **Move to accept the transfer request from North Carolina to Georgia** (Page 2). Motion by Louis Daniel; second by Adam Nowalsky. Motion carried (Page 2).
4. **Move to approve the plan review and compliance report summary and the de minimis requests** (Page 3). Motion by Bill Adler; second by John Duren. Motion carried (Page 4).
5. **Motion to adjourn, by Consent** (Page 7).

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ATTENDANCE

Board Members

Douglas Grout, NH (AA)	Roy Miller, DE (GA)
Dan McKiernan, MA, proxy for P. Diodati (AA)	Bernie Pankowski, DE, proxy for Sen. Venables (LA)
Bill Adler, MA (GA)	Tom O'Connell, MD (AA)
Rep. Sarah Peake, MA (LA)	Bill Goldsborough, MD (GA)
Jocelyn Cary, MA, Legislative proxy	Russell Dize, MD, proxy for Sen. Colburn (LA)
Robert Ballou, RI (AA)	Rob O'Reilly, VA, proxy for J. Travelstead (AA)
Mark Gibson, RI, Administrative proxy	Louis Daniel, NC (AA)
Rick Bellavance, RI, proxy for Rep. Martin (LA)	Mel Bell, SC, proxy for R. Boyles (LA)
Dave Simpson, CT (AA)	Spud Woodward, GA (AA)
Steve Heins, NY, proxy for J. Gilmore (AA)	John Duren, GA (GA)
Peter Himchak, NJ, proxy for D. Chanda (AA)	Aaron Poday, FL (AA)
Adam Nowalsky, NJ, proxy for Asm. Albano (LA)	Derek Orner, NMFS
Tom Fote, NJ (GA)	Jaime Geiger, USFWS
David Saveikis, DE (AA)	

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

Ex-Officio Members

Jeff Brust, Delaware Bay Ecosystem Technical
Committee Chair

ASMFC Staff

Vince O'Shea	Mark Robson
Robert Beal	Kate Taylor
Danielle Chesky	

Guests

Stewart Michels, DE DFW	Alan Burgenson, Lonza Walkersville, Inc
Steve Meyers, NOAA	Benje Swan, Limuli Laboratories-Dias Creek

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

The Horseshoe Crab Management Board of the Atlantic States Marine Fisheries Commission convened in the Presidential Ballroom of the Crowne Plaza Hotel, Alexandria, Virginia, May 3, 2012, and was called to order at 10:30 o'clock a.m. by Chairman David Simpson.

CALL TO ORDER

CHAIRMAN DAVID SIMPSON: Let's get started for the Horseshoe Crab Board. It's a few minutes early but I think we have the necessary quorum. We have a fairly brief agenda, a hour's worth of working we're hoping.

APPROVAL OF AGENDA

CHAIRMAN SIMPSON: We need to approve the agenda. Are there any changes to the agenda? Seeing none, we'll consider the agenda approved.

APPROVAL OF PROCEEDINGS

CHAIRMAN SIMPSON: The proceedings of the February 9 meeting; any issues or problems with that? Seeing none, we'll approve the proceedings.

PUBLIC COMMENT

CHAIRMAN SIMPSON: Is there any public comment on issues not on the agenda? I don't see any.

ELECTION OF VICE-CHAIRMAN

CHAIRMAN SIMPSON: The next agenda item is to elect a vice-chair. Tom.

MR. THOMAS O'CONNELL: You know, when you don't come to meetings you get penalized, so I would nominate Jim Gilmore from New York.

CHAIRMAN SIMPSON: Thank you, Tom. Is there a second to that nomination of nominating Jim in absentia? I'll take Steve Heins. Any objection to that motion? **Seeing none, I will welcome Jim as my sidekick since this is my first meeting as chair.**

TRANSFER REQUEST FROM NORTH CAROLINA TO GEORGIA

CHAIRMAN SIMPSON: The next agenda item is the transfer request from North Carolina to Georgia. Danielle.

MS. DANIELLE CHESKY: As part of the 2011 compliance reports that came in, North Carolina requested a transfer of crabs from Georgia. North

Carolina had exceeded its quota in 2011. The quota currently is set at 24,036 crabs. The overage came as bycatch in the blue crab trawl fishery.

New proclamation authorities to help control the bycatch went into effect actually April 1, 2011. However, according to the request the overage had occurred prior to the date. The request was for 3,500 crabs from Georgia. This request was reviewed by both advisory panels, the Horseshoe Crab Technical Committee, and the comments of these reviews were reviewed by the plan review team and summarized here.

The main comments that were made and summarized reflect the fact that this should be a one-time request, that future continued transfers would in fact be a de facto quota redistribution. There was some uncertainty raised in terms of the populations with the genetics of how related the two stocks were. This information came from Dr. King's work.

There are shorebird populations that overwinter and utilize the beaches in Georgia and North Carolina although all of it indicates that they are not likely eating horseshoe crabs down there and likely eating other bivalves. There is no biomedical impact that was noted as neither state has biomedical companies or harvest. Finally, there was a little bit of concern in terms of pushing the fishery demand elsewhere, especially with the focus on Delaware Bay.

However, the final conclusion would be that the PRT would recommend approval of the transfer request given the small number of crabs and the regulatory steps that North Carolina has taken to provide greater control of the fishery and the harvest. The PRT and the committees would warn against potential future transfer requests; and if those would occur, to consider having those mediated through deductions in the state's quota. Thank you, Mr. Chairman.

CHAIRMAN SIMPSON: Any questions? Pete.

MR. PETER HIMCHAK: I just had two quick comments. That's amazing, three conference calls and all these reports and correspondence; it shows you what a premium the commission puts on 3,500 horseshoe crabs. I'm fully supportive of the transfer. One thing that really caught my attention is in the Shorebird AP Report on the transfer – and they talk about hundreds to thousands of red knots feeding in North Carolina and Georgia on their way to their breeding grounds.

Now we see red knots feeding in Florida; Virginia; Maryland; New Jersey; Jamaica Bay, New York. I mean, this has gotten a rather – this picture has gotten a lot more complex and what I believe years ago where they all had to come to Delaware Bay or they weren't going to make it. That really caught my attention and it just points out there is a lot more to this life strategy of red knots than we can imagine.

DR. JAIME GEIGER: Pete's comments are right on. As part of the red knot status review we're certainly identifying much more locations due to increased monitoring and assessment activities on populations of migratory shorebirds included red knot. We're seeing them not only in the locations where has mentioned but also I believe on the Texas Gulf Coast as well.

Again, I think part of that is the increased focus on the relationships between red knots and migratory shorebirds and quite frankly a lot of it is due to the emphasis of management on horseshoe crabs and the inclusion of the shorebird community in the horseshoe crab management plan that this commission has undertaken.

I do think we need to get a little more serious about some of the genetic implications of quota transfer. I know the genetics are not well laid out, but again as we all know the biomedical industry and some of the issues of returning horseshoe crabs back to their less than native or collection points may have compromised some of the genetics of horseshoe crab populations. We really don't know but we need to do obviously some more work on that, and I would urge the commission to be always cautious when we're looking at these quota transfers related to genetics of a population. Thank you very much, Mr. Chairman.

CHAIRMAN SIMPSON: Any other comments or questions on this? Is there a motion relative to this? Louis.

DR. LOUIS DANIEL: **Move to accept the transfer.**

CHAIRMAN SIMPSON: Is there a second; second from Adam. Any discussion? Is there any need to caucus? **All those in favor raise your hand, 14 in favor; opposed, none; any abstentions, none; any null votes, none.** Okay, thank you. Louis.

DR. DANIEL: I just want to say thanks to Georgia for accommodating our request; I appreciate it.

FMP PLAN REVIEWS AND STATE COMPLIANCE REPORTS

CHAIRMAN SIMPSON: Okay, we have the FMP Plan Reviews.

MS. CHESKY: The compliance reports for horseshoe crab from the states were due March 1, 2012. The plan review team looked over them and has provided for you the compliance report summary as well as this FMP Review, which we will review today. The yearly total harvest, you can see on the graph the bait harvest in gray and the biomedical harvest is in the darker black.

The bait harvest itself was a little bit up this year from last year, but you can see it's pretty on par with where we have been over the past few years. The bait fishery itself had about 650,000 crabs harvested this year; and I said it's a little bit up but pretty well on target over the past five years. These increases incurred in Massachusetts, Delaware, New York and North Carolina.

In terms of the biomedical harvest about 628,000 crabs were brought to biomedical facilities this year. This included both bait and biomedical crabs that were used. It was about a 28 percent increase over the past five-year average continuing the trend of an increasing biomedical harvest. Over 82,000 crabs were used this year as both bait and biomedical. That's an 11 percent increase as well.

In terms of coast-wide mortality for biomedical harvest, that was estimated at 80,827 crabs. As part of Addendum III the board included a threshold trigger to consider actions set at 57,500 crabs. As part of the recommendations the PRT would recommend that the board consider action on including continuing work on and implementation of the best management practices.

There was a document that was prepared and presented to the board at the annual meeting in Boston. It included what I think the board termed a skeleton outline of best management practices. As part of the direction from that meeting the board tasked this group to continue working on those best management practices.

Dr. Dawson from the Associates of Cape Cod in Massachusetts has volunteered to work with the other biomedical companies over these next few months to further develop those and see what they can flesh out in terms of more details on them. We're hoping to be

able to report back to the board potentially some time this fall at least on the terms of the status of that.

In terms of state compliance the PRT did recommend that all states be found in compliance. The PRT does note for the board that the District of Columbia did not submit a compliance report. As in years past, the PRT would recommend that DC as well as the Potomac River Fisheries Commission take the necessary steps to be removed from the board as Pennsylvania and Maine have done.

This would relieve the administrative burden on both DC and PRFC and this board. The PRT also wanted to note that Virginia's overages which have been a topic of discussion over the past few years have been fully accounted for. Other concerns that have been highlighted is mainly the importation of Asian horseshoe crabs for bait. The board heard about this via memo last August, I believe.

Also then also at the annual meeting I believe Rick Robins came up and gave some information to the board. This continues to be of concern not only because the Asian horseshoe crab populations are in severe decline and struggling but also the potential for invasive species interactions and just other things we don't know about coming in. The PRT would recommend that the board continue to monitor and investigate management opportunities for this.

Additional concerns that have been included, gender of catch recording; according to Addendum III if a state's catches are under 5 percent of the total coast-wide harvest, it is not required to record gender. However, the PRT would recommend that states do consider including this on their catch reporting as it would help to indicate the total gender harvest coastwide.

The PRT does note that there is a continued need for data from the Virginia Tech Trawl Survey, especially with the implementation of the ARM Framework due to come in 2013. Finally, the PRT recommends that all tagging programs, which need to generally be approved by the states under scientific collection permits, coordinate with the U.S. Fish and Wildlife Service Tagging Program, which you will hear more about in the next presentation. I apologize for the repeat on the Asian Horseshoe Crabs, but it is a large issue.

Finally, Maine, New Hampshire, the Potomac River Fisheries Commission, South Carolina, Georgia and Florida all requested de minimis. New Jersey qualified but did not request it. The PRT

recommends that all requests for de minimis be granted. Thank you, Mr. Chairman.

CHAIRMAN SIMPSON: Any questions for Danielle? Bill.

MR. WILLIAM A. ADLER: In one of the slides you said that the Potomac River Fisheries Commission should be removed from the board, and then later on it said they're requesting de minimis status. What is the different here?

MS. CHESKY: It is more of an administrative difference. It would relieve them of having to submit a compliance report every year, and it would relieve the PRT of continuing to recommend to the PRFC that its compliance report follow the outline with all the different components.

MR. ADLER: All right, so which do they want? Do they want to be removed from the board and/or de minimis status?

MS. CHESKY: Sorry for the confusion; the PRFC has not asked to be removed from the board. They have asked for de minimis status be granted. The plan review team recommended that PRFC and the District of Columbia take the necessary steps to be removed from the board to relieve those administrative requirements.

MR. ROB O'REILLY: It's really just a comment, Mr. Chairman; but in consideration of what Danielle indicated about the Virginia quota overages, this is an ongoing process with a quota that is probably about 10 percent of maybe the harvest or the landings in the past. Industry is working well with Virginia, with VMRC, and we will have new information coming up in our regulations. You have to be very aggressive to monitor this quota.

What Virginia has done is established gear-based quotas now, so each gear-based quota is monitored, and there can be shutoff individually which helps aid the monitoring overall. Other states may have had similar difficulties in trying to address lag times with reporting, and you really do have to be very aggressive.

CHAIRMAN SIMPSON: Thanks, Rob. Any other comments? **We need a motion then to approve the plan review and compliance report summary and the de minimis requests.** Bill.

MR. ADLER: I will so move.

CHAIRMAN SIMPSON: And, John, you're seconding? Okay. Any discussion on this motion? Any objection to it? **Seeing none, we'll consider it approved.** Next is the technical committee report.

TECHNICAL COMMITTEE REPORT ON TAGGING PROGRAM

CHAIRMAN SIMPSON: Next is the technical committee report.

MS. CHESKY: Penny Howell from Connecticut is now the Horseshoe Crab Technical Committee Chair but was unable to make it due to some scheduling, so I'll be giving the summary of the technical committee report today. Our technical committee met in April in Baltimore.

They considered the transfer request from North Carolina as well as the Horseshoe Crab Tagging Program and discussed some other issues that came up with the proposed ARM implementation for next year. In terms of discussing the ARM implementation, the technical committee discussed that there have been past concerns about the external impacts of the horseshoe crab management in Delaware Bay and the impacts that it has had.

Most notably New York and Massachusetts have seen their harvest of horseshoe crabs go up in response to decreases of harvest in the Delaware Bay. Considering moving forward with the ARM will be a complete new management strategy for this board, the technical committee is recommending that the board task the technical committee and the stock assessment subcommittee to gather, review and summarize the available coastal and state indices with data through 2012.

That would give a before picture of the status of the indices along the coast prior to ARM implementation in 2013. The technical committee would anticipate that this would occur next spring. Most of these indices are reported as part of the state compliance reports already, so the technical committee members felt this wouldn't be a large task in terms of work for them.

Additionally, John Sweka, who received the award the other day, would be the one who would be inputting the data into the modeling, and he has indicated that it would not be a large effort on his part. The technical committee feels that this could be done with relatively minimal time and effort moving forward.

The other main topic of conversation was the tagging program at this technical committee meeting. The program was established through the U.S. Fish and Wildlife Service to be able to have a standardized tagging program along the coast. The requirements for the program weren't necessarily standardized, though. The data were originally intended to be used for a stock level analysis. The program was established originally back in 1999 and it has grown from about 10,000 tags a year to over 30,000 tags a year distributed in 2011.

Just a quick summary, almost 200,000 tags have been released with about 28,000 recaptures, which is pretty good considering. The issues with the current program that have been identified was that the tags have been supplied free of charge to the programs that have been putting them out, and the costs are becoming too large for the U.S. Fish and Wildlife Service to support this increasing trend.

The program itself, as I've mentioned, has no current set requirements for recording in terms of who gets to put out the tags, what tags and where they're putting them out or why they're having a tagging program of these different groups. Additionally, the technical committee noted that the resighting efforts are inconsistent and often given much less consideration than the tagging effort, and to have a successful tagging program there needs to be effort on both putting the tags out and then also resighting and recording the data.

These resighting issues include not only the effort that is being put out but also the phone calls that are coming in require considerable staff time by the U.S. Fish and Wildlife Service Office. Additionally, those who report crabs have been awarded a pewter pen in the past. The Fish and Wildlife Service indicated that they've got enough stock left over from previous years to continue to this reward program for 2012, but they are investigating options for future work.

Additionally, being able to use this tagging and resighting data and the mechanisms for using it have not necessarily been established. We ran across this when looking at the tagging data for use in the ARM Framework in terms of allocation among the states. As part of this revised program guidelines, the technical committee has indicated that the tag requests will be made on an annual basis from the different providers.

However, added to this will be the fact that tagging programs would be required to submit a study design that meets at least one of the following objectives;

either determining sub-population structure along the coast; estimating movement and migration; and then also potentially estimating survival and mortality.

The technical committee felt that being able to prioritize these objectives would help with the use of these data in management efforts by this board. Additionally, resighting effort is required to be proportional to the initial tag release effort, which just means that if you're going to be planning for tagging one year you need to be able to provide resighting effort for a year as well, so that's during that season, and then also a year-end summary report would be required.

There was a lot of support from the technical committee members who said you might get a really thorough report or perhaps just a couple of paragraphs, but either way it would help to be able to track what the programs are doing with the tags and the efforts that are being made. Additionally, the technical committee is recommending a geographical distribution for the tags with a large focus in the northeast and Delaware Bay, but still keeping a coast-wide focus on it as well by recommending smaller levels but still levels along the New York/New Jersey coast and then in the southeast.

The strata in terms of the numbers were based on current demands for tags and the data, and they can be altered to meet future management needs as these are only included as recommendations within the guidelines. In terms of recommendations that have come from the technical committee regarding the tagging program, they would recommend that the board accept the revised program guidelines for use by the U.S. Fish and Wildlife Service.

They are also recommending – and you heard this recommendation during the FMP Review Report – that all states when considering scientific collection permit applications encourage and/or require applicants to work through the U.S. Fish and Wildlife Service Tagging Program to maintain the consistency in this coast-wide tagging effort.

Finally, the technical committee recommended that the U.S. Fish and Wildlife Service print the web address for reporting the tags on the tag itself. In working with Sheila Eyler, who runs this program in the U.S. Fish and Wildlife Service, she has indicated that is likely going to be a real possibility, so hopefully that will also help with the phone calls that folks are receiving.

In terms of some additional considerations that were included, the technical committee recommends that the board continue to support and promote this coast-wide tagging program. Consistency is vital to the future use for management purposes as well as public interest is vital to the resighting efforts.

There is a possibility the technical committee included for expansion of the tagging program beyond this 20,000 tag cap, but that would be on a case-by-case basis, working with Sheila and the U.S. Fish and Wildlife Service in terms of estimating additional costs that would need to be covered to cover these efforts. As a note, the U.S. Fish and Wildlife Service was part of this meeting in terms of creating these program guidelines moving forward. Thank you, Mr. Chairman.

CHAIRMAN SIMPSON: Any questions for Danielle? There were some recommendations coming from the group. Any thoughts on those?

MR. STEWART MICHELS: Danielle, the technical committee is willing to be tasked basically by the board to kind of update the trend analysis from like the last stock assessment?

MS. CHESKY: That's correct.

MR. MICHELS: Would we need a motion for that or can we just simply –

CHAIRMAN SIMPSON: I think we can do it without objection. Do we need to take any action on their recommendations; accept the revised program guidelines and all states considering in their application permit encouraging or requiring the applicants to work through the U.S. Fish and Wildlife Tagging – we also have the tagging protocols for the commission; does that come into play at all here? Presumably the Fish and Wildlife is consistent with it already.

MS. CHESKY: Yes, those play directly into the tagging program and are consistent. They were developed through the technical committee and the U.S. Fish and Wildlife Service and the former Horseshoe Crab Tagging Subcommittee, I believe it was called.

DR. GEIGER: Mr. Chairman, it would be very, very helpful to the Fish and Wildlife Service for the board to accept these recommendations. Thank you.

CHAIRMAN SIMPSON: Do we need a motion to that effect or do you – what is the pleasure of the

group? Is there any objection to accepting these? Okay, great.

UPDATE ON THE ARM FRAMEWORK IMPLEMENTATION SCHEDULE

MS. CHESKY: Just one last thing, I wanted to give the board an update on the ARM Framework. Originally the Delaware Bay Technical Committee and the ARM Working Group had anticipated being able to give the harvest output recommendations to the board in August at its meeting.

However, being able to get the shorebird data from 2012 through the QAQC process and input into the model would be a bit of a tight timeline. The Delaware Bay Technical Committee met with the ARM Working Group and with folks who collect the shorebird data. Those data will be ready and provided to the board at its annual meeting. I just wanted to give you folks a heads up. The technical committee members indicated that this would not be an issue in being able to implement the management regulations in time for the 2013 season. Thank you.

CHAIRMAN SIMPSON: Any questions or comments on the ARM? Is there anything else for the Horseshoe Crab Board? Dan.

OTHER BUSINESS

MR. DAN McKIERNAN: I am wondering if the plan review team or the technical committee could consider in the future reporting on the demand within our states for horseshoe crabs as bait. We as marine fisheries regulators are responsible – most of us are as you know – for the whelk pot fisheries, which is as I understand it the number one demand for horseshoe crabs.

The eel pot fishery, which is obviously waning given the status of eels, but it is very much related to the increase I think that we saw in the Massachusetts bait harvest. In Massachusetts we saw an increase of about 50 percent in pots fished for conch – in Massachusetts we have a specific conch pot permit, and we define the gear as a conch pot and we also have limited entry; and we have a pot limit of 200 pots.

I'm wondering if it would be useful for the states to reveal the trends within their state about the setting of whelk pots and maybe eel pots so that we can understand the growing demand for this bait product

and sort of getting a total picture of where the trends in the fishery are.

CHAIRMAN SIMPSON: Yes, I can see where that would be important. Can you help with the envisioning of how that information would be collected? Would it be through some measure of effort in the whelk fishery or a more direct method of measuring bait sales into a state?

MR. McKIERNAN: No, I was thinking more of the performance of the pot fishery as a proxy for demand. In your state, mine and Mark's, we have trip level reporting. Presumably if the harvesters are reporting accurately to their activities, they might tell us on a given day they hauled so many pots for purposes of harvesting whelk, and so those trap hauls could be segregated from lobster trap hauls.

I think in Southern New England whelk has become the crutch or the safety for lobstermen. In fact our landings in Massachusetts for the channeled whelk are valued at \$6 million now, which is about three times more than our lobster landings. People don't fear that this is a growing monster. We have seen a leveling off of effort and of landings so I don't expect it is going to continue to spike, but it might be spiking elsewhere and that might be accounting for why this increased demand for bait crabs.

MS. CHESKY: I think the PRT would be more than happy to collect that data from states if they would be able to provide it and we could put together a summary of trends or landings, if that would be helpful to the board.

MR. O'REILLY: I think there might be some complications. For example, in Virginia we can tell you exactly the type of fishery there is and the requirements. When it comes to the overall fishery, it is about 90 percent from federal waters so that the requirements are limited to how much can be landed in terms of bushels and also a possession size limit.

Some of that information would have to be refined by the PRT for exactly looking at each state and how much is federal and how much is state waters. That would be the start because the federal waters part is really just based on the landing itself and not so much on pot control or anything else.

CHAIRMAN SIMPSON: Yes, it is interesting that we've had the same quota in place for several years now. I've lost track of how many, but that whelk fishery has really grown and so it sort of begs the

question of how those two things sync up. I think it's worth looking into. Mark.

MR. MARK GIBSON: I'll just back up Dan's comments. The whelk fishery is really taking off. In fact, it is placing great demands on the horseshoe crab bait. We have already closed this year and incurred a significant overage because of the landings coming in or the bait being taken at a rate faster than our reporting interval.

It may be that this fishery is going to extinguish itself on an official basis. If we keep recurring overages, there is going to be no quota at some point, but it begs the question of where are these whelk fishermen getting the bait.

CHAIRMAN SIMPSON: Yes, I think that's a good point. Is there anything else for the Horseshoe Crab Board? Danielle.

MS. CHESKY: Thinking about the complications that have come up, if all states would be able to report landings of conch or whelk; would that get at some of those questions that you were asking about in terms of demand from state to state?

MR. McKIERNAN: I think if you just asked each jurisdiction to provide some evidence or trends in those fisheries, I think we'll take what we can get. And then if we want to refine the data collection in future years, we'll do that. Just to follow up on Mark's point as an anecdote, we emulated Rhode Island's regulations on the spawning moon closures.

We thought it was a great conservation strategy, but we never anticipated they would be spawning in April, but the warm year we had there was some significant harvest in April, but now we're into that May and June period, which is the traditional time to protect the crabs during spawning moons.

ADJOURNMENT

CHAIRMAN SIMPSON: Okay, and maybe Bob Glenn on your staff and some of the others that have worked a lot on whelk could provide some guidance to the horseshoe crab committee in terms of what kinds of sort of indirect measures might be helpful. If there is nothing else, I'll entertain a motion to adjourn. Moved by everybody. All right, thank you.

(Whereupon, the meeting was adjourned at 11:05 o'clock a.m., May 3, 2012.)

Delaware Bay Ecosystem Technical Committee Report – Species Reports

September 5 – 6, 2012

Participants

Delaware Bay Ecosystem Technical

Committee Members

Jeff Brust (NJ), Chair
Greg Breese (FWS), Vice Chair
Dr. Mandy Dey (NJ)
Jordan Zimmerman (DE)
Kevin Kalasz (DE)
Dr. Jim Fraser (Virginia Tech)
Dr. Eric Hallerman (Virginia Tech)
Alicia Nelson (VA)
Steve Doctor (MD)
Wendy Walsh (FWS)
Dr. Mike Millard (FWS)
Dr. Dave Smith (USGS), ARM
Subcommittee Chair

Additional Participants

Dr. Sarah Karpanty (Virginia Tech),
Shorebird Advisory Panel Chair
Dr. James Cooper (NC), Horseshoe Crab
Advisory Panel Chair
Dr. Larry Niles (Conserve Wildlife), ARM
Subcommittee
Richard Wong (DE), ARM Subcommittee
Richard Robins (VA), Horseshoe Crab
Advisory Panel
Danielle Chesky (ASMFC)

The Delaware Bay Ecosystem Technical Committee (TC) met September 5-6, 2012 in the ASMFC office in Arlington, Virginia to discuss the horseshoe crab and shorebird species reports from surveys over the past year. The following reports were reviewed by the TC:

- 1) Virginia Tech Horseshoe Crab Trawl Survey Report
- 2) Delaware Bay Trawl Surveys (Delaware 16-foot and 30-foot) Report
- 3) New Jersey Surveys (Ocean Trawl, Delaware Bay Trawl, Surf Clam) Report
- 4) Delaware Bay Horseshoe Crab Spawning Survey Report
- 5) Maryland Horseshoe Crab Spawning Survey Report
- 6) Delaware Bay Horseshoe Crab Egg Survey Evaluation and Report
- 7) Virginia Shorebird Survey Report
- 8) Delaware Bay and Atlantic flyway Red Knot Survey Report

Additionally, the TC elected Kevin Kalasz as its new vice-chair, as Greg Breese steps into the chair position.

Summary of Horseshoe Crab Reports (1-5)

The TC agreed that surveys reflected declines in horseshoe crab numbers in the 1990s followed by stabilization in the mid-2000s. Some surveys have shown improvements since the mid 2000s, whereas most others have shown variable trends with neither increases nor decreases. An overview of the surveys is provided in Table 1. The Virginia Tech Trawl Survey (Figure 1) is used in the implementation of the ARM Framework. Figures 2-4 provide examples of the wide variety in trends observed from other surveys reviewed and should not be taken as the only indicators of stock status. Full time series of the surveys are provided in Appendix I. The TC discussed how abundances have not increased as quickly as one might expect given management actions and the life history characteristics of horseshoe crab. The TC was relieved to see that surveys generally indicated the horseshoe crab population was no longer declining and discussed possible reasons for not seeing expected increases, including:

- Insufficient time since significant management actions were implemented (2000, 2004, 2006)
- Insufficient spawning habitat or other early life history bottleneck (models indicate species is driven by first-year survival)
- Excessive mortality (documented and undocumented) from fishery or otherwise
- Inadequacies/uncertainties in survey design, survey platform, etc
- Predation/competition
- New equilibrium of system due to changes in population ecology or environment; *e.g.* horseshoe crab food availability, climate change, etc.

The above list should not be considered comprehensive of the potential factors. In addition, the TC did not come to consensus on the likelihood or magnitude of impacts for all of these items. The TC should continue to evaluate the likelihood of each of these factors through data collection, literature reviews, modeling, and other appropriate methods.

Table 1. Reviewed horseshoe crab survey indices.

Survey	Demographic	Gear Used
Virginia Tech Trawl – Coastal Area	Males Immature	Trawl
Virginia Tech Trawl – Coastal Area	Males Newly Mature	Trawl
Virginia Tech Trawl – Coastal Area	Males Mature	Trawl
Virginia Tech Trawl – Coastal Area	Females Immature	Trawl
Virginia Tech Trawl – Coastal Area	Females Newly Mature	Trawl
Virginia Tech Trawl – Coastal Area	Females Mature	Trawl
Delaware Bay Spawning Survey	Males	Beach
Delaware Bay Spawning Survey	Females	Beach
Delaware Bay 16-ft Trawl	Adults	16-ft Trawl
Delaware Bay 16-ft Trawl	Juveniles	16-ft Trawl
Delaware Bay 30-ft Trawl	All (April-July)	30-ft Trawl
Delaware Bay 30-ft Trawl	All (All months)	30-ft Trawl
NJ Surf Clam Dredge	Males	Surf Clam Dredge
NJ Surf Clam Dredge	Females	Surf Clam Dredge
NJ Surf Clam Dredge	Juveniles	Surf Clam Dredge
NJ Delaware Bay Trawl	Males	Trawl
NJ Delaware Bay Trawl	Females	Trawl
NJ Delaware Bay Trawl	Juveniles	Trawl
NJ Ocean Trawl – April	All	Trawl
NJ Ocean Trawl – October	All	Trawl

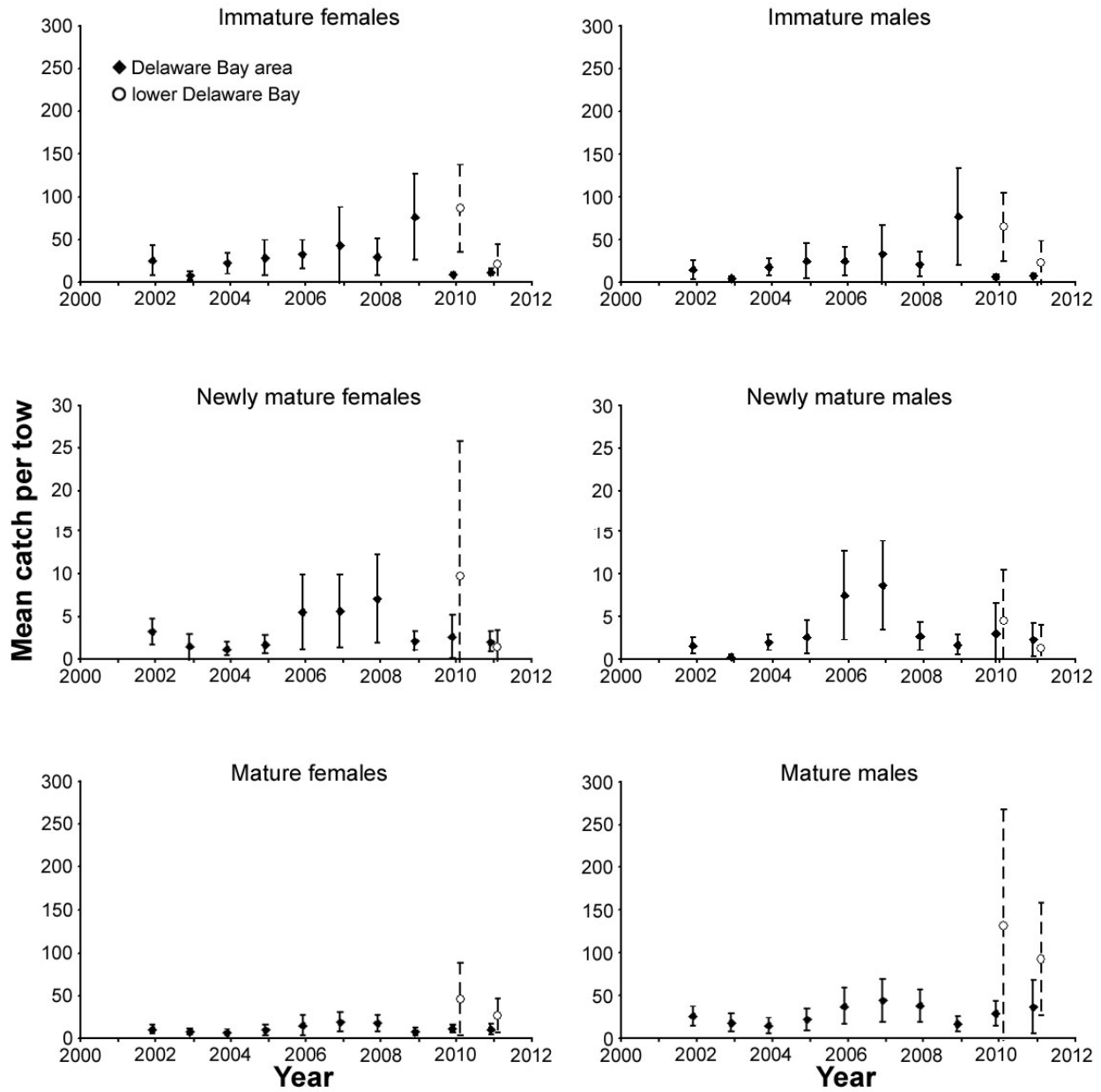


Figure 1. Stratified mean catches per tow of horseshoe crabs from the Virginia Tech Horseshoe Crab Trawl Survey in the lower Delaware Bay survey by demographic group, 2010-2011, with coastal Delaware Bay area survey means for comparison. Vertical lines indicate 95% confidence limits. Delta distribution model means are presented. Solid symbols and lines indicate the coastal Delaware Bay area survey. Open symbols and dashed lines indicate the lower Delaware Bay survey. Note differences in y-axis scales.

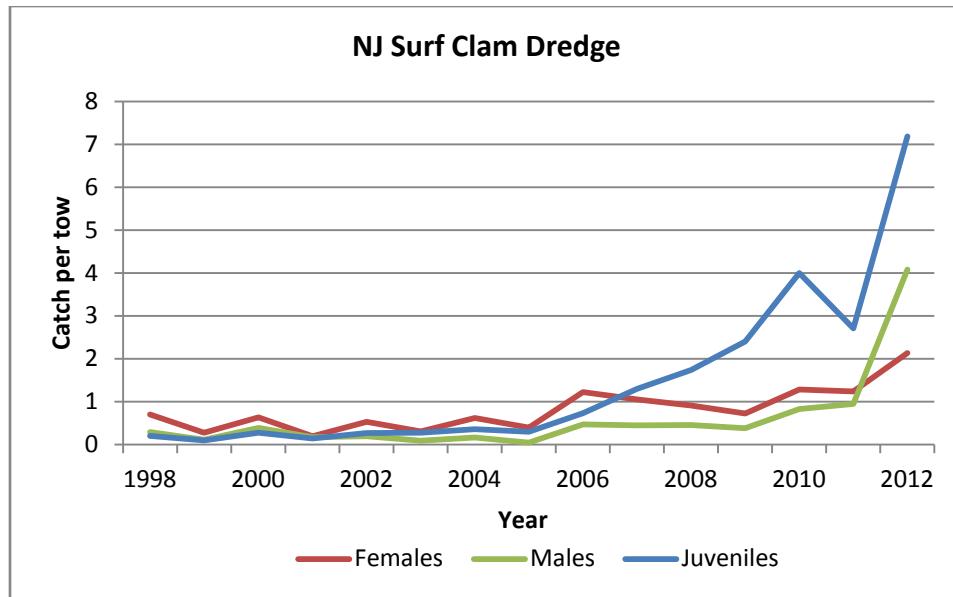


Figure 2. New Jersey Surf Clam Index of demographics (Mean CPUE).

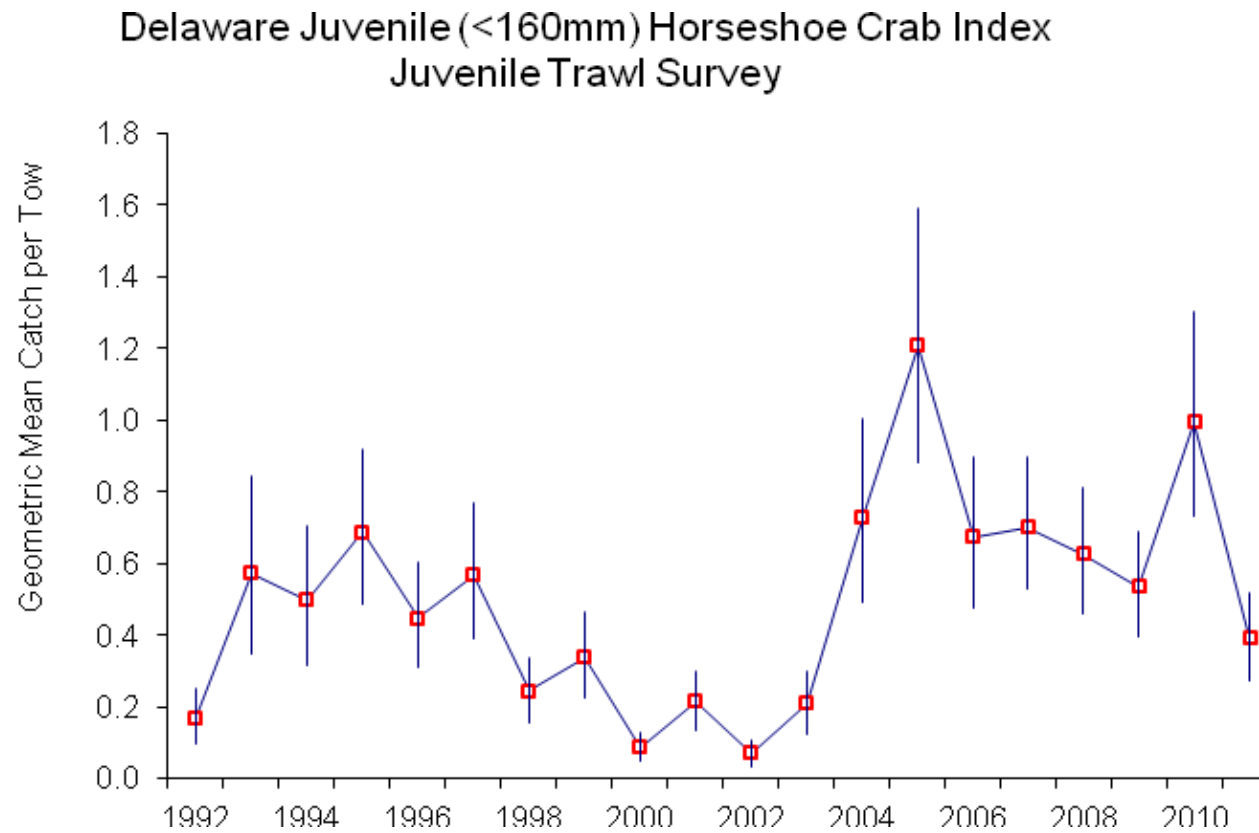


Figure 3. Juvenile (<160mm) index for horseshoe crabs from Delaware Bay 16-foot Trawl Survey. Vertical lines indicate 95% confidence limits.

Delaware Adult (>160mm) Horseshoe Crab Index Juvenile Trawl Survey

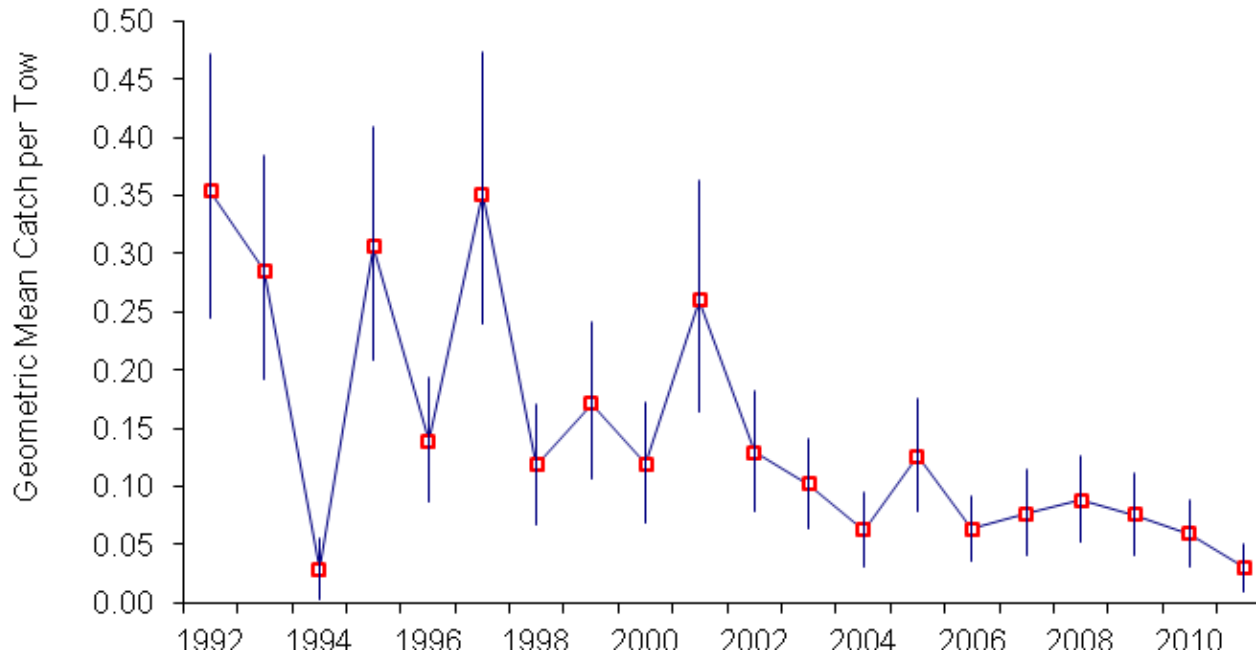


Figure 4. Adult (>160mm) index for horseshoe crabs from Delaware Bay 16-foot Trawl Survey. Vertical lines indicate 95% confidence limits.

The TC offered advice on survey design and is investigating other metrics to potentially help improve trend detection within the current surveys. Specifically, the Delaware Bay Spawning Survey showed a positive trend for males and a stable trend for females, bay wide (Figure 5), as well as an increasing male:female ratio. However, questions remain as to whether the spawning survey has reached “saturation” levels, by which appreciable increases in population levels may not be detected under the current survey design. The TC and state staff are investigating whether this has occurred and if so, what could be done to address the problem.

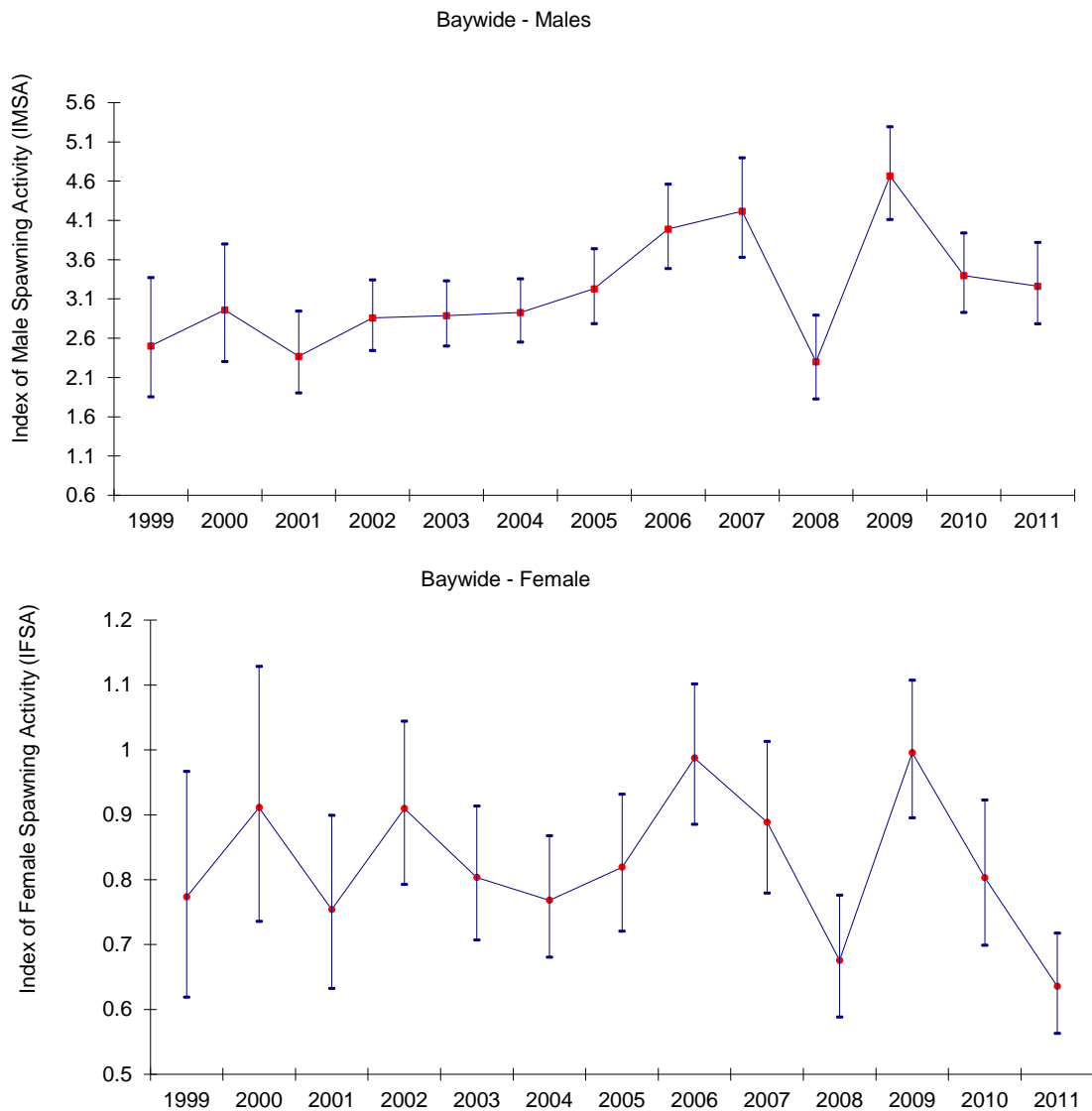


Figure 5. Delaware Bay Index of Male Spawning Activity (top) and Female Spawning Activity (bottom) over time. Note differences in scale

The TC also reviewed the Maryland Spawning survey, which provides an extension of the spawning survey along the coast; however, its current time series (standardized in 2008) is too short to have confidence in its apparent recent positive trend.

The TC also reviewed the funding levels for the Virginia Tech Trawl Survey for 2012, which are below what is needed to continue the survey as run in the past. The TC provided recommendations to try to maintain as much of the essential survey area as possible. Most of the initial tradeoffs considered and recommended by the TC are no longer necessary due to the donation recently made by the biomedical company Lonza Walkersville, Inc. Combined with donations made earlier by the horseshoe crab processing and dealer industry and a biopharmaceutical organization, the full core area will be retained within the survey. The TC had raised concerns that a reduced effort level may complicate the use of the data in the ARM Framework. **The TC notes the importance of these data to the ARM Framework and the need for its continued operation, in order to fully implement the new management framework.**

The TC recommends continuing with the ARM Framework and using the full concept of the ARM to manage horseshoe crabs and shorebirds.

Summary of Delaware Bay Egg Survey Evaluation and Report (6)

There was no significant trend in Baywide egg densities (Figure 6). Trends in egg density for New Jersey were positive, even excluding Moore's Beach, which had dramatically higher egg densities in the last two years. Delaware trends in egg density have not shown significant changes over 2005-12. If Mispillion (DE) and Moore's (NJ) Beaches were excluded, no significant trend was observed (Figure 6).

Higher egg densities on some beaches can strongly influence baywide and state trends. However, these higher densities predictably occur in a few locations (e.g., Mispillion Harbor, DE; Moores Beaches NJ) and their influence on trend is known.

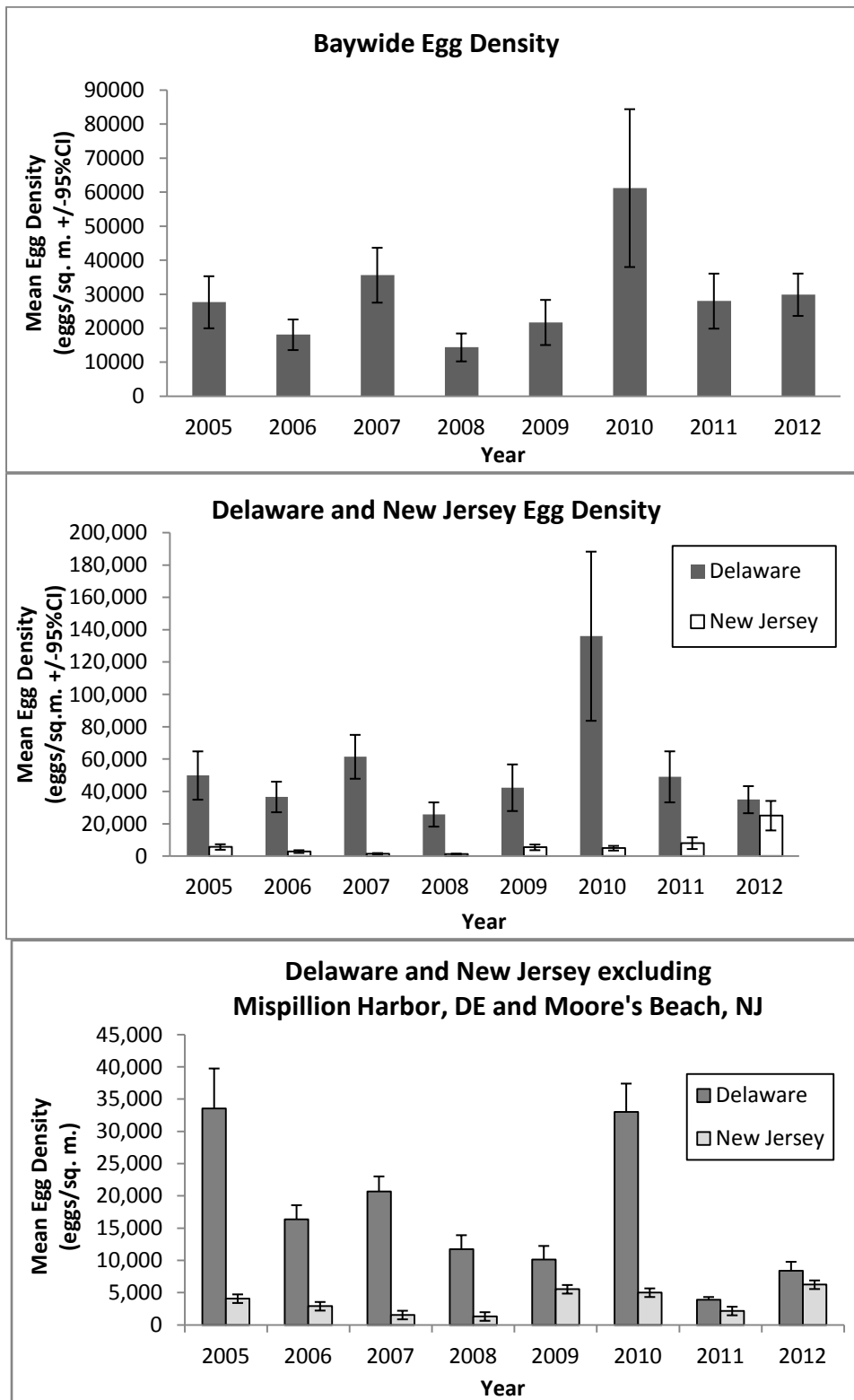


Figure 6. Baywide egg density (top), for Delaware and New Jersey (middle) and excluding Mispillion Harbor, DE and Moore’s Beach, NJ (bottom). Vertical bars represent 95% confidence intervals. Note differences in scale.

The TC identified a number of factors that limit the usefulness of the current baywide egg survey, including:

Ability to capture trends: The TC could not reach consensus on the ability of the egg survey to capture trends in availability of eggs for shorebird consumption. On one hand, egg densities show very high variability both within and between sites. Highly variable results compromise the ability of a survey to detect true trends. The ephemeral nature of surface egg densities is due to a number of factors, such foraging by shorebirds, fish and other organisms; wind and wave action; and bioturbation. Even high surface egg densities do not always ensure egg availability to shorebirds if predators are present or other factors prevent the shorebirds from using a given beach. On the other hand, a strong correlation has been found between egg survey results and the proportion of red knots achieving 180-g for the flight to Arctic breeding grounds. This correlation suggests that, despite the variability, the egg survey may provide a reasonable trend in egg availability. As noted above, the TC could not reach consensus on this issue, and further evaluation is required.

Survey methodology: The TC discussed differences in methodology and the impacts on survey results. Samples are similarly collected in both states, but the egg enumeration methodologies are substantially different. Results of side-by-side comparisons from a common sample indicate New Jersey's counts of egg densities have been 35% lower, on average, than Delaware's counts. No explanation for these differences has been identified, but they could be related to differences in the enumeration method. In addition, neither state has fully and explicitly documented their enumeration methodology, so neither states' results can be independently verified. The TC identified this issue as a major concern, and the states will work with their contractors to address this issue as soon as possible.

Value to the ARM Framework: This data set currently is not used in the ARM Framework. When it was considered for the ARM, the following summary was provided in the report:

“...the egg survey is further subject to high temporal and spatial uncertainty which could be due to sampling issues or real biological/ecological patterns. There is a tremendous amount of uncertainty that needs to be resolved in this data set before incorporating it into our decision analysis...Furthermore, we believe that it makes most sense to link red knot population dynamics directly to horseshoe crab abundance rather than through eggs...We view egg availability/density as a relevant quantity that is a direct function of spawning crab numbers.”

In light of the ARM Framework, the egg survey is helpful, but limited in value.

Value to the States: New Jersey has legislation linking egg abundance to decisions on when the bait fishery might be opened in the future. Therefore, the egg survey is critical to the State's decision making ability.

Other Considerations: This survey has shown statistically significant correlation between surface egg densities in weeks 3 and 4 of sampling and the proportion of red knots making adequate weight in the Delaware Bay stopover (≥ 180 grams). Egg abundance has been shown to be a good predictor of which beaches get used by red knots and other shorebirds. At eight years, it is becoming a long term data set. Work has been done that shows the survey is consistent with

historical egg density results using quadrat sampling methodology, thus extending the time series and providing a possible bench mark of egg availability.

Further, the TC reviewed the continued efforts by Delaware and New Jersey to rectify differences in counting results and methodologies. These efforts culminated in side-by-side counts in 2008 and 2011, as well as a day of observation on both sides of the Delaware Bay in Spring 2012. The TC combined these observations along with the above opportunities for improvement into recommendations for future efforts:

- Step 1 – State staff in New Jersey and Delaware will work with contractors to document egg washing and enumeration methodologies. State staff will discuss TC concerns with contractors and see if they are willing to work together. State staff will report back to TC on progress.
- Step 2 – A Working Group of the TC will investigate methodological differences, survey utility/performance, methodology etc further; compare 2008 and 2011 side by sides plus other associated data (*e.g.* NJ and DE replicate counts); report back to DBETC for discussion on how to move forward

TC Members involved in the working group will include the state staff and their contractors, along with Greg Breese (upcoming TC chair), Dr. Jim Fraser from Virginia Tech, Dr. Dave Smith from USGS or other federal partner (helped design original egg survey), and Richard Wong from Delaware (ARM Subcommittee member). The Working Group will be guided by these recommendations and terms of reference, that will be developed, for moving the egg survey forward in a standardized, repeatable way with as much certainty as practical.

Summary of Shorebird Reports (7-8)

Red knot surveys showed peak counts in Delaware Bay approximately doubling in size (12K to 25.5K) between 2007 and 2012, but are still 50% of the recent peak in 1998 (50K) and approximately 25% of the long-term peak in 1989 (90K) (Figure 7). The noted increases in recent years may be due to peak counts capturing the large staging events and increased recruitment in 2009-10.

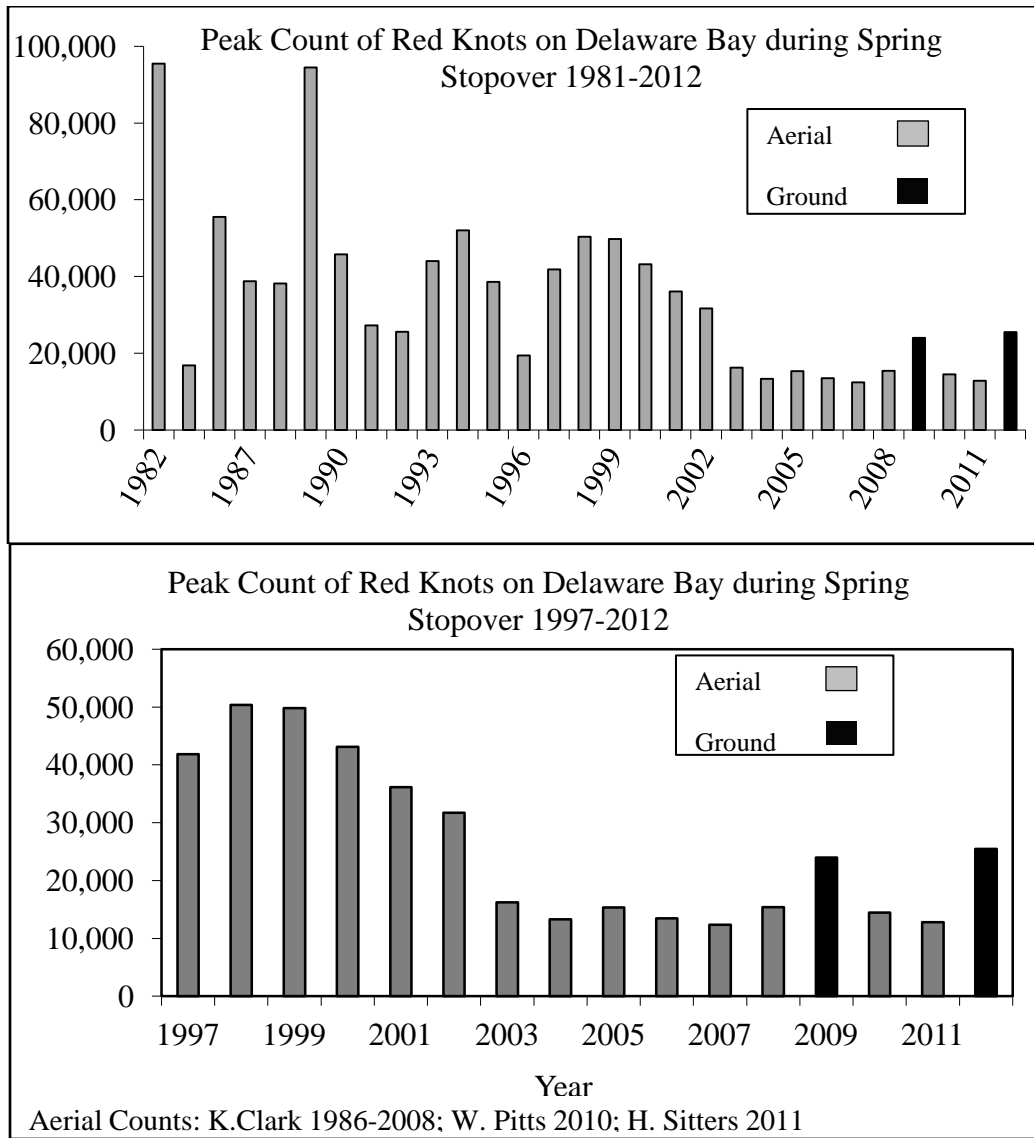


Figure 7. Peak counts of Red Knots in Delaware Bay during spring stopover 1981 – 2012 (top) and recent stopover period 1997-2012 (bottom). Aerial counts are used 1982-2008, 2010-2011. Ground counts were used in 2009 (26 May) and 2012 (24 May).

In reviewing the Virginia red knots counts, the TC noted those levels have tripled from 2007 to 2012 (4K to 12K) (Figure 8). The longer-term trend in Virginia bird counts from the 1990s tended to be around 10K (Watts and Truit 2000). Recent increases back to these previous levels may correlate with increases in mussel availability (Domax, Blue mussels, Figure 8) and a

resultant shift in population between Delaware Bay and Virginia. Additionally, the increased recruitment suspected in 2009-10 may also be contributing to increases in birds in the Mid-Atlantic stopover. **The TC agreed the Virginia bird count data are important and should be incorporated into the process where possible.**

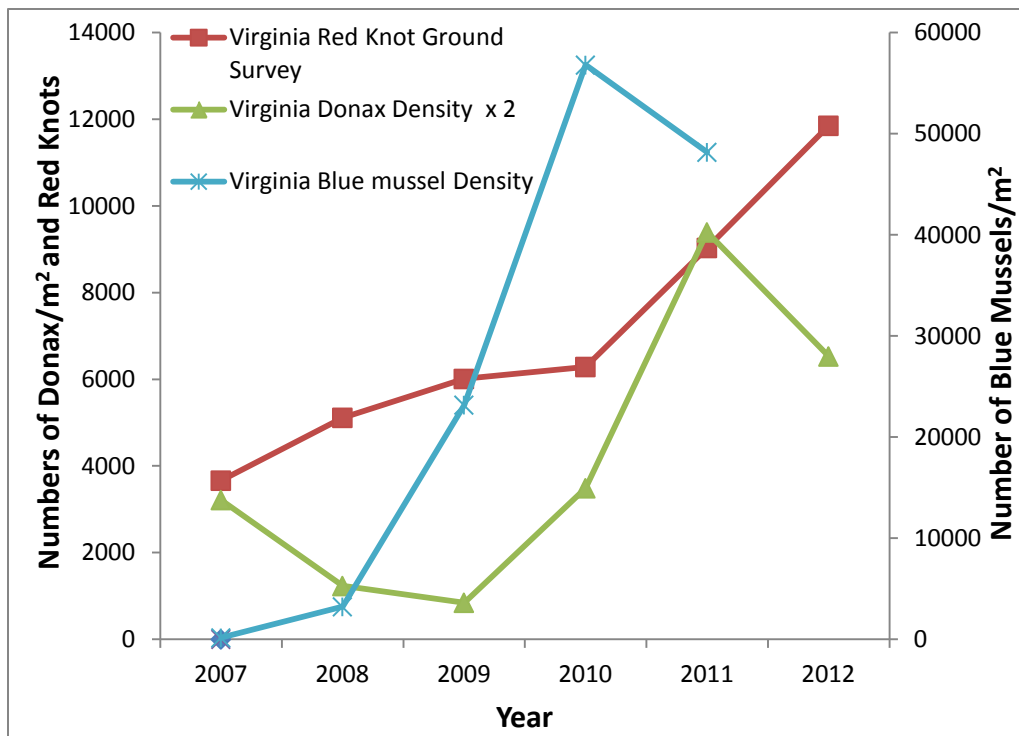


Figure 8. Virginia Red Knot counts from ground surveys, as well as estimates of prey species Donax and Blue mussels.

Winter counts of long-distance migrants from Tierra del Fuego and Patagonia were down from the baseline of 67K in 1985, although these counts have been stable around 15K since 2004/5 (Figure 9). The TC noted the birds may have experienced a range contraction since the 1980s, with losses in Patagonia first followed by reductions in the Tierra del Fuego numbers. Winter counts in other areas (*e.g.* Central America and northern South America) are not systematically collected, making population inferences difficult. Winter counts, in contrast to the stopover counts made in Delaware Bay, represent a more stable population count, as birds are not moving through the area.

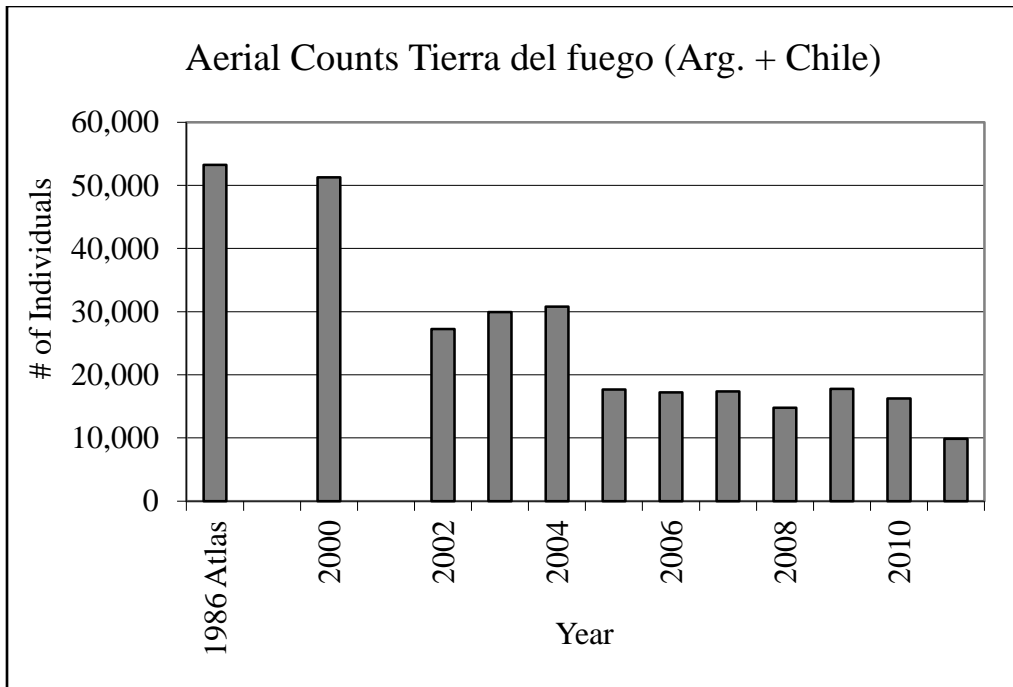


Figure 9. Winter Counts from Tierra del Fuego.

The TC noted the proportion of red knots achieving the 180g mass goal at departure declined from 1997 to 2006 but has increased since 2009. These increases in making weight are likely due to good conditions on the beaches, including weather, timing, and egg distribution. As noted in Figure 10, weight gain in red knots is strongly and positively correlated with beach egg densities in weeks 3 and 4 of the stopover period.

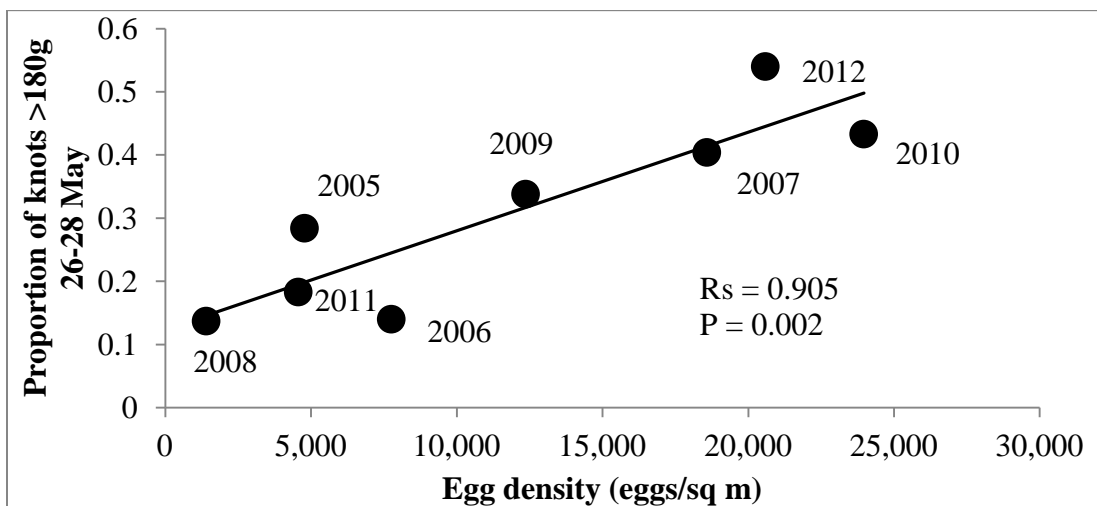


Figure 10. Proportion of Red Knots in the >180 g body-mass category in Delaware Bay during 26-28 May versus median horseshoe crab egg density during 14-27 May, from 2005-12 in Delaware (excluding Mispillion Harbor) and New Jersey.

The TC noted uncertainty in shorebird counts and egg survey results, due to environmental factors affecting availability of surface eggs and the turnover of shorebirds during migratory stopover. As with the horseshoe crab surveys, the TC is working with the states and ARM

Subcommittee to make progress towards standardizing and modifying methods, in order to improve estimates and minimize uncertainty.

The TC reviewed the East Coast Count of red knots, a survey recently developed in 2006. The survey combines counts across the east coast over a four-day period, in order to assess a reasonable estimate of the Atlantic flyway population. The intent of the east coast survey is to obtain a single-day count of red knot on the US east coast at peak of migration -- a minimum population estimate. In 2012 the estimate was 40,429, which agrees with the mark recapture estimate that the ARM Modeling Subcommittee made, of 44,680.

References

Watt, B.D, and B. R. Truitt. 2000. Abundance of shorebirds along the Virginia Barrier Islands during spring migration. *The Raven* 71(2):33-39.

Appendix I.

Survey	VA Tech Trawl	VA Tech Trawl	VA Tech Trawl	VA Tech Trawl	VA Tech Trawl	VA Tech Trawl	VA Tech Trawl	DE Bay 16-ft	DE Bay 16-ft	DE Bay 30-ft	DE Bay 30-ft	NJ Surf Clam	NJ Surf Clam	NJ Surf Clam
								DE	DE	DE	DE	NJ	NJ	NJ
	Males Immature	Males Newly Mature	Males Mature	Females Immature	Females Newly Mature	Females Mature	All	Adults	Juveniles	All	All	Males	Females	Juveniles
										All months	April-July			
1990	x	x	x	x	x	x	x	x	x	5.29	6.77	x	x	x
1991	x	x	x	x	x	x	x	x	x	4.66	5.60	x	x	x
1992	x	x	x	x	x	x	x	0.35	0.17	1.67	3.72	x	x	x
1993	x	x	x	x	x	x	x	0.29	0.57	2.09	3.10	x	x	x
1994	x	x	x	x	x	x	x	0.03	0.50	0.84	1.13	x	x	x
1995	x	x	x	x	x	x	x	0.31	0.69	1.34	1.10	x	x	x
1996	x	x	x	x	x	x	x	0.14	0.45	2.38	3.59	x	x	x
1997	x	x	x	x	x	x	x	0.35	0.57	1.47	1.79	x	x	x
1998	x	x	x	x	x	x	x	0.12	0.24	0.83	0.83	0.294	0.704	0.205
1999	x	x	x	x	x	x	x	0.17	0.34	1.80	1.01	0.113	0.278	0.101
2000	x	x	x	x	x	x	x	0.12	0.09	0.92	1.23	0.392	0.637	0.275
2001	x	x	x	x	x	x	x	0.26	0.21	0.72	1.53	0.172	0.197	0.141
2002	4,990,000	620,000	9,000,000	8,260,000	1,210,000	4,050,000	28,090,000	0.13	0.07	0.33	0.15	0.194	0.534	0.268
2003	2,140,000	70,000	6,530,000	2,790,000	570,000	3,030,000	14,380,000	0.10	0.21	0.83	1.38	0.094	0.309	0.280
2004	5,510,000	720,000	5,690,000	7,090,000	440,000	2,560,000	21,920,000	0.06	0.73	0.06	0.06	0.165	0.622	0.359
2005	10,850,000	1,090,000	7,810,000	10,420,000	730,000	4,140,000	35,020,000	0.13	1.21	0.17	0.20	0.042	0.400	0.301
2006	8,280,000	3,020,000	14,010,000	12,490,000	2,410,000	6,070,000	46,060,000	0.06	0.67	1.81	1.37	0.469	1.221	0.732
2007	14,050,000	3,230,000	14,930,000	16,380,000	2,030,000	7,070,000	57,690,000	0.08	0.70	1.15	1.72	0.449	1.051	1.301
2008	7,170,000	1,050,000	15,090,000	10,420,000	2,890,000	7,330,000	43,940,000	0.09	0.63	0.44	0.77	0.458	0.912	1.739
2009	23,720,000	670,000	6,510,000	24,320,000	830,000	3,180,000	59,210,000	0.08	0.53	0.69	1.06	0.383	0.725	2.403
2010	2,350,000	1,210,000	12,490,000	3,550,000	1,510,000	4,750,000	25,860,000	0.06	1.00	0.47	0.75	0.828	1.285	4.002
2011	2,810,000	880,000	14,460,000	4,630,000	880,000	4,100,000	28,610,000	0.03	0.39	0.79	1.15	0.949	1.241	2.713

Survey	NJ DE Bay Trawl	NJ DE Bay Trawl	NJ DE Bay Trawl	NJ Ocean Trawl	NJ Ocean Trawl	MD Spawning	MD Spawning	DE Bay Spawning	DE Bay Spawning	DE Bay Spawning	DE Bay Spawning	DE Bay Spawning	DE Bay Spawning
	NJ	NJ	NJ	NJ	NJ			Baywide	DE	NJ	Baywide	DE	NJ
	Males	Females	Juveniles	All	All	All	All	Males	Males	Males	Females	Females	Females
				April	October	[Hours]	[Surveys]						
1990	x	x	x	5.844	37.893	x	x	x	x	x	x	x	x
1991	x	x	x	7.013	17.852	x	x	x	x	x	x	x	x
1992	x	x	x	11.396	26.592	x	x	x	x	x	x	x	x
1993	x	x	x	22.481	2.352	x	x	x	x	x	x	x	x
1994	x	x	x	5.869	4.645	x	x	x	x	x	x	x	x
1995	x	x	x	2.003	3.900	x	x	x	x	x	x	x	x
1996	x	x	x	7.594	6.519	x	x	x	x	x	x	x	x
1997	x	x	x	10.059	2.663	x	x	x	x	x	x	x	x
1998	0.290	0.206	0.152	10.107	13.566	x	x	x	x	x	x	x	x
1999	0.167	0.094	0.027	18.288	2.019	x	x	2.50	3.78	1.82	0.77	0.93	0.61
2000	0.330	0.179	0.027	9.636	11.995	x	x	2.96	3.93	2.00	0.91	1.02	0.80
2001	0.179	0.071	0.401	9.076	3.030	x	x	2.37	2.76	2.01	0.75	0.82	0.64
2002	0.248	0.113	0.101	1.876	2.056	13.96	5.53	2.86	2.74	3.43	0.91	0.76	1.09
2003	0.182	0.046	0.408	11.346	3.213	93.90	40.23	2.89	2.90	2.98	0.80	0.81	0.83
2004	0.185	0.069	0.353	9.369	9.920	19.56	13.00	2.93	2.85	3.07	0.77	0.76	0.78
2005	0.464	0.245	0.214	14.955	12.290	11.41	6.72	3.23	2.49	4.00	0.82	0.65	0.99
2006	0.305	0.080	0.190	8.859	4.249	210.31	68.74	3.99	3.80	4.45	0.99	0.81	1.17
2007	0.578	0.239	0.432	3.933	2.594	279.22	66.23	4.22	4.64	4.00	0.89	0.96	0.82
2008	0.419	0.092	0.323	8.859	1.339	645.14	124.30	2.30	4.03	2.23	0.68	0.78	0.57
2009	0.211	0.106	0.187	4.720	7.438	1099.63	346.76	4.67	3.87	5.46	1.00	0.73	1.26
2010	0.527	0.259	0.637	2.858	4.108	2114.71	558.05	3.40	3.48	3.31	0.80	0.79	0.81
2011	0.423	0.177	0.205	4.698	4.133	748.95	398.36	3.31	4.36	2.24	0.64	0.71	0.56