Delaware Bay Ecosystem Technical Committee Report – ARM Recommendation

September 5, 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, 2012 in the ASMFC office in Arlington, Virginia to discuss the harvest output recommendation from the Horseshoe Crab Adaptive Resource Management (ARM) Subcommittee.

Dr. Dave Smith (USGS), Chair of the ARM Subcommittee, presented the Subcommittee's recommendations on the ARM Framework harvest output (Appendix A). Based on the most recent data inputs from the 2011 Virginia Tech Horseshoe Crab Trawl Survey and the aerial/ground counts of red knots, the ARM Framework selected Harvest Package 3 as the optimal harvest package, which allows harvest of 500,000 Delaware Bay male horseshoe crabs and zero female horseshoe crabs. Based on the allocation mechanism set up in Addendum VII to the Horseshoe Crab Fishery Management Plan, the following quotas would be set for the Delaware Bay states of New Jersey, Delaware, Maryland, and Virginia:

	Delaware Bay Origin HSC Quota		**Total Quota***	
State	**Male**	**Female**	**Male**	**Female**
Delaware	162,136	0	162,136	0
New Jersey	162,136	0	162,136	0
Maryland	141,112	0	255,980	0
Virginia	34,615	0	81,331	0

*Virginia harvest refers to harvest east of the COLREGS line only

The Delaware Bay Ecosystem Technical Committee accepted the ARM Subcommittee report and **recommends the Board accept Harvest Package #3, the optimal selected harvest package, for management of the 2013 horseshoe crab harvesting season.**

Additionally, the Delaware Bay Ecosystem Technical Committee recommended the ARM Subcommittee continue to develop its new methodology to assess the stopover population of red knots in the Delaware Bay region.

Appendix A.

Horseshoe Crab Harvest Recommendations Based on Adaptive Resource Management (ARM) Framework and Most Recent Monitoring Data

Report to the Delaware Bay Ecosystem Technical Committee by the ARM Subcommittee

August 2012

This report summarizes annual harvest recommendations. Detailed background on the ARM framework and data sources can be found in previous technical reports[i].

Objective statement
Manage harvest of horseshoe crabs in the Delaware Bay to maximize harvest but also to maintain ecosystem integrity and provide adequate stopover habitat for migrating shorebirds.

Alternative harvest packages
These harvest packages were compared to determine which will best meet the above objective given the most recent monitoring data. Harvest is of adult horseshoe crabs of Delaware Bay origin.

Harvest package	Male harvest (×1,000)	Female harvest (×1,000)
1	0	0
2	250	0
3	500	0
4	280	140
5	420	210

Population models
Population dynamics models that link horseshoe crabs and red knots were used to predict the effect of harvest packages. Three variations in the models represent the amount and type of dependence between horseshoe crabs and red knots. Stochastic dynamic programming was used to create a decision matrix to identify the optimal harvest package given the most recent monitoring data.

Monitoring data
Sources of data were VT trawl survey for horseshoe crab abundance[ii] and aerial/ground counts for red knot abundance[iii].

Horseshoe crab abundance (millions)			Red knot abundance (×1,000)	
Year	Male	Female	Year	Male and female
2011 (Fall)	14.5	4.1	2012 (Spring)	25.5

Harvest recommendations

Recommended harvest package	Male harvest (×1,000)	Female harvest (×1,000)
3	500	0

Quota of horseshoe crab harvest for Delaware Bay region states. Allocation of allowable harvest under ARM package 3 (500K males, 0 females) was conducted in accordance with management board approved methodology in *Addendum VII to the Interstate Fishery Management Plan for Horseshoe Crabs*. Note: Maryland and Virginia total quota refer to that east of the COLREGS line.

	Delaware Bay Origin HSC Quota		**Total Quota**	
State	**Male**	**Female**	**Male**	**Female**
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Maryland	141,112	0	255,980	0
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References

[i] McGowan, C. P., D. R. Smith, J. D. Nichols, J. Martin, J. A. Sweka, J. E. Lyons, L. J. Niles, K. Kalasz, R. Wong, J. Brust, M. Davis. 2009. A framework for the adaptive management of horseshoe crab harvests in the Delaware Bay constrained by Red Knot conservation. Report to the Atlantic States Marine Fisheries Commission Horseshoe Crab Technical Committee.

ASMFC Horseshoe Crab Stock Assessment Subcommittee. 2009. Horseshoe crab 2009 stock assessment report. Report to the Atlantic States Marine Fisheries Commission Horseshoe Crab Technical Committee.

ASMFC 2009. Terms of Reference and Advisory Report to the Horseshoe Crab Stock Assessment Peer Review. Stock Assessment Report No. 09-02.

[ii] Hata, D. and E. Hallerman. 2012. 2011 horseshoe crab trawl survey report to the ASMFC Horseshoe Crab Technical Committee

[iii] Amanda Dey (person. comm., New Jersey Division of Fish and Wildlife)

Delaware Bay Ecosystem Technical Committee Report – Species Reports

September 5 – 6, 2012

Participants

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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

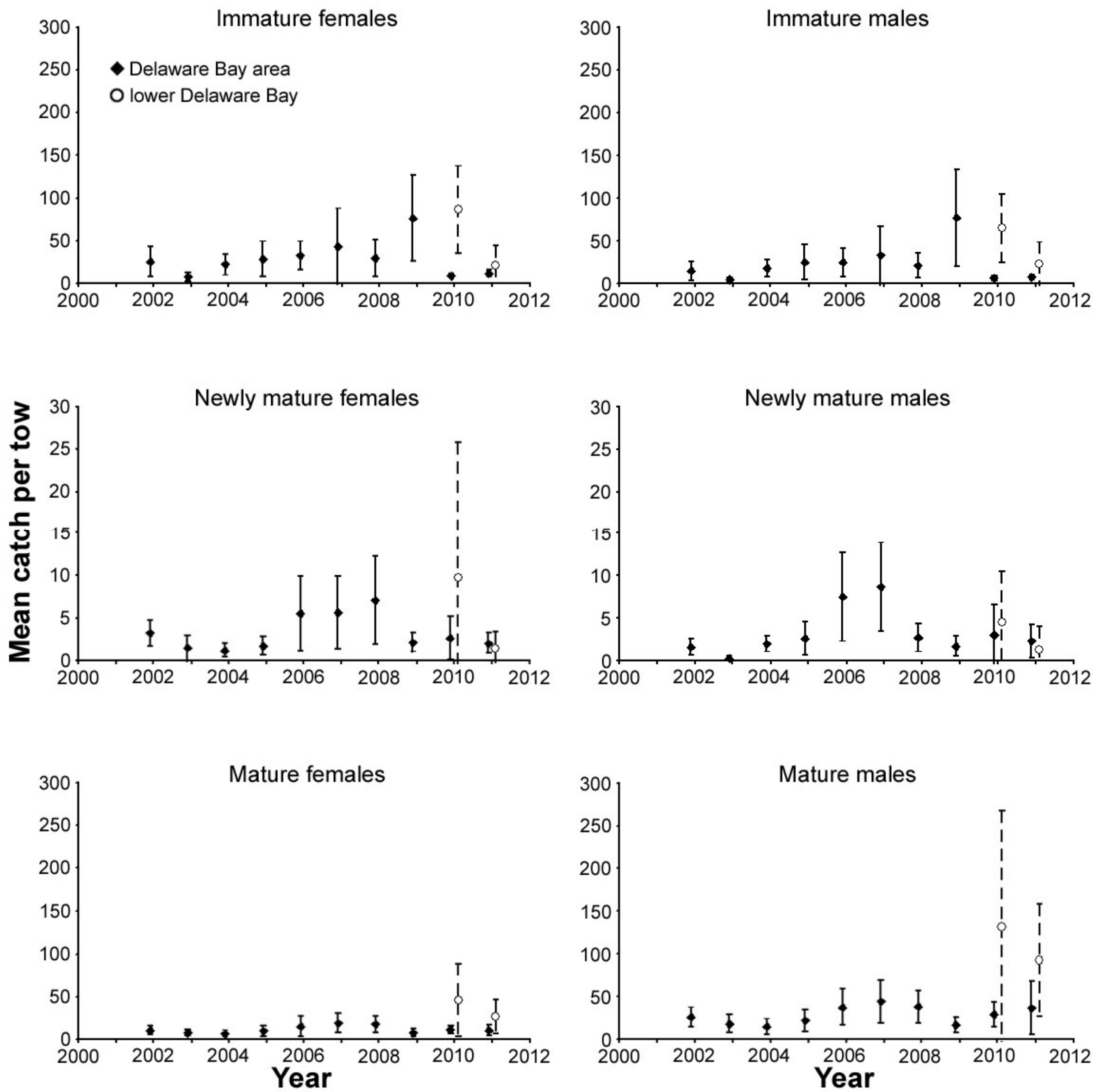

Figure 1. Stratified mean catches per tow of horseshoe crabs from the Virginia Tech Horseshoe Crab Trawl Survey in the lower Delaware Bay survey by demographic group, 2010-2011, with coastal Delaware Bay area survey means for comparison. Vertical lines indicate 95% confidence limits. Delta distribution 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.

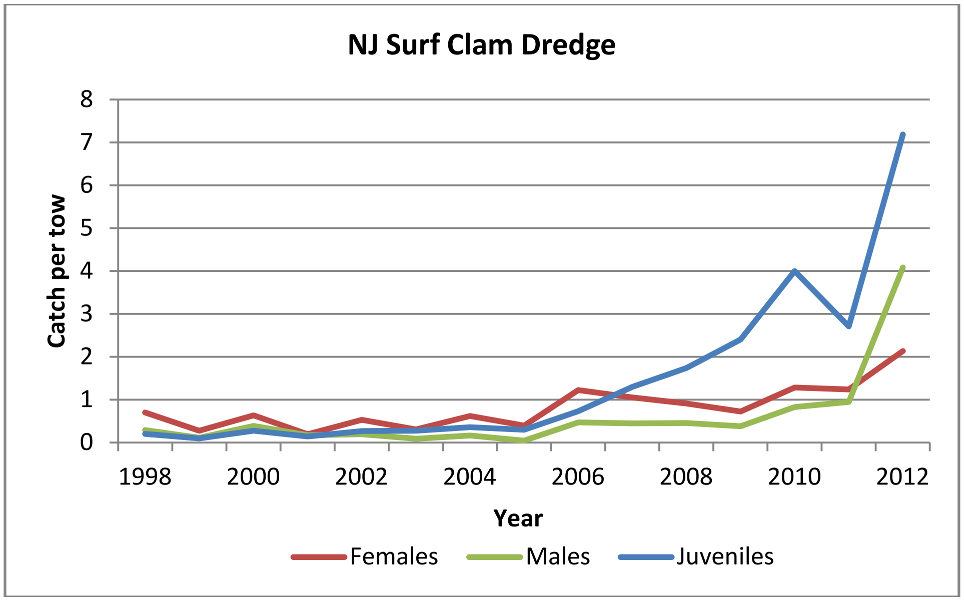

Figure 2. New Jersey Surf Clam Index of demographics (Mean CPUE).

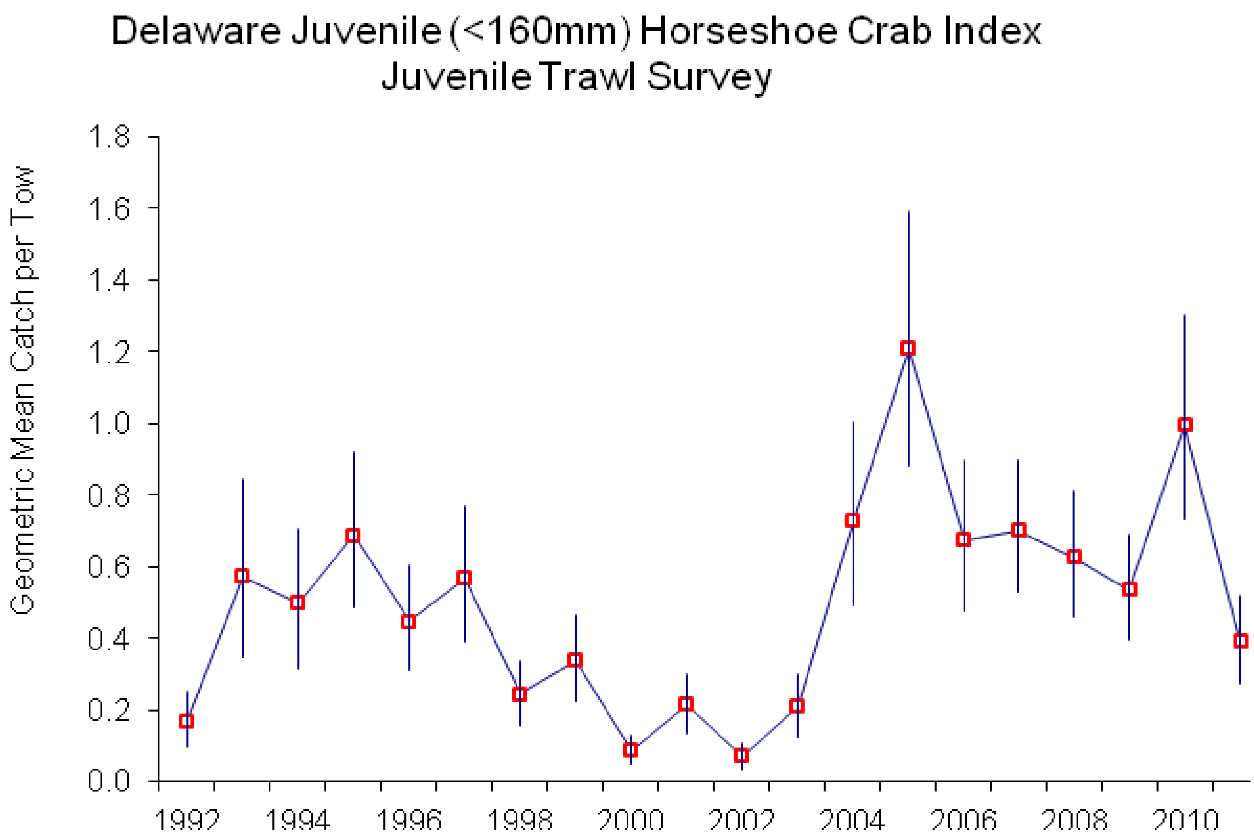

Figure 3. Juvenile (<160mm) index for horseshoe crabs from Delaware Bay 16-foot Trawl Survey. Vertical lines indicate 95% confidence limits.

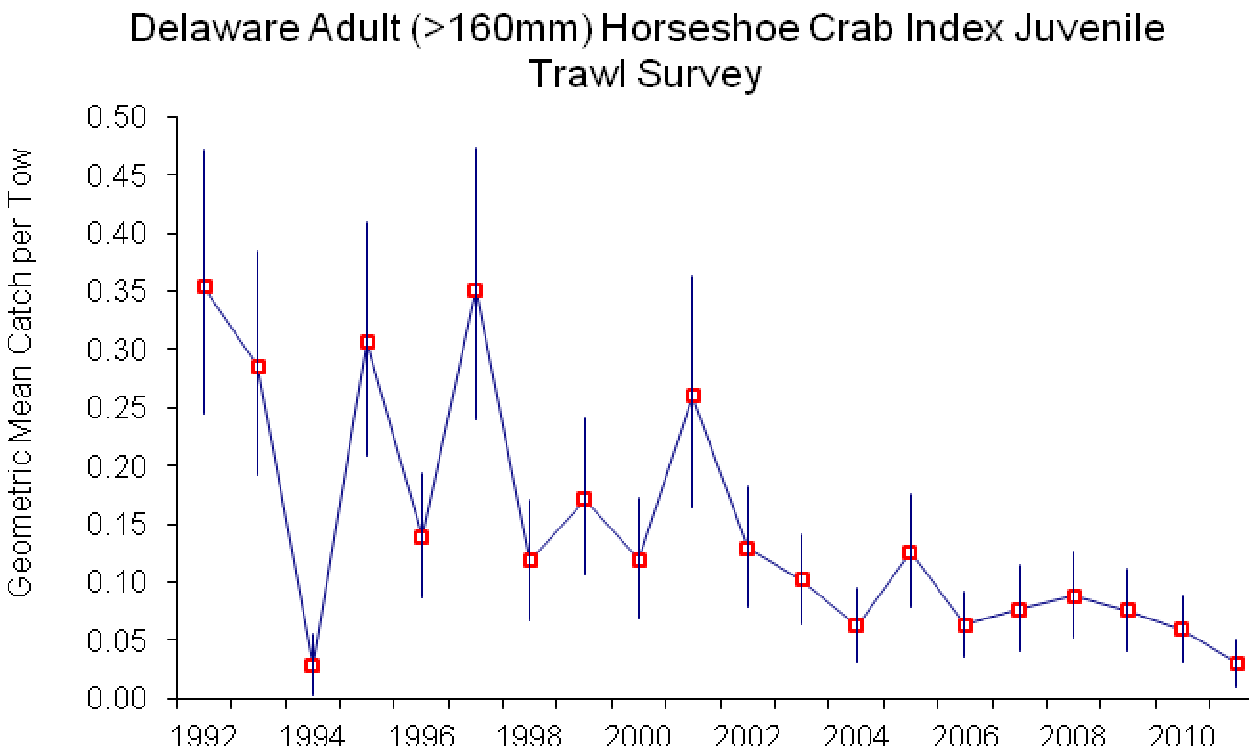

Figure 4. Adult (>160mm) index for horseshoe crabs from Delaware Bay 16-foot Trawl Survey. Vertical lines indicate 95% confidence limits.

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.

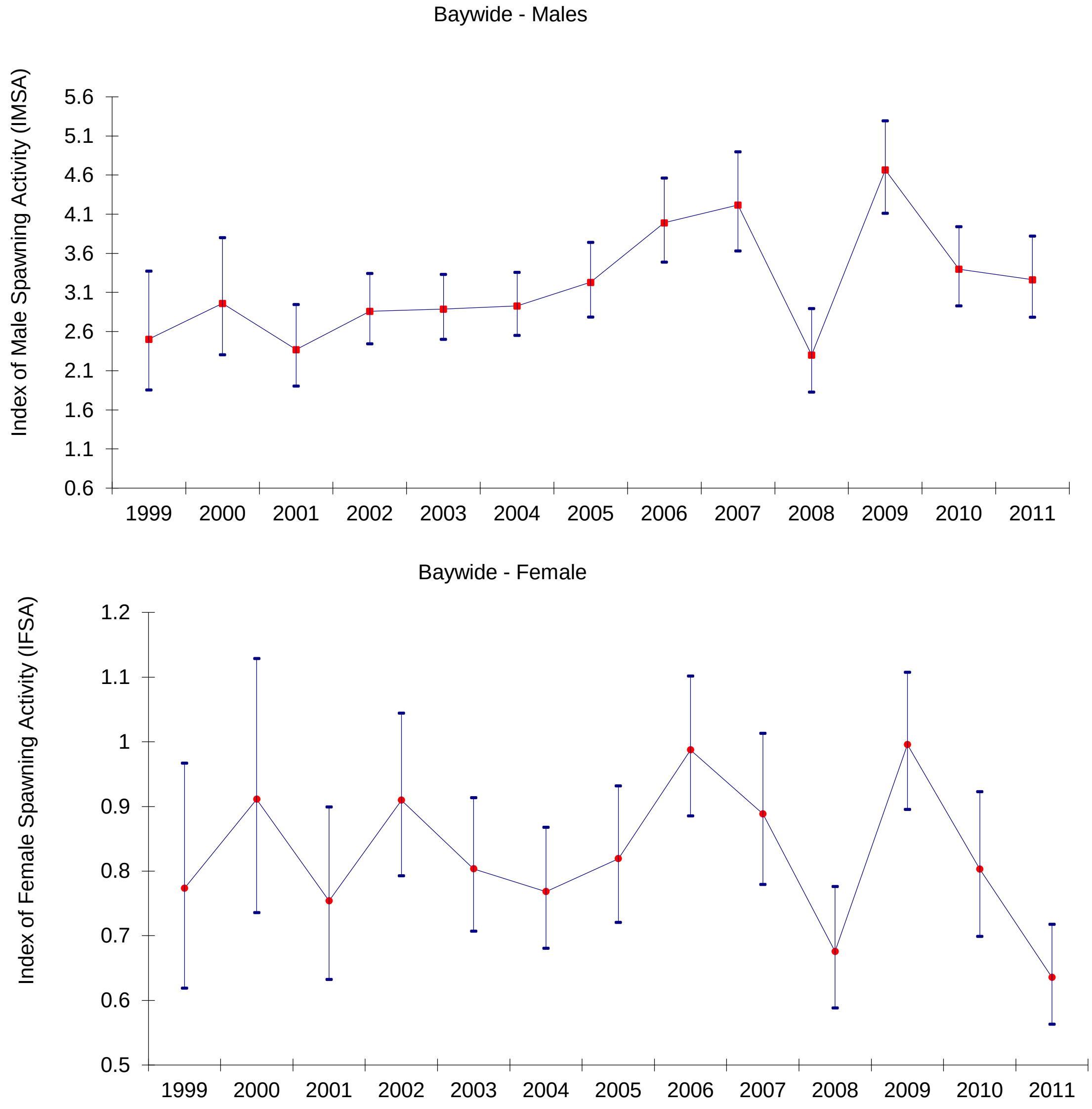

Figure 5. Delaware Bay Index of Male Spawning Activity (top) and Female Spawning Activity (bottom) over time. Note differences in scale

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.

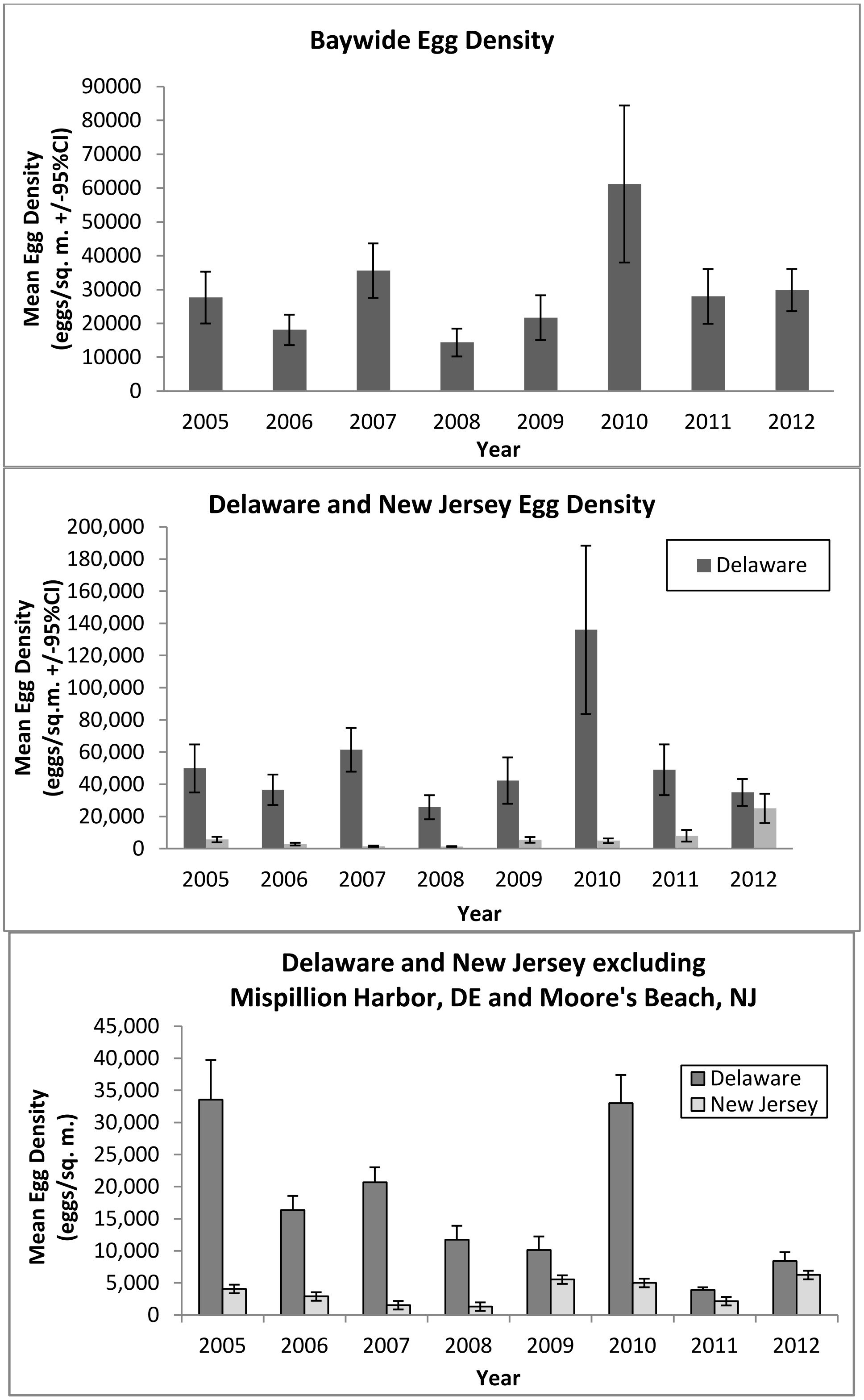

Figure 6. Baywide egg density (top), for Delaware and New Jersey (middle) and excluding Mispillion Harbor, DE and Moore’s Beach, NJ (bottom). Vertical bars represent 95% confidence intervals. Note differences in scale.

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 quadrate 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:

- Step1 – 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.

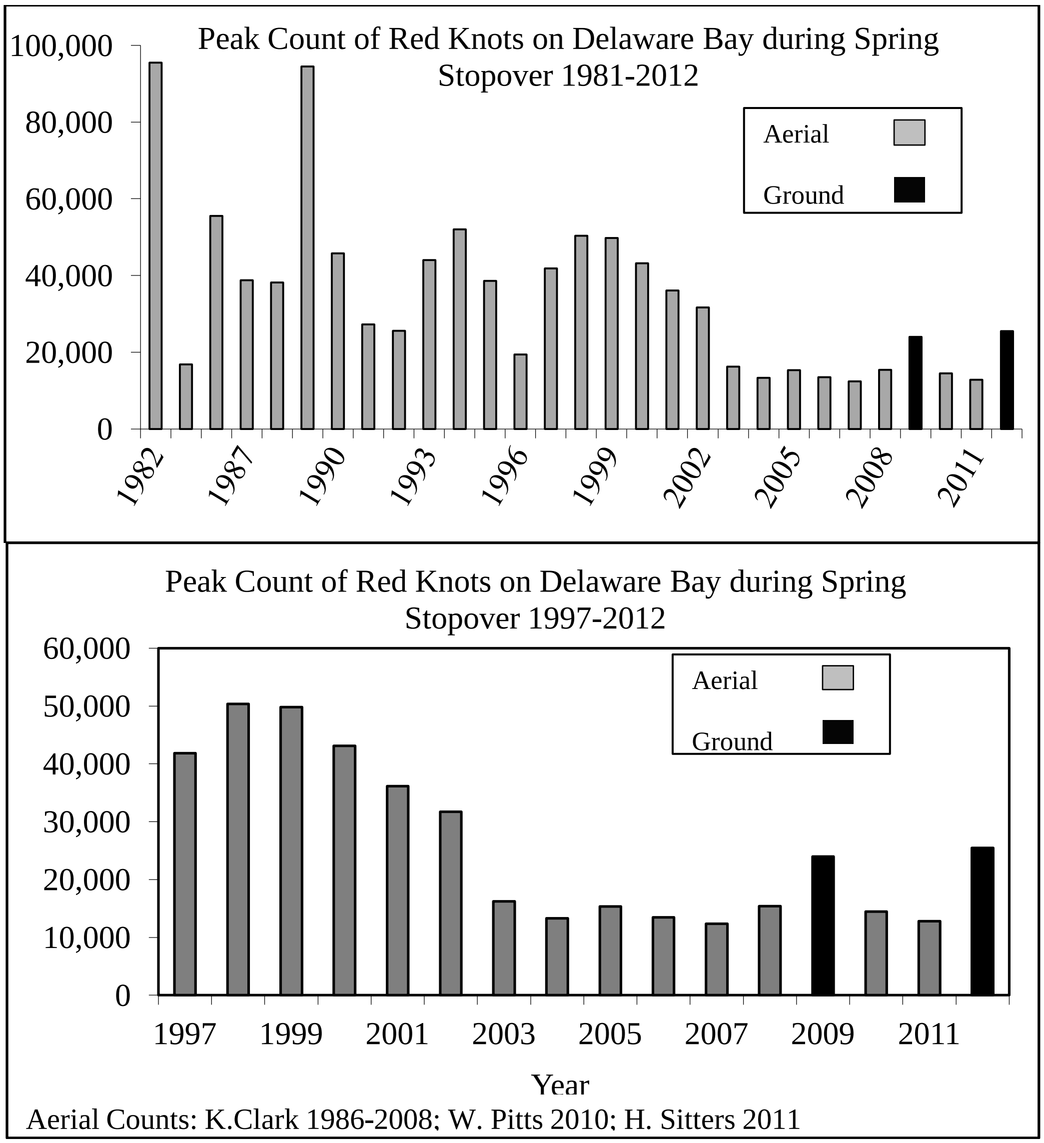

Figure 7. Peak counts of Red Knots in Delaware Bay during spring stopover 1981 – 2012 (top) and recent stopover period 1997-2012 (bottom). Aerial counts are used 1982-2008, 2010-2011. Ground counts were used in 2009 (26 May) and 2012 (24 May).

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.**

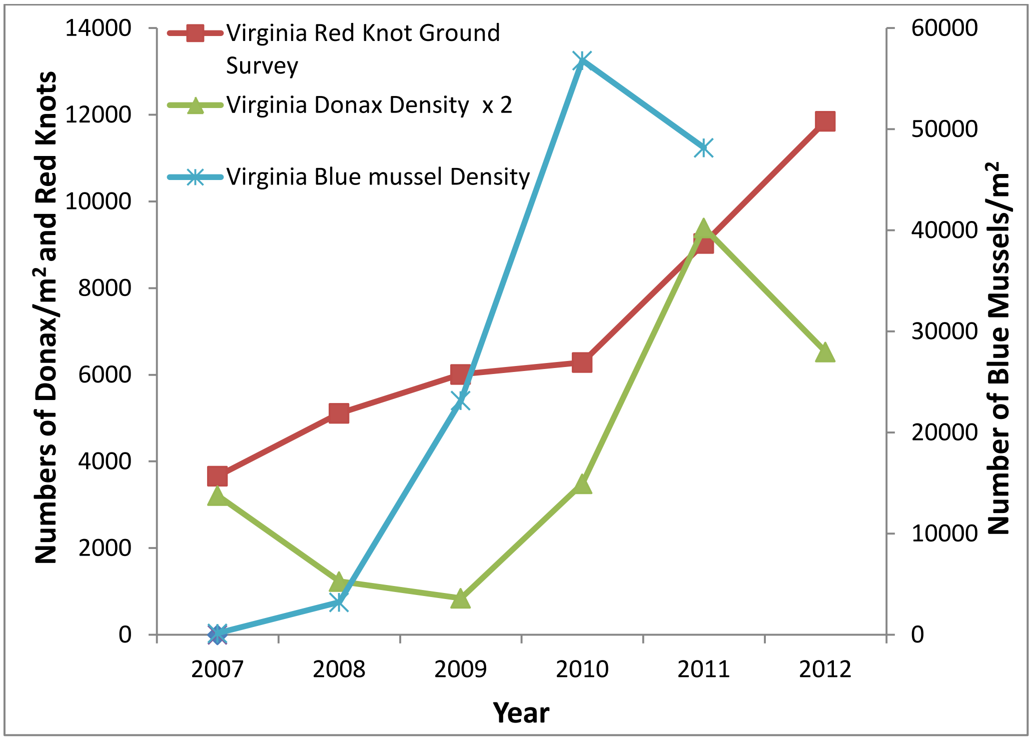

Figure 8. Virginia Red Knot counts from ground surveys, as well as estimates of prey species Domax and Blue mussels.

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.

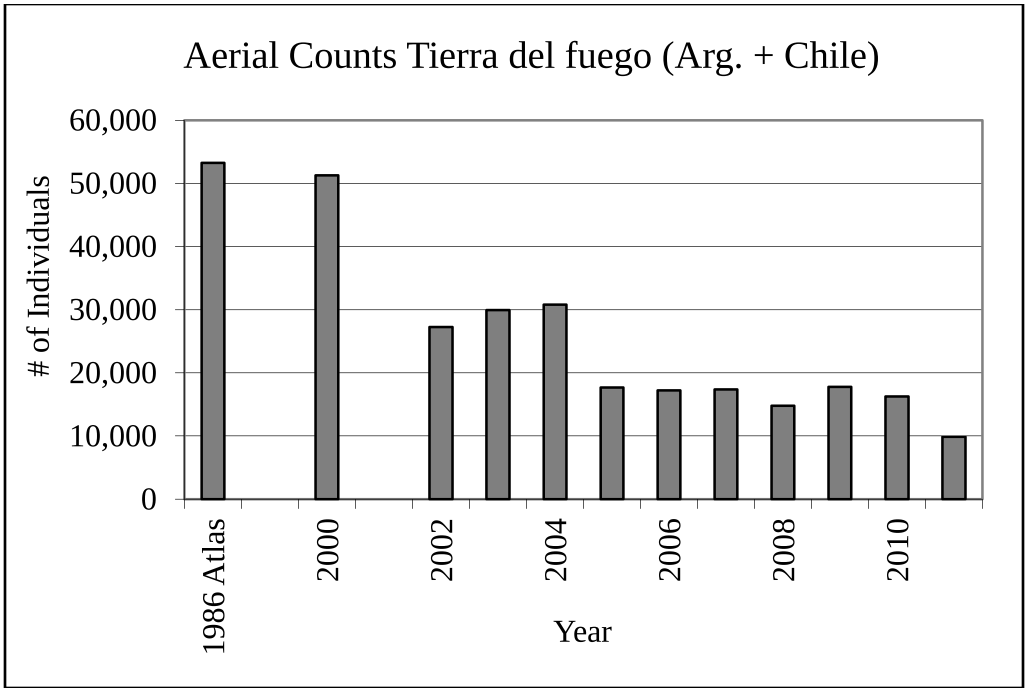

Figure 9. Winter Counts from Tierra del Fuego.

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.

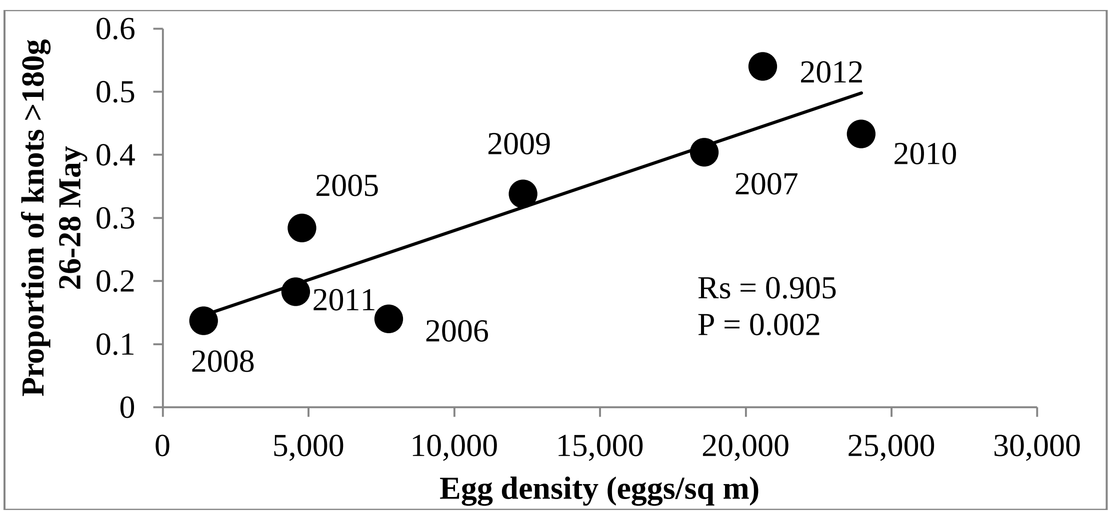

Figure 10. Proportion of Red Knots in the >180 g body-mass category in Delaware Bay during 26-28 May versus median horseshoe crab egg density during 14-27 May, from 2005-12 in Delaware (excluding Mispillion Harbor) and New Jersey.

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	17.20	21.88	x	x	x
1991	x	x	x	x	x	x	x	x	x	14.68	20.14	x	x	x
1992	x	x	x	x	x	x	x	0.95	0.73	4.64	8.92	x	x	x
1993	x	x	x	x	x	x	x	0.69	12.41	5.48	6.20	x	x	x
1994	x	x	x	x	x	x	x	0.07	3.94	2.72	4.22	x	x	x
1995	x	x	x	x	x	x	x	0.76	3.29	2.99	2.39	x	x	x
1996	x	x	x	x	x	x	x	0.26	1.93	6.97	9.43	x	x	x
1997	x	x	x	x	x	x	x	1.16	2.51	3.55	3.83	x	x	x
1998	x	x	x	x	x	x	x	0.24	0.68	1.61	1.77	0.294	0.704	0.205
1999	x	x	x	x	x	x	x	0.42	1.25	4.13	2.55	0.113	0.278	0.101
2000	x	x	x	x	x	x	x	0.23	0.15	2.56	3.08	0.392	0.637	0.275
2001	x	x	x	x	x	x	x	0.90	0.56	1.60	2.97	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	0.24	0.13	0.71	0.33	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	0.16	0.78	2.10	4.06	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	0.10	6.92	0.10	0.08	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	0.21	6.59	0.30	0.28	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	0.09	3.59	7.82	3.17	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	0.13	1.74	2.89	4.83	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	0.14	1.88	0.82	1.36	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	0.13	1.24	1.47	1.64	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	0.09	5.25	1.00	1.36	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	0.05	1.11	1.51	2.17	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