Report to the Horseshoe Crab Plan Review Team on
North Carolina's request to Georgia for a transfer of 3,500 crabs for the 2011 season
ASMFC Horseshoe Crab Advisory Panel

The Horseshoe Crab Advisory Panel met, via conference call, on March 12, 2012 to discuss the transfer request. Per Addendum II to the Horseshoe Crab Fishery Management, all transfer requests are reviewed by the Technical Committee(s) and Advisory Panels, whose comments are summarized and presented to the Board by the Plan Review Team. These committees are to review the request in light of the following considerations:

(i) Amount of transfer being requested;
(ii) Amount of all previous transfers approved in that calendar year;
(iii) Impact that the transfer will have on the Atlantic coast horseshoe crab population(s) as determined by genetic studies that have passed the peer review process conducted by or through the Atlantic States Marine Fisheries Commission;
(iv) Impact that the transfer will have on shorebird populations; and
(v) Impact that the transfer will have on the biomedical industry.

The Horseshoe Crab Advisory Panel (AP) noted the small number of horseshoe crabs requested, and North Carolina's history of having low harvest levels compared to their quota in past years (2004-07, 2010). The AP also felt the transfer will have no significant impact on the biomedical industry. The AP was encouraged by the commitments of the Dr. Louis Daniel, III, Director of the North Carolina Division of Marine Fisheries, to close the bycatch fishery through April 1, 2012 and reopen it with the lower 50-crab bycatch level, thus addressing the main source of the overage. The AP continued to raise concerns of the impacts of pushing fishery demand onto smaller populations, and thus, for future work, recommended an assessment of North Carolina's horseshoe crab populations. An assessment will allow a proper evaluation of the current quota and fishery capacity in relation to the status of the population.

In conclusion, the AP did not feel the current transfer request poses any long-term threats to the horseshoe crab population in either North Carolina or Georgia and recommended approval of the request.

Report to the Horseshoe Crab Plan Review Team on
North Carolina's request to Georgia for a transfer of 3,500 crabs for the 2011 season
ASMFC Shorebird Advisory Panel

The Shorebird Advisory Panel met, via conference call, on March 5, 2012 to discuss the transfer request. Per Addendum II to the Horseshoe Crab Fishery Management, all transfer requests are reviewed by the Technical Committee(s) and Advisory Panels, whose comments are summarized and presented to the Board by the Plan Review Team. These committees are to review the request in light of the following considerations:

(i) Amount of transfer being requested;
(ii) Amount of all previous transfers approved in that calendar year;
(iii) Impact that the transfer will have on the Atlantic coast horseshoe crab population(s) as determined by genetic studies that have passed the peer review process conducted by or through the Atlantic States Marine Fisheries Commission;
(iv) Impact that the transfer will have on shorebird populations; and
(v) Impact that the transfer will have on the biomedical industry.

The Shorebird Advisory Panel (AP) recognizes the small number of horseshoe crabs requested but raises the issue that the claim in the transfer request that Georgia or North Carolina's importance to migratory shorebirds is "undetermined" is not supported by the literature or current research. Hundreds to thousands of red knots have been spotted and recorded as stopping over in North Carolina and Georgia on their way to breeding grounds, including near the end of the stopover period, suggesting that these knots may primarily fuel at these southeastern sites. For example, as part of a coordinated coast-wide count of red knots on two consecutive days between 20-24 May 2006 to 2010, near the end of the stopover season, state collaborators have recorded between 235-1466 red knots in North Carolina and between 796-2155 red knots in Georgia (Dey et al. 2011).Red knots are not known to eat horseshoe crab eggs in significant numbers in the southeastern United States, as they do in the Delaware Bay region, but rather prey primarily on bivalves such as coquina clams (*Donax variabilis*) and blue mussel spat (*Mytilus edulis*; for example, see Cohen et al. 2010). The presence of red knots and their dependence on bivalve food sources at these southeastern sites is consistent with the historical record (for example, see Mackay 1893).

As the shorebird population does not depend heavily on horseshoe crab eggs in either North Carolina or Georgia, the AP does not believe this specific transfer request will have significant or negative impacts on shorebird populations. However, breeding populations of one of the preferred bivalve prey, *Mytilus edulis*, have retracted from Cape Hatteras, NC to Lewes, DE in the last 50 years due to warming water temperatures (Jones et al. 2010); if this trend continues, alternate prey in the southeastern U.S. may be increasingly important for red knots.

Further, Dr. Timothy King's (USGS) work on horseshoe crab genetics has suggested that North Carolina and Georgia crabs may be from different source populations (King et al. 2005, Faurbyet al. 2010). Without additional knowledge of these population genetics as well as a lack of information on the status of these southeastern populations and the concerns with bivalve

populations shifting, the AP feels strongly that this transfer request should be an anomaly and not become an annual or biannual occurrence.

The AP was encouraged by the commitments of Dr. Louis Daniel, III, Director of the North Carolina Division of Marine Fisheries, to close the bycatch fishery through April 1, 2012 and reopen it with the lower 50-crab bycatch level. This singular occurrence of an overage should remain as such and not be used to set a precedent for considering transfer for overages within the Delaware Bay region. An overage in horseshoe crab harvest in the Delaware Bay region will have negative impacts on shorebird populations. Consistent overages, whether in Delaware Bay or in other coastal areas, should not be permitted to use the Addendum II transfer measures to allow a *de facto* increase in a state's quota, but rather be remedied through deductions in a state's quota the following year.

References:

Cohen, J.B., S.M. Karpanty, J.D. Fraser, and B.R. Truitt. 2010. The effect of benthic prey abundance and size on red knot (*Calidris canutus*) distribution at an alternative migratory stopover site on the US Atlantic Coast. Journal of Ornithology.151:355–364.

Dey, A.D., L.J. Niles, H. P. Sitters, K. Kalasz, and R.I.G. Morrison. Update to the Status of the Red Knot *Calidris canutus* in the Western Hemisphere, April 2011, Accessed 9 April 2011, http://www.whsrn.org/sites/default/files/file/Red_Knot_status_update_2011_Dey_et_al_11_05-28.pdf

Faurby, S., T.L. King, M. Obst, C. Pertoldi, and P. Funch. 2010. Population dynamics of American horseshoe crabs—historic climatic events and recent anthropogenic pressures. Molecular Ecology. 19:3088-3100.

Jones, S.J., F.P. Lima, and D.S. Wethey, 2010. Rising environmental temperatures and biogeography: poleward contraction of the blue mussel *Mytilis edulis L.* in the western Atlantic. Journal of Biogeography. 37:2243-2259.

King, T.L., M.S. Eackles, A.P. Spidle, H.J. Brockmann. 2005. Regional differentiation and sex-biased dispersal among populations of the horseshoe crab (*Limulus polyphemus*). Transactions of the American Fisheries Society 134: 441-465.

Mackay, G. 1893 Observations on the knot (*Tringa canutus*). Auk 10:25–35.

Horseshoe Crab Technical Committee Meeting
Baltimore, Maryland
3 April 2012

Attendees

Members

Penny Howell (CT-chair)	Steve Doctor (MD- vice chair)
Larry Delancey (SC)	Jeff Brust (NJ)
Rachel Sysak (NY)	Joe Grist (VA)
Jordan Zimmerman (DE)	Vin Malkoski (MA)
Tina Moore (NC)	Jim Page (GA-via phone)
Tiffany Black (FL-via phone)	Joanna Burger (NJ)
Greg Breese (USFWS)	Derek Orner (NMFS)

Others

Danielle Chesky (ASMFC)	Sheila Eyler (USFWS)

The Horseshoe Crab Technical Committee (TC) met to discuss the requested transfer of crabs to North Carolina from Georgia to cover a harvest overage in the 2011 season and to discuss the current framework for the USFWS coastwide horseshoe crab tagging program. In addition to these discussions, the TC elected a new vice chair, Steve Doctor (MD) to serve for two years.

Tina Moore of North Carolina gave a brief overview of the transfer request, including the challenges and limitations in management that led to the overage as well as the management flexibility North Carolina has since instituted to prevent overages in the future. She also noted the gill net survey, which is reported in the annual compliance report, has indicated a three-fold increase in the horseshoe crab population over the last ten years, suggesting the population has not been harmed by the low level of fishing that occurs in North Carolina. Neighboring states suggested their indices are increasing or are level in most cases, and thus likely are not being negatively impacted. The TC agreed the transfer request should be granted, based on the small number of crabs being transferred (3,500), the efforts North Carolina has made to address the overages now and in the future (proclamation ability expanded, closure of bycatch fishery until April 1, 2012), the likelihood that shorebirds are feeding on mussels and other bivalves (not horseshoe crab eggs) while on the coasts of North Carolina and Georgia, and a lack of impacts on the biomedical industry.

In addition to these discussions, the TC discussed the possibility of modifying state quotas in the future, which would need to include additional analysis on the status of the subpopulations. Further, as part of this discussion, TC members raised concerns about the potential for impacts from the new Adaptive Resource Management (ARM) Framework, which may push additional effort on horseshoe crabs for bait to populations outside the Delaware Bay area. New York and Massachusetts had already seen impacts of effort migration from past management efforts, and concern was raised that increased effort on females may be seen in other states as well as a result of the ARM Framework's male-only regulation. As a result of these concerns, **the TC recommends the Board task the TC and the Stock Assessment Subcommittee to gather, review, and summarize the available coastal and state indices, including data through the**

2012 field season, in order to give a relative status of the horseshoe crab populations along the coast. The TC felt this exercise could be accomplished via webinar and conference calls, with minimal time and effort. Indicators used in past assessments (2004, 2009) would not necessarily have to be the same indices used in this status update, although consistency of indices would be helpful. The TC anticipated this effort be completed in the Spring of 2013 after all indices from 2012 had been prepared. These efforts will establish a trend baseline for evaluation of future impacts of the ARM Framework and would be a valuable tool for managers.

Sheila Eyler provided an overview of the current tagging program and the budgetary and staff challenges of continuing such a large program. The TC discussed the uses of the tagging data, past, current, and future, and agreed that a better structured program would assist the states and the ASMFC with future management decisions. The TC reviewed and edited the Coastwide Tagging Program document, last edited by the TC's ad-hoc tagging subcommittee in September 2008 (see additional report). Edits include a targeted number for the regional distribution of tags, required and voluntary information for tagging and re-sighting, program objectives, and additional information requirements for cooperators. This document provides greater structure to the program for a more focused, and hopefully for useful, collection of the data. In addition to this protocol, **the TC recommends the USFWS include the website for reporting on their tags, in order to better inform the public of this method for submitting tag re-sightings data**. The TC agreed that eliminating the call-in program could jeopardize the data coming in and was not the most effective way to cut program costs at this time. The TC suggested the USFWS look at phone contractor options for fulfilling this need, as it may be less expensive than hiring a seasonal technician. Greg Breese also suggested the tagging program look at a bird reporting website (http://bandedbirds.org/index.html), which provides a map-based system for individuals to identify where the sighting occurred. This system may increase the accuracy of the re-sighting information and eliminate confusion of political jurisdictions and bodies of water. The TC also discussed the current reward system and agreed with the USFWS' approach to limit the number of pewter horseshoe crab pins to reporters to one per year. The TC agreed the information sent to the reporter was more important than the pin, as it provides an additional educational outreach to the interested public.

As the program's extent will be reduced from its current level of 30,000 tags per year to less than 20,000 tags per year, the TC raised concerns that some groups may decide to initiate their own tagging program. The TC agreed that multiple tagging programs, with unique tags and points of contact for reporting re-sightings, would confuse the general public and potentially undermine the goals of a coastwide tagging program to provide useful information for management and assessment. Thus, **the TC recommends that all states, when considering applications for scientific collection permits to tag horseshoe crabs, encourage and/or require applicants to work through the USFWS tagging program, in order to maintain a consistent coastwide program.** These efforts by the state will ensure a coordinated tagging effort and collection of data to assist managers in future decisions. The TC agreed that expansions of the program, provided the cooperator will provide in-kind services, can be considered on a case-by-case basis. These exceptions will allow interested research, non-government, and other partners to continue their efforts without exceeding the abilities of the USFWS tagging office.

Request from North Carolina to transfer 3,500 horseshoe crabs from Georgia for 2011 Horseshoe Crab Plan Review Team Summary of Comments

Sheila Eyler (USFWS), Stewart Michels (DEDNREC), Danielle Chesky (ASMFC)
19 April 2012

The Plan Review Team (PRT) met via conference call to discuss the transfer request from North Carolina for 3,500 horseshoe crabs to cover an overage during the 2011 season. The PRT reviewed the transfer request and the comments submitted by the Horseshoe Crab and Shorebird Advisory Panels and the Horseshoe Crab Technical Committee. The PRT cautions that further overages and requests for transfers could be construed as a *de facto* redistribution of the quota. Given the suggestion from work by Dr. Timothy King (USGS) that North Carolina and Georgia crabs may be from different source populations (King et al. 2005, Faurbyet et al. 2010), the impacts of continued transfers and/or a redistribution of quota from Georgia to North Carolina are unknown at this time. The Shorebird AP also provided evidence of shorebird use of Georgia and North Carolina beaches, although currently horseshoe crab eggs are not believed to be a main component of their diet. The Horseshoe Crab AP noted neither North Carolina nor Georgia has biomedical harvesting, and thus the transfer is not likely to have impacts on the biomedical industry. The Horseshoe Crab AP also raised concerns of the impacts of pushing fishery demand onto smaller populations, and thus, for future work, recommended an assessment of North Carolina's horseshoe crab populations. Such an assessment will allow a more robust evaluation of the current quota and fishery capacity in relation to the status of the population. The TC discussed the relative indices in North Carolina and neighboring states. The gill net survey in North Carolina has indicated a three-fold increase in the horseshoe crab population over the past decade, and neighboring states noted their indices are increasing or are level in most cases. The TC agreed these results suggest the past level of fishing in North Carolina has not negatively impacted the horseshoe crab populations in North Carolina and neighboring states.

In summary, **the PRT recommends approval of the transfer request, given the small number of crabs and the regulatory steps North Carolina has taken to provide greater control over the allowed harvest.** However, consistent overages, whether in Delaware Bay or in other coastal areas, should not be permitted to use the Addendum II transfer measures to allow a *de facto* increase in a state's quota, but rather be remedied through deductions in a state's quota the following year.

Faurby, S., T.L. King, M. Obst, C. Pertoldi, and P. Funch. 2010. Population dynamics of American horseshoe crabs—historic climatic events and recent anthropogenic pressures. Molecular Ecology. 19:3088-3100.

King, T.L., M.S. Eackles, A.P. Spidle, H.J. Brockmann. 2005. Regional differentiation and sex-biased dispersal among populations of the horseshoe crab (*Limulus polyphemus*). Transactions of the American Fisheries Society 134: 441-465.

Coastwide Horseshoe Crab Tagging Program

I. Background

In August 1998, the Atlantic States Marine Fisheries Commission's (Commission) Management and Science Committee hosted a one-day, facilitated workshop to develop recommended protocols for fish tagging programs. This workshop was initiated by the need to maximize the utility of data collected by scientific and constituent-based tagging programs. By following standard protocols in the design and conduct of such programs, data may be of a higher quality and utilized for purposes beyond a single purpose design. Collection of tagging data using consistent formats provides greater compatibility among various tagging programs and more extensive use of data for stock assessment and management purposes. Additionally, use of consistent protocols by constituent-based tagging programs (programs conducted by non-management agencies) enhances the contribution of collected data to address specific management efforts.

The United States Fish and Wildlife Service (USFWS) began administering a tagging program for horseshoe crabs in 1999. The program grew from distributing less than 10,000 tags per year to a record 30,000 tags in 2011. The immense interest in the tagging program has proven to exceed the staff and resource capacities for the USFWS to continue to administer the program at the current level. As a result, the Atlantic States Marine Fisheries Commission (ASMFC) Horseshoe Crab Technical Committee took up the task of providing guidelines for this program in the future. As the forum for coastwide management of horseshoe crabs, the ASMFC and its member states have a large interest in the utility of these data for current and future management and assessment of the horseshoe crab population. These efforts follow on the work of the Technical Committee's ad-hoc tagging subcommittee from 2003 through 2008 to provide a program design for tagging and reporting.

II. Purpose

As of the last stock assessment in 2009, trends in the horseshoe crab population along the coast indicated decreasing levels in the northeast and stable or slightly increasing in the Delaware Bay and southeast regions. However, biological reference points were not reliably available from the data. To address some of the information gaps, many concerned entities, such as the USFWS, universities, and non-governmental organizations, have developed tagging programs at various locations along the Atlantic coast. While these programs may have different designs and objectives, they all seek to acquire information about the horseshoe crab. The purpose of a coastwide tagging program is to gain population-level information that could not otherwise be achieved by individual, smaller-scale programs operating independently. Importantly, a coastwide tagging program provides a framework under which new programs could be developed. The end result, ideally, is a coordinated program with common objectives to provide information on horseshoe crab population status valuable to management decisions. These efforts respond to identified research needs within the 2009 stock assessment and the annual Fishery Management Plan reviews, among other ASMFC technical reports.

The following program design was developed in response to the expansion of the tagging efforts beyond the budget and staff resources committed by the USFWS to this program. The design provides common objectives, necessary information, and a distribution of effort that will help meet current and future management challenges for horseshoe crabs along the Atlantic coast. As part of these efforts, all cooperators will be required to submit an application for tags for 2013 by January 15, 2013 to the program coordinator (Sheila Eyler). In addition, all cooperators are required to submit an annual report, summarizing their yearly activities (beginning after the 2013 season), along with a yearly application for tags by January 15th of each year. These reports will allow the program coordinator and the management agencies to learn more about the cooperators' efforts and better use their resultant data for management.

III. Objectives

In order of importance, with the most important first:

- To determine horseshoe crab sub-population structure
- To estimate horseshoe crab movement/migration rates (seasonal and yearly)
- To estimate survival/mortality of horseshoe crabs

IV. Design

A. Tagging and Release Areas

Consistency in protocol is necessary within each program. Priority will be given to distribute tags among tagging programs to cover the full geographic range of horseshoe crabs. Areas include:

- at spawning sites throughout the horseshoe crab's range (i.e. from Maine to Florida)
- during trawl surveys in nearshore and offshore habitats

B. Length of Program

In order for horseshoe crab tagging programs to achieve the aforementioned objectives, a minimum duration of two years is required for each tagging program, which includes at least one year of tagging followed by at least one year of dedicated resighting effort. Additional priority will be given to programs designed to operate for 5 years or longer.

C. Number of Tags

The coastwide tagging program is limited, at this time, to the tag and release of 20,000 horseshoe crabs per year, due to budget and staff limitations. If program objectives include estimation of population rates at a local scale (e.g., estimate

survival within an embayment), then program allocation of tags will depend on location-specific factors, such as parameters of interest, size of the local population, and expected recapture rates. No more than 5,000 tags will be supplied to an individual program.

Suggested Regional tag distribution levels

- Northeast to Long Island Sound: 7,500
- Southern New York/New Jersey coast: 3,500
- Delaware Bay/Delmarva: 7,500
- Southeast: 1,500

D. Tag Type and Tagging Procedure

A USFWS standardized tag is used. USFWS has established a tagging procedure that will be provided to tagging programs.

E. Critical Data for Tagging Crabs

Submitted data are required to be in electronic format using the excel sheet provided by the USFWS Tagging Coordinator. All programs will be required to submit an annual report, summarizing their activities, at the end of the year.

Required information:

Site info

- Date tagged
- Location
- Beach distance surveyed
- Selection criteria if sub-sample tagged
- Percentage of crabs tagged
- Sampling method (hand, net, etc.)

Individual info

- Tag number
- Gender of tagged crab
- Crab injured?

Voluntary information:

- Total abundance of crabs by gender in surveyed area, estimated if necessary (if tagging on spawning beach)
- Prosomal width

F. Critical Data for Resighting Crabs

As part of any tagging program, substantial resighting effort is expected to be part of the program design. Resighting effort is critical to the success of the tagging program and needs to be part of the tagging effort.

General Public required information:

Site info

- Date sighted
- Location
- Sampling method (hand, net, etc.)

Individual info

- Tag number
- Condition (dead, alive, tag-only)
- Tag removed?
- Disposition (bait, biomedical, released live, found dead)
- Reporter type

Optional: Contact information

Cooperator required information:

Submitted data are required to be in electronic format using the excel sheet provided by the USFWS Tagging Coordinator.

Site info

- Date sighted
- Location
- Beach distance surveyed
- Number of untagged crabs (estimate if necessary)
- Selection criteria if sub-sample resighted
- Sampling method (hand, net, etc.)

Individual info

- Tag number
- Condition (dead, alive, tag-only)
- Tag removed?
- Disposition (bait, biomedical, released live, found dead)
- Reporter type

G. Promoting and Rewarding Tag Recapture

Rate of recapture of tagged horseshoe crabs is a critical factor determining the success of the tagging program. Recapture rate is a function of capture effort and reporting rate. Knowing reporting rate can be very useful when measuring fishing mortality and harvest rate, which is an important term of reference in fisheries management plans.

To ensure a sufficient number of tag recaptures, it is recommended that the tagging program be promoted through public announcements and distribution of educational materials.

The current reward program provides a certificate with information on the history of the reported crab. Reporters, currently, are also provided one pewter horseshoe crab pin per year.

H. Reporting and Data Management and Analysis

The USFWS Maryland Fisheries Resource Office maintains the database to support the horseshoe crab tagging program. Collected data will be provided to state, interstate, and federal agencies for management purposes.

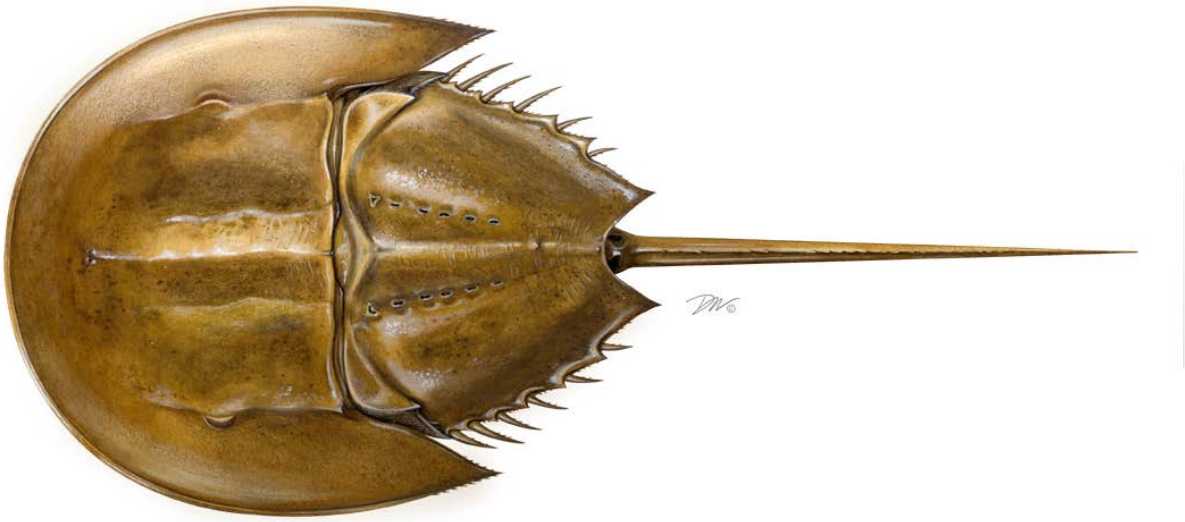
I. Program Effort Beyond the Current Limitations

As noted, the program is currently limited by budget and resources to 20,000 tags per year. For programs looking to expand beyond the current limitations of the program, options are available, on a case-by-case basis, to meet these program needs. Interested programs and individuals will need to provide in-kind contributions and program support in order to fill these program expansions. Interested parties should contact the USFWS Tagging Program Coordinator.

2012 Plan Review Team Report for Compliance in 2011

Horseshoe Crab

Annual State Compliance and Law Enforcement Reports



Presented to the
ASMFC Horseshoe Crab Management Board

Prepared by the ASMFC Horseshoe Crab Plan Review Team:

Sheila Eyler, U.S. Fish and Wildlife Service
Stewart Michels, Delaware Department of Natural Resources and Environmental Control
Danielle Chesky, Chair, Atlantic States Marine Fisheries Commission

For Board Review

Introduction

In accordance with the ASMFC Charter, Plan Review Teams shall at least annually or as provided in a given fishery management plan, conduct a review of the stock status and states' compliance with the implementation requirements of the fishery management plan for which it was established. The Plan Review Team shall report all findings in writing to the Management Board for appropriate action.

The Plan Review Team held a conference call on April 18, 2012, to discuss state compliance status. Mandatory compliance elements for states are listed in detail in the Interstate Fishery Management Plan for Horseshoe Crab and Addenda I, II, III, and VI of the plan.

Status of State Compliance

Included in this report are state-by-state charts outlining compliance and monitoring measures. The PRT recommends all jurisdictions were in compliance with the FMP and Addendum I, III, and VI in 2010. However, there are a few overall issues of which the Plan Review Team (PRT) believes the Board should be aware.

In 2009, Virginia's preliminary reported overharvest was 15,387 crabs. Final counts revealed that the overharvest was 35,051 crabs. Virginia had adjusted its 2010 quota to account for the preliminary reported overharvest and set the 2010 quota to 137,108. In 2010 Virginia harvested above this threshold by 7,541 crabs. Virginia's 2010 harvest east of the COLREGS line was less than 40% of the total harvest; however, the continued overharvest, using the 2010 preliminary reported data, put Virginia at a two-year overage of 21,562 crabs. The PRT noted its concerns last year about this high overage level, as these crabs are made up, partially, of Delaware Bay origin crabs. The PRT had recommended a minimum decrease in harvest to compensate for the 21,562 crab overage and also suggested Virginia consider an area-specific overage. In 2011, according to the preliminary reports, Virginia remained well below its adjusted quota of 130,933, with a harvest of 95,009. In addition, harvest east of the COLREGS amounted to 15,686 crabs, which is 16.5% of the total harvest and very near to the PRT's suggested quota to account for the area-specific overages.

The PRT maintains that landings for marine life collection are not a problem but asks that all states include any of this activity, including crabs collected for scientific and educational purposes, in their annual state reports so the PRT may monitor the situation.

Most of the southern states (from Virginia south) have harvesting seasons that extend through December. Because of lag time for reported data to become available, not all of the landings were reported in the state reports for the past year. The PRT asks states to supplement their landings data in their state reports by submitting the final tally for the past years' total harvest.

In 2011, North Carolina exceeded its annual quota by 3,040 crabs. North Carolina has requested a quota transfer of 3,500 crabs from Georgia to account for this overage. The Horseshoe Crab Advisory Panel, Shorebird Advisory Panel, and the Horseshoe Crab Technical Committee have all reviewed this transfer request and submitted their comments to the PRT. In consideration of

these comments, and North Carolina's recent rule-making efforts, which should allow for better management of the quota, the PRT recommends approval of the transfer. The PRT cautions that data for this region are limited. Although a one-time transfer is reasonable in this case, recurring transfer requests are not advisable given the paucity of fishery-independent data to monitor horseshoe crabs in the region. Therefore, it is suggested that future consideration of overages include a quota deduction in the following year.

The District of Columbia did not submit a compliance report to the ASMFC for the 2011 fishing season. The District has not submitted a compliance report for horseshoe crabs for several years in a row. Washington, D.C. was added to the HSC Management Board to close a landings loophole that existed in the late 1990s. Since then Washington, D.C. has adopted regulations that prohibit landings of horseshoe crabs, thereby closing the loophole. All jurisdictions on the Board are required to submit annual compliance reports. In order to free the District of the requirement to submit compliance reports, the PRT recommends Washington D.C. request removal from the HSC Board.

Compliance Reporting

The PRT reminds states to submit compliance reports that reflect the monitoring requirements and recommendations of Addendum III and the management measures of Addendum VI. As many states report preliminary landings in their annual compliance reports due to timing, the PRT requests states include past years' harvest levels in order to verify previous landings.

De Minimis Status

The preliminary average coastwide horseshoe crab landings of the past two years (2010 and 2011) is 627,671 horseshoe crabs. As described in Addendum I, a state qualifies for *de minimis* status if for the previous two years its landings comprise less than 1% of the total coastwide landings over the same two-year period. The preliminary *de minimis* threshold for 2011 is set at 6,277 horseshoe crabs. Maine, New Hampshire, Potomac River Fisheries Commission, South Carolina, Georgia, and Florida have requested *de minimis*status for 2012. The PRT recommends that the states/jurisdictions listed above be granted *de minimis* status for 2012. New Jersey qualifies for *de minimis* status in 2012 but did not request it.

Law Enforcement Committee Report

The Atlantic States Marine Fisheries Commission Law Enforcement Committee has been surveyed to determine if there are any significant problems with the horseshoe crab fisheries management plan that affect law enforcement efforts. Overall compliance with the horseshoe management plan is high with very few serious violations. Tight restrictions, season closures and moratoriums have resulted in few violations. However, the PRT has heard about possible illegal harvest during the night on Long Island, New York.

Two minor cases occurred in Delaware that led to arrests in past years. In one, a commercial HSC harvester was arrested for using three teenagers to collect crabs for him while he was not present. Delaware law requires the licensed collector to be present. In the other case, a boat

operator was caught with six horseshoe crabs caught from a dredge. The individual was not licensed to dredge for HSCs. In both cases, charges carry a fine of $100 plus court costs per count. There were no additional reports of illegal harvest in Delaware.

MAINE		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	*De minimis* status granted.	N/A
- Ability to close fishery if *de minimis*threshold is reached	Yes	N/A
- Daily possession limit <25 for *de minimis* state	Yes	N/A
- HSC landing permit	Permit required	No permits will be issued
Bait Harvest Restrictions and Landings		
- ASMFC Quota	13,500	-
- Other Restrictions	Closed season (May 1- October 30)	Closed, no permits will be issued
- Landings	0	--
Monitoring Component A_1		
- Mandatory monthly reporting	No – But, annual reporting can be substituted for monthly reporting when a daily possession limit of 25 or less HSCs is implemented.	N/A
- Characterize commercial bait fishery	Not Required	N/A
Monitoring Component A_2		
- Biomedical harvest reporting	Not Applicable	N/A
- Required information for biomedical use of crabs	Not Applicable	N/A
Monitoring Component A_3 Identify spawning and nursery habitat	Yes	N/A
Monitoring Component B_1 Coastwide benthic trawl survey	No	N/A
Monitoring Component B_2 Continue existing benthic sampling programs	No	N/A
Monitoring Component B_3 Implement spawning survey	Yes	N/A
Monitoring Component B_4 Tagging program	No	N/A

Note: Maine did not issue any permits to harvest horseshoe crabs in 2011.Until Maine can legislatively change their permitting system for horseshoe crab harvests, the PRT recommends Maine disapprove any applications for horseshoe crab bait harvest.

NEW HAMPSHIRE		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	*De minimis*status granted.	*De minimis* requested and meets criteria.
- Ability to close fishery if *de minimis*threshold is reached	Unspecified	Unspecified
- Daily possession limit <25 for *de minimis* state	Yes – 10/day	Yes – 10/day
- HSC landing permit	Permit required, but not limited to historical participation.	Permit required, but not limited to historical participation.
Bait Harvest Restrictions and Landings		
- ASMFC Quota	350	350
- Other Restrictions	None	None
- Landings	0	--
Monitoring Component A_1		
- Mandatory monthly reporting	Yes	Yes
- Characterize commercial bait fishery	Not Required	Not Required
Monitoring Component A_2		
- Biomedical harvest reporting	Not Applicable	Not Applicable
- Required information for biomedical use of crabs	Not Applicable	Not Applicable
Monitoring Component A_3 Identify spawning and nursery habitat	Yes, by state personnel, Great Bay Watch and volunteers	Yes
Monitoring Component B_1 Coastwide benthic trawl survey	No	No
Monitoring Component B_2 Continue existing benthic sampling programs	Not Applicable	Not Applicable
Monitoring Component B_3 Implement spawning survey	As part of Component A_3, NH conducts a limited spawning survey	Yes
Monitoring Component B_4 Tagging program	No	No

Note: In New Hampshire, six permits were open for horseshoe crab harvesting in 2011. NH has continued its spawning and nursery survey since 2001.

MASSACHUSETTS		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	Did not qualify for *de miminis*	Does not qualify for *de miminis*
Bait Harvest Restrictions and Landings		
- ASMFC Quota (Voluntary State Quota)	330,377 (165,000)	330,377 (165,000)
- Other Restrictions	Bait: 400 crab daily limit through Jan 1- June 30; 600 crab daily limit after June 30- Dec 31; limited entry; Biomedical: 1,000 crab daily limit; Conch pot and eel fishermen: no possession limit All: May and June 5-day lunar closures; No mobile gear harvest Fri-Sat during summer flounder season; 7" PW minimum size; Pleasant Bay Closed Area	Bait: 400 crab daily limit through Jan 1- June 30; 600 crab daily limit after June 30- Dec 31; limited entry; Biomedical: 1,000 crab daily limit; Conch pot and eel fishermen: no possession limit All: May and June 5-day lunar closures; No mobile gear harvest Fri-Sat during summer flounder season; 7" PW minimum size; Pleasant Bay Closed Area
- Landings	85,573	--
Monitoring Component A_1		
- Mandatory monthly reporting	Yes, plus weekly dealer reporting through SAFIS	Yes, plus weekly dealer reporting through SAFIS
- Characterize commercial bait fishery	Yes	Yes
Monitoring Component A_2		
- Biomedical harvest reporting	Yes	Yes
- Required information for biomedical use of crabs	Yes	Yes
Monitoring Component A_3 Identify spawning and nursery habitat	Yes	Yes
Monitoring Component B_1 Coastwide benthic trawl survey	Supports it, but lacks resources to expand state trawl survey	State trawl survey
Monitoring Component B_2 Continue existing benthic sampling programs	Yes	Yes
Monitoring Component B_3 Implement spawning survey	Yes, began in 2008 and adapted from DE Bay survey	Yes
Monitoring Component B_4 Tagging program	Yes – w/NPS and USFWS; Pleasant Bay, Monomy NWR, Waquoit Bay	Yes, with Woods Hole Sea Grant (2010-11)

Note: The PRT requests that MA provide a summary of landings by month in its report as is required by Addendum III. As data for harvest by gender were not available in time for the PRT report, the PRT requests Massachusetts submit these data once available. Sex ratios in Pleasant Bay, an area harvested solely for biomedical purposes, are

increasingly male-skewed. Massachusetts DMF noted it will increase monitoring in the Bay in 2012. Second, observed numbers of spawning crabs continued to be low overall.

RHODE ISLAND		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	Did not qualify for *de minimis*	Does not qualify for *de minimis*
Bait Harvest Restrictions and Landings		
- ASMFC Quota (Voluntary State Quota)	26,053 (8,169)	26,053 (14,348)
- Other Restrictions	None	None
- Landings	12,632	--
Monitoring Component A_1		
- Mandatory monthly reporting	Yes, though exempt, with weekly call in and monthly on paper.	Yes, though exempt, with weekly call in and monthly on paper.
- Characterize commercial bait fishery	Yes	Yes
Monitoring Component A_2		
- Biomedical harvest reporting	Yes	Yes
- Required information for biomedical use of crabs	Yes, details within Massachusetts' reports	Captured in Massachusetts' reports
Monitoring Component A_3 Identify spawning and nursery habitat	Yes	Yes
Monitoring Component B_1 Coastwide benthic trawl survey	No	No
Monitoring Component B_2 Continue existing benthic sampling programs	Yes	Yes
Monitoring Component B_3 Implement spawning survey	Yes, since 2000 (methods unspecified)	Yes
Monitoring Component B_4 Tagging program	RI DEM 2001-2004 only Outside, independent groups currently	No

Note: RI's Aquatic Education Resource program continued the 'Green Eggs and Sand' program in 2011. Students participated in spawning surveys and tagging with USFWS tags.

CONNETICUT		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	Did not qualify for *de miminis*	Does not qualify for *de miminis*
Bait Harvest Restrictions and Landings		
- ASMFC Quota	48,689	48,689
- Other Restrictions	Limited entry program, possession limits, and seasonal and areas closures	Limited entry program, possession limits, and seasonal and area closures
- Landings	20,538	--
Monitoring Component A_1		
- Mandatory monthly reporting	Yes	Yes
- Characterize commercial bait fishery	No – exempt under Addendum III because landings are < 5% of coastwide total	No – exempt under Addendum III because landings are < 5% of coastwide total
Monitoring Component A_2		
- Biomedical harvest reporting	Not Applicable	Not Applicable
- Required information for biomedical use of crabs	Not Applicable	Not Applicable
Monitoring Component A_3 Identify spawning and nursery habitat	Yes	Yes
Monitoring Component B_1 Coastwide benthic trawl survey	No	No
Monitoring Component B_2 Continue existing benthic sampling programs	Yes	Yes
Monitoring Component B_3 Implement spawning survey	Yes, since 1999 (methods differ from DE Bay survey)	Yes
Monitoring Component B_4 Tagging program	Yes, in collaboration with local universities	Yes

Note: The report notes that a master's degree candidate, funded to complete a resource selection modeled based on the physical characteristics of Connecticut's spawning beaches, concluded that beaches in the western basin had a much higher probability of sustaining high density populations than beaches east of the Connecticut River. The DEP has partnered with Sacred Heart University and other volunteers to tag horseshoe crabs and will use the recapture data to estimate local spawning population size and movements.

The PRT requests that CT provide a summary of landings by month in its report as is required by Addendum III.

NEW YORK		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	Did not qualify for *de miminis*	Does not qualify for *de miminis*
Bait Harvest Restrictions and Landings		
- ASMFC Quota (Voluntary State Quota)	366,272 (150,000)	366,272 (150,000)
- Other Restrictions	Ability to close areas to harvest; seasonal quotas and trip limits; 200 crab/harvester daily quota; W. Meadow Beach, Cedar Beach, and Fire Island National Seashore harvest closures	Ability to close areas to harvest; seasonal quotas and trip limits; 200 crab/harvester daily quota; W. Meadow Beach, Cedar Beach, and Fire Island National Seashore harvest closures
- Landings	146,995	--
Monitoring Component A_1		
- Mandatory monthly reporting	Yes (weekly April – July)	Yes
- Characterize commercial bait fishery	No	Yes
Monitoring Component A_2		
- Biomedical harvest reporting	Not Applicable	Not Applicable
- Required information for biomedical use of crabs	Not Applicable	Not Applicable
Monitoring Component A_3 Identify spawning and nursery habitat	Yes	Yes
Monitoring Component B_1 Coastwide benthic trawl survey	No	Dependent on survey funding
Monitoring Component B_2 Continue existing benthic sampling programs	Yes	Yes
Monitoring Component B_3 Implement spawning survey	Yes – adapted from DE Bay survey	Yes
Monitoring Component B_4 Tagging program	Yes, since 2007	Yes

Note: The Peconic Trawl Survey observed overall numbers and size of females decreasing in Peconic Bay. New York reported on its spawning survey efforts that have been building and adapting through 2008. New York also reported on its shorebird and egg surveys in 2010-11, which showed associations between shorebird feeding and horseshoe crab eggs as well as relatively high peak numbers (close to 1,000 shorebirds) on some beaches.

NEW JERSEY		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	Qualified for *de miminis*	Qualifies but not requesting *de miminis*
Bait Harvest Restrictions and Landings		
- ASMFC Quota (Voluntary state quota)	100,000 [male only] (0)	100,000 [male only] (0)
- Other Restrictions	Bait harvest moratorium	Bait harvest moratorium
- Landings	0	--
Monitoring Component A_1		
- Mandatory monthly reporting	N/A	N/A
- Characterize commercial bait fishery	N/A	N/A
Monitoring Component A_2		
- Biomedical harvest reporting	Yes	Yes
- Required information for biomedical use of crabs	Yes	Yes
Monitoring Component A_3 Identify spawning and nursery habitat	Yes	Yes
Monitoring Component B_1 Coastwide benthic trawl survey	Yes	Yes
Monitoring Component B_2 Continue existing benthic sampling programs	Yes	Yes
Monitoring Component B_3 Implement spawning survey	Yes – since 1999	Yes
Monitoring Component B_4 Tagging program	No	No
Monitoring Component B_5 Egg abundance survey	Yes	Yes
Monitoring Component B_6 Shorebird monitoring program	Yes	Yes

Note: New Jersey passed legislation on March 25, 2008, implementing a full harvest moratorium on horseshoe crabs (excluding biomedical and scientific harvest). New Jersey's Delaware Bay Trawl survey horseshoe crab indices continued to increasing trends in all three demographics (juveniles, males, and females); in addition, the indices for these demographics derived from the Surf Clam survey also showed increasing trends since 2005.

DELAWARE		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	Did not qualify for *de miminis*	Does not qualify for *de miminis*
Bait Harvest Restrictions and Landings		
- ASMFC Quota (State-reduced quota for overage)	100,000 [male only] (97,887)	100,000 [male only]
- Other Restrictions	Closed season (January 1 – June 7)	Closed season (January 1 – June 7)
- Landings	95,663 males	--
Monitoring Component A_1		
- Mandatory monthly reporting	Yes (weekly reports& monthly logbooks)	Yes
- Characterize commercial bait fishery	Yes	Yes
Monitoring Component A_2		
- Biomedical harvest reporting	Not Applicable	Not Applicable
- Required information for biomedical use of crabs	Not Applicable	Not Applicable
Monitoring Component A_3 Identify spawning and nursery habitat	Yes – updates once every 5 years or as needed	Yes – updates once every 5 years or as needed
Monitoring Component B_1 Coastwide benthic trawl survey	Yes	Yes
Monitoring Component B_2 Continue existing benthic sampling programs	Yes	Yes
Monitoring Component B_3 Implement spawning survey	Yes	Yes
Monitoring Component B_4 Tagging program	No state program but has assisted in the past with various Delaware Bay horseshoe crab tagging initiatives	No
Monitoring Component B_5 Egg abundance survey	Yes	Yes
Monitoring Component B_6 Shorebird monitoring program	Yes	Yes

Note: Delaware's egg survey reported a substantial decrease in beach egg density compared to 2010, though levels were similar to 2005-09.Continued discrepancies in egg counts between Delaware and New Jersey remain, with additional efforts to determine the source of these differences planned for 2012.

MARYLAND		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	Did not qualify for *de miminis*	Does not qualify for *de miminis*
Bait Harvest Restrictions and Landings		
- ASMFC Quota	170,653	170,653
- Other Restrictions	Delayed harvest and closed season/area combinations	Delayed harvest and closed season/area combinations
- Landings	167,053	--
Monitoring Component A_1		
- Mandatory monthly reporting	Yes (weekly reports for permit holders; monthly for non-permit holders)	Yes (weekly reports for permit holders; monthly for non-permit holders)
- Characterize commercial bait fishery	Yes*	Yes
Monitoring Component A_2		
- Biomedical harvest reporting	Yes	Yes
- Required information for biomedical use of crabs	Yes	Yes
Monitoring Component A_3 Identify spawning and nursery habitat	Yes	Yes
Monitoring Component B_1 Coastwide benthic trawl survey	Yes	Yes
Monitoring Component B_2 Continue existing benthic sampling programs	Yes	Yes
Monitoring Component B_3 Implement spawning survey	Yes (Counts)	Yes
Monitoring Component B_4 Tagging program	Yes – through biomedical harvest	Yes – through biomedical harvest

*MD characterized the bait fishery using samples from the biomedical fishery as a proxy. The PRT felt this substitution was acceptable considering the fisheries take place at the same time, are in the same area, and use the same gear type.

Note: MD has self-imposed a required 2 : 1, male : female ratio for conservation measures.

POTOMAC RIVER FISHERIES COMMISSION		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	*De minimis* status granted.	*De minimis* requested and meets criteria.
- Ability to close fishery if *de minimis*threshold is reached	No horseshoe crab fishery	No horseshoe crab fishery
- Daily possession limit <25 for *de minimis* state		
- HSC landing permit		
Bait Harvest Restrictions and Landings		
- ASMFC Quota	0	0
- Other Restrictions	None	None
- Landings	0	0
Monitoring Component A_1		
- Mandatory monthly reporting	Yes - weekly	Yes - weekly
- Characterize commercial bait fishery	Not Applicable	Not Applicable
Monitoring Component A_2		
- Biomedical harvest reporting	Not Applicable	Not Applicable
- Required information for biomedical use of crabs	Not Applicable	Not Applicable
Monitoring Component A_3 Identify spawning and nursery habitat	Not Applicable	Not Applicable
Monitoring Component B_1 Coastwide benthic trawl survey	No	No
Monitoring Component B_2 Continue existing benthic sampling programs	Not Applicable	Not Applicable
Monitoring Component B_3 Implement spawning survey	Not Applicable	Not Applicable
Monitoring Component B_4 Tagging program	Not Applicable	Not Applicable

Note: PRFC should use the format required by Addendum III for reporting Monitoring Requirements and Recommendations (A_1, A_2, B_1, etc.). Further, the PRT recommends that the PRFC implement the needed requirements in order to request removal from the Horseshoe Crab Management Board.

DISTRICT OF COLUMBIA – NO REPORT SUBMITTED		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**		
- Ability to close fishery if *de minimis*threshold is reached		
- Daily possession limit <25 for *de minimis* state		
- HSC landing permit		
Bait Harvest Restrictions and Landings		
- ASMFC Quota	0	0
- Other Restrictions		
- Landings		
Monitoring Component A_1		
- Mandatory monthly reporting		
- Characterize commercial bait fishery		
Monitoring Component A_2		
- Biomedical harvest reporting		
- Required information for biomedical use of crabs		
Monitoring Component A_3 Identify spawning and nursery habitat		
Monitoring Component B_1 Coastwide benthic trawl survey		
Monitoring Component B_2 Continue existing benthic sampling programs		
Monitoring Component B_3 Implement spawning survey		
Monitoring Component B_4 Tagging program		

Note: DC was added to the HSC Management Board to close a landings loophole that existed in the late 1990s. Since then DC has adopted regulations that prohibit landings of horseshoe crabs, thereby closing the loophole. In order to free DC of the requirement to submit compliance reports, the PRT recommends DC request removal from the HSC Board. Pennsylvania was in this same situation and was removed from the Board in 2006.

VIRGINIA		
	2011 Compliance Report	2012 Management Proposal
***De minimis* status**	Did not qualify for *de miminis*	Does not qualify for *de miminis*
Bait Harvest Restrictions and Landings		
- ASMFC Quota (State-reduced quota for overage)	152,495 (137,186)	152,495 (suggested 130,933 or area-specific quota- see Note below)
- Other Restrictions	Closed season (January 1 – June 7) for federal waters. Harvest east of COLREGS line must comprise 2 to 1 male to female ratio and make up no more than 40% of total landings.	Closed season (January 1 – June 7) for federal waters. Harvest east of COLREGS line must comprise 2 to 1 male to female ratio and make up no more than 40% of total landings. Planned additional restrictions to mitigate 2010 overage.
- Landings	95,099	--
Monitoring Component A_1		
- Mandatory monthly reporting	Yes – daily call in required for HCEL permit holders	Yes – daily call in required for HCEL permit holders
- Characterize commercial bait fishery	Yes	Yes
Monitoring Component A_2		
- Biomedical harvest reporting	Yes	Yes
- Required information for biomedical use of crabs	Yes	Yes
Monitoring Component A_3 Identify spawning and nursery habitat	Yes – completed	No
Monitoring Component B_1 Coastwide benthic trawl survey	Yes	Yes
Monitoring Component B_2 Continue existing benthic sampling programs	No	No
Monitoring Component B_3 Implement spawning survey	No	No
Monitoring Component B_4 Tagging program	No	No

Note: Virginia's overages in 2009 and 2010 were a large concern for the PRT; however, through additional management restrictions and possession limit flexibility, Virginia's harvest in 2011 was below the levels needed to correct for the overages and restore the long-term balance of harvest between east and west of the COLREGS line. In addition, landing time and notification requirements will help ensure reliable tracking ability, especially with the short season duration as experienced in 2011.The PRT requests Virginia report the 2011 NMFS landings once available.

NORTH CAROLINA		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	Did not qualify for *de miminis*	Does not qualify for *de minimis*
Bait Harvest Restrictions and Landings		
- ASMFC Quota (Potential decreased quota without approved transfer)	24,036	24,036 (20,996)
- Other Restrictions	Trip limit of 500 crabs per vessel New rule in April allowed greater flexibility for Fisheries Director	Trip limit of 0 crabs until April 1, 2012 Trip limit of 50 crabs after April 1, 2012 Proclamation authority to adjust trip limits, seasons, etc.
- Landings	27,076	--
Monitoring Component A_1		
- Mandatory monthly reporting	Yes – trip level reporting each month	Yes – trip level reporting each month
- Characterize commercial bait fishery	Yes	Yes
Monitoring Component A_2		
- Biomedical harvest reporting	Not Applicable	Not Applicable
- Required information for biomedical use of crabs	Not Applicable	Not Applicable
Monitoring Component A_3 Identify spawning and nursery habitat	Little information available Survey discontinued after 2002 and 2003 due to low levels of crabs recorded	Not specified
Monitoring Component B_1 Coastwide benthic trawl survey	No	No
Monitoring Component B_2 Continue existing benthic sampling programs	Yes	Yes
Monitoring Component B_3 Implement spawning survey	No	No
Monitoring Component B_4 Tagging program	No	No

Note: North Carolina requested a transfer of 3,500 crabs from Georgia to cover the overage in harvest for 2011. This request is currently being considered by the technical committee and advisory panels, whose comments will be reviewed by the Board during its consideration of the transfer request at its May 3, 2012 meeting.

SOUTH CAROLINA		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	*De minimis* status granted.	*De minimis* requested and meets criteria.
- Ability to close fishery if *de minimis*threshold is reached	No horseshoe crab bait fishery	No horseshoe crab bait fishery
- Daily possession limit <25 for *de minimis* state		
- HSC landing permit		
Bait Harvest Restrictions and Landings		
- ASMFC Quota	0	0
- Other Restrictions	None	None
- Landings	0	--
Monitoring Component A_1		
- Mandatory monthly reporting	Yes (Biomedical)	Yes (Biomedical)
- Characterize commercial bait fishery	Yes (Biomedical)	Yes (Biomedical)
Monitoring Component A_2		
- Biomedical harvest reporting	Yes	Yes
- Required information for biomedical use of crabs	Yes	Yes
Monitoring Component A_3 Identify spawning and nursery habitat	Completed	No
Monitoring Component B_1 Coastwide benthic trawl survey	No	No
Monitoring Component B_2 Continue existing benthic sampling programs	Yes	Yes
Monitoring Component B_3 Implement spawning survey	No	No
Monitoring Component B_4 Tagging program	No	No

Note: Catch per tow in South Carolina's trawl survey was the lowest since 1998 and represents a second consecutive year of low catch rates.

In spring of 2010, SCDNR began a two-year South Carolina Sea Grant-funded research study, aimed at addressing mortality effects of tagging bled crabs, long- and short-term mortality of bleeding, and the economic impacts of the biomedical industry in South Carolina. Results from the tagging study indicated no significant differences after two weeks between mortality rates of tagged bled versus untagged bled crabs. Returns of tagged bled and unbled crabs demonstrated no appreciable difference between live rates of return. However, a pond study of bled and unbled crabs indicated a significant

bleeding effect, with 20% mortality of bled crabs after two weeks. South Carolina also funded an economist to assess the economic impact of the biomedical fishery in South Carolina, with results expected in 2012.

GEORGIA		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	*De minimis* status granted.	*De minimis* requested and meets criteria.
- Ability to close fishery if *de minimis*threshold is reached	Yes	Yes
- Daily possession limit <25 for *de minimis* state	25/person; 75/vessel with 3 licensees	25/person; 75/vessel with 3 licensees
- HSC landing permit	Must have commercial shrimp, crab, or whelk license	Must have commercial shrimp, crab, or whelk license
Bait Harvest Restrictions and Landings		
- ASMFC Quota	29,312	29,312
- Other Restrictions	None	None
- Landings	0	--
Monitoring Component A_1		
- Mandatory monthly reporting	Yes	Yes
- Characterize commercial bait fishery	No bait landings	Yes
Monitoring Component A_2		
- Biomedical harvest reporting	Not Applicable	Not Applicable
- Required information for biomedical use of crabs	Not Applicable	Not Applicable
Monitoring Component A_3 Identify spawning and nursery habitat	Completed	Not Applicable
Monitoring Component B_1 Coastwide benthic trawl survey	No	No
Monitoring Component B_2 Continue existing benthic sampling programs	Yes	Yes
Monitoring Component B_3 Implement spawning survey	No	No
Monitoring Component B_4 Tagging program	No	No

Note: North Carolina requested a transfer of 3,500 crabs from Georgia to cover an overage in the 2011 fishing season. Georgia was agreeable to this transfer, which is currently being reviewed by the technical committee and advisory panels and will be considered by the Board at its May 3, 2012 meeting.

FLORIDA		
	2011 Compliance Report	**2012 Management Proposal**
***De minimis* status**	*De minimis* status granted.	*De minimis* requested and meets criteria.
- Ability to close fishery if *de minimis*threshold is reached	Yes	Yes
- Daily possession limit <25 for *de minimis* state	25/person w/ valid saltwater products license; 100/person with marine life endorsement	25/person w/ valid saltwater products license; 100/person with marine life endorsement
- HSC landing permit	See above	See above
Bait Harvest Restrictions and Landings		
- ASMFC Quota	9,455	9,455
- Other Restrictions	None	None
- Landings	0*	--
Monitoring Component A_1		
- Mandatory monthly reporting	Yes	Yes
- Characterize commercial bait fishery	No	Yes
Monitoring Component A_2		
- Biomedical harvest reporting	Not Applicable	Not Applicable
- Required information for biomedical use of crabs	Not Applicable	Not Applicable
Monitoring Component A_3 Identify spawning and nursery habitat	Yes	Yes
Monitoring Component B_1 Coastwide benthic trawl survey	No	No
Monitoring Component B_2 Continue existing benthic sampling programs	No	No
Monitoring Component B_3 Implement spawning survey	No	No
Monitoring Component B_4 Tagging program	No	No

Note: *Florida reported an additional 933 crabs harvested along the east coast for 'marine life' use in 2011.

2012 REVIEW OF THE FISHERY MANAGEMENT PLAN IN 2011 FOR

HORSESHOE CRAB

(*Limulus polyphemus*)

Presented to the
ASMFC Horseshoe Crab Management Board

Prepared by the ASMFC Horseshoe Crab Plan Review Team:

Sheila Eyler, U.S. Fish and Wildlife Service
Stewart Michels, Delaware Department of Natural Resources and Environmental Control
Danielle Chesky, Chair, Atlantic States Marine Fisheries Commission

Draft for Board Review

2012 REVIEW OF THE 2011 ASMFC FISHERY MANAGEMENT PLAN FOR HORSESHOE CRAB (*Limulus polyphemus*)

I. Status of the Fishery Management Plan

The framework for managing horseshoe crabs along the Atlantic coast was approved in October 1998 with the adoption of the Interstate Fishery Management Plan for Horseshoe Crabs (FMP). The goal of this plan is to conserve and protect the horseshoe crab resource to maintain sustainable levels of spawning stock biomass to ensure its continued role in the ecology of coastal ecosystems, while providing for continued use over time.

In 2000, the Horseshoe Crab Management Board approved Addendum I to the FMP. Addendum I established a state-by-state cap on horseshoe crab bait landings at 25 percent below the reference period landings (RPL's), and *de minimis* criteria for those states with a limited horseshoe crab fishery. Those states with more restrictive harvest levels (Maryland and New Jersey) were encouraged to maintain those restrictions to provide further protection to the Delaware Bay horseshoe crab population, recognizing its importance to migratory shorebirds. Addendum I also recommended that the National Marine Fisheries Service (NMFS) prohibit the harvest of horseshoe crabs in federal waters (3-200 miles offshore) within a 30 nautical mile radius of the mouth of Delaware Bay, as well as prohibit the transfer of horseshoe crabs in federal waters. A horseshoe crab reserve was established on March 7, 2001 by NMFS in the area recommended by ASMFC.

In 2001, the Horseshoe Crab Management Board approved Addendum II to the FMP. The purpose of Addendum II was to provide for the voluntary transfer of harvest quotas between states to alleviate concerns over potential bait shortages on a biologically responsible basis. Voluntary quota transfers require Technical Committee review and Management Board approval.

In 2004, the Board approved Addendum III to the FMP. The addendum sought to further the conservation of horseshoe crab and migratory shorebird populations in and around the Delaware Bay. It reduced harvest quotas and implemented seasonal bait harvest closures in New Jersey, Delaware, and Maryland, and revised monitoring components for all jurisdictions.

Addendum IV was approved in 2006. It further limited bait harvest in New Jersey and Delaware to 100,000 crabs (male only) and required a delayed harvest in Maryland and Virginia. Addendum V, adopted in 2008, extends the provisions of Addendum IV through October 31, 2010. In early 2010, the Board initiated Draft Addendum VI to consider management options that will follow expiration of Addendum V. The Board voted in August 2010 to extend the Addendum V provisions, via Addendum VI, through April 30, 2013. The Board also chose to include language, allowing them to replace Addendum VI with another Addendum during that time, in anticipation of implementing the ARM framework.

The Board approved Addendum VII, which implements the ARM Framework, in February 2012 for use during the 2013 fishing season. The Framework considers the abundance levels of

horseshoe crabs and shorebirds in determining the optimized harvest level for the Delaware Bay states of New Jersey, Delaware, Maryland, and Virginia (east of the COLREGS).

II. Status of the Stock

No definitions for overfishing or overfished status have been adopted by the Management Board. However, the majority of evidence in the most recent stock assessment, the 2009 Benchmark Horseshoe Crab Stock Assessment (available at http://www.asmfc.org/horseshoeCrab.htm), indicates abundance has increased in the Southeast and Delaware Bay Regions. In the Delaware Bay Region, increasing trends were most evident in juvenile indices, followed by indices of adult males. Over the time series of the survey, no trend in the abundance of female crabs is evident. In contrast, declining abundance was evident in the New York and New England regions. Declines in the New England Region had been evident in the 2004 assessment; however, declines in the New York Region noted in the 2009 stock assessment represent a downturn from the 2004 assessment. Decreased harvest quotas in Delaware Bay have potentially redirected harvest to nearby regions. Current harvest within the New England and New York Regions may not be sustainable. Continued precautionary management is therefore recommended coastwide to anticipate effects of redirecting harvest from Delaware Bay to outlying populations. Under a general five-year trigger, the next horseshoe crab stock assessment will likely occur in 2014. As part of implementing Addendum VII for 2013, the PRT supports the Horseshoe Crab Technical Committee's efforts to update the coastwide indices prior to ARM Framework implementation.

The PRT and TC will continue to monitor any harvest increases in regions outside of Delaware Bay, which are coincident with harvest reductions within Delaware Bay. An overarching conclusion of recent coastwide assessments has been that management should be regional or embayment specific. Current harvest levels of the Delaware Bay population appear consistent with population growth. However, it is unclear whether harvest of crabs in the outlying regions is sustainable.

III. Status of Assessment Advice

The Stock Assessment was externally peer reviewed by a panel of experts. The panel included their comments and recommendations in the 2009 Horseshoe Crab Terms of Reference and Advisory Report, available at http://www.asmfc.org/horseshoeCrab.htm. Below is a selection of recommendations from their report.

Assessment Methodology

- The Panel considers the ARIMA method superior to the linear trend analysis, and recommends focusing on this approach in the future, in areas where more sophisticated modeling is not possible. The Panel concluded that the ARIMA method could supersede the linear trends analysis, provided the unsmoothed (input) index estimates are reported along with the smoothed (output) estimates.
- We are concerned the surplus production model for Delaware Bay is not suitable, given the life history of horseshoe crab and the presumed mechanism of density dependence. As noted in the report, surplus production models assume an instantaneous response of

the stock to changes in conditions, which seems unrealistic given the late age of maturity of horseshoe crab and the belief that density dependence operates at the egg stage. We urge that the sensitivity of the production model to this assumption be explored more thoroughly if it is to be used further. A simple age-structured operating model (e.g., Sweka et al. 2007) could be used to generate simulated data that are then fit to the surplus production model and the biomass/exploitation rate estimates compared to true values to test for biases.

- The catch-survey methodology appears to be a promising tool for assessment in Delaware Bay, but will require further examination of the evidence for differential catchability of primiparous and mulitparous horseshoe crab. As a first step we suggest a spatial analysis of the catch data, using habitat variables as covariates that may explain differences in the distribution and thus catchability of the two life stages.

Biological Reference Points

- We recommend development of plausible biological reference points using life history information for horseshoe crab, comparisons to other species with similar life histories (e.g., long-lived, late maturing invertebrate species), and development of yield per recruit or egg per recruit models.
- We also suggest empirical reference points based on an estimated historic state are preferable to percentile-based reference points because of the vulnerability of the latter to the influence of the period for which past data are available. This is especially true when the reference point analysis is being used in an aggregated manner (i.e., across multiple surveys). Rather than basing the historical reference point on a single year, we recommend using the average across a range of years that represent, in the SASC's judgment, a period of relatively high abundance.

IV. Status of the Fishery

Bait Fishery

For most states, the bait fishery is open year round. However, because of seasonal horseshoe crab movements (to the beaches in the spring; deeper waters and offshore in the winter), the fishery operates at different times. State waters from New Jersey south to Virginia coastal waters are closed to horseshoe crab harvest and landing from January 1st through June 7th each year.

Reported coastwide bait landings in 2011 remained well below the coastwide quota (Table 2, Figure 1). Bait landings increased 7.6% from the previous year, due to increased landings in Massachusetts, Delaware, New York, and North Carolina. Except for North Carolina, which is pursuing a transfer of quota from Georgia for an overage in the 2011 season, there were no overages in quota. The overall harvest remains below the ASMFC-mandated coastwide harvest.

An alternative bait/gear workshop conducted under the auspices of ASMFC in 1999 introduced the concept of using bait savings devices (bait bags) in whelk (conch) pots. Free bait bags were distributed to whelk potters in the Mid Atlantic and southern New England regions through a state, federal, and NGO partnership. National Marine Fisheries Service funded the acquisition of the bait bags. The Ecological Research and Development Group (ERDG), Delaware, Maryland, New Jersey, Virginia, New York, Connecticut, Rhode Island and Massachusetts assisted in the

funding and distribution of the bags. The reductions in reported bait landings in excess of the 25% reductions required under Addendum I were largely attributed to the success of this program, with the widespread use of the devices by the commercial fishery. Massachusetts fishermen have been using bait cups in conch traps with success, and some form of bait-reduction device is mandated within the Delaware fishery. The cups use about a 10^{th} of a crab and can be fished for 2-3 days in relatively cold waters.

Reported coastwide landings since 1998 show more male than female horseshoe crabs were annually harvested, though a large proportion of the reported landings in 1998 and 1999 were unclassified (Table 3). The American eel pot fishery prefers egg-laden female horseshoe crabs as bait, while the whelk (conch) pot fishery is less dependent on females. Unclassified landings have generally accounted for around 10% of the reported landings since 2000, although 2008 had a slightly higher proportion of unclassified landings (14%). Due to some staffing challenges, the numbers for Massachusetts by gender have yet to be tallied, putting the current level of unclassified landings at 20%. The PRT anticipates this number will drop closer to the normal 10% once numbers are available.

The hand, trawl, and dredge fisheries typically account for over 85% of the reported commercial horseshoe crab bait landings. Other methods that account for the remainder of the harvest include gill nets, pounds, and traps.

The dominance of the hand fishery was reflected in the seasonal distribution of landings. Most of the monthly reported coastwide harvest since 1998 came during May and June as crabs come ashore to spawn and, thus, were readily available to the fishery. There is typically a secondary mode in monthly landings during the late summer or fall. This secondary peak coincides with an increased demand for horseshoe crabs in the conch pot fishery, and these crabs are generally harvested by dredge or trawl.

An additional issue that has caused concern for the PRT and some states was the importation of frozen Asian horseshoe crabs for bait use in 2011. As detailed in the memo to the Board from Drs. Dave Smith and Mike Millard on July 12, 2011, the populations of Asian horseshoe crabs are rapidly declining, both due to bait and biomedical harvesting. In addition, invasive species and pathogen concerns are present with the import of a foreign species. The PRT recommends the Board continue to monitor this situation and investigate management opportunities to control the importation of Asian horseshoe crabs for bait at the state and federal levels.

Biomedical Fishery

The horseshoe crab is an important resource for research and manufacture of materials used for human health. There are four companies along the Atlantic Coast that process horseshoe crab blood for use in manufacturing Limulus Amebocyte Lysate (LAL): Associates of Cape Cod, Massachusetts; Lonza (formerly Cambrex Bioscience), Maryland; Wako Chemicals, Virginia; and Charles River Endosafe, South Carolina. There is one company that bleeds horseshoe crabs but does not manufacture LAL: Limuli Labs, New Jersey. Addendum III requires states where horseshoe crabs are collected for biomedical use to collect and report harvest data and characterize mortality.

The Plan Review Team annually calculates total coastwide harvest and estimates mortality. It was reported that 628,476 crabs (including crabs harvested as bait) coastwide were brought to biomedical companies for bleeding in 2011 (see Table 1 below). This represents a 28.7% increase over the average of the previous five years. Of this total, 83,312crabs were reported as harvested for bait and counted against state quotas, representing an 11.3% increase over the average of the previous five years (Table 1: row C). These crabs were not included in the mortality estimates (Rows D, F, and G) below. It was reported for 2011 that 545,164 crabs were harvested for biomedical purposes only. Mobile gear types accounted for 50% of total biomedical harvest, whereas hand harvest accounted for 43% and 7% was unknown. Males accounted for 48% of total biomedical harvest; females comprised 34%; 18% of the harvest was unknown. Crabs were rejected prior to bleeding due to mortality, injuries, slow movement, and size. Based on state reports for 2011, approximately 8.3% of crabs (or 45,300 crabs) harvested and brought to bleeding facilities were rejected. Approximately 1.2% of crabs, collected solely for biomedical purposes, suffered mortality from harvest up to the point of release.

The Technical Committee has reviewed, multiple times, the available literature for estimating crab mortality during and after the bleeding process. It had previously concluded that using an estimate of 15% mortality is reasonable; most recently, in June 2011, the TC recommended using a range of values (5-30%) for estimating mortality, in order to include the known variances in conditions and situations that can occur over the geographical and temporal range of collecting and bleeding the horseshoe crabs. Total estimated mortality of biomedical crabs for 2011 was 80,827crabs (at 15% post-release estimated mortality), with a range of 31,554 to 154,737 crabs (5-30% post-release estimated mortality).

Table 1. Characterization of Biomedical Use of Horseshoe Crabs

		2006	*2007*	*2008*	*2009*	*2010*	*2011*
A	**Number of crabs brought to biomedical facilities (bait and biomedical crabs)**	367,914	500,251	511,478	512,552	548,751	628,476
B	**Number of biomedical-only crabs harvested (not counted against state bait quotas)**	309,289	428,872	423,614	402,202	482,704	545,164
C	**Number of bait crabs bled**	38,625	71,379	87,864	110,350	66,047	83,312
D	**Reported mortality of biomedical-only from harvest to release**	4,639	3,599	2,973	6,298	9,665	6,917
E	**Number of biomedical-only crabs bled**	296,958	398,844	402,080	362,291	438,417	492,734
F	**Estimated mortality of bled biomedical-only crabs post-release (15% est. mortality)**	44,543	59,833	60,312	54,344	65,763	73,910
G	**Total estimated mortality on biomedical crabs not counted against state bait quotas (15% est. mortality)**	49,182	63,432	63,285	60,642	75,428	80,827

The 1998 FMP establishes a mortality threshold of 57,500 crabs, where if exceeded the Board is required to consider action. Based on an estimated total mortality of 80,827 crabs for 2011, this threshold has been exceeded. The PRT notes that estimated mortality from biomedical use is approximately11.1% of the total horseshoe crab mortality (bait and biomedical) coastwide for 2011, down from 12.7% in 2010. The reported biomedical use of horseshoe crabs has increased 85% since the biomedical landings have been tracked (2004). This increase in harvest has corresponded to an approximate increase in mortality of 75% since 2004. Given the increased demand for LAL product and the continued increase in biomedical harvest and mortality, the PRT recommends the Board continue efforts to reduce mortality in the biomedical industry through development and implementation of Best Management Practices and other state efforts.

V. Status of Research and Monitoring

The Horseshoe Crab FMP set forth an ambitious research and monitoring strategy in 1999 and again in 2004 to facilitate future management decisions. Despite limited time and funding there are many accomplishments since 1999. These accomplishments were largely made possible by forming partnerships between state, federal and private organizations, and the support of over a hundred public volunteers.

Addendum III Monitoring Program

Addendum III requires affected states to carry out three monitoring components. All states who do not qualify for *de minimis* status report monthly harvest numbers and subsample of portion of the catch for gender and harvest method. In addition, those states with annual landings above 5% of the coastwide harvest report all landings by sex and harvest method. Although states with annual landings between 1 and 5% of annual coastwide harvest are not required to report landings by gender, the PRT recommends all states require gender reporting for horseshoe crab harvest.

States with biomedical fisheries landings are required to monitor and report harvest numbers and mortality associated with the transportation and bleeding of the crabs. Last, states must identify spawning and nursery habitat along their coasts. All states have completed this requirement and a few continue active monitoring programs.

Virginia Tech Research Projects

The VT benthic survey was conducted for its ninth year in a row for the Delaware Bay region. The survey was unable to sample in the NY Apex in 2009 and 2011, although the area was covered in 2010. Additionally, 2010 and 2011 marked the first years that the survey included tows within lower Delaware Bay.

Major findings through the 2011survey include: 1) relative abundance of immature horseshoe crabs in the coastal Delaware Bay area was significantly lower in 2010 and 2011 than in 2009; 2) this difference is apparently due to large numbers of small immature crabs in the peripheral region associated with later sampling in 2009; 3) relative abundances of newly mature crabs in the coastal Delaware Bay area have been consistently below peaks in 2007 (males) or 2008 (females); 4) relative abundances of mature females and males in the coastal Delaware Bay area

have not changed significantly since 2002; 5) relative abundances of horseshoe crabs in the lower Delaware Bay and coastal Delaware Bay area did not significantly differ; and 6) mean sizes of newly mature and mature horseshoe crabs have remained consistent since 2002. As part of the trawl survey in 2011, gear efficiency studies began to better estimate the trends and abundances measured over the past decade by the survey.

Through donations by the biomedical and the fishing industry, which were matched by a grant from the National Fish and Wildlife Foundation, full funding for the 2011 survey was achieved. However, funding for the survey in 2012 has still not been found, and a long-term funding solution is not solidified. The PRT stresses the importance of the survey, as it is expected to provide the most reliable estimates of horseshoe crab population abundance. Even more importantly, the PRT stresses the need for the abundance data as inputs into the newly-approved ARM Framework for management under Addendum VII.

Spawning Surveys

The redesigned spawning survey was completed for the thirteenth year in 2011; however, results for 2011are not yet available. For 2010, no trend was detected in the baywide index of female spawning activity for the time series (1999 – 2010). There was a significant increase in the index of male spawning activity over the time series. Both male and female indices of spawning activity were precise ($CV_{males} < 20\%$; $CV_{females} < 14\%$ over the entire series). Most spawning activity was observed in May in 2010. Sex ratios observed in the surveys have increasingly favored males, which is consistent with the sex-specific trends in spawning activity. The observed spawning sex ratio in 2010 was 4.2:1.

Egg Studies

The first coordinated baywide horseshoe crab egg sampling was completed in 2005. The purpose of this survey was to provide a baywide index of horseshoe crab surface egg abundance during the spring shorebird migration. Monitoring the availability of horseshoe crab eggs throughout the Delaware Bay is an important step in managing horseshoe crabs and migratory shorebirds. Such monitoring activities may be useful in establishing harvest thresholds, guiding beach nourishment activities, setting time-of-year restrictions, etc. Prior horseshoe crab egg surveys conducted by the states of Delaware and New Jersey were not designed to provide a baywide index of egg availability to migratory shorebirds. Survey design and implementation was the result of cooperation by numerous state and federal agencies, university researchers, and input from members of the horseshoe crab stock assessment and shorebird technical committees. A long-term funding source to ensure a continuation of the survey by both states has not been identified. Details in survey reporting responsibilities and format still need to be formalized.

Though the survey has been conducted on a baywide basis since 2005, the results have not been reported regularly. Survey researchers from both sides of the Delaware Bay have met to discuss reporting details and responsibilities. Concerns were raised over the large discrepancies in mean egg abundance found on Delaware beaches versus New Jersey beaches. Although the large differences in mean egg abundance between the two sides may be real, researchers conducted side-by-side sampling in 2008 to ensure these differences were not the result of sampling and/or counting procedures. The draft report of this study, summarizing data from 2005-09, concluded that the side-by-side differences, while not statistically significant, did raise concerns about the

consistently higher counts by Delaware samplers (35%)than by New Jersey samplers. Follow up side-by-side sampling and exchange of samples for counting occurred in 2011. The results did not compare different methods of enumerating eggs (volumetric versus counting), as both groups counted eggs individually. The results, which indicated a consistently higher count of eggs in Delaware, are being investigated for different processing methods that may lead to the differences in counts seen between the two states. Overall conclusions remain that egg densities are highly variable, in terms of season, year, and spatial distribution. Further coordination of sampling effort, in order to determine the source of the discrepancies, is expected in 2012.

Delaware includes a report on their egg sampling efforts in their annual compliance report. Results from Delaware indicated an average surface egg density of 49,115 eggs/m^2 for 2011, a significant decrease from 2010but in line with previous years' sampling. Conditions in 2010 were particularly optimal for spawning, which could have resulted in the large increase in egg density. Again, as in the past, the highest mean egg density (greater than 100,000 eggs/m^2) occurred in Mispillion Harbor.

Tagging Studies

The USFWS continues to maintain a toll-free telephone number as well as a website for reporting horseshoe crab tag returns and assists interested parties in obtaining tags. Tagging work continues to be conducted by biomedical companies and other parties involved in outreach and spawning surveys. As noted in past PRT and other reports, the tagging efforts would benefit by establishing clearly defined objectives and insuring better coordination among researchers. To increase quality of tagging data being collected and supplied to the USFWS in Annapolis, the Horseshoe Crab Technical Committee developed guidelines for the program specifying desired distribution of tags along the coast, data requirements for tagging and resighting, effort requirements for resighting, as well as required information for applying and receiving tags. An application based on these requirements is in development. The program guidelines will give the USFWS and the managers a better understanding of taggers' objectives and data that are more applicable to existing management questions. The PRT recommends all tagging programs, approved by the state, coordinate with the USFWS tagging program, in order to ensure a consistent coastwide program for providing management input.

Since 1999, over 195,000 crabs have been tagged and released through the USFWS tagging program along the Atlantic coast. Over 10% of tagged crabs have been recaptured and reported. Crabs have been tagged and released from every state on the Atlantic Coast from Georgia to Massachusetts. In the early years of the program, tagging was centered around Delaware Bay; however, in recent years, more tagging has occurred in the Long Island Sound and the Massachusetts Coast as well as new tagging programs in South Carolina and Georgia. The Technical Committee noted that recapture rates inside and outside Delaware Bay are likely not directly comparable due to increased re-sighting effort and spawning concentration in Delaware Bay compared to other areas along the coast. There may be data in the USFWS tagging database to determine differences in effort and recapture rates.

Adaptive Resource Management Modeling
The ARM Work Group is a subset of the ASMFC Horseshoe Crab (HSC) and the former USFWS Shorebird (SHBD) Technical Committees. The ARM Work Group is chaired by Dave Smith (USGS-Leetown), with lead modeler Conor McGowan (Auburn University).

The Work Group developed models to estimate horseshoe crab harvest levels that will support the energetic needs of the red knot population passing through Delaware Bay. A peer review of the ARM framework/model in 2009 concluded it is a useful tool for management and recommended improvements as it continues refinement. The Management Board sees value in this tool and adopted its use in management through Addendum VII. Although data will be available for implementation of the ARM harvest output for the 2013 fishing season, continued implementation of the ARM Framework is uncertain due to funding challenges for the Virginia Tech Trawl Survey, the source of horseshoe crab abundance data for the model.

VI. Status of Management Measures and Issues

ASMFC
Initial state-by-state harvest quotas were established through Addendum I. Addendum III outlined the monitoring requirements and recommendations for the states. Addendum IV set harvest closures and quotas, and other restrictions for New Jersey, Delaware, Maryland, and Virginia, which were continued in Addendums V and VI.

The Board approved Addendum VII, implementation of the ARM Framework, in February 2012 for implementation in 2013. Addendum VII includes an allocation mechanism to divide the Delaware Bay optimized harvest output from the ARM Framework among the four Delaware Bay states (New Jersey, Delaware, Maryland, and Virginia east of the COLREGS). Season closures and restrictions, present within Addendum VI, remain in effect as part of Addendum VII.

Shorebird
The US Fish and Wildlife Service formed the Shorebird Technical Committee in 2001 with the purpose of providing technical advice to the Board on how horseshoe crab management action might affect shorebird populations. This Committee was comprised of shorebird experts and a representative of the Horseshoe Crab Technical Committee and Stock Assessment Subcommittee. The group produced a peer-reviewed report that synthesized current literature and data on the status of shorebirds in the Delaware Bay and to determine their energetic dependency on horseshoe crab eggs. The report's findings led to the initiation of Addendum III. In 2010 the Board decided to form the Shorebird Advisory Panel, as well as the Delaware Bay Ecosystem Technical Committee, to split the roles of value-based and technical input.

The USFWS received petitions in 2004 and 2005 to emergency list the red knot under the Endangered Species Act. In fall 2005, it determined that emergency listing was not warranted at the time. As part of a court settlement, the USFWS agreed to initiate proposed listings of over 200 species, including the red knot. Consideration for listing the red knot will occur throughout 2012, with a proposed rule expected in the fall.

The state of New Jersey upgraded the state listing of the red knot from threatened to endangered in2012 based on recent analysis using the Delphi Technique, a method for expert opinion to consider species population and trends, productivity, survival and mortality factors, habitat requirements, and threats to populations and habitats, and come to consensus.

VII. Implementation of FMP Compliance Requirements

Currently, the PRT recommends no jurisdiction is out of compliance with regard to their 2011 horseshoe crab programs. ME, NH, PRFC, SC, GA and FL have requested and qualify for *de minimis* status. Please see the PRT report on State Compliance for more information on each state's program.

In past years, Virginia had consistent overages. Through regulatory efforts in 2011, Virginia has accounted for the 2009 and 2010 overages.

All state reports for 2012 should continue to comply with the requirements of the FMP, Addendum I, Addendum III, and Addendum VI.

Washington, D.C. was added to the HSC Management Board to close a landings loophole that existed in the late 1990s. Since then DC has adopted regulations that prohibit landings of horseshoe crabs, thereby closing the loophole. In order to free DC of the requirement to submit compliance reports, the PRT recommends DC request removal from the HSC Board. Pennsylvania was in this same situation and was removed from the Board in 2006.

In November 2011, Maine requested removal from the HSC Management Board. Until Maine can legislatively change their permitting system for horseshoe crab harvests, the PRT recommends Maine disapprove any applications for horseshoe crab bait harvest.

Law Enforcement
There were no significant law enforcement cases regarding horseshoe crabs reported by states for 2011.

VIII. Research Needs/PRT Recommendations

Funding for Research and Monitoring Activities
The PRT strongly recommends the continuation of the VT benthic trawl survey in order to provide the critical information for stock assessments and the ARM model. A long-term benthic sampling program for horseshoe crabs has been repeatedly identified as a critical stock assessment need and now an ARM necessity to continue implementation. This effort provides a statistically reliable estimate of horseshoe crab relative abundance at a relatively low cost. Congressional funding seems unlikely, and the PRT recommends seeking funding from multiple avenues, including state and federal governments, as well as industry stakeholders and non-governmental organizations.

Tagging

All entities that currently have tagging programs are encouraged to continue. The PRT recommends using USFWS tags and reporting all data to the repository in the USFWS office in Annapolis.

Biomedical Industry
According to the FMP, the Board must consider potential restrictions on biomedical harvest because estimated mortality exceeded 57,500 horseshoe crabs in 2011.

The PRT reminds states that they are required to obtain the information outlined in Addendum III. This became a requirement in 2004. Please refer to Monitoring Requirement Component A_2. States must report this information in their annual compliance reports.

The PRT recommends that the Technical Committee continue to explore opportunities to engage the biomedical companies through improved reporting and development of best management practices, especially given the increasing trend in biomedical harvest and mortality. Multiple companies are already involved with tagging horseshoe crabs. Research underway in South Carolina, considering the mortality impacts of tagging bled crabs, has preliminary results indicating no appreciable difference between rates of returns of bled and unbled animals. In addition, South Carolina Department of Natural Resources performed a biomedical mortality study in 2011 with bled and unbled crabs held in ponds. Results indicate a significant bleeding effect of 20% mortality after two weeks, which is within the range of mortality (5 – 30%) suggested by the Horseshoe Crab Technical Committee.

Adaptive Resource Management Modeling
The application and continued refinement of the ARM modeling can provide a valuable tool to guide horseshoe crab management in the Delaware Bay area and support red knot recovery. The PRT recommends the Board continue to support development and use of the ARM Framework.

IX. Literature Cited

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Table 2. Reported commercial horseshoe crab bait landings by jurisdiction.

Jurisdiction	RPL	Addendum IV Quota	State Quota [a]	2005	2006	2007	2008	2009	2010	2011
ME [b]	13,500	13,500	-	0	0	0	0	0	0	0
NH	350	350	-	0	0	5	0	41	0	0
MA	440,503	330,377	165,000	73,740	171,906	150,829	103,963	98,332	54,782	85,573
RI	26,053	26,053/19,540	13,586	8,260	15,274	15,564	15,549	18,729	12,502	12,632
CT [c]	64,919	48,689	-	15,311	26,889	25,098	32,565	27,065	30,036	20,538
NY	488,362	366,272	150,000	155,108	172,381	298,222	148,719	123,653	124,808	146,995
NJ	604,049	100,000	0	87,250	3,444	0	0	0	0	0
PA [d]	-	0	-	0	-	-	-	-	-	-
DE	482,401	100,000	-	154,269	147,813	76,663	102,113	102,659	61,751	95,663
MD	613,225	170,653	-	169,821	136,733	172,117	163,495	165,434	165,344	167,053
PRFC	-	0	-	0	0	0	0	0	0	0
DC	-	0	-	0	0	0	0	0	0	0
VA	203,326	152,495	-	97,957	155,704	79,570	68,149	187,546	144,649	95,009
NC	24,036	24,036	-	7,713	10,331	9,300	26,191	33,025	9,938	27,076
SC	-	0	-	0	0	0	0	0	0	0
GA	29,312	29,312	-	0	0	0	0	0	0	0
FL	9,455	9,455	-	0	469	186	50	0	993	0
TOTAL	2,999,491	1,345,139		769,429	840,944	827,554	660,794	756,484	604,548	650,539
Pct. Reduction Relative to RPL				74.3	72.0	72.4	78.0	74.8	79.8	78.3
Pct. Reduction Relative to Addendum IV Quota						38.5	50.9	43.8	55.1	51.6

States that qualify for de minimis status are not required to reduce landings by 25%

[a] State quotas listed for states that have adopted quotas more restrictive than ASMFC.

[b] Maine was removed as a member of the Horseshoe Crab Management Board in 2011. It no longer reports landings.

[c] CT landings prior to 2000 are estimated based on bait usage in the eel and conch fisheries.

[d] Pennsylvania was removed as a member of the Horseshoe Crab Management Board in 2007. It no longer reports landings.

RPL = Reference Period Landings

Table 3. Commercial horseshoe crab bait landings by sex by jurisdiction.

	2003			2004			2005			2006			2007		
	Males	Females	Unknown	Males	Females	Unknown	Males	Females	Unknown	Males	Females	Unknown	Males	Females	Unknown
ME	0	0	98	0	0	0	0	0	0	0	0	0	0	0	0
NH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
MA	60,877	64,487	0	28,469	36,153	3,814	36,549	37,191	0	82,525	80,734	8,647	72,433	68,972	9,424
RI	0	0	5,824	0	0	6,030	0	0	8,260	0	0	15,274	0	0	15,564
CT	0	0	13,386	0	0	23,788	0	0	15,240	0	0	25,280	0	0	24,761
NY	66,417	67,847	0	69,275	73,004	0	83,830	71,278	0	89,992	82,389	0	154,905	129,215	0
PA	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-
NJ	84,518	29,422	0	33,725	12,844	0	58,426	18,665	10,159	2,028	1,416	0	0	0	0
DE	233,878	122,502	0	83,380	43,074	754	104,940	49,329	0	120,952	26,861	0	76,663	0	0
MD	95,792	73,073	0	96,955	64,973	0	108,707	61,114	0	46,833	89,900	0	70,568	101,549	0
PRFC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VA	28,862	56,940	20,775	19,344	41,987	33,382	28,825	44,296	24,836	61,597	70,768	23,339	39,017	39,203	1,350
NC	0	0	24,367	0	0	9,437	0	0	7,462	0	0	10,331	0	0	7,091
SC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FL	0	0	1,628	0	0	0	0	0	0	0	0	469	0	0	186
Total	570,344	414,271	66,078	331,148	272,035	77,205	421,277	281,873	65,957	403,927	352,068	83,340	413,586	338,939	58,381
Grand Total	1,050,693			680,388			769,107			839,335			810,906		

	2008			2009			2010			2011 Preliminary		
	Males	Females	Unknown	Males	Females	Unknown	Males	Females	Unknown	Males	Females	Unknown
ME	0	0	0	0	0	0	0	0	0	0	0	0
NH	0	0	0	0	0	41	0	0	0	0	0	0
MA	48,046	53,764	2,153	42,343	48,040	7,949	13,086	21,390	20,306	0	0	85,573
RI	0	0	15,549	9,835	7,064	1,830	6213	4851	1,438	6,493	6,139	0
CT	0	0	32,535	0	0	27,065	0	0	29,387	0	0	20,538
NY	78,581	67,353	2,785	60,961	60,670	2022	59,270	65,518	20	76,144	69,594	1,257
NJ	0	0	0	0	0	0	0	-	0	0	0	0
DE	102,113	0	0	102,659	0	0	61,751	0	0	95,663	0	0
MD	97,237	66,258	0	114,134	50,698	602	114,134	50,698	602	131,375	35,568	110
PRFC	0	0	0	0	0	0	0	0	0	0	0	0
DC	-	-	-	-	-	`	-	-	-	-	-	-
VA	29,756	23,529	14,864	112,654	64,892	0	87,629	55,031	1,989	58,930	36,079	0
NC	0	0	26,191	0	0	33,025	0	0	9,938	0	0	27,076
SC	0	0	0	0	0	0	0	0	0	0	0	0
GA	0	0	0	0	0	0	0	0	0	0	0	0
FL	0	0	50	0	0	0	0	0	993	0	0	0
Total	355,733	210,904	94,127	442,586	231,364	72,534	342,083	197,488	64,673	368,605	147,380	134,554
Grand Total	660,764			746,484			604,244			650,539		

Figure 1. Coastwide horseshoe crab landings for bait expressed as number of crabs.