Shorebird Advisory Panel Report

May 3, 2011

The ASMFC Shorebird Advisory Panel (AP) met on May 3, 2011 in Wilmington, DE. Previously, the Horseshoe Crab Management Board reviewed the Delaware Bay Ecosystem Technical Committee (DBETC) report on the proposed allocation model for the Adaptive Resource Management (ARM) Harvest output. The Board requested further stakeholder input on the DBETC report and the allocation model from the Advisory Panels to the Board, both the Shorebird and the Horseshoe Crab APs. This report responds to the Board's request and summarizes the Shorebird AP's discussions regarding the recommendations of the DBETC and the allocation process at the May 3, 2011 meeting.

Attendees

Shorebird AP members and Invited Participants
Mr. Chris Bennett (DE)
Dr. Jean Woods (DE)
Mr. Tim Dillingham (NJ)
Dr. David Mizrahi (NJ)
Dr. Sarah Karpanty (VA)
Dr. John Sweka (USFWS)
Danielle Brzezinski (ASMFC)

Public participants
Maya van Rossum (Delaware Riverkeeper)

Introduction

Horseshoe crabs are linked ecologically with shorebirds in the Delaware Bay region, where many horseshoe crabs come ashore to breed and shorebirds stopover on their way to their breeding grounds. The need to successfully manage the horseshoe crab fishery to sustain both populations has driven the development of the Adaptive Resource Management (ARM) framework for management under the ASMFC. The ARM framework uses a double-loop process to allow for yearly and benchmark re-assessment based on model outputs and stock assessments. The model incorporates the population dynamics of both the horseshoe crabs and the red knots, a specific shorebird of international concern that is a candidate for listing under the Endangered Species Act.

Thresholds incorporated into the model structure the output of an optimized harvest, based on current conditions of the two populations. While providing novel management, the output of the ARM model is limited to a Regional Harvest Allocation only. That is, the optimized harvest is suggested for the entire Delaware Bay population of horseshoe crabs, from which it is assumed that Delaware, New Jersey, Maryland, and Virginia draw at least a portion of their yearly horseshoe crab harvest. The ARM model does not dictate the allocation of these crabs among the four states.

In order to determine a state-by-state allocation in an open and objective way, four factors or decisions need to be considered:

1) How much of each state's harvest is comprised of Delaware Bay-origin crabs?
2) On what basis should the total recommended harvest, output by the ARM model, be divided among the four states of Delaware, New Jersey, Maryland, and Virginia?
3) Should there be an overall harvest cap placed on Maryland and Virginia's harvest to protect non-Delaware Bay origin horseshoe crabs?
4) Should there be an allowable but minimal harvest of Delaware Bay origin horseshoe crabs for Maryland and Virginia if the ARM-recommended harvest option requires a moratorium on one or both genders?

In a report the Horseshoe Crab Management Board, presented on March 23, 2011, the Delaware Bay Ecosystem Technical Committee (DBETC) presented background and recommendations on each of the four decisions. The Board further requested input on this report and the four decisions from the stakeholder community, represented by the two Advisory Panels. This report presents the input from the Shorebird Advisory Panel (AP) on the four decisions and recommendations to the Board. These recommendations include setting the lambda values based on the genetics data; using the Addendum IV quota levels as the basis for the proportional allocation of the harvest; the use of a cap based on Addendum IV quota levels to protect non-Delaware Bay crabs; and maintain the integrity of the ARM optimized harvest recommendation by maintaining a moratorium on the harvest of Delaware Bay female crabs.

The problem

Under the ASMFC Fishery Management Plan, harvest is allocated on a state-by-state basis; however; the ARM framework, as designed, only recommends a regional (NJ, DE, MD, and VA combined) harvest. In order to translate this regional harvest into a state-by-state harvest, it is necessary to consider four factors and to decide how to incorporate these factors when calculating the state-by-state allocation. There are both technical and policy/value-based aspects to consider when incorporating these four factors. The DBETC report represents technical background and recommendations on the four factors. The AP convened a meeting to offer additional value-based background in order to determine:

1) How much of each state's harvest (DE, NJ, MD, and VA) annually comes from Delaware Bay, based upon tagging and genetic data as well as expert opinion (λ, lambda);
2) What weighting method to allocate the Delaware Bay harvest quota among the four states;
3) Whether to place an overall cap on MD and VA harvest levels; and
4) Whether to institute an allowable Delaware Bay Stock Allowance (DBSA) harvest option for Maryland and Virginia, should the ARM model recommend a complete or female-only moratorium.

Once these decisions are made and the ARM framework is fully implemented, the benefits will likely include:

- Management that is responsive to the current state of horseshoe crab and red knot populations

- Better ecological management of the fishery and the red knot and shorebird populations
- Improved understanding over time of the connections among the species, and
- Improved long-term management, anticipating more stable harvest levels

This report offers the AP's input and recommendations on the four decisions.

Decisions to be made in implementing ARM-based Management Harvest

Decision 1- Lambda (λ), Delaware Bay origin of Maryland and Virginia's catch

Delaware, New Jersey, Maryland, and Virginia all draw some portion of their yearly quota from Delaware Bay crabs. For Delaware and New Jersey, this level is assumed to be 100%; that is, all horseshoe crabs harvested by fishermen in Delaware and New Jersey come from the Delaware Bay population. This assumption is likely correct, as most of the fishery occurs by hand on the spawning beaches or during the spawning period. Thus it is a safe assumption that the crabs are in the Delaware Bay at that time to spawn. Thus their lambda values, λ, would be set to one (1.0).

For Maryland and Virginia, the proportion of crabs is not as straight-forward to assess. As summarized by the DBETC, tagging data and genetics studies offer information on the movement and origins of crabs. The DBETC report included three options for lambda values, based on these data as well as a highly risk-averse default option that assumed all crabs caught in Maryland and Virginia fisheries originate in Delaware Bay.

The AP agreed with the DBETC that the default option, where Maryland and Virginia lambda values are set to 1.0, should not be used. The AP agreed that sufficient evidence exists, suggesting that there are spawning populations separate from Delaware Bay that support horseshoe crab populations along the Virginia and Maryland coasts. Although this option is the most risk-averse, recommending this option would call into question the reliability of the science and the credibility of the recommendations.

The AP also agreed that basing the lambda values on the tagging data would present such a high level of risk that was not substantiated by a robust scientific determination. The AP concurred with the DBETC on its concerns with the tagging data. The small sample sizes for some tagging locations and resightings, as well as violation of effort assumptions, make conclusions from these data highly suspect. That said, the AP expressed interested in the new efforts by Dr. Conor McGowan's lab with the tagging data, although any results will likely be unavailable for one to two more years.

The AP considered the genetics data to be the most reliable of the data available for estimating lambda. The AP felt that the approach, which is slightly more risk-averse as low levels of breeding across populations can maintain genetic similarity, would provide additional security against the uncertainty.

Based on the available science and the reliability of the science behind the three methods, the AP agreed with the DBETC and recommends the lambda values be based on the genetics data (Option 3).

Option 1: Highest Risk, based on tagging data

State	Lambda, λ
NJ	1.0
DE	1.0
MD	**0.13**
VA	**0.09**

Option 2: Lowest risk, highest possible lambda values

State	Lambda, λ
NJ	1.0
DE	1.0
MD	**1.0**
VA	**1.0**

Option 3: Medium risk, based on genetics data and expert opinion

State	Lambda, λ
NJ	1.0
DE	1.0
MD	**0.51**
VA	**0.35**

Decision 2- W_i, Weighting system for state allocation of optimized harvest

Based on the optimized harvest level, a total Delaware Bay horseshoe crab harvest will be set. The weighting system used will determine how that harvest will be apportioned among the four states of Delaware, New Jersey, Maryland and Virginia. The DBETC did not offer a recommendation but rather a set of three options that could provide the Board a baseline for its decision. The AP considered these three options and their pros and cons.

1) Historical, unregulated harvest levels:
   The Reference Period Landings (RPLs) represent the historic distribution of the catch, and presumably, also the historic distribution of the fishery.

State	Allocation weight, w_i
NJ	31.7%
DE	25.3%

MD	32.2%
VA	10.6%

2) Current management quotas:
These allocations mirror the current quotas set by Addendum IV, which include the Addendum III reductions for NJ, DE, and MD as well as the Addendum IV restriction for VA regarding harvest east of the COLREGS line. This option recognizes the distribution of quota that is currently occurring, although those numbers are based on entire quota levels and not just Delaware Bay.

State	Allocation weight, w_i
NJ	23%
DE	23%
MD	40%
VA	14%

3) Current estimated abundance levels:
These levels are based on state-by-state estimates from the Virginia Tech trawl survey. This option has the advantages of being based on fishery-independent data and can be updated yearly pending survey results. It should be noted, however, that the survey design is not meant to be analyzed on a state-by-state basis, possibly introducing error into these estimates.

State	Allocation weight, w_i
NJ	28%
DE	47%
MD	18%
VA	7%

The AP noted that addendum-based allocations have a good deal of historical influence on how and at what levels they were set, rather than a true biological connection. The AP also concurred that the weights themselves do not have any impact on the overall influence of the ARM-recommended harvest, except the impact of New Jersey's continued moratorium. Basing the weights on estimated abundance levels, using the trawl survey data, was attractive in that it is based on an empirical data set; however, the data set and structure of the survey was not designed to be used in a state-by-state manner. The AP felt that these factors should preclude selection of this method.

The AP also felt that basing allocation on average landings would be misleading, as New Jersey would be punished for instituting a more conservative management scheme. The AP felt that using that approach would present conservation measures as a disincentive.

The AP agreed that weights based upon the Addendum IV quotas were preferred due to their risk-averse nature in protecting male Delaware Bay horseshoe crabs. The AP felt that male horseshoe crabs are still important to the Delaware Bay horseshoe crab population, and the use of

Addendum IV quota offsets some of the devaluation on male horseshoe crabs within the ARM model.

The AP recommends basing the allocation weight on the Addendum IV quota levels.

Decision 3- Harvest cap for Maryland and Virginia

Placing a cap on the quota for Maryland and Virginia would prevent any further increases in their harvest should the ARM model output an optimized harvest level that, under the current allocation decision scheme, would allow for such an increase. The DBETC reviewed potential scenarios that could occur in the future and recommended a cap based on Addendum IV allocation levels to serve as a precautionary measure against overharvest of non-Delaware Bay crab populations.

The AP reviewed the DBETC's recommendation and proposed options for cap levels (**Table 1**).

Table 1. Proposed cap and resultant maximum quota levels for Maryland and Virginia

Cap Basis	MD quota	VA quota
RFPs	613,225	203,326
Add I	459,919	152,495
Add III	170,653	152,495
Add IV	170,653	60,998
Av Landings	160,746	21,280

The AP agreed with the DBETC that there is no evidence that populations of non-Delaware Bay crabs can sustain higher harvest levels. The AP concurred with the DBETC's reasoning of maintaining the status quo cap, based on Addendum IV quota levels.

The AP agrees with the DBETC and recommends a harvest cap based on Addendum IV quota allocations to cap the non-Delaware Bay harvest of Maryland and Virginia.

Decision 4- Delaware Bay Stock Allowance (DBSA)

The Delaware Bay Stock Allowance (DBSA) decision is only relevant should the ARM model suggest a harvest package that has either a full or female-only moratorium AND should the Lambda values for Maryland and Virginia be set at some value less than 1.0. The current recommended ARM Harvest package, Package 3, contains a female-only moratorium, and both the DBETC and the AP have recommended that the Board consider lambda values less than 1.0 for Maryland and Virginia.

This option, if chosen, would still allow Maryland and Virginia to harvest some Delaware-Bay origin horseshoe crabs that are under a moratorium (e.g. females under Harvest Package 3) at a defined minimal level. The option recognizes that at least some portion of the Maryland and

Virginia harvest is composed of non-Delaware Bay origin crabs. Without this option, any sort of a moratorium on Delaware Bay origin crabs would impose a similar moratorium on Maryland and Virginia's harvests of non-Delaware Bay origin crabs

The AP discussed the options presented and reviewed by the DBETC, as well as the option for status quo levels requested by the Board. The AP agreed that the DBSA's greatest impact under the currently-recommend ARM Harvest Package (#3) would be on females, which are considered to be more valuable to shorebird recovery and sustaining and growing horseshoe crab populations. As there is consensus, not only from the AP members, but from the larger population biologist community on the importance of females, the AP felt that holding to the ARM recommendation regarding female harvest was of utmost importance. The AP raised concerns that allowing variance from the female moratorium would not only allow deviation from the ARM recommendation but would also present a serious issue for law enforcement and compliance.

The AP members understood the origination of the DBSA and recognized that the recommended lambda values implied that not all Virginia or Maryland crabs come from Delaware Bay. However, the AP agreed that the ARM framework was a large change from the previous approach of management. Basing the major decisions, such as total quota, on a modeled relationship between horseshoe crabs and shorebirds and their present population levels is very different than basing quota on a portion of historical catch, which is the basis for most of the current state-by-state quota levels. The AP agreed that there needs to be a change in management strategy if the ARM framework is to function as intended. In light of the ARM recommendation of a female moratorium, the AP was concerned about the sizeable number of Delaware Bay origin females currently being harvested in Maryland and Virginia. The AP members noted that additional variables in the implementation of the ARM will complicate the interpretation of the management measures' impact, thus further complicating the double loop review process. Without additional evidence of sustained increases in either the horseshoe crab or shorebird populations, the AP agreed that the ARM recommendation should be followed and not further obscure the implementation of the ARM framework with a DBSA. The ARM process represents a significant transition in horseshoe crab management, and the AP felt that watering down that transition would not assist in the future management of the horseshoe crabs or the shorebirds.

The AP recommends that the Board maintain the ARM optimized harvest and its moratorium on Delaware Bay female horseshoe crabs. Given the inability to discriminate in the field between Delaware Bay and other horseshoe crab populations, this moratorium will impose a moratorium on the harvest of female crabs in Maryland and Virginia as well, which harvest crabs from a recognized mixed stock. The AP maintains that this approach will allow for the most efficient and clear measure of the ARM's impacts and the ecosystem's response to its recommended measures.

Conclusions

The ARM Framework does not provide state-by-state allocations. In order to convert the ARM Regional Allocations to state-by-state allocations, the AP recommends the following options for the four decisions set up in the spreadsheet allocation model:

1) *Lambda, λ*
   The AP recommends lambda values based on the genetics data (Option 3), in agreement with the DBETC recommendation.

2) *Allocation weights, w_i*
   The AP recommends basing the allocation weights on the Addendum IV quota levels.

3) *Harvest cap for Maryland and Virginia*
   The AP agrees with the DBETC recommendation and recommends basing a harvest cap for Maryland and Virginia on Addendum IV quota levels.

4) *Delaware Bay Stock Allowance (DBSA)*
   The AP recommends maintaining the ARM optimized harvest recommendation of a female moratorium on Delaware Bay crabs.