(K)not on Our Watch: 
The Politics of Saving Migratory Shorebirds 
in Delaware Bay 

by 

Taran Catania 
Class of 2013 

A thesis submitted to the 
faculty of Wesleyan University 
in partial fulfillment of the requirements for the 
Degree of Bachelor of Arts 
with Departmental Honors in Government
Abstract

Every year, shorebirds like the red knot make a remarkable roundtrip migration from the southernmost tip of South America to the Canadian Arctic. Their survival is dependent on the mid-migration nourishment of horseshoe crab eggs. With the world’s largest concentration of horseshoe crabs, Delaware Bay serves as the principal migratory stopover for shorebirds. Due to horseshoe crab overharvesting by fishing and pharmaceutical industries, shorebird populations are rapidly declining.

This thesis examines the political aspect of shorebird conservation. Limitations in the institutional architecture of federal statutes and public regulators, compounded by the difficulty of funding nongame species management, have made shorebird conservation a challenge. In response, public and private environmental organizations in Delaware Bay have formed ad hoc collaborative partnerships to improve horseshoe crab management and prevent shorebird extinction.
Acknowledgements

First and foremost, a wealth of thanks is due to my thesis advisor, Professor Marc Eisner. His patience, guidance, and swift feedback have been invaluable in the process of writing and developing this thesis. I would also like to thank Professor Barry Chernoff and the College of the Environment. This work is the direct result of my COE fellowship in Tanzania, where I experienced firsthand the process of (and passion for) endangered wildlife conservation.

I owe a debt of gratitude to Amanda Dey and Larry Niles, who welcomed me into the world of Delaware Bay shorebirds and provided me with a great deal of assistance. I must also thank Eric Stiles, Cari Wild, and David Wheeler for taking the time to help me understand the intricate world of collaborative conservation.

Additionally, I would like to thank Professor Elvin Lim, my academic advisor, to whom I owe a great deal of my intellectual curiosity and confidence. Thank you to all my friends, without whose company I would have spent much of these last months unhappy and unfed. Special thanks are due to Erhard Konerding and Gabriel Finkelstein for their careful eyes and bent for diction. All remaining errors are mine.

Finally, I must thank my parents, Jan Rosenfeld and Michael Catania. Without their love, support, and careful review, this thesis would not have been possible. I want to especially acknowledge my father for unknowingly introducing me to birding, and for providing me with a direct connection to a field of policy and science for which I have developed enormous interest and respect.
# Table of Contents

List of Figures ........................................................................................................... vi

List of Acronyms ......................................................................................................... vii

Chapter 1 – Introduction ............................................................................................... 1
   In the Wake of a Superstorm
   Literature Review: Migratory Resource Governance
   Questions and Methodology
   Overview

Chapter 2 – The Problem: A Species in Peril ................................................................. 13
   Ecology of Migratory Red Knots
   Rapidly Declining Numbers
   History of Shorebird Research
   Justification for Saving Shorebirds

Chapter 3 – Conservation Policy and Funding ............................................................ 23
   The Public Regulatory Structure .............................................................................. 24
      Bird Conservation via Federal Laws and Treaties
      U.S. Fish and Wildlife Service and Federal Funding
      Game Species vs. Nongame Species Management
      New Jersey Endangered and Nongame Species Program
   The Nongovernmental Conservation Community ................................................. 45
      Partnerships with Endangered and Nongame Species Program
      The Shorebird Fund and Committee
   Planning and Coordinating Mechanisms ................................................................. 56
      Overview of Coalitions, Plans, Initiatives, and Ventures
      Site Designation Programs
      Broad and Formal: Ineffective Consolidation
   Chapter Conclusion: Ad Hoc Success ...................................................................... 69
Chapter 4 – Resource Competition: Horseshoe Crabs ................. 70

Ecology of a Prehistoric Species ............................................................ 70

Horseshoe Crab Use ............................................................................ 74
  Early Human Use
  Scientific Research and Manufacturing
  Pharmaceutical Industry
  Eel and Whelk Fishing Industries

Regulatory Implications ...................................................................... 82
  Common-Pool Resource Management
  Atlantic States Marine Fisheries Commission
  Disadvantageous Harvest Paradigms
  New Jersey Moratorium
  State Discrepancies in Horseshoe Crab Conservation

Chapter 5 – Saving Red Knots ............................................................ 94

Improving Horseshoe Crab Management ............................................ 94
  Fishing Harvest Moratorium and Adaptive Resource Management
  Potential Steps Backward for New Jersey
  Reinventing Pharmaceutical Practice and Involvement
  Consequences of Coalition
  Additional Strategies

Shorebird Conservation Reform ......................................................... 104
  Stabilize Funding
  Change the Institutional Architecture of Policy
  Retain Informality

Impact of Hurricane Sandy ............................................................... 113

Conclusion: Preventing Shorebird Extinction .................................... 118

Bibliography ......................................................................................... 119
List of Figures

Chapter 1
1.1 Damage from Hurricane Sandy: Hoboken Subways ...................... 3
1.2 Damage from Hurricane Sandy: Seaside Heights Rollercoaster .......... 3
1.3 Red Knot Rufa .......................................................... 3
1.4 Horseshoe Crab Spawning on Delaware Bay .................................. 3
1.5 Map of Delaware Bay ........................................................ 4
1.6 Damage at Thompson’s Beach .................................................. 4
1.7 Shorebird Committee Surveys Reed’s Beach Damage ....................... 4
1.8 Ownership of Sites Used by Red Knot ...................................... 6

Chapter 2
2.1 Migration Route of the Red Knot ............................................. 13
2.2 Aerial Counts of Red Knots in Delaware Bay .............................. 17

Chapter 3
3.1 Endangered Species Act Listing Priority for Red Knot .................. 28
3.2 Migratory Bird Joint Ventures .................................................. 61
3.3 Partners in Flight: Physiographic Areas ....................................... 61
3.4 Partners in Flight: Organizational Regions ................................. 61
3.5 North American Bird Conservation Initiative ................................ 61
3.6 U.S. Shorebird Conservation Plan ............................................ 61
3.7 Atlantic Flyway Shorebird Business Strategy ............................... 61
3.8 Western Hemispheric Shorebird Reserve Network ....................... 63

Chapter 4
4.1 Bleeding Horseshoe Crabs for LAL Production ........................... 77
4.2 U.S. Biomedical Companies with LAL Production Licensing ............ 78
4.3 Horseshoe Crab Survey ....................................................... 81
4.4 Horseshoe Crab Harvest ....................................................... 81
4.5 Horseshoe Crab Egg Density .................................................. 82
4.6 General Classification of Goods ............................................... 83

Chapter 5
5.1 Kimbels Beach after Hurricane Sandy ....................................... 117
5.2 Kimbels Beach after Restoration .............................................. 117
List of Acronyms

ACJV — Atlantic Coast Joint Venture
ARM — Adaptive Resource Management
ASMFC — Atlantic States Marine Fisheries Commission
CITES — Convention on International Trade in Endangered Species
CRI — Conservation Resources, Incorporated
CWF — Conserve Wildlife Foundation of New Jersey
DEP — Department of Environmental Protection
ENSP — Endangered and Nongame Species Program
EPA — Environmental Protection Agency
ESA — Endangered Species Act
FDA — United States Food and Drug Administration
FIFRA — Federal Insecticide, Fungicide, and Rodenticide Act
IDEA — Impact-Directed Environmental Account
ISFMP — Interstate Fisheries Management Program
JV — Joint Venture
LAL — *Limulus* amebocyte lysate
MBTA — Migratory Bird Treaty Act
NFWF — National Fish and Wildlife Foundation
NGO — Nongovernmental Organization
NMFS — National Marine Fisheries Service
NOAA — National Oceanic and Atmospheric Administration
PSEG — Public Service Electric and Gas Service Company
SWAP — State Wildlife Action Plan
SWG — State Wildlife Grant program
TSCA — Toxic Substances Control Act
TWW — Teaming With Wildlife
USFWS — United States Fish and Wildlife Service
WHSRN — Western Hemisphere Shorebird Reserve Network
WSFR — Wildlife and Sport Fish and Restoration program
Chapter 1
Introduction

In the Wake of a Superstorm

In the fall of 2012, the Mid-Atlantic United States experienced one of the worst hurricanes in its history. On October 29, Hurricane Sandy made landfall on the coast of New Jersey and caused unprecedented damage. More than 2.4 million New Jersey households lost power. Approximately 346,000 homes were damaged, with 22,000 rendered uninhabitable.¹ Twelve New Jersey residents were killed.² Half of the estimated damage in the United States occurred in New Jersey alone.³ As Governor Chris Christie fought for a disaster relief bill of $60 billion for areas destroyed by “Superstorm Sandy,” he also began the daunting task of rebuilding. How would the state restore beachfront property along the Jersey Shore? How would it continue to draw revenue from tourism in places like Atlantic City? Images of subway tunnels submerged by storm surge in Hoboken and a roller coaster swept out to sea at Seaside Heights made it clear that these questions had no easy or immediate answers.

For a group of environmental activists clustered together on the Delaware Bay beaches of southern New Jersey one month after the hurricane, a different question arose: would this be the year that red knots finally faced extinction? (K)not on Our Watch is the account of their efforts to save these shorebirds before it is too late.

¹ Christopher Smith, Floor Statement on Sandy Supplemental, U.S. House of Representatives, January 2, 2013.
² Eric Blake et al., Tropical Cyclone Report: Hurricane Sandy (National Hurricane Center, 2013).
³ Ibid.
Hurricane Sandy is just the latest event in a much more lengthy saga involving the decline of shorebirds on the Atlantic coast. The red knot, the most endangered of these shorebirds, makes a remarkable migration from nearly pole to pole, stopping at Delaware Bay to refuel on its way to the Arctic. Since researchers began collecting data on these shorebirds in the 1980s, the number of red knots in Delaware Bay has fallen by more than 80 percent. Such declines put this species at risk for extinction in the next 10 years.\(^4\)

As the scientists and policymakers walked the Delaware Bay coastline in late November, examining the aftereffects of Hurricane Sandy, they asked each other: what is necessary now? The hurricane ruined the quality and accessibility of the beaches used by spawning horseshoe crabs. Given the fragility of the red knot as a species and their reliance on horseshoe crabs, the failure of crab spawning on these beaches will have great ramifications.

After a nonstop flight from the northern coast of Brazil, red knots have a brief period of time in Delaware Bay before they must resume their journey to Arctic breeding grounds. During this short window, shorebirds must double their body weight in order to successfully complete the last leg of their migration. To do this, they feed principally on Delaware Bay’s abundance of horseshoe crab eggs. Horseshoe crab spawning occurs once each spring, and the shorebirds’ arrival is timed perfectly to take advantage of this event. However, horseshoe crabs are in decline in Delaware Bay and elsewhere along the Eastern seaboard, and the decrease in their eggs has led directly to the decline of shorebirds. With horseshoe crab

---

spawning beaches in Delaware Bay now destroyed by Hurricane Sandy, shorebirds will arrive this spring unable to refuel and reach their breeding grounds. In this event, red knot numbers will drop below critical levels, and this species – along with the legacy of their remarkable trans-hemispheric migration – will be lost forever.

While the red knot is just one endangered shorebird species, its case provides an excellent opportunity to explore the complex mechanisms behind conservation policy for migratory wildlife from a local to hemispheric scale.

Figure 1.1 Damage from Hurricane Sandy: Hoboken Subways
(Source: journovation.syr.edu)

Figure 1.2 Damage from Hurricane Sandy: Seaside Heights Rollercoaster
(Source: almostfamousnyc.com)

Figure 1.3 Red Knot *Rufa*, breeding plumage
(Source: Manomet)

Figure 1.4 Horseshoe Crab Spawning on Delaware Bay (Source: USFWS)
Figure 1.5 Map of Delaware Bay (Source: Niles, et al. 2009)

Figure 1.6 (left) Scientists and policymakers from New Jersey gather at Reed’s Beach to assess damage from Hurricane Sandy. Larry Niles (kneeling) discusses rubble removal and sand supplementation. November 29, 2012

Figure 1.7 (right) In this state, the erosion at Thompson’s Beach will prevent horseshoe crab spawning this year, as crabs will be unable to reach spawning sand. November 29, 2012
Literature Review: Migratory Resource Governance

One of the challenges policymakers face is the management of public goods. Public goods are characterized by non-excludability and non-rivalry in consumption; that is, the good cannot be reasonably withheld from any person, and one person’s use of the good does not depreciate another’s use. Environmental examples of public goods include a stable climate and a healthy ozone layer. Shorebirds, because they are enjoyed through non-consumptive use, can be understood as a public good.

As Mancur Olson’s logic of collective action demonstrates, a major difficulty with public goods is that rational actors will tend to free ride. Given the key features of public goods, it is irrational for consumers to incur unnecessary costs. Unfortunately, this logic results in the depreciation of the good in question, hence creating justification for public policy intervention.

For policymakers, shorebirds are a particularly challenging public good to manage because they are so highly migratory. Many shorebird species span hemispheres and are only in one place for part of the year. Much of the work of conservation is done region by region, but this approach complicates a macro strategy. Focusing only on breeding sites, as the existing regulations do, is not sufficient to protect shorebirds; wintering habitats and migration stopovers must also be incorporated into conservation strategies.

---


6 In mid-nineteenth century, the ideals of American conservation split into two opposing schools: Conservationism and Preservationism. Conservationists like Gifford Pinchot advocated the proper and sustainable use of nature through moderation and regulation. Preservationists, including John Muir and David Brower, believed in the inherent worth of living things regardless of their instrumental value and called for protection of nature from human use. Although historically word choice here is charged with corresponding beliefs, I use the words conservation, protection, and preservation interchangeably in a “nondenominational” justification for saving shorebirds.
To make matters more difficult, land used by shorebirds in any one country is not under uniform jurisdiction (see Figure 1.8). Delaware Bay is itself fragmented by patchwork ownership. Because of this, even country- or region-specific conservation strategies must incorporate numerous stakeholders and negotiate a complex political, legal, and jurisdictional environment.

![Figure 1.8 Ownership of Sites Used by Red Knots](image)

As a result, the management systems for this migratory public good are complex. Regulatory authority lies with the federal and state agencies that control migratory bird conservation in the United States. Because migrating shorebirds cross international borders, there are also transnational partnerships and agreements that dictate conservation policy decisions. In the midst of this institutional patchwork of international, federal, and state actors in the public sector, nongovernmental private organizations also play a critical role. The conservation of this migratory resource at

---

7 Adapted from “U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form: Red Knot,” (U.S. Fish and Wildlife Service, 2011).

state, national, multinational, and intercontinental scales, across both the private and public sector, presents a “challenge of unprecedented proportions.”

Because of this multiplicity of actors, migratory bird conservation has been hampered by lack of communication, collaboration, or implementation. Conventional understanding of public good management at this scale suggests that the federal government should be the main player in conservation. However, pointing to the conflict between public access demand and ecosystem conservation, some have suggested that state or local-level wildlife management might better resolve this tension. Moreover, others have argued that “the existing fragmented framework of laws and authorities is insufficient to protect migratory populations against a diversity of threats across multiple jurisdictions and broad geographic scales.”

Arguing for this more local focus, certain scholars have prioritized the participation and education of direct stakeholders in conservation, and advocated for the benefits of small-scale conservation because of a need for variably managed environmental “mosaics.”

Looking beyond the capacity of the public sector, there is potential for private, nongovernmental organizations to protect biodiversity. Although government

---

agencies provide the infrastructure for policymaking and funding, it is often the nonprofit conservation community that has been the catalyst.\(^\text{16}\) These nongovernmental organizations are responsible for much of the research and advocacy that drive policy decisions. Scientific data, public concern, and policymaking are all “enmeshed in a complex feed-back system.”\(^\text{17}\) Nonprofits, because they can play an active role in each of these, are at an advantage.

At an individual level within the private sector, landowner conservation incentive programs provide an opportunity for small-scale conservation. Particularly with environmental issues in which federal protection does not apply to private lands, such as the Endangered Species Act, these programs provide more holistic solutions to fragmented conservation. However, studies have shown serious negative environmental effects associated with private conservation policies that have been oversimplified in order to be generalizable.\(^\text{18}\)

As for the problems associated with trans-national governance in migratory bird conservation, there is the concern of “mismatch” – that implementation failure is due to different procedures and frameworks for linking scientific and policymaking processes. At an international level, substantial tensions between reliance on the

\(^\text{17}\) Berta Martin-Lopez et al., “What drives policy decision-making related to species conservation?,” Biological Conservation 142, no. 7 (2009).
established linear approach and an emerging collaborative approach may undermine the credibility, relevance, and legitimacy of these institutions.\textsuperscript{19}

In light of this range of strategies, there is evidence that suggests environmental conservation which spans geographic and governance-level jurisdiction, such as migratory bird conservation, must be integrated to be effective – and for shorebirds particularly, the solution must be collaborative on a hemispheric scale. To facilitate this, a number of formal and informal coalitions and site-designation organizations have formed to incorporate environmental actors from the public and private sectors.\textsuperscript{20} Such a “constellation of arrangements” is designed to maximize the efficiency of conservation efforts by coordinating scientific practices and fostering private-public partnerships and intergovernmental relationships.\textsuperscript{21} These broad, formal strategies at larger geographic scales are aimed at overcoming the “parochial limitations of local-scale planning.”\textsuperscript{22}

Although much has been said about integrated conservation policy at these larger scales,\textsuperscript{23} for the particular case of Delaware Bay shorebird conservation, there is little to no scholarly literature that thoroughly lays out this complicated network of


\textsuperscript{23} Chapter 3 further evaluates these broad initiatives. For additional assessment, see ibid.; Jeremy Wilson, “Institutional interplay and effectiveness: assessing efforts to conserve western hemisphere shorebirds,” \textit{International Environmental Agreements: Politics, Law and Economics} 8, no. 3 (2008).
interacting local players. This thesis is intended to serve as a road map for this system of conservation. It provides an analysis for the weaknesses of the public regulatory structure and draws attention to the strengths of informal ad hoc collaborations, which challenge conventional understanding of successful resource management and environmental governance.

**Questions and Methodology**

This thesis is both descriptive and evaluative. The core questions that animate the research include: (1) How does migratory shorebird conservation work?, (2) Has it been effective?, and (3) What might be done to improve performance? For the purpose of narrowing the area of study, I focus primarily on conservation efforts in Delaware Bay, where shorebird survival is most jeopardized. Discussion features the red knot, the most endangered of the shorebird species that migrate through the Atlantic coast flyway. By laying the groundwork of what formal policy and funding mechanisms exist for protecting shorebirds, I dissect the limitations of these political and financial structures and call attention to the strengths of informal networks between public and private partners.

Primary and secondary sources have provided the factual substance for the arguments here, and interviews with the key players themselves provided invaluable synthesis. I conducted these interviews with expert researchers and policymakers connected with agencies and organizations directly involved in shorebird conservation. Additionally, in the urgent restoration planning that took place following Hurricane Sandy, I was allowed to monitor conference calls and meetings
with the Shorebird Committee. I also attended a Committee damage assessment walk on the beaches of Delaware Bay, and was able to see firsthand how these passionate individuals are saving species from extinction.

**Overview**

In this thesis, I argue that there are three main barriers to swift and effective shorebird conservation: (1) a flawed governance system composed of many jurisdictions with incomplete capabilities; (2) poor and unstable funding mechanisms for nongame species conservation; and (3) a high demand for and inadequate management of horseshoe crabs, a resource critical to shorebird survival. I discuss how ad hoc partnerships with public and private organizations are overcoming the obstacles of a deficient public regulatory system, and indicate suggestions for how both shorebird conservation and horseshoe crab management could be improved.

Chapter 2 presents the logistics of the problem, exploring the specific ecology of shorebirds and the factors that make prevention of their decline so complex and unique. It summarizes the history of shorebird research and reviews the rapidly declining population trend across the Western hemisphere. This chapter also provides ecological and economic justifications for saving shorebirds.

Chapter 3 discusses the first two theories of stymied shorebird conservation: policy and funding. It begins with an overview of the major treaties and statues protecting migratory birds before turning to analyze federal and state agencies. Given high levels of fragmentation, effective coordination and communication depends heavily on informal networks. Thus, the chapter examines ad hoc coalitions formed
between the New Jersey Endangered and Nongame Species Program and a number of private, nonprofit organizations. Chapter 3 also explores the potential of broader, more formalized bird conservation initiatives and provides an explanation as to why local efforts have made the most significant progress.

As noted above, the survival of the red knot depends on the availability of horseshoe crab eggs, the primary food source during a critical migratory stopover. Chapter 4 concentrates on the critical state of horseshoe crabs. Because horseshoe crab harvesting is under the jurisdiction of a different legal regime, fisheries management, this chapter analyzes the alternative regulatory mechanisms for horseshoe crabs. It explains why their management is both extremely intertwined with, while very distinct from, the problem of shorebird conservation.

Chapter 5 offers suggestions for restructuring both horseshoe crab management and shorebird conservation mechanisms, and advises ways in which the existing regulatory systems can be revised. The chapter concludes with a review and analysis of current restoration efforts after Hurricane Sandy.
Chapter 2
The Problem: A Species in Peril

Ecology of Migratory Red Knots

In one of the longest known migrations in the world, the *rufa* subspecies\(^{24}\) of the red knot (*Calidris canutus*) travels round trip from the tip of South America to the Canadian Arctic, a journey of approximately 17,000 miles.\(^{25}\) Scientists have mused that a red knot – measuring a mere 10 inches in length – will have traveled the same distance as from the earth to the moon before it turns 13 years old.\(^{26}\) Not only does the red knot travel such an inconceivable distance, but it also does so with only a small number of stops. In one of the most amazing bird flights ever recorded, a red knot carrying a geo-location device flew 3,000 miles nonstop over six days.\(^{27}\)

![Migration Route of the Red Knot](figure21.png)

*Figure 2.1* Migration Route of the Red Knot (Source: Encounters North)

---

\(^{24}\) *Rufa* is the only red knot subspecies that migrates through Delaware Bay. In this thesis, red knots discussed as a species refer specifically to the *rufa* subspecies.

\(^{25}\) Niles, Burger, and Dey, *Life Along the Delaware Bay*: 43.


\(^{27}\) Niles, Burger, and Dey, *Life Along the Delaware Bay*: 46.
The term shorebird broadly includes all wading birds. The red knot is one of 177 shorebird species found around the world. Many of these shorebird species make annual migrations driven by resource needs and reproduction. Shorebirds differ from other groups of migrating birds by several traits: extremely long and demanding migratory flights, a tendency to live in flocks (gregariousness), restriction to a limited number of sites, a particularly long lifespan, and a slow rate of population increase (low recruitment). Many of these migrating shorebird species, such as the red knot, are Nearctic-Neotropical migrants: traveling each year from wintering areas in South America to northern breeding grounds.

In their trans-hemispheric migration, red knots spend October through February wintering on the large tidal flats of the southernmost tip of South America, in Argentina’s Patagonia and Chile’s Tierra del Fuego. There they feed on mussels buried in restinga, unique coastal sediment formed by the region’s high winds. In March and April, the red knots depart in unison and travel north together, making only a minimal number of stops in Brazil. Then, in an unbelievable flight over the Atlantic Ocean, the red knots travel 7,000 miles and reach the United States’ Delaware Bay in mid-May.

Unique to shorebirds, 80 percent of the individuals of a given species will stop together at a single site in a migratory flyway. With the reliance of the majority of an

30 Ibid.
31 For the purposes of explanatory ease, this thesis will refer to all seasons from the perspective of the Northern hemisphere, even in reference to seasons occurring below the equator.
entire species on one location, it is crucial that this stop provides the perfect
combination of specific intertidal wetlands and easily retrievable high-density food.\textsuperscript{33}
As the premier location for these resources, Delaware Bay serves as the principal
spring migration stopover for red knots and many other shorebirds during their
northerly migration. Essential to these shorebirds’ survival and reproductive success
is the ability to accumulate sufficient fat reserves midway through this journey.\textsuperscript{34}

Their refueling success depends on the availability of an abundant supply of
horseshoe crab eggs in Delaware Bay. At this stage in their migration, the size and
capacity of red knots’ digestive organs have decreased significantly as a result of the
physical requirements of their long flight. Although red knots feed mainly on
shellfish during the rest of the year, by this point in their migration they are unable to
swallow whole and break down tough shellfish. Additionally, because of the short
ten-day window during which red knots stop in the Bay, a quick and readily available
food resource is also necessary. As a consequence of these physical limitations and
time constraints, horseshoe crab eggs – which are energy-rich, easily digested, and
found in prolific amounts in Delaware Bay – are a vital food resource.\textsuperscript{35}

By early June, after refueling in Delaware Bay, the red knots depart
independently for the Arctic in time for the summer thaw. From June to August, these
shorebirds establish widely dispersed breeding grounds and mate with seasonally
monogamous partners. After laying about four eggs, the female departs and head
south. In early July, after the eggs have hatched, the male departs as well. By means
of another remarkable evolutionary development, red knot chicks leave the Arctic

\textsuperscript{33} Ibid., 13.
\textsuperscript{34} Niles, Burger, and Dey, \textit{Life Along the Delaware Bay}: 42.
\textsuperscript{35} Ibid., 43-44.
several weeks later and navigate their way to South America without the help of their parents.³⁶

In their return journey from August to October, shorebirds travel south by way of the Massachusetts coastline instead of Delaware Bay. Without a cross-Atlantic flight and desperate refueling needs, this stopover is considerably less critical than the Bay – however, significant habitat destruction on the New England coast is beginning to reveal that it is not inconsequential. Again passing through Brazil, red knots reach the southern tip of South America by late October, at which time the marvel of their annual journey begins again.

**Rapidly Declining Numbers**

During the 1980s, aerial counts during the spring migration in Delaware Bay topped 90,000 red knots. However, numbers of red knots have dropped to barely 16,000 in the last 30 years³⁷ – a decline of more than 80 percent (See Figure 2.2). Surveys of wintering knots along the coasts of southern Chile and Argentina also indicate this serious population decline, with sharp decreases in the annual survival rate of adult knots.³⁸

---

³⁷ Niles, Burger, and Dey, *Life Along the Delaware Bay*: 44.
The red knot is now a species in peril, and scientists fear it will face extinction within the next 10 years without immediate conservation action.\textsuperscript{40} Moreover, the red knot is not the only species at risk: 60 percent of the shorebird species that stop at Delaware Bay – including semipalmated sandpipers, ruddy turnstones, and sanderlings – are also experiencing unprecedented population decrease.\textsuperscript{41}

Unfortunately, this is not an isolated trend: around the world, 65 to 70 percent of shorebird species are in serious decline.\textsuperscript{42}

The primary cause of the decline of shorebirds that stop in Delaware Bay is the overharvesting of horseshoe crabs by fishing and pharmaceutical industries. The eggs of horseshoe crabs provide a vital food resource needed at shorebirds’ mid-migration stopover. Because of horseshoe crab overharvesting, the availability of crab

\textsuperscript{39} Adapted from Niles, Burger, and Dey, \textit{Life Along the Delaware Bay}: 44.
eggs on coastline beaches has dropped by 90 percent.\textsuperscript{43} This decline in food supply has led to a decrease in the knots’ average departure weight from Delaware Bay. The proportion of knots achieving threshold weight gain dropped from almost 80 percent to as low as 14 percent.\textsuperscript{44} As lower departure weight has been shown to cause higher mortality, red knots are being lost before they even reach their breeding grounds. Moreover, it is not guaranteed that red knots will be able to reproduce each year; upon reaching the Arctic, red knots spread out great distances and do not always find a mate or breed successfully. With this slow rate of recruitment, there is even greater risk that population decline will be slower and more difficult to reverse.

Studies have indicated that other than the immediate threat of horseshoe crab overharvesting, red knot extinction is being accelerated by habitat loss, wetlands development, ecological die-offs from red tide events, hunting in the Caribbean, wind energy development, and urbanization along the North and South American migration flyways.\textsuperscript{45} Estuarine systems used by the red knot are being degraded; during the 1990s, metal contaminant in the Delaware Estuary increased from 5 to 22 percent over above Environmental Protection Agency (EPA) limits.\textsuperscript{46}

Global climate change is also expected to be a major obstacle to shorebird conservation. Precise timing of Arctic melting is necessary so that shorebirds can find food upon arrival, and an estimated 16-33 percent of Arctic breeding habitat for red

\textsuperscript{43} Niles et al., “Effects of Horseshoe Crab Harvest in Delaware Bay on Red Knots.”
\textsuperscript{44} Ibid.
\textsuperscript{46} Wells, “Red Knot,” 185.
knots could be lost from sea level rise. Additionally, climate change will have negative effects at lower latitudes like Delaware Bay, where sea level rise will eliminate crucial horseshoe crab spawning beaches.

**History of Shorebird Research**

Shorebird scientists were unaware of the highly critical connection between horseshoe crabs and shorebirds until the 1980s. Although they had located summer and winter locations for shorebirds at opposite ends of the hemisphere, scientists at the Manomet Center for Conservation Science (then called the Manomet Bird Observatory) could not determine where shorebirds stopped along the way during these incredible migrations. In 1978, Brian Harrington of Manomet sent out a questionnaire to fellow scientists and volunteers around the United States, asking if anyone had seen 20-30 red knots anytime during the spring. In 1979, he received a single response from a colleague in Cape May, New Jersey: “there are thousands here in Delaware Bay.”

With this discovery, research on red knots and other shorebirds accelerated. Driven by work led by Larry Niles, chief biologist and later head of the New Jersey Endangered Species Program, the scientific community developed an awareness and understanding of the decline of shorebirds. In the mid-1990s, Delaware Bay horseshoe crabs suffered a drastic tenfold increase in harvest for fishing bait and other

---

47 Ibid.
48 Hoose, *Moonbird*: 47.
uses. The resulting horseshoe crab population decline fueled a severe loss of red knots and other species, and research on these shorebirds has since intensified. This work continues today by state wildlife agencies and a number of nonprofit organizations.

**Justification for Saving Shorebirds**

There are many reasons why we should save red knots and other endangered shorebird species. One of these reasons is the alarming and unprecedented rate of extinction that our planet is currently experiencing: animal and plant species are dying off faster than at any other time in the last 65 million years. This loss of biodiversity will affect the health of the world’s ecosystems. Birds in general play ecologically essential roles in the environment, such as seed dispersal, pollination, excavation of holes in trees for use by other animals, and pest control through insect feeding. Shorebirds specifically play crucial roles in fragile coastal and wetlands ecosystems across the globe. The true ecological services and benefits of certain bird species may not be fully known until they are extinct, at which time the ecosystem functions they contribute will be lost.

The economic value of shorebirds is a stronger and more politically viable claim for their protection. In the United States, wildlife watching has great monetary value. According to the U.S. Fish and Wildlife Service’s most recent National Survey of Fishing, Hunting, and Wildlife-Associate Recreation, nearly 71.8 million people

---

50 Niles et al., “Effects of Horseshoe Crab Harvest in Delaware Bay on Red Knots,”
spend $55 billion to enjoy observing, feeding, or photographing wildlife. Despite no significant increase in the number of non-consumptive wildlife users, wildlife watching expenditures have gone up by 13 percent from 2001.

Of all the wildlife in the United States, birds attract the largest following. Approximately 46.7 million observers spend 5.2 billion days watching birds each year. More than 5 million people feed birds. Of wildlife watchers who travel away from home, 18.9 million participants watch birds, 10.6 million of which watch “non-waterfowl water birds” including shorebirds. Each year, approximately $34 million is spent on shorebird-related ecotourism in the United States.

Shorebird-based ecotourism draws thousands of people to Delaware Bay each spring, generating economic activity that supports both local businesses and conservation. Although Delaware has only recently begun collecting data on birders visiting Delaware beaches, New Jersey’s records indicate that approximately 10,000 to 15,000 people visit the state’s beaches during the time of shorebird migration. In the Delaware Bayshore area, shorebird and horseshoe crab ecotourism generates between $7 million and $11.8 million. Employees in this industry annually receive between $2 million and $3 million in salaries distributed among 120 to 180 jobs.

---

54. Ibid.
57. Ibid.; Eubanks, Stoll, and Kerlinger, The Economic Impact of Tourism Based on the Horseshoe Crab-Shorebird Migration in New Jersey.
58. Manion, West, and Unsworth, Economic Assessment of the Atlantic Coast Horseshoe Crab Fishery Report to the US Fish and Wildlife Service.
As this evidence indicates, there both are intrinsic and instrumental reasons to save shorebirds from extinction.\textsuperscript{59} In light of the ecological functions of shorebirds, the profusion of individuals who enjoy watching them, and their significant contribution to local economies, there is ample justification to manage this public good with public policy-driven conservation.

Chapter 3
Conservation Policy and Funding

Success in conservation ultimately requires funding, research, staffing, land preservation, regulatory authority, and advocacy. In other words, to protect open space and natural resources, one must have money to operate and purchase land, research to identify and monitor problems, the authority to restrict the use of the land or resources, and the ability to petition political officials for specific policy decisions or funding. Because no one actor can perform all of these functions, conservation also requires collaboration.

This chapter examines the limitations of policy and funding in shorebird conservation, which I suggest are the two most fundamental obstacles from a governance standpoint. Although it would seem logical to have a separate chapter each for policy and money, separating these issues would be artificial: political ability is conflated with financial stability. This chapter intentionally blurs the distinction.

I argue that a large part of what inhibits shorebird protection is an abundance of jurisdictions, each with incomplete capabilities, compounded by poor and unstable funding mechanisms. There are many cooperating actors that contribute different functions to the overall conservation picture: for example, public agencies can regulate but not advocate, while private organizations can advocate but not regulate. No single actor is able to provide the full variety of functions needed for successful conservation. Limited financial resources exacerbate the difficulty caused by this separation of “skills” into different sectors. Further complicating this patchwork of institutions, different organizations working for similar outcomes often have
inconsistent missions: for example, although waterfowl protection is by no means incompatible with shorebird protection, specific goals for waterfowl and shorebirds are not identical.

To show the debilitating complexity of this system, I begin by exploring the limitations of federal and state regulatory authority. I then discuss how shorebird conservationists are able to bridge the gaps within this jurisdictional patchwork through informal, ad hoc partnerships with a community of private organizations. As a national answer to the need for collaboration, a variety of formal planning and coordinating mechanisms have been developed. However, I argue that these broad strategies are ultimately ineffective because they are redundant, run in parallel, and are unable to finance the projects they propose.

Concluding this chapter, I return to the strengths of the public-private ad hoc collaborations in the Delaware Bay conservation community. In contrast with the public regulatory system and formalized large-scale conservation coalitions, these New Jersey organizations and agencies have formed the most adaptable and cohesive network – and are actually saving shorebirds.

THE PUBLIC REGULATORY STRUCTURE

The United States has an impressive legacy in conservation at the federal and state levels, dating back to the Progressive Era. The legacy of President Theodore Roosevelt (1901-1909) includes the U.S. Forest Service, four national game preserves, 150 national forests, and five national parks – protecting approximately
230 million acres of public land.\textsuperscript{60} Driven in large part by his lifelong passion for ornithology, Roosevelt also created 51 federal bird reservations. Adding to the “wilderness warrior’s”\textsuperscript{61} crusade for bird conservation, a large number of international treaties and domestic laws have been enacted to protect birds.\textsuperscript{62} Legal authorities at the federal level include international conventions and major domestic laws focused on both migratory bird conservation and protection of their habitats.\textsuperscript{63} Additionally, there are a number of federal and state agencies whose primary mission is conservation, including conservation of – and occasionally specifically for – birds.

How do shorebirds fit into this picture of federal and state protection? Between the migratory bird treaties and conservation statutes of the twentieth century, and the host of public agencies created for natural resource protection, it would appear as if there is a vital political and regulatory framework in place for public preservation of shorebirds. This section seeks to explore these foundational regulatory institutions, and eventually leads to an assessment of why these federal and state institutions actually provide only the skeletal framework for the kind of policy and implementation needed to save shorebirds.

Bird Conservation via Federal Laws and Treaties

Bird conservation at the federal level began with the Lacey Act in 1900. By the late 1800s, commercial hunting had greatly depleted many of America’s bird species. A prime example is the now-extinct passenger pigeon, whose flocks were once dense enough to “darken the skies.”\(^6\) As a measure to counter the prevalence of this illegal hunting and trade, the Lacey Act invoked the Interstate Commerce Clause to protect wildlife from illegal capture, transportation, and sale across state lines. In 1913, Congress passed the Weeks-McLean Act, which prohibited hunting and trade of migratory birds during certain seasons. Enacting the first nationwide hunting regulations, this law reinforced the Lacey Act’s mission by claiming federal authority for all migratory birds across the United States.\(^5\)

Despite the Lacey and Weeks-McLean Acts, commercial trade was still wreaking havoc on many bird species. In 1918, the Migratory Bird Treaty Act (MBTA) reaffirmed federal power by prohibiting the “take” of any migratory bird in compliance with four international conventions – one each with Canada, Japan, Mexico, and Russia – for the protection of shared migratory bird species.\(^6\) In 1920, federal authority over the protection of migratory birds was further reinforced by Missouri v. Holland, which ruled that the hunting of bird species that cross the Canadian-American border was under federal jurisdiction.\(^7\) Upholding the authority of the MBTA, the Supreme Court determined that regulation of internationally migrating birds was primarily a national issue and only secondarily under state

\(^{64}\) Ibid.
\(^{65}\) Ibid.
\(^{66}\) Ibid.
authority. In 1929, the Migratory Bird Conservation Act more effectively carried out the responsibilities stipulated in the MBTA by establishing a Migratory Bird Conservation Commission and including land acquisition as a means of bird conservation.  

While the Migratory Bird Treaty Act is a landmark in the United States’ commitment to bird conservation and remains the only federal protection provided for red knots, this statute is not drawn on by today’s conservationists. The MBTA has become something of a regulatory formality, and is not a useful strategy for obtaining federal protection. To save red knots and other shorebirds, conservationists need to ensure protection of their habitat and food resources, not merely protection from hunting or illegal trade. The MBTA only affords protection for nesting sites – which, for shorebirds, are not even located in the United States – and does not protect wintering or migrating sites, like the shorebirds’ critical Delaware Bay stopover.

The federal authority that does have the potential to facilitate red knot conservation is the 1973 Endangered Species Act (ESA). This act authorizes the listing of species as endangered and threatened, reinforces the illegality of unauthorized endangered species “take,” and establishes civil and criminal penalties for violation. The ESA also provided authority for land acquisition of habitat for listed species and institutes a number of grants to state endangered species programs. Additionally, the Endangered Species Act also implements agreements in the Convention on International Trade in Endangered Species of Wild Fauna and

---

69 “U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form: Red Knot,”
Flora (CITES) and the Pan American Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere.\textsuperscript{71}

The Endangered Species Act has been heralded for a number of successes, including the Florida panther, gray wolf, grizzly bear, peregrine falcon, red-cockaded woodpecker, and – perhaps the most well known case of ESA extinction prevention – the bald eagle.\textsuperscript{72} With this level of success, Endangered Species Act listing is the red knot’s best chance at sufficient federal power and funding. Currently, the red knot is listed as endangered by the state of New Jersey. After official petition in 2004, it was named a candidate for the federal Endangered Species Act in 2006. Although official listing is still pending, the red knot is currently Priority 3 (see Figure 3.1).\textsuperscript{73}

<table>
<thead>
<tr>
<th>Magnitude</th>
<th>Immediacy</th>
<th>Taxonomy</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Imminent</td>
<td>Monotypic genus</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Species</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subspecies/Population</td>
<td>3</td>
</tr>
<tr>
<td>Non-imminent</td>
<td>Monotypic genus</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Species</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subspecies/Population</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Moderate to Low</td>
<td>Imminent</td>
<td>Monotypic genus</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Species</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subspecies/Population</td>
<td>9</td>
</tr>
<tr>
<td>Non-imminent</td>
<td>Monotypic genus</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Species</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subspecies/Population</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

\textit{Figure 3.1} Federal Endangered Species Act Listing Priority Table for the Red Knot\textsuperscript{74}

\textsuperscript{71}“Laws and Treaties of the United States for Protecting Migratory Birds.”


\textsuperscript{74}“U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form: Red Knot.”
The U.S. Fish and Wildlife Service has “continue[d] to find that listing this species is warranted,” but the red knot’s candidacy has been perpetually renewed without approval for listing. This decision will be pending until at least 2014. Currently, federal listing has been deemed unnecessary because of protective measures taken by the states against horseshoe crab overharvest and human disturbance. In other words, because federal listing was not finalized, the state agencies and nonprofits stepped in; yet, now that states and nonprofits have stepped in, emergency ESA listing is no longer warranted.

Unfortunately, even if red knots are listed, there are two pragmatic problems with the Endangered Species Act: that it is too little and too late. On the first point, the ESA is often criticized for its insufficiency. Enforcement mechanisms are minimal at best. ESA protection applies only to federal property or if federal actions are involved, such as federal permitting. ESA review is not triggered by general development, and so cannot regulate a variety of activities that affect endangered species on non-federal lands. For red knots in particular, only 25 percent of sites used in the United States are directly under federal jurisdiction. Moreover, red knots are a species that cannot recover quickly, so changes that only occur in federal land and resource use will not be enough to ensure survival.

The second problem, too late, is a criticism of the ESA’s belated timing. Analogous to needing to declare bankruptcy before one can gain protection from

creditors, the Endangered Species Act only offers protection to species that are so far gone as to be on the brink of extinction. The setup of ESA protection ignores the saying “an ounce of prevention is worth a pound of cure.” The benefits of listing can only be accessed once basic management solutions (the ounce of prevention) are no longer viable. For species like the endangered piping plover, ESA has been activated so late that now only major damage control (a pound of cure) has the potential to prevent extinction. Because of this, the legacy of piping plover conservation has become one of extreme public distaste. Instead of an early coexistence plan for beach-nesting shorebirds and beach-going tourists, piping plovers have come so close to extinction that the Endangered Species Act prohibits public access to many of these beaches. This has created a great deal of animosity, as seen by the bumper stickers in some coastal areas that read: “Piping plovers taste like chicken.”

Ultimately, although federal ESA listing has the potential to be a species’ salvation by enacting useful federal power, the act of listing also signifies that a species is at the last stop before extinction. Ideally, conservation efforts need stronger preventative mechanisms. A species should not have to be near extinction in order to qualify for and obtain the federal protection granted under the Endangered Species Act.

Although funds are limited, there are several public or publicly chartered organizations that provide this necessary federal financing for shorebird and other wildlife protection before Endangered Species Act protection is needed. Two

---

78 Dey, March 15, 2013.
79 Ibid.
prominent examples of such organizations include the U.S. Fish and Wildlife Service and the National Fish and Wildlife Foundation.

**U.S. Fish and Wildlife Service and Federal Funding**

The U.S. Fish and Wildlife Service (USFWS) is an agency within the Department of the Interior designed to work with other environmental agencies and organizations to conserve and protect wildlife and their habitats. With a focus on stewardship, USFWS enforces federal wildlife laws, protects endangered species, manages migratory birds, restores fisheries, conserves critical habitats like wetlands, and manages the 150 million acre National Wildlife Refuge System— which includes the 11,500 acre Cape May National Wildlife Refuge, a critical protected area for shorebirds in Delaware Bay.81

USFWS plays another key role in conservation by distributing hundreds of millions of dollars in revenue from excise taxes to state fish and wildlife agencies through the Wildlife and Sport Fish and Restoration (WSFR) program.82 This program provides oversight and administrative support for grants, including the State Wildlife Grant Program (SWG).83 Since its creation in 2000, this grant program allocates federal funding toward wildlife and habitat conservation programs for research, surveys, species and habitat management, and monitoring.

---

82 “About the U.S. Fish and Wildlife Service.”
In order to qualify for grant funding, a state fish and wildlife agency must create a comprehensive State Wildlife Action Plan (SWAP) identifying different conservation priorities. These SWAPs are then approved by the USFWS and implemented by the SWG program. Annually, SWG funds are given to states, commonwealths, and U.S. territories by congressional appropriation. Because it is a matching grant fund, the SWG program requires the states to raise one dollar for every three federal dollars; however, because federal portions allocated for this fund have shrunk from over $100 million to less than $60 million over the last several years, this three-to-one match has become one-to-one. Each year, the states have fewer dollars to match any sizable grants.

At this point I think it worthwhile to pause and call attention to the abundance of abbreviations used in this field. As the acronyms pile up, the complexity of the system becomes evident. Throughout this thesis I do not shy away from using these acronyms because it proves this very point: this system is elaborate to a fault. With such a large number of programs involved in conservation, there is diffusion of responsibility and active leadership by any one federal agency or program. The absence of a focused governmental entity in which to consolidate federal conservation efforts is yet another flaw in this regulatory and grant-making system.

So, why do SWGs and SWAPs matter for shorebirds? These grants are the only sources of federal funding explicitly aimed at preventing wildlife from...
becoming endangered and then listed under the Endangered Species Act. Moreover, they have become the primary funding mechanism for most state nongame wildlife conservation. These grants assist state agencies and partner organizations with the protection of more than 12,000 at-risk species, including shorebirds. In 2004 alone, USFWS announced 40 grants totaling $3.8 million for migratory bird conservation, matched by $16 million in contributions by partnering organizations. Of this, $223,000 in federal grants was dedicated to the conservation of imperiled shorebirds.

Shorebirds and their Delaware Bay coastal habitat are featured in New Jersey’s wildlife action plan. For programs like the New Jersey Endangered and Nongame Species Program that do not receive funding from the state, federal State Wildlife Grants provide much-needed funding. At the end of this section I discuss the New Jersey Endangered and Nongame Species Program, the principal state program involved in shorebird conservation, and show why lack of funding is its greatest obstacle.

USFWS helps shorebirds through partnership activities as well. Because the vast majority of fish and wildlife habitat is on non-federal lands, as is certainly true for shorebirds, collaborations with partnership organizations are one of the main ways USFWS assists voluntary conservation. A more in-depth discussion of these

---

89 Stiles, March 25, 2013.
90 “About Teaming With Wildlife (TWW).”
91 “The Red Knot (Calidris canutus rufa).”
92 “About the U.S. Fish and Wildlife Service.”
partnerships and their coordinating mechanisms, including those initiated by USFWS, is covered in Section 3 of this chapter.

In addition to USFWS and State Wildlife Grants, the federal government provides conservation funding through another significant source: the National Fish and Wildlife Foundation. NFWF is a congressionally chartered independent nonprofit corporation, and is one of the largest funders of conservation projects in the United States. NFWF is subject to congressional oversight and a board of directors that includes the heads of USFWS, the National Oceanic and Atmospheric Administration (NOAA), and representatives from states, nongovernmental organizations, and industry.93 Currently, NFWF works with 14 federal partners and more than 50 corporate partners. Since its creation in 1984, NFWF has committed more than $2.1 billion to conservation projects and become one of the world’s largest conservation grant-makers. The corporation manages more than $100 million in mitigation and settlement funds,94 including recent settlements that have been partially allocated toward Hurricane Sandy beach restoration.

Although NFWF is not directly within the federal regulatory system, it provides another critical access point to federal funding for conservation projects by non-federal actors. Federal programs like SWG and intermediary organizations like NFWF are the backbone of stable conservation funding, as state programs have only limited resources of their own. Furthermore, SWG and NFWF funds are accessible by

conservation programs for both game and nongame species – a critical distinction that reveals how shorebird conservation is even further disadvantaged.

*Game Species vs. Nongame Species Management*

For the purpose of clarity and in the interest of streamlining the overview of federal wildlife conservation funding, I have not yet made a distinction between game and nongame species. It is critical that this distinction now be made clear, and that an explanation be provided for why this difference is critical for shorebirds, a nongame (in other words, not hunted) group of birds.

Game species are some of the best-managed species on the planet because they appeal to sport hunters. Since the late 1800s, America’s sportsmen have had the “political will and [financial] commitment” to protect their game species. This will and commitment manifests itself in two forms: advocacy and financial support.

Game species have a strong constituency of voters. There are many sportsmen and hunting hobbyists who care about the proper management of the wildlife they hunt. Because these sportsmen make up a large voting bloc, politicians are invested in satisfying their demands to garner their votes. Sportsmen are also tied to commercial interests through major hunting and outdoor recreation companies that contribute to political campaigns, making them even more appealing to vote-maximizing politicians. When hunters advocate for conservation, these political figures can use their power to expand wildlife agencies or write and pass (or block) environmental

---

legislation. Take the example of the New Jersey State Federation of Sportsmen’s Clubs. When these Federation members demand the preservation of a particular game species, such as pheasants or ducks, the proper management of that species is “as good as ensured.” With their advocacy and political clout, hunters secure the continuation of effective game species conservation programs.

Game species management is also well funded because of hunters’ willingness to pay for their sport. They exercise their financial commitment through several stable funding mechanisms set up as early as the 1930s. These mechanisms are what finance a wide range of conservation grants through the federal Wildlife and Sport Fish Restoration program, such as State Wildlife Grants.

There are two key ways in which game species create a stable stream of financial resources in ways that nongame species cannot. First, revenue is generated through a tax on hunting and fishing gear created by the Federal Aid in Wildlife Restoration Act of 1937. Now commonly called the Pittman-Robertson Act, it provides federal aid to states for wildlife management and restoration through the Wildlife and Sport Fish Restoration program (as of 2006). An 11 percent federal excise tax is applied to the purchase of sporting arms and ammunition, generating over $400 million annually. The Secretary of the Interior allocates these funds to approved state projects. Pittman-Robertson funding covers the cost of these projects by up to 75 percent, assisting in acquisition and improvement of wildlife

97 Dey, November 7, 2012.
98 Ibid.

36
habitat, research, and hunter education programs. Since 1937, the Act has been amended several times to include: pistols and revolvers (1970), bows and arrows (1972), and crossbows (1984). Pittman-Robertson also provides funding for the development of comprehensive fish and wildlife management plans.\textsuperscript{102}

Additionally, Pittman-Robertson has made it a priority to partner with sportsmen’s groups like the National Wild Turkey Federation and Ducks Unlimited, partnerships that provide matching funds for research projects. Since 1937, more than $6.4 billion overall has been invested in wildlife restoration through the Pittman-Robertson program. It has turned into “one of the most successful federal-state-conservationist-sportsmen partnerships in history.”\textsuperscript{103}

Second, game species generate revenue through the sale of hunting licenses in the form of duck stamps. Under the 1934 Migratory Bird Hunting Stamp Act, intended as “firm action to stop the destruction of migratory waterfowl and the wetlands so vital to their survival,” all waterfowl hunters 16 years old and over must annually purchase a Federal Duck Stamp.\textsuperscript{104} Income from these stamps is used to purchase wildlife habitat as part of the National Wildlife Refuge System.

Federal Duck Stamps have become valuable as more than just hunting licenses. Wildlife artists compete to win the title of Federal Duck Stamp Artist in the only federally mandated art competition, sponsored by USFWS. Duck stamp collection as a hobby is accelerating as well, with full sets of stamps now worth more than $5,000 – over 20 times their original value. Additionally, royalties from the sale of art reproductions and stamp-related products in the private sector are also used to

\textsuperscript{102} Ibid.
\textsuperscript{103} “Wildlife and Sport Fish Restoration Program: The 75th Anniversary of a Conservation Legacy.”
\textsuperscript{104} \textit{The Federal Duck Stamp Story}, (U.S. Fish and Wildlife Service, Federal Duck Stamp Office, 2002).
purchase habitat for the National Wildlife Refuge System. For conservationists and anyone who enjoys the outdoors, admission into all of these national refuges is free with the most recent stamp. Purchase of a federal duck stamp is both a symbolic and tangible way of ensuring that “wild places will be around for all generations.”

Since the program’s creation, Federal Duck Stamps have generated over $500 million to purchase more than 5 million acres. Because of this, the Federal Duck Stamp Program has earned the reputation of “one of the most successful conservation programs ever initiated.” Through these Pittman-Robertson excise taxes and revenue from duck stamps and other licenses, America’s sportsmen have contributed more than $12 billion to conservation through the Wildlife and Sport Fish Restoration Program. Annually, this provides more than 80 percent of the funding for most state fish and wildlife agencies.

The success of funding game species management stands in stark contrast to the problems of funding nongame species conservation. Although money from the WSFR program is allocated to both game and nongame species programs, nongame species programs typically get what is left after game management programs are financed. Because nongame species have neither strong advocates nor reliable funding mechanisms, their management is not guaranteed.

The “use” of nongame species is by definition non-consumptive, and thus takes the form of a public good characterized by non-excludability and non-rivalry in

105 Ibid.
106 Ibid.
108 For the most part, management and conservation are used interchangeably. However, their implications fall into different school of thought: management for human use, conservation for the sake of wildlife.
consumption. As discussed previously, public goods are particularly prone to problems of free riding.\textsuperscript{109} There is currently no stable mechanism by which nongame species can exclude users to generate income for their own management. And as the public regulatory structure is designed around enforcement for wildlife that can be “taken,” the federal government has significantly less jurisdiction over the conservation of nongame species. Because there is no federation of sportsmen or a comparable constituency petitioning congressmen to save nongame species, there is no political voice asking for increased involvement by public regulators.

It is clear that, in theory, the federal government has a significant responsibility for protecting birds like the red knot. Congress authorized protective regulations through the Migratory Bird Treaty Act and the Endangered Species Act, and has appropriated a variety of funds for conservation efforts through USFWS. However, because the groups working to save shorebirds are unable to obtain federal funding or protection, the system suffers from fragmentation and is ultimately flawed. In Delaware Bay, where there is little political constituency for shorebirds, and no stable income to fund their conservation, this breakdown is caused by the failure of the regulatory structure to protect the public trust.\textsuperscript{110} In place of sufficient federal involvement, state agencies and private organizations have taken up the work of shorebird conservation.

\textsuperscript{109} Olson, *Logic of Collective Action*.
\textsuperscript{110} Stiles, March 25, 2013.
New Jersey Endangered and Nongame Species Program

As in so many environmental policy areas, the task of protecting natural resources has fallen to individual states. State agencies, often working with nongovernmental organizations, collect the data that informs and directs federal policymaking. States are in the forefront, compensating for insufficient federal involvement. They provide “the boots on the ground,” collecting data, monitoring species status and habitat availability, and sounding the first alarm when conservation efforts are needed.\footnote{Dey, November 7, 2012.}

To investigate the role of state agencies in shorebird conservation, logically one would look to the state programs of the two states bordering the Delaware Bay: New Jersey and Delaware. However, this thesis only examines the role of New Jersey’s involvement in shorebird conservation. Because research done by New Jersey biologists is what has fueled the awareness and urgency to save red knots from extinction, New Jersey has been the frontline actor in shorebird conservation in the Delaware Bay area. While Delaware’s state program has also recently begun to work toward and make progress with similar goals to protect shorebirds, this thesis examines the more established legacy of New Jersey’s state agency and its partnerships.

In New Jersey, all federal sources of funding from Pittman-Robertson and duck stamps are applied to game species management, and not to conservation efforts for nongame species.\footnote{Ibid.} In lieu of neither stable funding nor an invested constituency comparable to that of sportsmen, work and advocacy for nongame species
conservation has largely fallen to state programs. This is where New Jersey’s Endangered and Nongame Species Program has played a critical role.

The Endangered and Nongame Species Program (ENSP) is part of the Division of Fish and Wildlife of New Jersey’s Department of Environmental Protection (DEP). Other offices within the New Jersey Division of Fish and Wildlife include: the Bureau of Freshwater Fisheries, the Marine Fisheries Administration, Bureau of Marine Fisheries, Bureau of Shellfisheries, and the Bureau of Wildlife Management. While each of these bureaus deals separately with related conservation issues, ENSP is the only program dedicated explicitly to nongame and endangered wildlife conservation. ENSP monitors and manages a variety of species including bald eagle, osprey, peregrine falcon, barred owl, American oystercatcher, bobcat, bat, harbor seal, wood turtle, timber rattlesnake, and longtail salamander.113

ENSP has been at the forefront of the scientific work of determining the level of red knots’ and other shorebirds’ decline and its cause. ENSP’s mission is “to actively conserve New Jersey’s biological diversity by maintaining and enhancing endangered, threatened and nongame wildlife populations within healthy, functioning ecosystems.” It is responsible for the protection of almost 500 species, 83 of which are currently listed as endangered or threatened.114

Originally, there was almost no funding for shorebird research. Because state tax dollars are not allocated to ENSP, its sources of funding are limited at best. For all of its work (and not just that of shorebirds), ENSP receives money from the state tax

check-off, in which a New Jersey taxpayer can designate one dollar or more of their taxes toward ENSP on line 58 of the 1040 income tax return.\textsuperscript{115} This generates approximately $158,000 for ENSP.\textsuperscript{116} There is also revenue from the “Protect Wildlife” license plates purchased by New Jersey state drivers – only some of which is used for the ENSP, which receives $110,000.\textsuperscript{117} However, as tax check-offs and license plates have become more popular for a variety of other charity causes, these two already minimal funding sources for ENSP are shrinking. Compared to New Jersey’s game wildlife agency, which receives $11,740,000 from hunter and angler licenses alone, the current state of nongame species funding – currently under $300,000 – is bleak.\textsuperscript{118}

In the face of this kind of a funding atmosphere, “staying alive [is] a major focus through tough economic times.”\textsuperscript{119} State programs must engage in defensive tactics and run like nonprofit organizations. Because of this, ENSP has been forced to downsize and its function has shifted away from the actual work of conservation toward raising money to meet its operating budget. Under this kind of pressure, many regional conservation efforts for nongame species are simply being phased out.\textsuperscript{120}

According to Amanda Dey, principal zoologist of ENSP, this is one of the greatest impediments for nongame shorebirds. Although game species management is a prime model for how nongame wildlife management and conservation can work, the institutions are not in place for making similar mechanisms alluring or feasible as

\textsuperscript{115} Ibid.  
\textsuperscript{117} Ibid.  
\textsuperscript{118} Ibid.  
\textsuperscript{119} Dey, November 7, 2012.  
\textsuperscript{120} Ibid.
sources of funding. There is neither a constituency like hunters with a political voice for nongame species conservation, nor any way to pay for it. Furthermore, ENSP is still a young program “working out the kinks.”  

In recognition of this problem, an association of state fish and wildlife agencies proposed the Fish and Wildlife Diversity Funding Initiative to the U.S. House of Representatives in 1996. This initiative, also known as “Teaming With Wildlife” (TWW), was designed to generate federal funding for the conservation and management of nongame wildlife in the same vein as Pittman-Robertson game species funding. With over 1,800 nongame species for which no reliably funded conservation program exists, the request for alternative funding sources was merited. While Congress had consistently approved funding authorization for nongame species agencies, these programs had never received any money in the appropriations process. USFWS agreed with the states that there is a growing need to accommodate increasing numbers of non-consumptive wildlife resource users, and the concept of funding wildlife conservation from taxes on certain merchandise has had well-demonstrated success.  

Compared to the 11 percent tax of Pittman-Robertson, the TWW Initiative suggested an excise tax between 0.25 and 5 percent. This would be applied to outdoor recreation equipment, including camping equipment such as backpacks and canoes, optical equipment like binoculars and spotting scopes, photographic equipment,  

---

121 Ibid.  
backyard wildlife supplies such as birdseed and feeders, outdoor and recreational 
books like field guides, and vehicles like RVs. This would mean an additional cost of 
$25 to $500 on an RV that costs $10,000 to manufacture and sold at $25,000. Each 
product would bear a logo and an explanation of how the funds are dedicated for 
wildlife conservation, recreation, and education.123

Although there was nothing about Teaming with Wildlife that particularly 
deviated from the Pittman-Robertson model, its proposal resulted in an uproar and 
was ultimately unsuccessful. Many sportsmen saw TWW as a scheme with purely 
monetary and not conservation-based interests, arguing that “the average hunting 
spender is going to pay more than the average Wildlife Watcher for taxes on [TWW] 
items.”124 One website went so far as to say “state game agencies and [US]FWS 
Federal Aid have shown where their hearts are. They have had 58 years and [more 
than] $2.3 billion with which to demonstrate how much they care for nongame.”125

Although this mistakenly cites Pittman-Robertson as a viable funding source for 
nongame species, the sentiment of these sportsmen and taxpayers was clear. For 
conservationists, the strength of TWW’s opposition was truly disheartening: many 
birders have expensive gear to participate in a pastime that is otherwise free while the 
birds themselves are in rapid decline.126

As previously stated, success in conservation requires funding, research, 
staffing, land preservation, regulatory authority, and advocacy. Government agencies

123 Ibid.
124 “Teaming With Wildlife: More Reasons Emerge to Beware Non-Game Tax,” Conservation Force, 
125 John Eberhart, “We Must Kill the Proposed Tax Called “Teaming with Wildlife”,” The C.A.S.H. 
Courier 1997.
126 Dey, November 7, 2012.
are prohibited from advocacy, as federal and state law dictates that public employees cannot lobby. And in the case of nongame bird conservation, ENSP also has almost no funding because it does not receive general tax dollars from the state.\textsuperscript{127} In addition to the already grim picture for nongame species protection, the recent financial crisis and deep recession have led to significant budget reductions for federal and state regulators.

This severing of functions from the public sector is yet another challenge created by a flawed regulatory system.\textsuperscript{128} With no power to advocate and increasingly minimal funding, which then hinders staffing and research, ENSP does not have the full range of capabilities for successful conservation under even the best of circumstances. Despite this, ENSP has found a way to supplement its limitations through partnerships with nongovernmental (NGO), nonprofit organizations.

\textbf{THE NONGOVERNMENTAL CONSERVATION COMMUNITY}

\textit{Partnerships with Endangered and Nongame Species Program}

Given the fragmented patchwork of public institutions and policies, the preservation of coastal biodiversity – such as that of Delaware Bay – depends on the cooperation and integration of federal, state, and private organizations.\textsuperscript{129} An explanation of New Jersey’s influential role in shorebird conservation in the Delaware Bay area is incomplete without first addressing the role of the New Jersey Natural Lands Trust. Created in 1968, the Trust is an organization “in but not of” the

\begin{flushright}
\textsuperscript{127} Catania, March 17, 2013.  \\
\textsuperscript{128} Ibid.  \\
\textsuperscript{129} Deblinger and Jenkins, “Preserving Coastal Biodiversity: The Private, Nonprofit Approach.”
\end{flushright}
Division of Parks and Forestry in the New Jersey DEP.\textsuperscript{130} It is a public-private hybrid agency that combines the power of the state with the support of private conservation organizations in order to obtain open space through donations and easements. The Trust is governed by an 11-member board, consisting of three members from the DEP (including the Commissioner), one member from the State Treasury, one member from the State House Commission, and six citizens with conservation experience from the private sector who are appointed by the Governor.\textsuperscript{131} Because its board is made up of members of the nonprofit, nongovernmental organizations involved in the Delaware Bay shorebird conservation community, the Trust serves a critical coordinating role.\textsuperscript{132}

By no small measure, New Jersey’s progress in shorebird conservation is due to the nongovernmental conservation community. These organizations, each with strong and unique partnerships with the Endangered and Nongame Species Program, have been the engine of Delaware Bay conservation for shorebirds and horseshoe crabs. Key players of this community include the Conserve Wildlife Foundation of New Jersey, the New Jersey Audubon Society, The Nature Conservancy, the Manomet Center for Conservation Sciences, the New Jersey Conservation Foundation, the American Littoral Society, the Natural Lands Trust, Inc., and a host of other foundations, corporations, and individuals. All of these players have had

\textsuperscript{131} Ibid.; Catania, March 17, 2013.
\textsuperscript{132} Ibid.
substantial involvement in this issue, and many of these nonprofits and even some corporate interests have representatives on ENSP’s Advisory Committee.\textsuperscript{133}

Take the example of the Conserve Wildlife Foundation of New Jersey (CWF), a private nonprofit organization focused on endangered species protection. CWF has partnered with ENSP for many years on the International Shorebird Project, assembling experts from across the globe to collect data and monitor trends of shorebird populations migrating through Delaware Bay each spring. The research done by this International Shorebird Team, led by Amanda Dey of ENSP and Larry Niles of CWF, provides the data that has been critical in documenting the decline of red knots and other shorebirds.\textsuperscript{134}

While the International Shorebird Project has been responsible for much of the collaborative scientific work, the most critical role of the Conserve Wildlife Foundation is financial. Despite unreliable public funding mechanisms, ENSP has enough funding to operate because it receives considerable financial support from the Conserve Wildlife Foundation.\textsuperscript{135} Acting as the nonprofit arm of ENSP, CWF is under contract with the New Jersey Natural Lands Trust to accept funding for shorebird research and shorebird docent work with ENSP.\textsuperscript{136} On behalf of the Trust, and under the immediate direction of the ENSP, CWF carries out banding operations, protection efforts, and population surveys. The Trust allocates private dollars from the Shorebird Fund to finance this work according to an annual CWF-approved

\textsuperscript{133} Ibid.
\textsuperscript{135} “Endangered and Nongame Species Program.”
\textsuperscript{136} Catania, March 17, 2013.
budget. Renewed for Fiscal Year 2013, the contract totals $81,100.\textsuperscript{137} There are no state dollars going into this work: ENSP’s work with CWF and other nongovernmental researchers is completely supported by private funding. With this arrangement through the New Jersey Natural Lands Trust, CWF is able to accept funding for shorebird projects with ENSP. This money can then be put toward actual work for shorebirds instead of being subject to a variety of state restrictions if given directly to ENSP.\textsuperscript{138}

CWF, like many of the key organizations in the nongovernmental community, also advocates on behalf of shorebirds and horseshoe crabs. As discussed before, advocacy is something that ENSP and other public agencies are prohibited from doing. Many of these NGOs have advocated to prevent further damage when the state could not, such as speaking out against horseshoe crab overharvesting.\textsuperscript{139} The groups use their individual expertise and memberships to work together to create an effective and holistic approach to shorebird conservation.

For instance, in one of its many roles, the New Jersey Audubon Society is the lead organization that lobbies for ENSP’s funding through State Wildlife Grants and other federal sources. Although wildlife agencies can venture to Washington, DC as experts, they cannot lobby for themselves. While working closely with CWF, New Jersey Audubon is able to act as ENSP’s lobbying arm, utilizing its political capital to talk to legislators and secure additional sources of funding.\textsuperscript{140} New Jersey Audubon has also played a pivotal role in successfully advocating for the enactment of a state

\textsuperscript{137} Contract between New Jersey Natural Lands Trust and Conserve Wildlife Foundation for fiscal year 2013.
\textsuperscript{138} Dey, March 15, 2013.
\textsuperscript{139} Ibid.
\textsuperscript{140} Ibid.; Stiles, March 25, 2013.
horseshoe crab harvest moratorium,\textsuperscript{141} which is discussed in greater detail in Chapter 4. Additionally, New Jersey Audubon has been doing research on shorebirds for the same period of time as ENSP, often collaborating with the program to share scientific resources and cooperate on shorebird banding operations on different species.\textsuperscript{142}

Several other NGOs have also been key players in shorebird conservation. In advocating and lobbying for listing the red knot as a state endangered species, as well as petitioning for federal Endangered Species Act listing, New Jersey Audubon and the American Littoral Society were heavily involved and co-signed the listing petitions. The American Littoral Society, an organization that promotes the conservation and appreciation of coastal marine life and habitat,\textsuperscript{143} was also involved in lobbying for the passage of the New Jersey horseshoe moratorium legislation. Another organization, the New Jersey Conservation Foundation, also participates in general policy advocacy and land conservation issues related to shorebirds. The Manomet Center for Conservation Sciences is involved with shorebird research and conservation throughout the entire Atlantic flyway, and is in the process of undertaking a social marketing study with ENSP to help educate the public about the link between economics and shorebird migration. Conservation Resources Inc. is another nonprofit that provides technical and financial assistance to other nonprofit conservation groups, specializing in matching various sources of “regulatory contributions” (payments required by permit conditions or enforcement settlements)

\textsuperscript{141} Catania, March 17, 2013.
\textsuperscript{142} Dey, March 15, 2013.
with sponsors of conservation projects.\textsuperscript{144} For more than 25 years, The Nature Conservancy of New Jersey has been investing millions of dollars to buy shorebird beaches and salt marsh areas behind beaches to protect habitat along the Delaware Bayshore.\textsuperscript{145} The Natural Lands Trust, Inc. (a private nonprofit not to be confused with the New Jersey Natural Lands Trust) also acquires land and maintains several large preserves in the Bayshore area.

There are also partnerships with corporate interests, such as utilities and water companies. These companies have been the source of donations of large parcels of land to The Nature Conservancy for use as nature preserves, such as Atlantic Electric’s conveyance of 200 acres at the Menatico Creek Preserve and DuPont’s donation of 1,100 acres at Willow Grove Lake.\textsuperscript{146} DuPont’s “Clear Into the Future” community-based conservation program also awards grants for Delaware Bay conservation projects, including shorebird research, to organizations including Conserve Wildlife Foundation and New Jersey Audubon.\textsuperscript{147} Public Service Electric and Gas (PSEG) Service Company, the largest utility in New Jersey and the largest landowner in the Delaware Bayshore area, acquired and restored 6,000 acres of coastal wetlands under the Estuary Enhancement Program, and serves a particularly important role for the Natural Lands Trust through the Shorebird Fund, as discussed in the following section.\textsuperscript{148}

\textsuperscript{144} Catania, March 17, 2013.  
\textsuperscript{145} Ibid.  
\textsuperscript{146} Ibid  
\textsuperscript{148} Catania, March 17, 2013.
A prime example of corporate partnering is southern New Jersey’s Stockton Alliance, a temporary collaborative effort in which chief executive officers of major companies worked with leaders of environmental nonprofits.\(^{149}\) In 1998, these groups successfully lobbied together for a constitutional dedication of $98 million annually for 30 years to help preserve one million acres of open space and farmland. Thanks in large part to the statewide campaign waged by the Stockton Alliance and the coalition of almost 200 organizations that was created and managed by these environmental and corporate executives, New Jersey voters approved this measure by a two-to-one margin – a victory that later became Governor Christine Todd Whitman’s environmental legacy.\(^{150}\)

Interviews with key participants revealed that there is also a network of strong personal ties that has facilitated the interaction of organizations. Circulation of personnel between organizations over time in addition to interlocking directorates at the board level has created a matrix of interworking and interrelated associates. One of the premier shorebird scientists in Delaware Bay, who was first chief biologist and then head of ENSP, now works with the Conserve Wildlife Foundation as a consultant. He has worked closely with all of the relevant shorebird conservation groups for the last 30 years, and also happens to be married to ENSP’s current chief biologist. Another key individual currently serves as chief executive officer for Conservation Resources Inc. and chairs the board of the New Jersey Natural Lands Trust. Previously, he worked as deputy commissioner for the New Jersey DEP and as the executive director of the New Jersey chapter of The Nature Conservancy. He also

\(^{149}\) Ibid.  
\(^{150}\) Ibid.
chaired the coalition that facilitated the Stockton Alliance’s one million acre open space legacy. Yet another of these key individuals has spent the last 20 years as the general manager of environmental affairs for PSEG. He serves as the principal liaison with regulatory agencies and has served on the ENSP Advisory Committee since 1995. He has also been appointed to a variety of positions at more than half a dozen different organizations, including the New Jersey Audubon Society.151

As the late anthropologist Margaret Meade once said, “Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.”152 The ad hoc coalitions formed by ENSP and numerous private organizations – strengthened by these crossover individuals – are nothing short of remarkable. Here is a group of people, connected by interpersonal relationships and networked through common goals, collaborating for a shared passion instead of competing for donors and prestige.153

This interlocking network of nonprofit, corporate, and governmental interests, aligned in their common goal to protect shorebirds, is successfully working to overcome the governmental regulatory system’s inherent constraints.154 Although the governmental programs in place for shorebird conservation are essentially unfunded, public and private partners have devised solutions to provide private funding for these efforts.155 Although ENSP must work like a nonprofit organization and compete with the NGOs for funding, the groups are able to share resources and delegate skills by

151 “Endangered and Nongame Species Program.”
153 Catania, March 17, 2013.
154 Ibid.
155 Ibid.
sector. Research has shown that through this pooling of talents and amenities, interagency cooperation leads to more efficient creation and implementation of habitat acquisition and management.\textsuperscript{156} These predominantly informal partnerships have created an impressively fluid collaboration of federal, state, nonprof, and corporate interests in New Jersey. This collaborative network is formalized only through the New Jersey Natural Lands Trust’s Shorebird Committee, created as a coordinating mechanism for these ad hoc coalitions.

\textit{The Shorebird Fund and Committee}

The Shorebird Fund is the primary mechanism that finances shorebird research and conservation in New Jersey. The Fund was set up in November of 1985 by an agreement between New Jersey DEP and Public Service Electric and Gas to satisfy a wetlands mitigation regulatory requirement.\textsuperscript{157} In Salem County, PSEG planned to build a new power plant, to be called Hope Creek. Building the new plant required a new access road through wetlands habitat. Under the New Jersey Fresh Water Wetlands Protection Act, it is mandatory to create mitigation projects for destruction to wetlands. New Jersey DEP, serving as the administrator of this law, knew of the work documenting shorebird decline and asked PSEG to create a $1 million fund for shorebird conservation. This fund was to be used for shorebird-related land acquisition, research, or operating costs including staff salaries or docents to patrol shorebird beaches.

\textsuperscript{156} Deblinger and Jenkins, “Preserving Coastal Biodiversity: The Private, Nonprofit Approach.”
Although the DEP Division of Fish and Wildlife initially administered the Shorebird Fund, the New Jersey Natural Lands Trust has been the sole administrator of this Fund for more than 25 years.\textsuperscript{158} Every year, the Trust collaborates with ENSP and Conserve Wildlife Foundation. First, ENSP submits a budget request including allocations for research, docents, banding, projects, aerial surveys, travel, and other shorebird-related funding needed for that year. The Trust approves the budget and then contracts with CWF, which serves as the fiscal agent for ENSP.

The Trust conservatively invested PSEG’s initial $1 million in U.S. government treasury bills and money market funds, and for the next two decades shorebird research was funded with the interest from this original sum. Only recently, when interest rates began to fall and shorebird numbers experienced even more alarming decline, has the shorebird project begun to draw from the principal of this original fund. As Michael Catania, Chairman of the Trust, put it, “having a large balance in the fund to help shorebirds after they went extinct was not going to help.”\textsuperscript{159}

In a New Jersey Natural Lands Trust board meeting in September of 2012, Amanda Dey presented the Delaware Bay Migratory Shorebird Project 2013 Budget Request. She advised the board that the annual amount the Trust provides is critical because it helps develop the scientific support for regulatory actions like horseshoe crab harvesting restrictions and red knot listing. The proposed 2013 shorebird budget was $98,800 – $20,200 more than budgeted in 2012. This increase was based on the uncertainty of what, if any, federal funds will be available for Delaware Bay.

\textsuperscript{158} Catania, February 5, 2013.
\textsuperscript{159} Ibid.
Migratory Shorebird Project activities this year. It was hoped that federal funding would become available and the full amount being requested from the Trust would not be needed.

The Trust’s Shorebird Fund has dropped below $400,000. At current spending levels, the Fund will be depleted in the next three or four years. As a result, the Shorebird Fund is desperately in need of additional financing. After lengthy discussion as to what could be done to replenish the account, Chairman Catania suggested forming a committee to explore Fund replenishment options and to investigate sponsoring a Delaware Bay Migratory Shorebird summit. The new committee could also act as local coordination mechanism for the collective and individual shorebird conservation efforts.\footnote{Ibid.} By a unanimous vote of 7 to 0, the Trust approved the 2013 budget and created the Shorebird Committee.\footnote{Minutes from the New Jersey Natural Lands Trust Board meeting on September 21, 2012.}

Officially, the Shorebird Committee consists of members of the Trust’s board, including chairman Michael Catania, Emile DeVito of the New Jersey Conservation Foundation, Steven Eisenhauer of the Natural Land Trust, and Thomas Gilmore of New Jersey Audubon. Along with staff and Advisory Committee members from ENSP, many other players are invited to Committee meetings, including individuals from the DEP Division of Fish and Wildlife, DEP coastal engineers, as well as representatives from the Wetlands Institute.

Before the Shorebird Committee existed, the Trust Board approved the annual budget of the Shorebird Fund, and there was no formal local structure for the ad hoc collaboration of the various shorebird conservation groups. The key individuals knew
each other and worked together, but they wanted a way to coordinate efforts and minimize duplication. When Hurricane Sandy hit, the new Shorebird Committee took on a critical role in light of a now-urgent task: to restore devastated shorebird beaches before the spring 2013 migration. Although the Shorebird Committee is in this way a more formalized collaborative institution, it is able to retain its informal and adaptable role by only loosely organizing all of these groups. Discussion of the Shorebird Committee’s current work and progress on Hurricane Sandy beach restoration projects is covered in Chapter 5.

PLANNING AND COORDINATING MECHANISMS

The 1980s and 1990s saw a surge of formal and extensive partnership-based bird conservation initiatives and coalitions.\textsuperscript{162} To achieve comprehensive management, these initiatives are aimed at facilitating collaborative work with organizations at state, regional, national, and international levels. Jeffrey Wells argues that these initiatives are designed to “overcome the parochial limitations of local-scale planning.” According to Wells, these initiatives highlight the importance of:

“(1) applying conservation values beyond that of simple rarity, (2) integrating conservation plans across political boundaries and even continents, (3) making conservation plans that are both spatially explicit and policy specific, and (4) emphasizing the needs of birds over the research needs of science.”

Unfortunately, these seemingly unique and beneficial coalitions are all alarmingly similar. The following section provides an overview of several prominent coalitions. After analyzing their utility and applicability in shorebird projects, I argue

\textsuperscript{162} To clarify, I use coalition and initiative interchangeably in reference to these planning and coordinating mechanisms.
that these broad and formal coalitions are ultimately ineffective at consolidating conservation efforts. I conclude with a review of why the informal ad hoc partnerships specific to Delaware Bay have the greatest potential to save red knots from extinction.

**Overview of Coalitions, Plans, Initiatives, and Ventures**

Since their creation in 1987, Migratory Bird Joint Ventures have served as one of the premier bird conservation initiatives in North America. A Migratory Bird Joint Venture (JV) is a regional partnership of government agencies, nonprofit organizations, corporations, tribes, and individuals designed to coordinate habitat conservation for priority bird species. Migratory Bird JVs were originally created as part of the North American Waterfowl Management Plan, but have since been expanded to include all migratory birds. As of 2005, USFWS oversees the Joint Ventures in the U.S.  

JVs use national and international bird conservation plans to design and implement continental efforts. There are 22 habitat-based geographic JVs (see Figure 3.2). There are also three species-specific JVs for Arctic goose, black duck, and sea duck. Since the program was established, JV partnerships have spent $5 billion in the conservation of 17.3 million acres.

The Atlantic Coast Joint Venture (ACJV) was established in 1988. This JV provides a forum for public and private coordination from Maine to Puerto Rico. The ACJV partners with each state’s wildlife agency, USFWS, NFWF, and several

---

164 Ibid.
private organizations such as The Nature Conservancy and Ducks Unlimited.\textsuperscript{166} The ACJV region consists of 283 million acres used by over 600 bird species, including 40 species of shorebirds.\textsuperscript{167} Supported by grants from the North American Wetlands Conservation Act and the U.S. Department of Agriculture’s Forest Legacy Program, the ACJV is responsible for the protection of two million acres of forested land.\textsuperscript{168}

Partners in Flight (PIF), another broad conservation plan, supports North American landbird conservation.\textsuperscript{169} Although PIF initially focused on conservation of neotropical migrants, it now incorporates all landbirds into conservation planning. Since 1990, PIF has been a cooperative effort between government agencies at all levels, conservation groups, industry, private organizations, and the academic community. The central premise of PIF is that “the resources of public and private organizations in the Western Hemisphere must be combined, coordinated, and increased in order to achieve success in conserving bird populations in this hemisphere.”\textsuperscript{170} In the 1990s, PIF was one of four major initiatives at the National Fish and Wildlife.\textsuperscript{171} PIF is arranged into four organizational regions and more than 90 physiographic planning areas (see Figures 3.3-3.4).

Another coalition is the North American Bird Conservation Initiative (NABCI). Founded in 1999, NABCI is a forum of government agencies, private

\textsuperscript{166} Ibid.
\textsuperscript{167} Ibid.
\textsuperscript{168} “Migratory Bird Joint Ventures.”
\textsuperscript{169} Ibid.
\textsuperscript{171} John Faaborg, \textit{Saving Migrant Birds: Developing Strategies for the Future} (Austin, TX: University of Texas Press, 2002), 190.
organizations, and bird initiatives. In other words, not only does NABCI include public and private organizations, but it also incorporates other coalitions themselves, such as PIF and Joint Ventures. NABCI’s mission is to “deliver the full spectrum of bird conservation through regionally based, biologically driven, landscape-oriented partnerships.” Its focus is enhancing the coordination of bird monitoring, acquisition of private lands, policy and legislative issues, international collaboration, conservation planning and design, and federal and state agency support. NABCI divides Canada, the United States, and Mexico into 67 bird conservation areas (see Figure 3.5).

The U.S. Shorebird Conservation Plan offers a more shorebird-specific approach to consolidation. Manomet Center for Conservation Sciences, in collaboration with partners from a variety of public wildlife agencies and nongovernmental organizations, developed the Plan in 2000. The mission of the Plan is to ensure the maintenance of shorebird habitat and restore declining shorebird populations at the local to hemispheric level. The Plan uses a scientific framework to determine species and habitats that need urgent conservation action. To enhance collaboration, the Plan works with Migratory Bird Joint Ventures and incorporates the Western Hemispheric Shorebird Reserve Network’s strategic plan (see following section). Like each of the coalitions discussed above, the U.S. Shorebird Plan divides the United States into delineated regions and has developed separate technical reports for each (see Figure 3.6). Of these 11 regional conservation plans, the North

173 Ibid.
Atlantic Regional Shorebird Plan of 2000 includes recommendations for management, research, outreach, funding, and education for red knot and other shorebird species.175

In February 2013, experts from the Manomet Center for Conservation Sciences and USFWS released a new overarching shorebird plan: the Atlantic Flyway Shorebird Business Strategy. The Strategy is an “unprecedented endeavor to implement conservation for shorebirds across an enormous geographic scale: the entire Atlantic Flyway.”176 At a predicted annual cost of $20 million, the Strategy’s goal is to create a long-term platform for stability and recovery of focal shorebird species, with a 10-15 percent increase in populations by 2020.177 Identifying different critical areas along the Atlantic Flyway, the Business Strategy uses key objectives to make regionally specific project recommendations (see Figure 3.7).

175 Wells, “Red Knot,” 185.
177 Ibid.
Figure 3.2 Migratory Bird Joint Ventures

Figure 3.3 Partners in Flight Physiographic Areas

Figure 3.4 Partners in Flight Organizational Regions

Figure 3.5 North American Bird Conservation Initiatives

Figure 3.6 U.S. Shorebird Conservation Plan Zones

Figure 3.7 Areas for Concern in the Atlantic Flyway Shorebird Business Strategy
Site Designation Programs

Another form of planning and coordinating mechanism is site designation. Instead of facilitating actor collaboration to help save shorebirds, site designation organizations or plans facilitate conservation by identifying geographic areas of concern. These programs play a more passive role, acting as frameworks around which conservationists – and coalitions of conservationists – can concentrate their efforts, strategize, and petition for support. This section reviews two prominent site designation programs for Delaware Bay shorebird conservationists.

The Western Hemisphere Shorebird Reserve Network (WHSRN) is by far the most prominent shorebird site designation program. In 1986, this new international project began with the discovery of Delaware Bay’s significance to shorebirds and designated the area as the first “stopover of hemispheric importance.”

Administered by the Manomet Center for Conservation Sciences, WHSRN is voluntary and non-regulatory. It provides a framework for a site-specific, hemisphere-scale shorebird conservation strategy. Aimed at sustaining viable populations of shorebirds, WHSRN’s objective is maintaining the ecological integrity of key sites spanning the full geography of shorebirds’ migration routes. To do this, the program facilitates habitat management and population monitoring in these protected areas.

Including 87 sites in 13 countries spanning North and South America, WHSRN partners have designated and conserved more than 32 million acres of shorebird habitat.

178 Niles, Burger, and Dey, Life Along the Delaware Bay: 44.
179 Mark A. Colwell, Shorebird Ecology, Conservation, and Management (Berkeley, CA: University of California Press, 2010), 244.
Landowners and stewards of WHSRN sites include government agencies, nonprofit organizations, indigenous peoples, academic centers, businesses, and individuals. To qualify as a WHSRN site, a minimum number or percentage of shorebirds must visit annually (see Figure 3.8). Dependent on these values, a site is given a designation of regional, international, or hemispheric importance.

![Figure 3.8 WHSRN Designation and Map of Sites](image)

With a strong focus on science-based solutions to conservation, WHSRN concentrates on species-specific conservation plans, among them the red knot. Working with BirdLife International and other partners, WHSRN has developed a systematic site assessment to evaluate a site’s status, major threats, and most efficient conservation strategy. WHSRN is directly helpful to shorebird conservationists because it brings attention to much-needed projects. Designation as a WHSRN site attracts recreational birders, whose visits boost local economies. The impact of ecotourism based on endangered shorebirds gains political attention, and helps push legislation for their protection.

\footnote{181 Ibid.}
The Ramsar Wetlands Convention serves a similar role in shorebird conservation. In 1971, seven nations agreed to the Convention on Wetlands of International Importance in Ramsar, Iran. Although not an original member, the United States joined the agreement in 1987. This intergovernmental treaty codifies member countries’ commitment to maintain wetlands of international importance.\textsuperscript{182}

Through local, regional, national, and international actions, the Ramsar Convention aims to achieve global and sustainable wetlands use.\textsuperscript{183} Ramsar designation, like WHSRN designation, is useful for shorebird conservationists because it indicates a need for environmental protection by legislative action and regulation.

Although WHSRN and Ramsar are not themselves regulatory institutions, they have been extremely successful in identifying and protecting many key breeding, wintering, and migratory stopover locations for red knots and other shorebirds. In some locations, these programs have even been able to initiate conservation and outreach projects.\textsuperscript{184} WHSRN or Ramsar designation as a site of international importance helps conservationists make the case to state legislatures for protective regulatory action in these areas.\textsuperscript{185} On an international scale, these programs have been critical in the process of protecting hemispheric-wide migration flyways.

\textsuperscript{183} Ibid.
\textsuperscript{184} Wells, “Red Knot,” 185.
\textsuperscript{185} Dey, November 7, 2012.
Broad and Formal: Ineffective Consolidation

The coalitions and initiatives described in this section each have the explicit goal of increasing efficiency and facilitating collaboration among numerous actors. Although this attempt at consolidation is not conceptually impractical, these broad initiatives are ultimately ineffective. This reality is different from the informal smaller-scale collaboration by organizations in southern New Jersey, which have created a network that is adaptable and effective. The broader, more formal initiatives discussed here represent redundancy at a higher level of aggregation. These presumably delineated coalitions are all trying to do the same thing, but there is no significant amount of crossover between them. These initiatives are running in parallel, using the same strategies to achieve the same goals – separately.

The first problem is simply one of “too many cooks in the kitchen.” If the descriptions of these coalitions seem redundant, it is because the coalitions themselves are redundant. There is a great deal of overlap in their missions, and very little that is unique about their strategies to “facilitate collaboration.” Furthermore, these coalitions are trying individually to rally the same resources and constituent base. The high number of shared member organizations between coalitions indicates this conflict. With single organizations involved in multiple coalitions, such as the Nature Conservancy’s participation in the Atlantic Coast Joint Venture and the U.S. Shorebird Plan, many of these coalitions have become merely membership formalities instead of active agents of consolidated shorebird conservation.

The issue of multiple separate efforts is made worse by a lack of crossover or communication between coalitions. There is no delegation of functions between
initiatives, and no framework to build on collective progress. The overall system fails, ironically, because there is no collaboration between coalitions – whose very purpose is to consolidate efforts. NABCI, in an attempt to remedy this problem, includes other coalitions in its framework. (In other words, by definition, NABCI is not only a coalition of organizations, but also a coalition of coalitions.) However, the reality is that each coalition is loosely connected to one or several others, but none are connected to all, and all are not under the leadership of one. If each of these coalitions were given unique tasks, and roles were delegated throughout the system, it is possible that multiple efforts to “facilitate collaboration” would not be a problem. If these groups worked toward the same goal with different strategies, or toward different goals with the same strategy, this system might not be so inefficient. Without crossover or collaboration between these coalitions, their efforts are redundant.

Further hindering their usefulness in conservation, these partnerships operate at large geographic scales. At different scales, there are different ecological phenomena that require different and often conflicting conservation priorities. The strategies employed for saving a species that is restricted to a single state are highly different from the strategies for saving shorebirds throughout the entire Western hemisphere. These coalitions create continent-wide priorities that suffer from their own generalizability. The breakdown occurs in trying to operationalize these national or international goals when the actual work of conservation occurs at the local or regional level. Coalitions like PIF and NACBI can set population goals that a state

\[\text{\footnotesize \cite{Stiles, March 25, 2013.}}\]

\[\text{\footnotesize \cite{Ibid.}}\]
agency or private organization can work toward; otherwise, these standards and objectives are merely guidelines.

The prospect of crossover is made even more difficult because these large-scale coalitions have each drawn their boundaries differently. Reexamine the different geographic configurations of Figures 3.2 through 3.7. Each coalition divides part or all of North America into a different combination of strategic regions. This variety of maps is akin to the variety of acronyms in federal programming; the elaborate array is a visual display of a system that is overly complicated and highly repetitive. If a shorebird conservation group in New Jersey wishes to synchronize its activity with each coalition, it must seek out the regional plans for region 30 of NABCI, the North Atlantic region for the U.S. Shorebird Plan, the Atlantic Coast Joint Venture, region 44 of PIF, and so on. But the Atlantic Coast Joint Venture, which spans from Maine to Puerto Rico, employs different strategies than PIF’s region 44, which spans only from New Jersey to Virginia. With so many coalitions, each with differently defined boundaries and a great deal of redundancy, state agencies and private organizations ultimately end up setting their own priorities that are only loosely connected to these broad initiatives.

There is also the problem of each coalition being internally problematic. With an elaborate network of commissions and advisory groups and a long list of partner organizations, many of these coalitions get caught up in bureaucratic operations. They are incapacitated by their formality, and are unable to quickly adapt and mobilize for new conservation problems. Take the example of PIF, which was once praised for its surprisingly efficient, complex hierarchy of committees. Although many of these
groups were productive, a “certain amount of time was spent reinventing the wheel”
during each turnover of participants.\footnote{Faaborg, \textit{Saving Migrant Birds}: 185.}

Moreover, the need for funding is always a problem. Each of these
organizations and even the coalitions themselves are competing for scarce resources
to make ends meet, and in the process many efforts are duplicated.\footnote{Dey, November 7, 2012.} Given the
relative financial powerlessness of the state and nonprofit groups, these formal
initiatives do not serve a functional role in shorebird conservation. By propagating
broad strategies requiring more funding than is realistically available, these coalitions
have set lofty goals that are unusable. With what little funding the regional and local
efforts have, they are working to meet area-specific goals.\footnote{Niles, March 25, 2013.} In the absence of a
focused governmental entity and a consolidation of broader national objectives, the
most that regional efforts can reasonably focus on are the immediate, local issues.

In short, these broad formalized planning coalitions are simply ineffective at
achieving the goal of consolidation. Although each of these initiatives creates the
basic structure for a collaborative forum, there is a great deal of overlap in the
coalition functions, a lack of crossover between coalition projects, and inadequate
funding to implement these large-scale strategies. This explains why progress in
Delaware Bay is being made primarily by the state-specific collaboration between
ENSP and private New Jersey conservation efforts.
CHAPTER CONCLUSION: AD HOC SUCCESS

In this overall system of shorebird conservation, federal and state agencies have regulatory authority. They are able to list species as endangered, acquire land and manage habitat, and regulate certain land use activities in order to preserve critical habitat and resources. However, as I have shown, this system alone is insufficient for protecting shorebirds. Although the state has regulatory power, it does not possess the full range of capabilities necessary for successful conservation; certain abilities are separated from this public structure and left to the private sector. This has created an opening for a vibrant NGO conservation community.

Although governmental and nongovernmental entities are not designed with the explicit purpose of inter-sector cooperation, in Delaware Bay these groups have evolved certain coordination mechanisms to do just that. State regulators have included the nonprofits in advisory committees. These NGOs have in turn raised private dollars and advocated to change public attitudes and drive legislation. The Endangered and Nongame Species Program, with help from the coordinating mechanisms of the New Jersey Natural Lands Trust, has developed a wide range of largely informal partnerships. Despite the inadequacy of the larger, formalized bird conservation coalitions – which merely create a forum for effort consolidation without actual means for implementation – local efforts like the one in southern New Jersey have found a way to informally yet effectively collaborate. In the name of preventing shorebird extinction, this network of ad hoc coalitions is overcoming the limitations of the public regulatory structure.
Despite the challenges posed in Chapter 3, the most pressing concern for red knot survival is the overharvesting of horseshoe crabs. Shorebird decline is being fueled by fewer horseshoe crab eggs, which provide critical nourishment during shorebirds’ migratory stopover in Delaware Bay. However, it is state and federal fisheries agencies – rather than state wildlife agencies, the U.S. Fish and Wildlife Service, or any other public agency directly concerned with shorebird extinction – that have jurisdiction over horseshoe crabs. Even if conservationists are able to draw on federal wildlife protection, obtain sufficient funding, and utilize the collaboration of state and nonprofit efforts, they will have won only half the battle. Without proper management by fisheries agencies, horseshoe crab overharvest will cause red knot extinction with or without conservation that is directed at shorebirds.

**ECOLOGY OF A PREHISTORIC SPECIES**

Each spring, as shorebirds migrate from South America to the Arctic, another migration happens simultaneously: the horseshoe crab spawning migration. During the full moon of late May or early June, when the spring tide is at its highest, horseshoe crabs undergo a “local migration.” They travel from deeper waters off the coast to the shores of sandy beaches in order to reproduce. The vast majority of Atlantic horseshoe crabs (*Limulus polyphemus*), the only species found in the Western Hemisphere, live in Delaware Bay. The Bay is particularly ideal because of its relatively shallow depth, allowing the water to warm quickly after winter and
stimulate horseshoe crab spawning.\textsuperscript{191} It is no coincidence that shorebirds have made Delaware Bay their mid-migration stopover, and that their arrival is synchronized perfectly with the horseshoe crab spawning migration each spring. Because of this dependent relationship, the fate of the red knot is interconnected with the fate of the horseshoe crab.

Horseshoe crabs are prehistoric: they have not undergone significant evolutionary change in over 400 million years ago, almost 200 million years \textit{before} the first dinosaurs. Although they are called crabs, horseshoe crabs are actually arthropods and are more closely related to arachnids like spiders and scorpions than to crustaceans. As they emerge from the water, horseshoe crabs look like hubcaps or horse hoofs and move like army tanks. They feed on marine worms, small clams, mussels, crustaceans, snails, and slugs. Towards its tail, a horseshoe crab has five “legs” called book gills that it uses for breathing and for propulsion when swimming. A horseshoe crab sheds its shell in a molting process up to 17 times before it finishes growing.\textsuperscript{192} Horseshoe crabs reach sexual maturity at age nine or 10, and are thought live up to 20 years old.\textsuperscript{193} Male horseshoe crabs possess a special arm for use during sex, a segment of which falls off upon grabbing a female to mate with for the first time. This provides scientists with a mechanism to differentiate between “virgin” and mature crab males.\textsuperscript{194}

\textsuperscript{191} Niles, Burger, and Dey, \textit{Life Along the Delaware Bay}: 19.
\textsuperscript{193} Ibid.
Delaware Bay has the world’s largest breeding concentration of horseshoe crabs.\footnote{195 Niles, Burger, and Dey, Life Along the Delaware Bay: 17.} Every spring, mature female horseshoe crabs make their way onshore using chemical clues to distinguish good, sandy beaches. Each female digs a hole at the water’s edge and lays between 3,000 and 10,000 eggs. While she does this, several males hold on to her while releasing sperm. The female then buries the cluster of eggs under six inches of sand.\footnote{196 Ibid.} She will do this several more times throughout the short spawning season, by the end of which she will have laid 80,000 eggs.\footnote{197 Ibid.} If every one of these 80,000 eggs hatched and grew to adulthood, the offspring would nearly cover the state of New Jersey. Before the decline of horseshoe crabs began in the 1990s, up to 100,000 eggs per square yard could be found on Delaware Bay shores.\footnote{198 Ibid., 26.} No other place in the world offers more fuel in less time than on these beaches.\footnote{199 Ibid., 26.}

Horseshoe crab eggs, because of their sheer profusion, create a significant influx of nutrients into coastal ecosystems. In addition to eels, fish, and gulls, horseshoe crab eggs support endangered wildlife, like loggerhead sea turtles,\footnote{200 Niles, Burger, and Dey, Life Along the Delaware Bay: 20.} finfish,\footnote{201 Economic Assessment of Mid-Atlantic Horseshoe Crab and Dependent Fisheries Including a Qualitative Discussion of the Potential Effects of Addendum IV, (Cambridge, MA: Industrial Economics, Incorporated, 2008).} and, of course, shorebirds. Without this perfectly timed and highly nutritious resource, red knots would not survive their trans-hemispheric migration. Because of this disproportionately large effect on other species in the coastal community, horseshoe crabs are considered a keystone species and are critical to overall ecosystem functioning.
The necessity for horseshoe crabs eggs as fuel makes it clear why shorebirds have made Delaware Bay their premier stopover. Since the discovery of the high volume of shorebirds stopping at the Bay, scientists have become well aware of the essential relationship between migrating shorebirds and horseshoe crabs. The scientists and policymakers gathered on the shore of Delaware Bay after Hurricane Sandy, discussed in Chapter 1, are no exception. As they survey the storm damage, they discuss possible restoration projects to ensure that horseshoe crabs will still be able to spawn here. Hurricane Sandy has made a wreckage of the Bay coastline, washing sand to higher grounds and leaving in its place a mess of concrete, brick, glass fragments, asphalt, and the remnants of old pilings and bulkheads. Urgently, these beaches need more sand and less rubble to support horseshoe crab spawning in a few short months.

“We also need a discussion for a long-term adaptation plan,” David Jenkins, chief of ENSP, reminds the group. “This is not a sustainable solution – it is just one to get us through a bottleneck.” They begin to debate over strategies for beach restoration designed for rising sea level and evolving coastlines due to climate change. Should the state be investing in infrastructure? Should certain beach communities receive less funding to bolster the resources for others? Which beaches most critical to horseshoe crabs should be the focus of restoration over the long haul? Is public access to the Bay limited because of a lack of facilities, and is this the reason for limited beach restoration funding? The odds are stacking against them as each obstacle is added to the picture. After this year, will every year be a struggle to
protect horseshoe crab spawning on Delaware Bay beaches and ensure a successful shorebird migration?

But there will be no need for a long-term solution if these scientists and policymakers cannot achieve an immediate beach restoration solution in time to save this year’s shorebird migration. Come late May of 2013, if horseshoe crabs do not spawn on these beaches and produce a sufficient number of eggs, there may not be another spring shorebird migration. The race to save red knots has now, more than ever, become a race against the clock.

HORSESHOE CRAB USE

In the face of general environmental threats such as habitat destruction and climate change, shorebird populations are already at risk. Complicating these threats is competition over horseshoe crabs, which are in high demand not just by shorebirds and other wildlife, but by humans as well. As horseshoe crab numbers have dropped drastically in the past two decades, shorebirds are forced to contend with humans for this coveted resource. Their failure to prevail may guarantee extinction.

Early Human Use

Although the utility of horseshoe crabs is rarely acknowledged, humans have a long history with Limulus. As references dating back to 1590 indicate, Native Americans were the first to use horseshoe crabs in the United States. Crabs were harvested for food, their tails were employed as spear tips, and their shells were used
as hoes and bailers for canoes. By the early 1600s, Native Americans used horseshoe crabs to enrich the soil for higher crop yields.

Commercial horseshoe crab use for agricultural purposes began in the 1800s, when crabs were ground into meal and sold to farmers as fertilizer for corn and tomatoes, or as a food supplement for poultry and livestock. This industry, called “cancerine” from the misunderstanding of horseshoe crabs as crustaceans, required an astonishing four million crabs from Delaware Bay in a single year. By the late 1800s, horseshoe crab populations had declined and harvest levels for the cancerine industry had substantially diminished. These practices died out by the 1960s, when it became cheaper for farmers to use artificial, oil-based fertilizers and also apparent that crab-fed chicken and pork had a strange taste.

**Scientific Research and Manufacturing**

The field of biomedical science began using horseshoe crabs in the 1930s, conducting physiology experiments on horseshoe crab optic nerves. These findings contributed to a Nobel Prize for Haldan Keffer Hartline in 1967 and have yielded much of what scientists understand today about human eyes. Additionally, horseshoe crab blood has been shown to be beneficial in cancer research, potentially for the diagnosis of leukemia. Other research on horseshoe crabs has contributed to

---

203 Ibid.
204 Ibid., 303-04.
205 *Cancerine* means “derived from crabs.”
206 Kreamer and Michels, “History of Horseshoe Crab Harvest on Delaware Bay,” 304.
207 Ibid.
208 *Economic Assessment of Mid-Atlantic Horseshoe Crab.*
discoveries in cell biology, neurobiology, immunology, biochemistry, and drug
development.209

Horseshoe crabs have also proven valuable in the manufacturing world
because their shell contains a substance called chitin. Chitin, which is also found in
other arthropods, can be processed into chitosan and used in a variety of consumer
goods and services. Examples include contact lenses and creams, medication for high
blood pressure and irritable bowel syndrome, and the removal of lead from
wastewater.210 Most significantly, because chitin has been shown to increase healing
time significantly, it has been used in suture string and wound care materials.211
Because chitin can be derived from a number of other sources, horseshoe crab
mortality for chitosan manufacturing is largely undocumented, but likely minimal.

Pharmaceutical Industry

Perhaps of all who benefit from horseshoe crabs, the pharmaceutical industry
has the largest stake. Horseshoe crabs have a prehistoric immune system that has been
perfected over hundreds of millions of years. In contrast with human blood’s iron-
based hemoglobin, horseshoe crab blood contains copper-based hemocyanin and
appears blue instead of red when exposed to oxygen. In the 1960s, scientists
discovered the compound Limulus amebocyte lysate (LAL) in horseshoe crab’s blue
blood. Because of its sensitive clotting ability as part of this prehistoric immune

209 Deborah Rutecki, Ruth H. Carmichael, and Ivan Valiela, “Magnitude of harvest of Atlantic
210 Economic Assessment of Mid-Atlantic Horseshoe Crab; Rutecki, Carmichael, and Valiela,
“Magnitude of harvest of Atlantic horseshoe crabs, Limulus polyphemus, in Pleasant Bay,
Massachusetts.”
211 Ibid.
system, LAL can be extracted from horseshoe crab blood and used to screen for bacterial contamination (see Figure 4.1). Today, because there is no other procedure with the same accuracy, LAL is the worldwide standard for this type of medical testing. As of 1979, every drug certified by the U.S. Food and Drug Administration (FDA) must be tested with LAL. Valued at $15,000 per ounce, horseshoe crab blood has become a multimillion-dollar industry. Direct annual revenue from LAL is estimated at $60 million in the United States.

![Figure 4.1 Bleeding Horseshoe Crabs for LAL Production (Source: Radiolab.org)](image)

In 1977, the FDA began issuing mandatory licenses for LAL production to ensure product quality. This licensing, which has recently become even more stringent, includes an application, sample LAL testing, on-site inspection, and investigation of daily records and operating procedures. Nine biomedical companies

---

212 Economic Assessment of Mid-Atlantic Horseshoe Crab.
213 Ibid.; Hoose, Moonbird: 51.
have been licensed since 1977, but only three remain as major producers (see Figure 4.2). These companies currently provide up to 90 percent of the world’s LAL.  

<table>
<thead>
<tr>
<th>Name</th>
<th>Buyout Ownership</th>
<th>Headquarters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endosafe</td>
<td>Charles River</td>
<td>Wilmington, MA</td>
</tr>
<tr>
<td>BioWhittaker</td>
<td>Cambrex Bio Science until 2006, now Lonza</td>
<td>Walkersville, MD</td>
</tr>
<tr>
<td>Associates of Cape Cod</td>
<td>Seikagaku Corporation</td>
<td>East Falmouth, MA</td>
</tr>
</tbody>
</table>

*Figure 4.2 U.S. Biomedical Companies with LAL Production Licensing*

Horseshoe crabs for LAL production are caught by fishermen under contract to these biomedical companies, who can make up to $1,000 per day in horseshoe crab collection. The crabs are then brought to a bleeding facility and “milked” for roughly one third of their blood (enough to fill a coffee mug). Labs return the crabs within approximately three hours of capture, although there is no data on how often crabs are returned to their collection site. Annually, the pharmaceutical industry requires the blood of over 250,000 horseshoe crabs.

Bleeding can be done without killing, and pharmaceutical companies report mortality at around 3 percent of crabs. However, outside groups have made estimates of up to 30 percent mortality, reflecting deaths associated with collection, transportation, and handling. Additionally, after being bled in a lab, horseshoe crabs need approximately one week to regenerate normal blood volume, and two to three weeks to recover from the bleeding procedure.

---

217 Sargent, *Crab Wars*: 114.
219 Economic Assessment of Mid-Atlantic Horseshoe Crab.
220 Ibid.
221 Hoose, *Moonbird*: 51.
three months to reach normal blood counts.\textsuperscript{222} There is no current system in place to identify a crab that has been bled recently upon capture, so there is no way to prevent a crab from being bled more often than once every three months. Because of these potentially non-negligible mortality rates, pharmaceutical bleeding of horseshoe crabs may be a significant part of the overharvesting problem and population decline.

\textit{Eel and Whelk Fishing Industries}

Fishing industries also have a large stake in horseshoe crabs, which make cheap, available, and highly successful bait. The American eel fishing industry has been using horseshoe crabs as bait since the 1800s. Eel is sold as a delicacy to domestic and international food markets or as bait to attract coveted striped bass\textsuperscript{223} (in which case, put simply, horseshoe crabs are bait for bait). In the last 20 years, the whelk (conch)\textsuperscript{224} fishing industry discovered that horseshoe crab makes excellent bait. Conch is sold as gourmet scungilli to U.S. meat companies or shipped in frozen blocks to Asia. Horseshoe crab is also used as bait in the catfish, minnow, and killifish industries. Estimates indicate that each year the American eel fishing industry creates about $2 million and 70 jobs, and the conch fishing industry creates up to $15 million and 370 jobs.\textsuperscript{225}

Although eel baiting required a steady but low number of horseshoe crabs for much of the twentieth century, this demand exploded in the 1990s when eel markets expanded and the conch industry emerged and rapidly intensified. Now eel prices are

\begin{footnotesize}
\begin{itemize}
  \item \textsuperscript{222} Ibid., 55.
  \item \textsuperscript{223} Kreamer and Michels, “History of Horseshoe Crab Harvest on Delaware Bay,” 308.
  \item \textsuperscript{224} Conch is colloquial term for whelk and similar organisms.
  \item \textsuperscript{225} Manion, West, and Unsworth, \textit{Economic Assessment of the Atlantic Coast Horseshoe Crab Fishery Report to the US Fish and Wildlife Service}.
\end{itemize}
\end{footnotesize}
high, and fishermen find that horseshoe crab is unrivaled as the best bait for potting eel. Because there were originally no restrictions on catching eel or conch (unlike haddock, cod, and other fish), there were no restrictions on catching horseshoe crabs as their bait.

Only recently have scientists and fishermen noticed the sharp decline in horseshoe crab populations. Trawl surveys showed a decline of 88 percent in crabs from 1990 to 2005 (see Figure 4.3). In 2006 and 2007, crab numbers increased to a level similar to that of the late 1990s, but were still at much lower levels than those of the early 1990s. Although crabbers have also noticed this sharp trend in the Delaware Bay horseshoe crab population, they blame the decline on habitat destruction. However, overharvesting is the reason for this decrease in Delaware Bay’s horseshoe crab population. Particularly because of the conch industry boom in the early 1990s, annual horseshoe crab harvests along the Atlantic coast have increased twenty-fold—from 100,000 crabs before the mid 1990s to more than 2 million crabs at the height of overharvest in 1998 (see Figure 4.4).

---

226 Kreamer and Michels, “History of Horseshoe Crab Harvest on Delaware Bay,” 309.
227 Larry Niles at the Shorebird Committee meeting, November 29, 2012.
228 Niles et al., “Effects of Horseshoe Crab Harvest in Delaware Bay on Red Knots.”
Figure 4.3 (left) Standardized survey data for number of adult horseshoe crabs caught in Delaware Bay.\textsuperscript{229}

Figure 4.4 (right) Harvest of horseshoe crabs reported by Mid-Atlantic states. Gray bars represent the estimated harvest. Black bars represent the sum of the harvest reported to the ASMFC by New Jersey, Delaware, Maryland, Virginia, and New York.\textsuperscript{230}

Although regulation now limits Delaware Bay harvest to 600,000 crabs, scientists fear that too much damage has already been caused for horseshoe crabs to be able to sustain even minimal levels of harvesting.

The fishing industries are also the cause of a skewed sex ratio, which is highly detrimental to the reproductive success of horseshoe crabs. Because females are larger, they are preferred as bait: females can bait up to four pots, whereas smaller males can bait only one to two pots. Pregnant females are regarded as especially good bait because their eggs give off chemicals attractive to eels. Where the sex ratio of horseshoe crabs was once one to one, newest estimates have placed this ratio around four to one (male to female).

What does this mean for the future of horseshoe crabs? Even if harvest regulations now minimize the number of crabs taken annually to 600,000, a disproportionate number of lost females will have an even more drastic effect on

\textsuperscript{229} Ibid.
\textsuperscript{230} Ibid.
population regrowth. Evidence of fewer horseshoe crabs – and specifically of even fewer females – can be seen in the density of eggs on Delaware Bay beaches. Current surveys indicate a 90 percent decrease in egg density (see Figure 4.5).²³¹

![Figure 4.5 Estimated density of horseshoe crab eggs (eggs per square meter in the top 5 centimeters of sand) on Delaware Bay beaches.](image)

Because horseshoe crabs take at minimum nine years to become sexually mature and reproduce, recovery will be measured in decades, not years. The problem of drastically fewer crabs, exacerbated by an unfavorable sex ratio, suggests that harvest limitations might not be enough to help crab populations regenerate in time to reverse the decline of migrating shorebirds. Egg densities will rise more slowly than population numbers, and it is these eggs in Delaware Bay that are critical to the survival of red knots.

**Regulatory Implications**

Up to this point, I have discussed shorebird conservation as management of a public good. However, I have yet to define and contextualize public goods within a greater theoretical framework. This matters for horseshoe crabs because their

²³¹ Ibid.
²³² Ibid.
management must be different from that of shorebirds, simply because they are not the same type of good.

**Common-Pool Resource Management**

Goods can be classified into four general groupings: public, private, toll, and common-pool (see Figure 4.6).\(^{233}\) Horseshoe crabs are not private goods because they are not clearly defined by individual property rights. They are not toll goods like highways, the access of which is easily made exclusive with entrance-ramp payment. And in contrast with shorebirds, horseshoe crabs are not a public good – instead, they are a common-pool resource. Although both public goods and common-pool resources suffer from a lack of excludability, common-pool resources also suffer from high subtractability. In other words, while one’s non-consumptive enjoyment of shorebirds does not deplete another’s, an individual’s take of horseshoe crabs will subtract from the resource, affecting everyone who partakes in its consumption.

![Figure 4.6 A General Classification of Goods](image)

This subtractability creates rivalry in consumption, making the resource prone to overdevelopment in the absence of rules or regulations for use. This is the case for horseshoe crabs. Because there is no sufficient limit on horseshoe crab harvesting


\(^{234}\) Ibid.
such that long-term viability – economic or ecological – is ensured, their decline is being driven by overconsumption. This poses the need for proper common-pool resource management.

Resource exploitation of this kind is not a unique or isolated occurrence. Doctrines of common-pool resource management have been shaped by three influential models: Garrett Hardin’s tragedy of the commons, Mancur Olson’s logic of collective action, and the prisoner’s dilemma game. Hardin’s and Olson’s theories exemplify scenarios of diffuse responsibility and free-riding, while the prisoner’s dilemma demonstrates the conflict between individual and group rationality. As understood by these theories, conventional solutions to resource exploitation include privatization and regulation.

Although Ostrom’s work shows that “communities of individuals have relied on institutions resembling neither the state nor the market to govern some resource systems with reasonable degrees of success over large periods of time,” this has not been the situation in Delaware Bay. For the case of horseshoe crabs, harvesting has been anything but sustainable. How then do we best manage this common-pool resource to secure viability for all users? Because bodies of water cannot be divided into separately owned plots, avenues for privatization are complicated in fisheries management. For this reason, management of marine life has fallen to state regulators.

**Atlantic States Marine Fisheries Commission**

The Interstate Commerce Clause, as stated in Article I, Section 8 of the U.S. Constitution, gives Congress the sole authority to regulate commerce between states. Because marine fish “do not adhere to political boundaries”\(^\text{237}\) such as those between states, fisheries management has fallen under Congressional jurisdiction. This authority preempts states from passing laws on interstate issues. Congress has established several commissions to include both state and federal powers in policymaking, recognizing that management of fisheries and other interstate industries is necessarily a collaborative task.

In 1942, Congress created the Atlantic States Marine Fisheries Commission (ASMFC), made up of the 15 Atlantic coast states to serve as a deliberative forum.\(^\text{238}\) The ASMFC coordinates the management and conservation of shared fisheries with a focus on responsible stewardship and sustainable use. In order to encourage stakeholder-resource solutions at the state level, each state has one vote and is represented by members from the state’s legislature and fisheries management agency.\(^\text{239}\)

In 1981, the ASMFC created the Interstate Fisheries Management Program (ISFMP) as the infrastructure for creating species-specific management plans. Building upon existing state, regional, and federal management systems, the ISFMP works to promote cooperative management by working with scientific “species

---


\(^\text{238}\) These states are: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida.

\(^\text{239}\) “About Us.”
technical committees” to determine priorities, develop management plans, make recommendations to management organizations, and monitor compliance. Under the direction of representatives from each member state (now including Washington, DC) as well as the Potomac River Fisheries Commission, National Marine Fisheries Service, and USFWS, the ISFMP coordinates the management and conservation of 22 Atlantic coastal species – including the horseshoe crab.

In 1993, Congress enacted the Atlantic Coastal Fisheries Cooperative Management Act to give “teeth” to the ASMFC. The Act created sanctions for state noncompliance: should a state fail to carry out its responsibilities in an ISFMP, a state-wide moratorium on that species would be issued and enforced by the U.S. Coast Guard.240 The Secretary of Commerce has delegated this decision-making authority to the National Marine Fisheries Service (NMFS), a federal agency of the National Oceanic and Atmospheric Administration.

The high demand for horseshoe crabs in the 1990s, and the relatively new discovery that crabs are in decline, created an urgent need for a sustainable management strategy. In 1998, the Interstate Fishery Management Plan for Horseshoe Crab provided such a strategy. This ISFMP has since been updated with seven addenda, with the most recent implementing a new adaptive multi-species management framework in February of 2012.

Disadvantageous Harvest Paradigms

When it comes to setting harvest restrictions, horseshoe crabs are at a disadvantage. Terrestrial wildlife harvest regulations dictate that a species cannot be harvested until there is evidence that a population *can* withstand harvest – placing the burden of proof on harvesters. However, horseshoe crabs fall under the category of fisheries harvest regulations, which dictate that harvest restrictions will not be set until there is evidence that a population *cannot* withstand harvest – placing the burden of proof on conservationists. This discrepancy between terrestrial and aquatic management reveals a deleterious inconsistency in the legal regime.

The contradictions of who bears the burden of proof are not unique to harvest restrictions. Take the example of the United States chemical industry in the 1970s. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) placed the burden of proof on insecticide production firms, requiring all companies to prove a reasonable level of environmental safety before entering the stream of commerce. In contrast, the Toxic Substances Control Act (TSCA) only required that companies mark their intent. Consequently, this placed the burden of proof on the Environmental Protection Agency (EPA), which was required to issue a testing rule within 90 days. Due to limiting time constraints and informational asymmetries, TSCA was ultimately ineffective. Because FIFRA followed an environmental precautionary principle and placed the burden of proof on industry, it was far more successful than TSCA. The regulatory system fails in cases where environmental protectors, rather than the industry that is possibly causing damage, carry the burden of proof.
Within the harvest regulatory logic of fisheries, conservation agencies fighting either for shorebirds or for horseshoe crabs must be the ones to prove that the fishing and pharmaceutical industries are collecting an unsustainable number of horseshoe crabs. However, many state programs are starved for the funding needed to conduct conclusive studies. In New Jersey, this problem is linked to its Bureau of Marine Fisheries, which is devoid of money because it is one of only three states in the country that still does not require the purchase of a saltwater fishing license.241 Without this stable source of funding that other states have, New Jersey does not collect data, and so there is no data to support the need for harvest restrictions on horseshoe crabs.

This lack of a mandate for the cautionary principle in an ecosystem context is the first broad failure of the state’s regulatory system. This, compounded with the elimination of funding for new species listings under the federal Endangered Species Act, set the stage for New Jersey’s environmentalists as they pushed for a statewide horseshoe crab harvest moratorium in 2008. For the policymakers from nongovernmental organization and the scientists-turned-political-activists of the state agency, the passage of this legislation was one of the “most intense six weeks of [their] professional lives.”242

241 Dey, November 7, 2012.
New Jersey Moratorium

By the time the ASMFC began to implement restrictions in 1998, some states, such as Delaware and Maryland, had already begun implementing their own restrictions. South Carolina set the precedent in 1991 when it was the first state to impose a moratorium on bait harvesting. Even after ASMFC regulations, states continued to create and implement even stronger restrictions. The enactment of New Jersey’s statewide moratorium is a testament to the highly cohesive partnerships formed between public and private organizations discussed in Chapter 3.

In New Jersey, crabs were being harvested at greater numbers than horseshoe crab populations could withstand or existing management systems could enforce. For the shorebird and horseshoe crab conservationists, the most challenging obstacle to instituting a statewide moratorium lay in the decision-making powers of the ASMFC and the New Jersey Marine Fisheries Council. As part of the New Jersey Department of Environmental Protection’s Division of Fish and Wildlife, the Fisheries Council advises the DEP Commissioner on regulations that it “deems necessary for the proper operation of an effective marine fisheries program.” In perhaps its greatest exercise of power, the Fisheries Council can disapprove any rule, regulation, or amendment proposed by the DEP Commissioner. For horseshoe crabs, a contentious natural resource critical for both industry and conservation, the Fisheries Council is itself dominated by commercial fishing interests; it is made up of four sports fishermen, two commercial fishermen, one fish processor, two members of the general public, and the chairman of the Shellfisheries Council. There is no place in this decision-

243 Niles et al., “Effects of Horseshoe Crab Harvest in Delaware Bay on Red Knots.”
making process that includes a voice for either the pharmaceutical industry or the public trust by means of conservation.

In 2008, the New Jersey Audubon Society and the New Jersey Endangered and Nongame Species Program developed moratorium legislation and crafted a strategy to make it politically viable. Larry Niles and Amanda Dey, in rare roles for biologists, helped edit the legislation and set concrete population targets. New Jersey Audubon served as the lobbying arm for this effort, communicating with then-Governor John Corzine and the DEP Commissioner. New Jersey Audubon was also able to arrange the approval for Dey to work with legislators as a state employee. Joined by the American Littoral Society and Delaware Riverkeeper, these groups arranged the introduction of this legislation.

Although the Fisheries Commission had struck down similar proposals during the last 25 years, these groups were persistent. Thanks to work done by the International Shorebird Team, there was now a solid database of scientific research to support the proposal for a moratorium. At the first hearing of the New Jersey State Legislature’s Agriculture and Natural Resource Commission, fisheries industry lobbyists testified and strategically excerpted research on horseshoe crab population from only the last five years. Since the 2006 ASMFC harvest limits, crab population has leveled out, and data from the last five years makes crab levels appear relatively stable. However, horseshoe crab populations have not returned to sustainable pre-1990s levels, from before shorebird populations plummeted.

In the next hearing with the New Jersey State Senate Committee, Dey took the stand. She presented numerous graphs properly tracing horseshoe crab populations
back to their pre-1990s levels – exponentially higher than those of the present day.

“And by the way,” she closed, “if anyone shows you data that does not go back this far, they are deliberately lying to you.” Next it was time for the Fisheries Commission to make its testimony. “Are there any materials you would like to share with the committee?” But Dey’s testimony had taken the wind from their sails. After 25 years of failed proposals, with a majority vote in the legislature and a signature from Governor Corzine, the New Jersey horseshoe crab harvest moratorium was enacted.

*State Discrepancies in Horseshoe Crab Conservation*

Although the restrictions implemented by the ASMFC are uniform for the entire Atlantic coast, the challenges caused by the fishing and pharmaceutical industries, as well as the political landscape of conservation efforts, differs greatly by state. For example, while Delaware Bay horseshoe crabs are harvested from both New Jersey and Delaware shores, New Jersey’s fishery was substantially larger and older; therefore, the most immediate conservation action was needed there first.\(^\text{245}\)

With this urgency in mind, New Jersey was able to enact some aggressive horseshoe crab harvest restrictions. However, in lieu of the urgency, advocacy, and mobilization experienced on the New Jersey side, Delaware has fewer and less stringent restrictions. Even if New Jersey’s harvest moratorium can protect its side of the Bay’s horseshoe crabs, fishermen can easily travel to the Delaware side of the Bay to satisfy the same harvest quotas.

To make matters more complicated, because horseshoe crabs are migratory – breeding on New Jersey and Delaware shores but wintering off the coasts of Maryland and Virginia – the common pool resource problem is further complicated. While state regulations may be sufficient to remedy horseshoe crab decline in New Jersey, none of this applies when the crabs travel to Virginia. Without unified and aggressive efforts by all states home to Delaware Bay horseshoe crabs, the valiant efforts of even several states are in vain. The complexity of the problem increases with the realization that, even if regulation is sufficient in the four states bordering Delaware Bay, this will have negative effects for horseshoe crabs elsewhere: fishermen coast-wide will turn to other, smaller populations of horseshoe crabs and decimate them. Examples of this are the “economically extinct” Massachusetts coast population, from which it is now not even profitable to try and catch horseshoe crabs,246 and the drastically increased harvests in Virginia, Pennsylvania, and Florida as a result of Delaware Bay restrictions.247

As for the biomedical harvest of horseshoe crabs, it is estimated that nearly all of the world’s LAL comes from the United States’ Atlantic coast – the majority of which is from Delaware Bay horseshoe crabs. However, neither New Jersey nor Delaware see a piece of this multimillion-dollar industry, and thus have no commercial interest in their conservation. Consequently, the out-of-state biomedical companies benefitting from horseshoe crab business have no obligation in the conservation decisions (and sacrifices) these Delaware Bay states must make in order to save horseshoe crabs.

246 Dey, November 7, 2012.
247 “Horseshoe Crab; Interstate Fishery Management Plans.”
In light of the new information of a skewed horseshoe crab sex ratio, conservation biologists have been able to strike what they consider a “devil’s bargain” with the fishing industries: in exchange for halting the harvest of female horseshoe crabs, harvests of male crabs will now increase. However, scientists fear that this will also have severe consequences. And with female horseshoe crabs currently selling for $5-6 each, illegal take is expected to be high.248

---

248 Dey, November 7, 2012.
The role of this thesis so far has been to provide a more fine-grained understanding of the politics of shorebird conservation, demonstrating how these issues are worked out on a day-to-day basis by groups without sufficient funding or organizational resources in a disjointed regulatory system. This final chapter is dedicated to possible avenues for improving this system, whether it is through horseshoe crab management or a reform in shorebird conservation itself.

In conclusion, I describe the current restoration efforts to combat the effects of Hurricane Sandy and contextualize this within the greater governance framework explained in previous chapters. Against the odds, Delaware Bay shorebird conservationists have managed to navigate bureaucratic structures and obtain the funding needed to replenish horseshoe crab spawning beaches. Because of their rapid and painstaking efforts, we may see another spring shorebird migration after all.

**Improving Horseshoe Crab Management**

Although the 1998 horseshoe crab ISFMP created a formal regulatory mechanism to secure the viability of Delaware Bay horseshoe crabs, the drastic decline of crab numbers in trawl and beach surveys over the last 15 years indicates that this program is insufficient. In order to ensure that horseshoe crabs will be available and plentiful for the benefit of shorebirds, fishing industries, and biomedical companies, more rigorous restrictions and innovative solutions are needed.
**Fishing Harvest Moratorium and Adaptive Resource Management**

With fisheries industry harvest numbers exponentially greater than those estimated of biomedical take – 18,000 annual horseshoe crab pharmaceutical mortalities compared to 600,000 for bait\textsuperscript{249} – the fishing industries are the largest contributor to horseshoe crab decline. Because it takes 10 years for crabs to reach sexual maturity, even immediate conservation action will be slow. Fishermen looking for the best bait take the largest crabs, therefore specifically decimate sexually mature adult crabs. As a new group of crabs matures each year, they become the largest crabs and are harvested systematically for their size. If restrictions are kept at current levels, harvesting will continue to inhibit recovery of pre-1990s population levels. A 10-year moratorium will allow crabs just being born to reach sexual maturity in numbers undiminished by harvesting. This will not only have a direct impact on horseshoe crab numbers, but will also exponentially increase egg density during spawning on Delaware Bay beaches.

In light of the possibility of red knots and other shorebirds facing extinction within the next 10 years, the need for aggressive horseshoe crab conservation action is urgent. Although it is controversial, a 10-year moratorium on fishing industry harvest is of immediate necessity for these shorebirds to even stand a chance. Conservationists have argued that the moratorium is necessary for the fishing industries themselves, as horseshoe crabs are being depleted to unsustainable and economically-nonviable levels. However, a *permanent* moratorium, these scientists offer, is not necessary – if after 10 years the population of horseshoe crabs has been

\textsuperscript{249} Jim Berkson and Elizabeth A. Walls, “Effects of blood extraction on horseshoe crabs (Limulus polyphemus),” *Fishery Bulletin* 101, no. 2 (2003).
given a chance to regenerate, controlled harvests with more restrictive limits would be acceptable.

In order to identify exactly what level of harvesting is sustainable, an addendum to incorporate an Adaptive Resource Management (ARM) framework was added to the horseshoe crab IFMP in February of 2012. Using collaborative data by the Atlantic States Marine Fisheries Commission, the U.S. Fish and Wildlife Service, the U.S. Geological Survey, and four state agencies, the ARM framework is designed to inform horseshoe crab management decisions with regard to multiple species, including the red knot. The model relies on data from Delaware Bay and “will base harvest quotas on biological measures, not historic or political quotas.”

By incorporating uncertainty and adapting to new information, the ARM framework’s predictive modeling can preemptively assess the consequences of different management strategies. This system advises the implementation of these strategies and provides a framework for evaluation to improve future management. Most importantly, while also incorporating stakeholder needs, this ARM framework includes the needs of other species, like shorebirds, in order to predict the ecologically optimal and sustainable strategy for horseshoe crab bait harvest.

Some have asked about the potential to save shorebirds without horseshoe crab eggs. Could shorebirds make weight for their Arctic migration by feeding on different eggs, like fish eggs? What if fish eggs were laid out on shorebird beaches at the same time of year and in the same capacity as horseshoe crab eggs?

Unfortunately, this strategy is simply impractical. The logistics of where (and with

---

250 Minutes from the Shorebird Committee meeting on November 29, 2012.
what funding) to get fish eggs in such high densities aside, the task of actually laying out all these eggs on beaches is nearly impossible – if not laid out at the right time, gulls will have a feeding frenzy before shorebirds see any of it. And there are unpredictable environmental problems with attempting to replace a keystone species and redistributing fish eggs instead at such a high level.

Scientists at Rutgers University are trying to enhance horseshoe crab populations by growing them in labs. These scientists also have investigated the possibility of creating fake horseshoe crab bait. They are working to develop an alternative that would use only a fraction of real horseshoe crab, but would be equally appealing to eel and conch. This could appease the fishing industry while placing significantly less strain on the population of horseshoe crabs.

Finally, many have suggested that management and conservation of horseshoe crabs, and even of shorebirds, should be funded by the fishing industries. This has begun on at least a small scale: for the last two years the commercial fishing industry has made contributions for horseshoe crab trawl surveying. In 2011, the survey was funded by commercial fishing with a matching grant from the National Fish and Wildlife Foundation. In June of 2012, Chesapeake Bay Packing, LLC and Bernie’s Conchs, LLC of the horseshoe crab and conch industry pledged $10,000 for the trawl survey. However, privately funded research runs the risk of commercial interest seeping into data-driven policy decisions.

From a regulatory governance standpoint, an institutional change may help remedy the overharvest problem. In following with an environmental precautionary principle, the harvest paradigm should be altered such that the burden of proof is on
fisheries. Requiring these industries to prove that harvest will not harm horseshoe crab populations – instead of having scientists scramble to demonstrate that overharvest does cause excessive damage in order to impose restrictions – will make the regulation process more stringent in its initial stages. Horseshoe crab harvest regulators may be more confident in allowing certain levels of harvest. This, in combination with the science-based ARM framework for setting specific restrictions, will create a more holistic and conservative regulatory system.

Potential Steps Backward for New Jersey

Currently, because state quotas control the commercial bait fishery, New Jersey already has a complete moratorium on horseshoe crab harvesting for fishing purposes. However, on January 17 of 2013, state Senator Jeff Van Drew (D-Cape May, Cumberland) and Assemblyman Nelson Albano introduced a bill that would overturn this moratorium, and give authority to the ASMFC to set harvest quotas. This bill has been heavily criticized by both environmentalists and the biomedical industry for being poorly timed and highly detrimental. Allegedly representing the some 40 part-time conch fishermen who have been negatively affected by the moratorium, Van Drew and Albano aim to help the local seafood industry by allowing a “desperately needed source of bait.” To get around the requirement for demonstrable increase in the crab population in order to legally lift the moratorium,


this new bill would simply repeal the previous legislation. Horseshoe crab conservationists are particularly aggrieved because this comes in the wake of Hurricane Sandy, which destroyed more than half of Delaware Bay’s horseshoe crab spawning beaches.255

**Reinventing Pharmaceutical Practice and Involvement**

Although it is a common misconception, shorebird conservationists are actually not against pharmaceutical bleeding of horseshoe crabs. Quite the opposite, these conservationists also understand this as a public health issue, and believe that this industry has the potential to be sustainable. However, bleeding of these crabs is only sustainable with a large, healthy population, and only if bleeding does not result in high levels of mortality. In accord with the 1998 ASMFC mandate, all companies must estimate horseshoe crab mortality rates resulting from their bleeding process. However, comparisons between companies or against a standard are inaccurate because estimates are self-reported. Furthermore, each company maintains its own unique procedures for harvest, extraction, and release.

Several changes could be made to improve pharmaceutical practices for horseshoe crabs. Moving labs to locations more local to horseshoe crab habitat would help the economies of areas responsible for horseshoe crab protection. Not one of the five LAL-producing biomedical companies is located in either New Jersey or Delaware. In producing more than 90 percent of the world’s LAL, these companies each annually contribute $22-33 million and create up to 200 jobs in their local

---

255 “Horseshoe crabs / Keep moratorium.”
Additionally, localizing these labs will shorten transit time for crabs out of water. Because transportation to and from the bleeding lab puts great strain on horseshoe crabs, this change could greatly reduce mortality. Bleeding conditions for crabs could also be improved with extraction of less blood. As mentioned previously, at current amounts of extraction it takes approximately one week for a crab’s blood to regenerate to normal levels, and several months for its blood counts to be restored.

Another option is finding a non-horseshoe crab alternative to LAL. Although no substitute currently exists, Lonza is working to create a PyroGene protein for endotoxin detection that does not rely on the use of horseshoe crab blood. In 2009, the FDA approved a final release test for PyroGene. Although such alternatives have not yet made it to the market, advancing this research may have fruitful outcomes that will benefit both crabs and people.

Conservationists have criticized the pharmaceutical industry for its lack of transparency. Without this, there is no way for the industry to be held accountable for horseshoe crab use. The creation of a conservationist-pharmaceutical interface would increase transparency and create a forum for conservationists to make suggestions for better management. Additionally, there is the prospect of instituting mandatory pharmaceutical funding of horseshoe crab conservation, such that the industry pays to ensure the viability of the common-pool resource on which it depends. This precedent has already been set, such as biomedical companies’ $100,000 contribution to the

---

256 Manion, West, and Unsworth, *Economic Assessment of the Atlantic Coast Horseshoe Crab Fishery Report to the US Fish and Wildlife Service.*

horseshoe crab survey in January of 2011. Further financial support from the pharmaceutical industry has the potential to be highly beneficial.

**Consequences of Coalition**

In discussing alternatives to the current status quo of horseshoe crab users, it is worthwhile to consider the possible consequences of a coalition between the pharmaceutical industry and the conservationists. It is certainly not unusual for commercial and environmental interests to pursue a common set of goals that are mutually beneficial. In the fight for this coveted resource, conservationists may be able to ride the coattails of pharmaceutical interests – which should soon realize that advocating for moratoriums on fishing industry harvest is the only way to preserve pharmaceutical access to crabs. A venture that includes both the conservationist plea to prevent crab decline for ecological preservation and a pharmaceutical appeal to ensure resource viability for commercial use will almost certainly be more successful than that of the conservationists alone.

This arrangement has been referred to before as a Baptist-bootlegger coalition. This scenario describes bootleg alcohol vendors who benefit from laws against liquor sales on Sundays, which are lobbied for by Baptists. Both the bootleggers and the Baptists gain from this regulation, and starkly different goals are achieved through mutual interest. However, the capacity in which the goals are

---

258 Tina Berger, “Biomedical Companies Pledge Over $100,000 to Continue Horseshoe Crab Survey,” (Atlantic States Marine Fisheries Commission, 2011).
achieved for one side may be minimal at best, and with longer-lasting negative consequences than can be realized upfront.

Particularly for environmental goals, in which negative externalities are easily uncounted, coalitions may produce minimal benefits at best. Take, for example, the acid rain provisions of the Clean Air Act of 1977. In this act, the installation of cleaning scrubbers was required in place of actually setting stricter coal quality standards. As a result, the market for dirty coal is preserved in the interests of eastern mining business and labor unions. This example shows that we must be wary of the negative impacts of Baptist-bootlegger coalitions. Seemingly equal environmental protection driven by non-environmental interests may not be equal at all, and may actually demand the introduction of further regulations.

But there is certainly room for cooperation to further the commercial interests of one side and broaden the environmental interests of another, with real benefits for both sides. For horseshoe crabs, cooperation of this kind between the pharmaceutical industry and shorebird conservationists may be essential to make any kind of regulatory progress; however, we must be vigilant to make sure that the interests of the red knot are not sacrificed to the commercial interests of industry.

**Additional Strategies**

A variety of non-pharmaceutical and non-fishing industry solutions have been posed as additional ways to help restore horseshoe crab and shorebird populations in Delaware Bay. Public awareness has become an issue of great concern. Beach communities even have come to believe that “the only good crab is a dead crab” and
put a bounty on horseshoe crabs – with wrenched-off crab tails receiving a one cent reward from shellfish wardens.\textsuperscript{260} Now there are organizations like the Ecological Research and Development Group (ERDG), which has been supporting conservation through cultural appreciation for horseshoe crabs since 1995.\textsuperscript{261} ERDG is also responsible for the Flip a Crab program, which encourages beachgoers to right upturned crabs when they can, saving the crab’s underbelly from hungry gulls.

Various media sources stressing the critical relationship between horseshoe crabs and shorebirds have become available for public consumption as well. \textit{Life Along the Delaware Bay: Cape May, Gateway to a Million Shorebirds} is the scientists’ personal attempt at public outreach, presenting and explaining the plight of shorebirds among a wash of beautiful photography.\textsuperscript{262} A similar strategy is employed in Phillip Hoose’s \textit{Moonbird: A Year on the Wind with the Great Survivor B95}, in which the story of a single red knot – the incredible B95, originally banded in 1995 and most recently recaptured in July 2012 – encapsulates the greater scientific and political narrative.\textsuperscript{263} Allison Argo’s documentary, \textit{Crash: A Tale of Two Species}, explores the world of shorebird conservation in Delaware Bay and features anecdotal interviews with key individuals like Amanda Dey and Larry Niles.

Another way to raise public awareness has simply been to involve volunteers in shorebird resighting surveys or banding projects. This has been extremely effective for creating personal investment with the fate of red knots and other birds. Jokingly, conservationists have speculated about the likely success of having a New Jersey

\textsuperscript{260} Sargent, \textit{Crab Wars}: 9.
\textsuperscript{262} Niles, Burger, and Dey, \textit{Life Along the Delaware Bay}.
\textsuperscript{263} Hoose, \textit{Moonbird}.
Governor’s children participate in shorebird banding – it certainly would not hurt the shorebird cause if a political figure developed a vicarious passion for endangered species conservation.

**SHOREBIRD CONSERVATION REFORM**

As discussed in Chapter 3, the current institutional arrangement and levels of funding do not provide an adequate solution to the challenges facing red knots and other migratory shorebirds. The groups that are succeeding in individual projects are not reaching the overall goal of reversing shorebird decline. There is a clear need for different strategies to deal with these obstacles. This poses the question: what avenues are available for reform? Conceptually, there are two main approaches: stabilize funding, or change the institutional architecture of conservation policy. Either the government can fund this public good, or the public good can be turned into a toll good with excludability. These options are not mutually exclusive, and the solution may lie in either strategy or a combination of the two. The following proposed changes reflect a combination of the insights of several key experts and the research presented in previous chapters.

The first option is to create a more permanent source of financial support for shorebird conservation. It is clear that the state agencies and even nongovernmental organizations directly involved with shorebird conservation need a more stable source of funding. In the first part of this section, I discuss the potential benefits of federal sourcing, including the maximization of efficiency, the creation of regional

---

264 Niles, March 25, 2013.
connectivity, and the increase of research objectivity. This is followed by a discussion of the drawbacks to increased federal funding, such as the risk of politicization.

The second option is changing the institutional architecture of conservation policy. This would involve altering the actual framework and policymaking instruments for nongame species protection. Learning from and adapting the game species management system, users of nongame species can either unite with sportsmen or develop independent models to create conservation funding and power, thereby addressing the public goods problem.

I conclude this section with a cautionary note about network formalization, returning once again to the unique and indispensible role that ad hoc partnerships have played in shorebird conservation.

**Stabilize Funding**

There is good justification for increased funding, in part because current limitations in financial resources forces these conservation groups to engage in defensive tactics: they must fundraise to stay operational, and thus compete for the same grants. First, a stable and reliable source of funding would maximize the productivity of the Delaware Bay conservation community by allowing these groups to focus on research and projects instead of fundraising. Currently, groups must spend a great deal of time and human capital seeking out unreliable, piecemeal sources to even meet operating budgets. Because ENSP is forced to fundraise as if it were a nonprofit organization, a more stable financial source would create the opportunity
for this state agency to concentrate its efforts on monitoring shorebird populations and implementing projects.

A second problem is that to receive this funding to stay operational, these groups must inadvertently compete against each other for the same pool of grants. This is a criticism of both the grant-making and grant-awarding private foundations, as well as the limited federal resources available. Currently, a unified source does not fund Delaware Bay shorebird conservation. In this system, there is no single entity that can delegate grants to ensure a sufficient breadth of projects. Often, a foundation will fund one group’s project while a different foundation awards another group a grant to do very similar work. Many projects are left underfunded or are funded as pilots for only the first several years. Although the ad hoc network of groups has created a specialization of functions, there is no such coordinated delineation at the grant-making level. The urgency of Hurricane Sandy has helped facilitate this consolidation, such as with the New Jersey Recovery Fund, but such a system has not been formally institutionalized. It is only in the groups’ collaborative networking that redundant grants do not create redundant conservation work.

This is the first strong case for a long-term, permanent, dedicated source of specifically federal funding. Such a fund presents an opportunity to create local connectivity at the initial phase of creating and awarding grants. For instance, to ensure that advocacy, research, and public outreach all are incorporated into the overall strategy of shorebird conservation, separate federal grants under the same administrative agency could be awarded for each task. Roles could be delegated even before they reach the ad hoc networking stage, and this would maximize the
efficiency of these groups’ collective work. This would decrease redundancy in the types of grants that are offered and thus further decrease duplication in research and conservation.

This federal “delegation” of grants has the potential to be reconfigured so that it funds efforts at a regional level. This coordinative function is in line with what broad, formal coalitions like NABCI and PIF have attempted to do. However, instead of merely laying out a framework for coordination, consolidated federal funding would create the framework and financially support this coordination. The existing State Wildlife Grant program provides such a framework by outlining regional goals and inviting states to meet these goals by way of their own prioritization systems. However, for shorebird conservation, SWGs are not enough to promote this kind of cohesion. Regional connectivity must be created by a stronger source of federal wildlife conservation financing.

Another benefit of a federal source of financial support would be increasing the objectivity of research. Because there is little public funding available, the majority of the money being applied to shorebird science and research is private. Because it subsists on these sources, this research is not invulnerable to commercial interest. Although it is no surprise that industry funds its own research, a risk for shorebird science is that this “commercial research” can easily dominate the field and dictate policy decisions.

This problem is aggravated when commercial interests are at odds with conservation goals, such as the reduction or moratorium on horseshoe crab harvesting. In this situation, industry can create alternative hypotheses to challenge
conservationist science, forcing conservation groups to conduct confirmative research. When this happens, ENSP must spend what little funding it has on research to reconfirm what is already known in order to satisfactorily negate these industry alternatives. For instance, research money from horseshoe crab fishermen has been put toward demonstrating a variety of claims in studies done by Virginia Technical University: there is no decline in horseshoe crabs, there are plenty of eggs but shorebirds are ignoring them, and birds are not making weight because of late arrival to Delaware Bay (not fewer crab eggs). In the period of time it took to complete the extra work to prove these alternative theories wrong, “half the red knot population was lost.”

However, growing partisan polarization in Congress has politicized the kind of conservation initiatives that were once supported by a broad bipartisan coalition. Allocating greater federal resources toward shorebirds may aggravate other fields of conservation and create divisiveness. The process of trying to create this stable source through the legislature might actually further hinder conservation progress. Moreover, given the high salience of budget deficits and the pressure currently placed on discretionary spending, federal funding no longer equates to stability.

The Shorebird Fund, which is quickly being depleted, is an example of a key conservation tool that would greatly benefit from a stable source of funding. Although the New Jersey Natural Lands Trust is eligible for matching grants, it needs to be able to leverage other funding to be appealing to grant-makers. However, the risk of politicization and the lack of federal stability suggest that a private source might better serve the Fund. As an alternative, utilizing the wetlands mitigation

\[265\] Ibid.
permitting process could create this stable source. Without involving the legislature, permit writers can follow the precedent set by Public Service Electric and Gas and use the Shorebird Fund as a creative way to address wetlands mitigation, instead of writing checks to the $10 million wetlands mitigation fund – an amount “no one knows quite what to do with.”266 There only needs to be a more institutionalized way of networking to let permitters know about the Fund. An example of this is the role played by Conservation Resources Inc., a financial intermediary organization that considers a broad scope of conservation priorities when distributing grants through its Conservation Exchange program.

**Change the Institutional Architecture of Policy**

An alternate avenue for shorebird conservation reform is changing the institutional architecture or instruments of nongame species conservation policy. For this purpose, the game species management model has set a useful precedent. There are two options for institutional reform: unify game and nongame efforts so that game species can more adequately fund less-lucrative nongame species, or create a new mechanism by which nongame species fund themselves.

The first approach understands that hunters serve as a strong voice for game species management and have direct access to the game wildlife agency by ultimately funding the program’s work. Furthermore, they are united by several membership organizations like Ducks Unlimited, which have an enormous amount of political influence over legislators. The unification of game and nongame would be an effort to resolve the lack of a constituent base for shorebirds, caused by non-consumptive

---

users of a “free” public good. This strategy could materialize in redistribution of existing federal grants derived from funding sources like the Pittman-Robertson Act and duck stamps, the creation of a comprehensive wildlife use license, or a transfer of management responsibility to a wildlife agency that represents both game and nongame interests. It may be as simple as creating a sense of allegiance, as with the upcoming inaugural New Jersey Wildlife and Conservation Conference, hosted April by the New Jersey State Federation of Sportsmen, the Conserve Wildlife Foundation of New Jersey, and the New Jersey Division of Fish and Wildlife. If the solution lies in the development of new systems born out of a better union of users, a nongame alliance with hunting and fishing constituencies is worth consideration.

The second option is to eliminate the free rider problem by creating excludability in “consumption” of nongame wildlife. Instead of merely throwing funding at a public goods problem, it may be most effective to turn the public good into a toll good, characterized still by low subtractability but now also by high excludability. As with any public good problem, birders do not have to pay to enjoy wildlife. The creation of an obligatory pass could require outdoor recreationists and wildlife watchers to pay a small fee to access publicly held lands. Taken a step further, land held by private conservation groups could be incorporated into this system, creating a single pass for entrance to all public and nonprofit-owned lands. This changes the nature of the public good. The combination of wildlife watching with land rights creates what is essentially a toll good. Birding would still be characterized by low subtractability, but would now be excludable through land
access – creating a stable stream of financial resources for nongame species conservation.

Additionally, this may create a constituent base for nongame species: birders would likely be more invested in the wildlife agencies that now collect their money. This model of consumer investment – both financial and otherwise – is what has made game species management so successful. In other words, it probably matters much more to an individual if species that he has paid even a small amount of money to see are becoming extinct. Fortunately, this constituency may already exist: of the 8 million people in the state of New Jersey, almost 2 million identify themselves as non-consumptive wildlife users. This method of institutional change overcomes the public good problem and eliminates the need for a nongame partnership with game species.

It is worth noting that there are partisan routes in the game/nongame species conservation dichotomy. Sportsmen are largely conservative. With skepticism of consolidated government to manage their game species, sportsmen have themselves created the best government system for managing wildlife. They maintain this with a stable source of funding through taxes, permits, and firearms. In contrast, birders and other non-consumptive wildlife users tend to be more liberal. Unlike conservatives, liberals have been content to let the government intervene – including on issues of environmental protection. Instead, by the avenue of institutional change for conservation reform, birders could follow the model set by game species management. By creating excludability and putting a price on this otherwise free public good, birders could create their own source of funding using free market
forces. With this strategy, nongame and endangered species conservation could be financed without politicization or uncertainty.

**Retain Informality**

As a cautionary note, regardless of which avenue is taken to reform shorebird conservation, it is necessary to address the option of formalization of the ad hoc coalitions in New Jersey. Speculation exists as to whether or not cementing these partnerships – such as with written contracts by Memorandum of Agreement or through some form of state or federal mandate – could help stabilize and reinforce the policymaking and funding resources available to these conservation groups.

During the interviews I conducted for this thesis, key leaders of these organizations were asked if they wished to formalize these coalitions. The resounding response was negative. The general belief was that greater formalization could be counter-productive. Eric Stiles, President of the New Jersey Audubon Society, remarked that informal systems are more responsive and adaptive:

“When you formalize things, you tend to drag them down into inertia. This community of conservation organizations operates like a super organism, and the informality of its structure allows for creativity, entrepreneurialism, and greater flexibility in the fabric of its collaboration.”

Given this Byzantine network of conservation groups in Delaware Bay, what makes shorebird conservation successful is this fluid governance system. With unexpected cohesion, these organizations work to coordinate and allocate responsibility by forming joint ventures, sharing information, and specializing. These connections oftentimes go beyond organizational charts. Networks are reinforced by

---

friendships, kinships, long term associations, social capital, trust, and informal modes of communication that facilitate collaboration.

If this system engages in more consolidation of groups through formalization, the benefits of this fluid universe of small groups may be lost. Regardless of the strategies employed, any avenues of conservation reform should herald this anomaly. If nothing else, it is thanks to this ad hoc collaboration alone that massive shorebird extinction has been staved off thus far.

**IMPACT OF HURRICANE SANDY**

When I first began work on this thesis, my intent was to analyze the governance structures that exist for shorebird protection and to document the uphill battle of these conservationists. Despite the inevitable depletion of the Shorebird Fund and the prospect of losing certain species within the next 10 years, there was little reason for shorebird conservation to take prominence in the minds of outside policymakers. I had intended to look at shorebird conservation as a somewhat stagnant system fueled only by the passion of networked groups.

But late October of 2012 offered a pivotal catalyst for shorebird conservation. As Hurricane Sandy decimated much of New Jersey’s coastline, human interests became aligned with shorebird needs. For New Jersey residents, the wreckage destroyed homes and livelihoods. For shorebirds, the storm decimated critical horseshoe crab spawning beaches. Sand had been lifted and deposited 20 to 50 yards inland, unveiling rubble and a muddy marsh mat in its place.²⁶⁸ A baywide aerial

---

²⁶⁸ Minutes from the New Jersey Natural Lands Trust Board meeting on February 22, 2013.
survey conducted by a team of shorebird and coastal geomorphology experts indicated an estimated 70 percent decrease in optimal habitat for horseshoe crab spawning and 20 percent decrease in suitable and less suitable habitat.\textsuperscript{269} In this damaged condition, these beaches would be unusable by crabs and shorebirds come spring.

Although the destruction of horseshoe crab spawning beaches in Delaware Bay put shorebirds at immediate risk of extinction, this crisis also provided the single greatest opportunity for their salvation: “this [could be] either the worst thing or the best thing that has happened to shorebirds.”\textsuperscript{270} Fortunately, many billions of dollars have been made available by Congress and the President to help restore New Jersey, including its environment.\textsuperscript{271} After several decades of fighting for political salience, conservation groups now had an opportunity to raise funds and awareness for shorebirds by way of Sandy-related beach restoration. The conservationists only needed to be swift in taking advantage of the opportunity.

After a flurry of emails and conference calls, mobilization began with a Shorebird Committee meeting including more than a dozen nonprofit and government agencies on November 29, 2012. They met and together walked the shorebird beaches to inspect damage and hear from the experts who had conducted beach surveys. They discussed the possible options for restoration, established priorities, set timetables, and delegated tasks. Their goal was to remove rubble and replace sand before horseshoe crab season in May, not six months away. Middle Township in Cape May

\textsuperscript{270} Shorebird Committee conference call, November 21, 2012.
County, where this critical shorebird habitat is located, had already made the necessary initial submissions to the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers. However, the shorebird conservationists knew that funding for these projects was needed immediately.\footnote{Minutes from the New Jersey Natural Lands Trust Board meeting on February 22, 2013.}

Although the New Jersey Natural Lands Trust noted at its September 2012 board meeting that the Shorebird Fund is rapidly depleting, “the Trust need[ed] to take whatever immediate action it [could] to ensure the protection of globally imperiled species before there is nothing left to protect.”\footnote{Ibid.} At the Trust’s February 2013 board meeting, an additional $25,000 from the Shorebird Fund was granted to the Conserve Wildlife Foundation to directly finance contractors or to serve as a match for grants from outside funds.

And thankfully, because of Hurricane Sandy’s tremendous impact on New Jersey, matching aid grants have been in strong supply. The shorebird beach restoration effort is now being funded by a federal grant of $415,000 from the National Fish and Wildlife Foundation, a grant of $515,000 from the New Jersey Recovery Fund (created by a consortium of private foundations and administered by the Community Foundation of NJ), and several smaller grants from other foundations and organizations.\footnote{“Christie Administration and Partners Work to Restore Delaware Bay Beaches Eroded by Sandy to Help Red Knots and Other Shorebirds During Upcoming Migration,” ed. New Jersey Department of Environmental Protection (Trenton, 2013).}

Currently, conservation groups are using this funding to remove rubble from the beach and intertidal zone and to truck in sand to recreate the shoreline conditions needed by both crabs and birds. They are also using these funds for a variety of other...
projects. An artificial oyster reef will lessen the intensity of waves hitting the shore, which will help horseshoe crab spawning. Shorebird-viewing platforms will encourage public access and increase awareness, education, and appreciation. Seasonally employed shorebird and crab stewards will reduce human impacts and interact with the public. A social marketing campaign will spread understanding of the economic value of shorebirds. Funding available through the New Jersey Department of Environmental Protection for acquisition of properties damaged by storms will help turn dilapidated beach houses into usable shorebird habitat. The conservationists are also filming a documentary of the restoration project itself, designed to show the connection between post-Sandy shorebird conservation efforts and the restoration of New Jersey beach communities.

As of early April of 2013, several beaches have already been successfully restored (see Figures 5.1-5.2). Where once were pilings, concrete, mud, and only dismal prospect of horseshoe crab spawning, there is now clean, fine-grain sand and hope for the future. Thanks to the swift work of dedicated conservation groups, red knots now stand a chance at surviving their migration this spring.

---

275 For more information on the Green Acres Program, please see http://www.nj.gov/dep/greenacres/
276 “Recommendation on CWF Proposal: Restoring NJ Beaches For Shorebird And Horseshoe Crabs.”
Figure 5.1 Kimbles Beach after Hurricane Sandy, November 2012 (Source: Larry Niles)

Figure 5.2 Kimbles Beach after restoration, April 2013 (Source: Larry Niles)
CONCLUSION: PREVENTING SHOREBIRD EXTINCTION

The rapid restoration projects after Hurricane Sandy serve as a microcosm of the overall effort to save shorebirds from extinction, demonstrating why the political aspect of conservation cannot be discounted. Limitations in the current institutional architecture of federal statutes and public regulators, compounded by the difficulty of funding nongame species management, have made shorebird conservation a challenge. The decline of shorebird species is not a problem of insufficient scientific understanding or incapable technology; it is a problem of political and financial barriers to conservation.

Despite these disadvantageous governance systems, environmental agencies and organizations in Delaware Bay have formed unique partnerships in the conservation of shorebirds. These adaptable, informal networks of ad hoc collaboration have made significant progress in protecting shorebirds and horseshoe crabs. In lieu of reform options like stabilizing funding or changing the institutional structure of nongame species management, the work of these conservation partners is invaluable. It is with passion and commitment that these groups have defeated the odds and made the preservation of shorebirds possible – that under their watch, the red knot will not be lost forever.
Bibliography


Berger, Tina. “Biomedical Companies Pledge over $100,000 to Continue Horseshoe Crab Survey.” Atlantic States Marine Fisheries Commission, 2011.


Economic Assessment of Mid-Atlantic Horseshoe Crab and Dependent Fisheries Including a Qualitative Discussion of the Potential Effects of Addendum IV. Cambridge, MA: Industrial Economics, Incorporated, 2008.


Myers, J. P. “Sex and Gluttony on Delaware Bay.” Natural History (1986), 68.


