



# National Fish and Wildlife Foundation

Atlantic Flyway Shorebird Business Plan

October 2018

## Purpose of a Business Plan

The purpose of a NFWF business plan is to provide a concise blueprint of the strategies and resources required to achieve the desired conservation outcomes. The strategies discussed in this plan do not represent solely the foundation's view of the actions necessary to achieve the identified conservation goals, but instead reflect the majority view of the many federal, state, academic, and organizational experts that developed the broader Atlantic Flyway Shorebird Initiative plan upon which this NFWF plan is based. This plan is not meant to duplicate ongoing efforts but rather to invest in areas where gaps might exist so as to support the efforts of the larger conservation community. Revisions to this plan may be considered over time, subject to the identification and securing of additional funding.

## Acknowledgements

This business plan builds on Atlantic Flyway Shorebird Initiative (AFSI) plan completed in 2014. NFWF gratefully acknowledges the time, knowledge, and support provided by many of the same stakeholders that contributed significantly to this business plan through input, review, discussion, and content expertise relative to the Atlantic flyway, species, habitats and conservation practices underway along the entirety of the flyway. In particular, thanks goes to members of the Atlantic Flyway Shorebird Team from: American Bird Conservancy, Antioch College, Association of Fish & Wildlife Agencies, Atlantic Coast Joint Venture, Biodiversity Research Institute, Bird Studies Canada, Birds Caribbean, BirdLife International, Canadian Wildlife Service, Clemson University, College of William & Mary, Connecticut Department of Natural Resources, Connecticut Department of Energy & Environmental Protection, Conserve Wildlife, Cornell Lab of Ornithology, Delaware Division of Fish & Wildlife, Eastern Massachusetts National Wildlife Refuge Complex, Eastern Shore of Virginia National Wildlife Refuge, Edwin B. Forsythe National Wildlife Refuge, Florida Fish & Wildlife Commission, French Government, Guadeloupe National Hunting & Wildlife Office, Georgia Wildlife Resources Division, Goldenrod Foundation, Great Bay National Wildlife Refuge, Maine Division of Inland Fish & Wildlife, Manomet Center for Conservation Sciences, Maryland Department of Natural Resources, Mass Wildlife, CWC Natural Heritage Commission, Massachusetts Audubon Society, Massachusetts Division of Fish & Wildlife, Monomoy National Wildlife Refuge, National Audubon Society, National Fish and Wildlife Foundation, Nature Canada, New Hampshire Audubon Society, New Jersey Audubon, New Jersey Division of Fish & Wildlife, North Carolina Wildlife Resources Commission, Parker River National Wildlife Refuge, Paul Smith Consulting, South Carolina Audubon Society, South Carolina Department of Natural Resources, Southern New England-New York Bight Coastal Program, The Nature Conservancy, Tufts University, University of Arkansas, University of Connecticut, University of Maine, University of Massachusetts, US Army Corps of Engineers, United States Fish and Wildlife Service (USFWS), Virginia Department of Game & Inland Fisheries, Virginia Tech University.

**Cover photo credit:** American oystercatcher (top left) on Oyster rake on Bull River off Little Tybee Island, GA (Curtis Compton); Horseshoe crab in Delaware Bay, NJ (Sean Crane Photography); and Ron Niebrugge (Alamy Stock Photo).

# Background



NFWF's Conservation Framework outlines the Foundation's approach to the conservation of fish, wildlife and their habitat across the United States. The Framework describes the organization's focus on generating measurable results for wildlife through species and landscape level investments.

This business plan builds off of NFWF's experience in showing measurable results for a single shorebird species in decline. In 2008, concerned for the decline of shorebird species and the American oystercatcher in particular, NFWF worked with its conservation partners and developed a business plan targeting the conservation of oystercatchers, a charismatic shorebird and native of the U.S. Atlantic coast. The planning effort consolidated and focused the efforts of many partners and helped establish the foundation for a strong and coordinated effort to conserve oystercatchers. Between 2008 and 2018, NFWF invested \$5 million to reduce the impacts of key threats which directly led to improving the Atlantic flyway oystercatcher population by an unprecedented 23%.

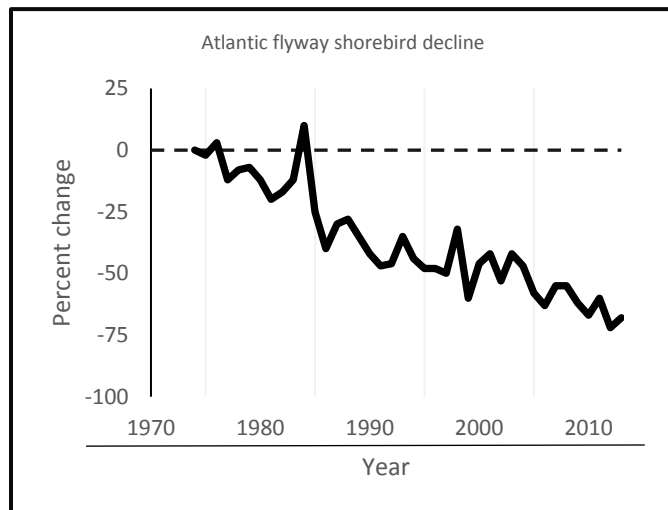
While continuing to support the successful implementation of the American oystercatcher business plan, NFWF worked with many state, federal, NGO and academic organizations to apply lessons learned to a broader suite of shorebirds facing similar threats in many of the same geographies. The resulting Atlantic Flyway Shorebird (AFSI) Plan (2014-2024) established a goal to increase focal species populations by up to 15% over a ten year period. From 2014 to 2018, NFWF targeted \$24 million towards priority actions outlined in the AFSI Plan.

To further define its role in the implementation of the AFSI Plan, NFWF has developed this business plan to define NFWF's contribution to the conservation of Atlantic Flyway shorebirds. Because the business plan adopts an approach where conservation actions need to target many important sites along the Atlantic flyway, NFWF has a unique opportunity to align conservation investments from multiple existing NFWF programs to fund conservation activities in those geographies (e.g. investments for red knot in the Delaware River watershed, beach nesting birds along the Gulf coast of Florida, etc.). Where the full lifecycle needs of shorebirds are not addressed by established or developing landscape level programs, NFWF will look for innovative ways to address key threats either through self-directed investments or through partnerships with organizations active in the U.S. and working throughout the full lifecycle of shorebirds.

This approach seeks to maximize the collective impact of the Foundation by aligning efforts across its programs to achieve the Atlantic Flyway Shorebird business plan goals.

# Conservation Need

Migratory birds link habitats, people and cultures, offering an extraordinary opportunity to connect people across a hemisphere. As one group of migratory birds, shorebirds use habitats across a vast geography each year, undertaking some of the longest migrations of any animals on earth. The great distances travelled every year, collectively called “flyways”, also subject shorebirds to numerous threats. In addition, shorebird populations are relatively small and hence vulnerable to both anthropogenic and environmental impacts ([Andres et al 2012](#)). As a consequence, shorebirds are one of the North American bird guilds undergoing the steepest population declines (Figure 1). To stop the declines and increase populations of these migratory birds we need to adopt a “flyway” approach that addresses the suite of threats these migrants face throughout the year.



**Figure 1:** Percent decline over 30 years in shorebird populations in North America is dramatic (State of the Birds report 2016).

Within the Americas, four major flyways are generally recognized for North American breeding migrants: the Atlantic, Mississippi, Central, and Pacific Flyways. The Atlantic flyway describes an area extending from the Canadian arctic, along the east coast of the United States, across the eastern Caribbean to Venezuela and along the north coast of Brazil south to the very tip of Tierra del Fuego (Figure 2).

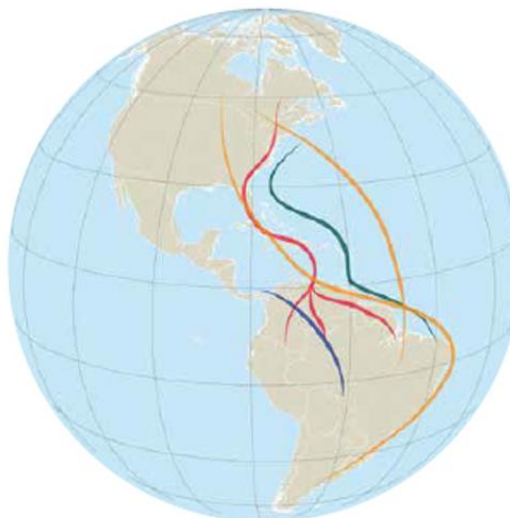
Along the Atlantic flyway, which is the focus of this business plan, shorebirds exhibit a variety of migratory strategies. Some like the American oystercatcher and many beach nesting species are **short distance** migrants. Their movements are confined to the U.S. and adjacent Caribbean

islands. **Medium-distant** migrants like the Whimbrel, a fiddler crab specialist, nest in the low-arctic and migrate to roosting sites in Massachusetts, North Carolina and Georgia before arriving in their Caribbean and northern South America wintering areas. **Long-distance** migrants like the red knot are globe-trotters, breeding in the arctic, migrating to, and staging at, critical foraging and roosting sites in the U.S., and wintering as far south as Tierra del Fuego on the southern-most tip of Chile and Argentina. While exceptions to these categories exist (e.g. populations of red knot fall into medium and long distance migrants), each category of migrant requires different conservation approaches.

Along the Atlantic flyway, migratory shorebirds encounter a host of threats regardless of the distance travelled. Shorebirds have evolved to respond to natural threats, such as predators, severe weather and periodic local food depletion events. Indeed, arrival and departure from stopover areas is carefully timed

to coincide with maximum food abundance, allowing individuals to replenish energy reserves before continuing their migration. However, human-induced threats, such as habitat destruction, human disturbance of nesting and foraging habitat, artificially-inflated predator populations, unregulated hunting, and pollution are relatively new and negatively impact shorebird populations. These threats, which produce additive stress and mortality, can lead to population decline. For example, habitat loss at stopover locations can result in higher densities of birds, thus increasing natural predation risk and/or success for predators (i.e. Peregrine Falcons). *Protecting and ensuring the ecological function of vital stopovers and staging sites is a key component of shorebird conservation.*

Atlantic flyway shorebirds are exposed to a diverse set of human-induced threats across this network of sites. While the nature and severity of the threats may vary, each site plays a critical role in shorebird survival. Loss of important sites reduces options for shorebirds to feed, stage and seek refuge – in some cases, the collapse of a site’s functionality can lead to the demise of an entire species (e.g. Delaware Bay provides an irreplaceable food source for red knot at a critical juncture in its migration to the arctic to breed). Therefore, effective shorebird conservation requires a wide-ranging approach to identify and ameliorate threats that shorebirds face at multiple locations throughout the flyway. Such an approach must attempt to coordinate research, conservation, and management efforts of diverse groups across many political boundaries and consolidate resources to undertake effective conservation activities.



**Figure 2:** Conservation of Atlantic flyway shorebirds requires a hemispheric approach.

## Current Conservation Context

Numerous organizations and partnerships in the Americas are engaged in shorebird conservation. In the United States, shorebirds are migratory and thus protected under the Migratory Bird Treaty Act (MBTA) and therefore a federal responsibility of the United States Fish and Wildlife Service (USFWS). The USFWS coordinates regular, range-wide population shorebird assessments that inform conservation and management efforts at the state, regional and national levels. The most recent assessment was completed in 2012 ([Andres et al 2012](#)) and provides a snapshot of the current status of 52 species and 75 taxa of shorebirds that occur in North America.

Perhaps the longest running shorebird initiative is the Western Hemisphere Shorebird Reserve Network (WHSRN). WHSRN is a voluntary coalition of people and communities linked through association with sites that host biologically important numbers of shorebirds. WHSRN’s mission is to protect shorebird species through a network of key sites in the Americas. The focus is on site-based actions, particularly actions that can best be accomplished through a network of partners acting in concert. As of 2018, twenty-five WHSRN sites have been designated along the Atlantic flyway. Eight of these are located along the U.S. coast from

Massachusetts through to Georgia. A comprehensive WHSRN site assessment tool provides important baseline data on the status of sites within the network. Together with data from the International Shorebird Surveys, these two programs provide a foundation for a “Flyway Health Index”.

While the United States Shorebird Conservation Plan ([Brown et al 2001](#)) sets goals for the conservation of all North American breeding shorebirds, it does not detail how these would be achieved. With support from NFWF in 2014, a consortium of federal, state, NGO and academic representatives completed the Atlantic Flyway Shorebird Initiative (AFSI) Plan (referred to as the “AFSI Plan”) which is a 10-year, hemispheric-wide plan that addresses major threats to 15 migratory shorebirds in the Americas (Appendix A). The goal of the AFSI Plan is to increase populations of 15 Atlantic flyway shorebird species by 10-15% over a ten-year period. The AFSI Plan builds on lessons learned through the implementation of the NFWF-led American oystercatcher conservation initiative, which over a ten-year period (2008-18) and a five million dollar investment, (a) reversed the decline of oystercatchers, (b) more than doubled the species’ average reproductive success (from 0.2 to 0.5 chicks per pair), and (c) ultimately led to a 23% increase in the overall population.

NFWF has been the primary funder of the AFSI Plan since 2014 and has invested \$24.2 million towards priority actions outlined in the AFSI Plan including: (1) mitigation of the shorebird hunting threat in Barbados, Martinique, Guadeloupe and the Guianas where recent studies suggest that current harvest levels are likely high enough to be of concern for some populations ([Watts and Turrin 2016](#)), (2) completion of a comprehensive inventory of important sites for Atlantic flyway shorebirds, (3) development of best management practices for human disturbance, predation and currently for coastal engineering, (4) building the capacity to implement monitoring protocols for shorebirds along the Brazilian and Argentina-Chilean wintering areas, (5) researched and implemented predator control measures along the Georgia coast, (6) strengthened on-the-ground capacity across the Florida Gulf coast to address both human disturbance and predation issues affecting state listed species – notably the American oystercatcher, snowy plover and Wilson’s plover, and (7) restored more than four miles of vital foraging and roosting habitat for red knot and other shorebirds along Delaware Bay coast.

Apart from NFWF’s investments, sources of direct funding for shorebird conservation are limited although broader habitat conservation (e.g. North American Wetland Conservation Act) and protected areas (e.g. National Wildlife Refuges) programs offer excellent opportunities to advance site-based conservation along the Flyway. Beyond the U.S., the Neotropical Migratory Bird Conservation Act and the recently approved U.S. AID-funded Flyways initiative, provide valuable funding for shorebird conservation in Latin America and the Caribbean.

This business plan (referred to as the NFWF Plan) articulates the Foundation’s strategic niche in the implementation of the original AFSI Plan, focusing on three species with life histories dependent wholly or in large part on important habitat along the U.S. Atlantic coast. Recognizing shorebirds are a shared responsibility, the NFWF Plan also identifies strategic opportunities to engage with its U.S.-based partners on important issues in key geographies in Canada, Latin America and Caribbean.


# Conservation Outcomes

The goal of the Foundation’s Atlantic flyway shorebird business plan is to safeguard the shorebird migration phenomena by improving the habitat functionality and condition at critical sites upon which these species depend at various stages of their full annual lifecycle.

Protecting stop-over sites along the migratory pathway is a critical component of shorebird conservation. Investments will target conservation actions at critical breeding, stopover and non-breeding habitat along the Atlantic coast of the U.S., the Caribbean and in South America. For data deficient segments of a species annual life cycle, NFWF will strategically invest in filling knowledge gaps to improve conservation delivery and impact.

Recognizing that data are deficient for most populations of Atlantic flyway shorebirds, NFWF will focus on three species (Table 1) for which available data is sufficient to set population level goals and monitor population change over the duration of the plan. Each focal species serves as an umbrella connecting conservation to a suite of other shorebirds with similar migration strategies and habitat needs. Furthermore, each focal species is charismatic, well studied and the focus of one or more networks actively engaged in their conservation.

**Table 1. Outcomes and goals associated with focal species.**

<b>Short distance migrants</b>		
Target habitat – breeding sites on beaches, estuaries, marshes.		
	<u>Outcomes</u>	<u>Goals</u>
<p><b>American oystercatcher (AMOY)</b> <i>Haematopus palliatus</i></p> 	<p>Improve productivity thus contributing to the continued growth of American oystercatcher populations along the U.S. Atlantic flyway.</p>	<p>Increase population of AMOY to 14,880 individuals - a 20% increase over the 2018 population level.</p> <p>Increase productivity to 0.55 chicks fledged per pair along the U.S. Atlantic flyway – a 10% increase in productivity of the U.S. breeding population.</p>

**Middle distance migrants**

Target habitat – coastal roosting and foraging beaches, islands, mangroves, salt marsh.

**Species: Whimbrel (WHIM)**

*Numenius phaeopus*



Outcomes

Improve habitat condition at key staging areas along the U.S. and reduce threats to stopover and wintering sites in the Caribbean and northern South America to sustain and enhance healthy populations of whimbrel during passage and wintering periods.

Goals

Increase the population size of Whimbrel by 15% at critical staging areas in central and southeastern United States.

**Long distance migrants**

Target habitat – coastal roosting and foraging beaches, islands, salt marsh.

**Species: Red knot (REKN)**

*Calidris canutus rufa*



Outcomes

Restore and conserve sufficient amount and diversity of beach habitat to sustain and enhance healthy populations of red knot during passage and wintering periods.

Goals

Increase overall population size of red knot using Delaware Bay by 15% during spring migration.

More than 80% of red knot maintain or exceed 180 gram optimal threshold weight using Delaware Bay during the Spring migration.

Increase overall population size of red knot using Tierra del Fuego by 30% during their wintering period.



## Geographic Focus



The NFWF Plan will support conservation actions implemented across priority breeding, staging and wintering sites for American oystercatcher, red knot and whimbrel in the U.S. and internationally.

In the U.S., ten priority focal areas comprise a portfolio or grouping of important breeding, staging and/or wintering shorebird sites in the same geographical area (Figure 3). Each focal area may contain one or more categories of sites as defined below:

- Tier 1: a site that supports >30% of a staging/ wintering population of a focal species
- Tier 2: a site that supports >10% of the breeding/ staging/ wintering population of a focal species
- Tier 3: a site that supports >1% of the breeding/ staging/ wintering population of a focal species

In the U.S., NFWF will prioritize its investments for red knot and whimbrel on Tier 1 and 2 sites and for American oystercatchers on Tier 2 and 3 sites for staging/ wintering and breeding populations respectively (Appendix B). There are no Tier 1 sites for American oystercatcher owing to the dispersed distribution of the species.

Conditional on funding availability, NFWF will consider funding Tier 1, 2 and 3 sites outside of the U.S. for red knot and whimbrel with an emphasis on sites impacted by hunting or where threats to species populations could limit population recovery. Where information on distribution and abundance is lacking, NFWF will invest to determine a site's importance (Appendix C).

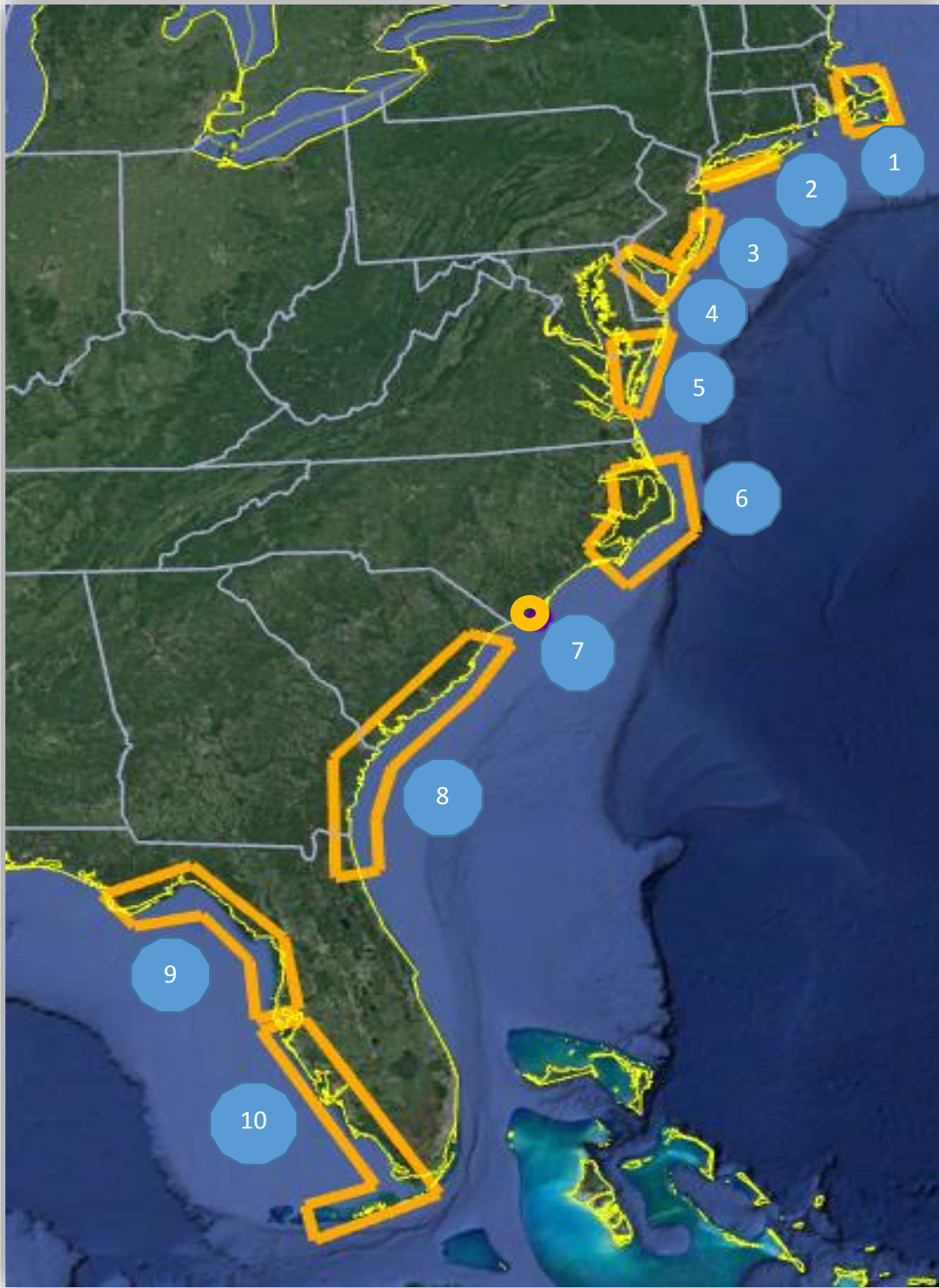


Figure 3 – Focal areas along the U.S. Atlantic flyway of the United States, including 1. Cape Cod and Islands, MA; 2. Long Island Sound, NY; 3. New Jersey Coast, NJ; 4. Delaware Bay, NJ/ DE; 5. Delmarva Peninsula, MD; 6. Cape Hatteras and Lookout, NC; 7. Cape Fear, NC; 8. Georgia-South Carolina Coast; 9. Coastal Florida Panhandle, FL; 10. Florida Southeast Coast, FL. These focal areas fall within the geographic priorities established in the AFSI Plan and are further detailed through an assessment of important shorebird sites completed in 2015.

# Implementation Plan

To address threats affecting shorebirds and achieve the goals of the business plan, investments will target seven conservation strategies (Table 2) outlined in the following section and logic model (Figure 4). These strategies were informed by previous NFWF investments made to identify and assess important shorebird habitat and to compile best management practices for addressing key threats facing shorebirds. Conservation investments described here, in addition to benefitting focal species in the NFWF Plan, are expected to support breeding, staging and or wintering populations of other Atlantic flyway shorebird species (as well as ancillary benefits to other terrestrial and aquatic wildlife).

Table 2: Geographic focus of strategies for each focal species.

Focal Areas	Strategy 1	Strategy 2	Strategy 3			Strategy 4	Strategy 5
	Conserve Habitat	Restore Habitat	Reduce Human Disturbance	Reduce Incompatible Mgt	Reduce Predation	Reduce Hunting Pressure	Fill Information Gaps
1. Cape Cod	AMOY, REKN	AMOY	AMOY				AMOY
2. Long Island	AMOY		AMOY, WHIM				AMOY, REKN WHIM
3. New Jersey Coast	AMOY, REKN	AMOY	AMOY, REKN				AMOY, REKN
4. Delaware Bay	REKN	REKN, SESA	AMOY, REKN	REKN			REKN
5. Delmarva	AMOY, WHIM	AMOY	AMOY		AMOY		AMOY, WHIM
6. Cape Hatteras	AMOY, WHIM		AMOY, WHIM		AMOY		AMOY, WHIM
7. Cape Fear	AMOY	AMOY	AMOY		AMOY		AMOY
8. Georgia-South Carolina Coast	AMOY, REKN WHIM	AMOY, REKN WHIM	AMOY	REKN	AMOY		REKN, WHIM
9. Florida Panhandle Coast	AMOY	AMOY	AMOY		AMOY		AMOY
10. Florida Southeast Coast	REKN	AMOY	AMOY		AMOY		REKN
11. Flyway focal areas in LAC*	REKN, WHIM		REKN			REKN, WHIM	REKN, WHIM

\* Priority focal areas and corresponding priority sites in Latin America and the Caribbean (LAC) are mapped in Appendix C.

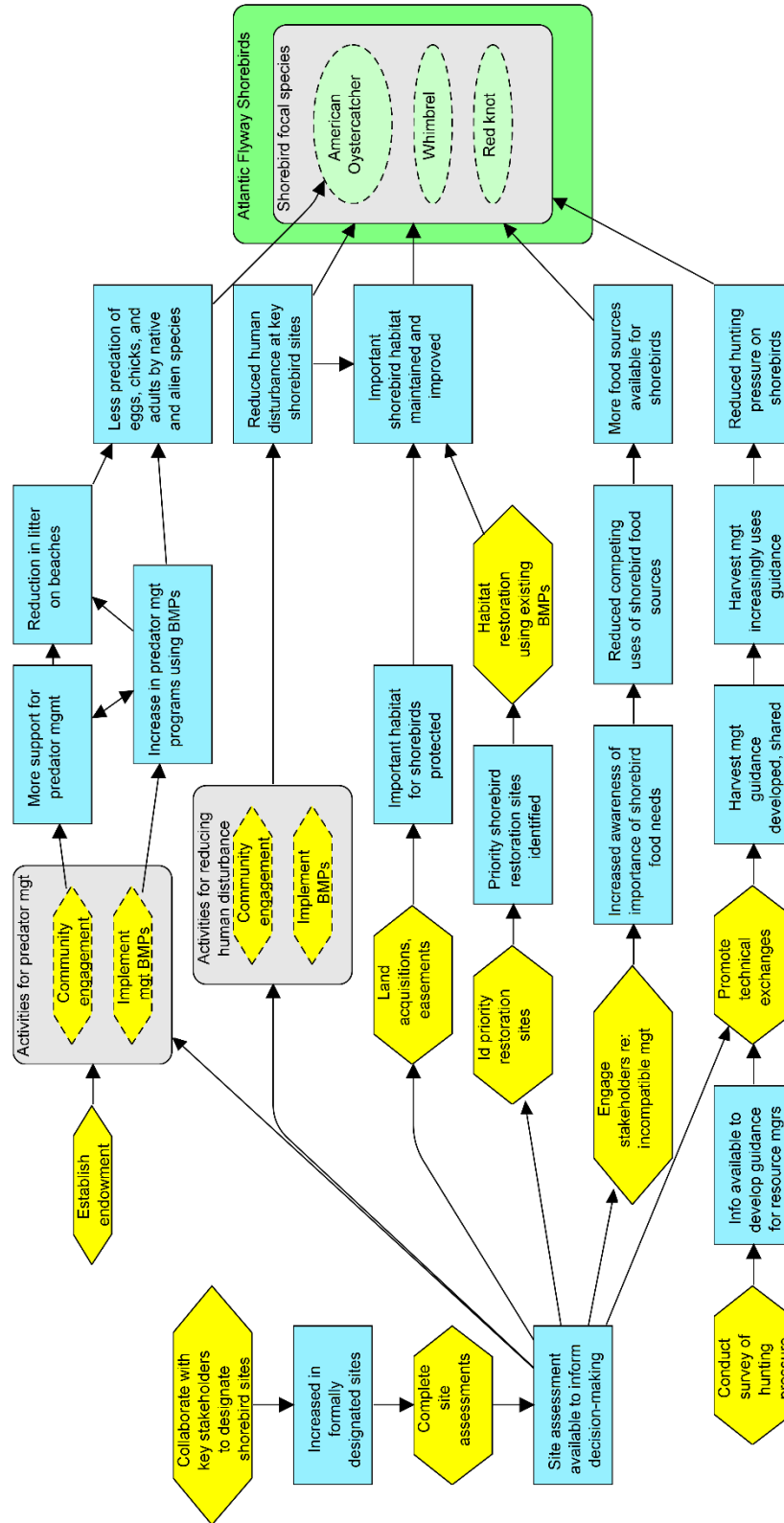


Figure 4: The Atlantic Flyway shorebird logic model maps the relationships between strategies, intermediate results and focal species goals.

### **Strategy 1: Conserve habitat**

The identification and protection of important shorebird sites which have values critical to the region's future and contribute to local economies through sustainable livelihoods, can help ensure that these sites are not lost to development. NFWF will continue to support efforts to identify and conserve priority sites for shorebirds, contributing to a growing network of protected sites along the U.S. Atlantic coast. This may be through formal and informal mechanisms such as a WHSRN designation, perpetual conservation easement, fee-title acquisition, or some other form of protected areas designation.

- a. *Support designation and management of important shorebird habitat at priority sites (as outlined in the Geographic Focus section).*

Currently, there are more than 70 Tier 1, 2 and 3 sites along the U.S. Atlantic coast supporting one or more focal species as well as large numbers of other shorebird species. Eight of these have been formally designated as WHSRN sites (Appendix B). The formal designation of potential new WHSRN sites is a first step towards greater habitat protection. NFWF will provide support to agencies seeking to (a) designate potential WHSRN sites and/or (b) develop management plans at designated sites for red knot and whimbrel within priority focal geographies.

- b. Secure habitat through land acquisition, easements or other recognized means for conserving shorebird habitat.

NFWF will prioritize efforts to secure habitat adjacent to existing or potential new WHSRN sites within each focal area. By securing these sites, NFWF will help strengthen the ecological integrity of priority breeding and stopover sites necessary to support the integrity of the Atlantic flyway. Funding dependent, NFWF will help secure shorebird shooting swamps in the Caribbean and critical red knot wintering sites in South America (Appendix C).

### **Strategy 2: Restore habitat**

NFWF will invest in shorebird habitat restoration actions that enhance degraded habitat, increase population resilience by improving habitat condition for focal species, and will ensure long-term sustainability of investments through community engagement and outreach activities.

- a. *Identify priority habitat for immediate restoration within each of the 10 focal areas.*

NFWF will invest in an assessment of each focal area and identify and prioritize global/regional high priority sites characterized by shorebird value, level of threat and potential impact on one or more shorebird populations.

- b. *Implement best management practices to restore critical breeding and foraging habitat (e.g. oyster rakes for AMOY, foraging beach habitat for red knot, roosting islands for whimbrel).*

Using best management plans developed by AFSI (*in press*, Manomet 2018), NFWF will invest in the restoration of critical habitat at sites identified as globally/regionally important, with a focus on limited foraging and roosting habitat in Delaware Bay, along the Gulf coast of Florida and Georgia, and the New Jersey coast (confirm geographies). Priority will be given to the restoration of degraded beaches in Delaware Bay; a site of hemispheric importance for red knot, semipalmated sandpipers, ruddy turnstones and dozens of other migratory shorebird species (see also NFWF business plan for the [Delaware River Watershed](#)).

### **Strategy 3: Improve habitat management through three primary strategies**

#### **3.1 Reduce human disturbance by engaging communities**

There is a growing awareness of shorebird needs among communities adjacent to important shorebird breeding and staging areas as evidenced by the proliferation of signage, awareness campaigns and local outreach materials made available to the public. Combined, these efforts have contributed towards increased productivity of American oystercatchers breeding in several New England states. NFWF will make strategic investments to reduce the impact of human activities on shorebirds at breeding, foraging and roosting sites.

- a. Implement best management practices (e.g. refer to [FWC 2017](#) for guidance) to address human disturbance issues affecting AMOY in focal areas supporting sites with >20 breeding pairs.

The use of signage and cordoning breeding areas has proven successful in increasing productivity of beach nesting birds along the entire U.S. Atlantic coast. Focusing on highly productive breeding areas, and using best management practices (BMPs) developed by AFSI (*in press*, Audubon 2018), NFWF will invest in building and or supporting existing local capacity to implement BMPs and steward AMOY nesting areas. Emphasis on supporting partnership networks (e.g. the Florida Shorebird Alliance) will help mobilize and coordinate the work of hundreds of volunteer stewards throughout the year.

- b. Implement community engagement activities in tandem with human disturbance management.

Successful predation management combines the removal of predators with active engagement of communities, landowners and users of beach habitat. Not only does this increase local awareness of the impact of predators on nesting shorebirds but also highlights actions that can be taken to mitigate predator use of sensitive beaches (e.g. litter removal to reduce use by human commensal predators). NFWF will support community engagement activities at sites where predator removal will be undertaken.

#### **3.2 Reduce the impacts of incompatible management of shorebird food resources at critical sites (e.g. horseshoe crabs, mollusks, others).**

Invertebrates and mollusks are a primary food source for shorebirds. These same invertebrates are also a source of economic benefit to local communities (e.g. harvest of wild oysters) as well as large

industrial interests (e.g. lysate production from horseshoe crabs). Increasing awareness of key users and managers of the importance of these food resources to shorebirds, presents opportunities to mitigate impacts of harvest activities, providing benefits to shorebirds and people. NFWF will invest in projects to increase awareness of the food resource needs of umbrella species with an emphasis on the importance of horseshoe crab eggs to the survival of red knot (and many other shorebirds) in Delaware Bay and similar sites along the Carolinas and Georgian coasts. This may include working with industry, governments and NGOs to explore and promote the production of synthetic lysate ([Atlantic 2018](#)).

### **3.3 Reduce mortality through predator management.**

Native and human commensal predators are one of the greatest threats to nesting shorebirds. If persistent, they can greatly reduce species productivity, creating population “sinks” at sites where adult birds waste their entire reproductive effort year after year. NFWF will make targeted investments to reduce threats posed by predators at specific sites considered population “sinks”.

- a. Using best management practices developed by AFSI (*in press*, USFWS 2018), implement predator management at priority breeding sites with high AMOY concentrations (>20 breeding pairs - refer to Appendix D for a site list).

While shorebirds must contend with a diversity of predators throughout their full-lifecycle, the greatest impact of predators along the U.S. Atlantic flyway is on beach nesting birds such as AMOY. Using best management practices developed by AFSI, NFWF will fund predator management activities at highly productive nesting sites in Virginia, the Carolinas, Georgia and Florida.

- b. Implement community engagement activities in tandem with predator management.

Research has demonstrated that predator management is most effective if it is paired with awareness raising activities targeting beach goers (*in press*, FWC 2018). NFWF will support activities that raise awareness of the “cause and effect” relationship between the presence of refuse, increase in native and human commensal predators (e.g. raccoons, gulls, cats) and shorebird mortality, and offer alternative strategies to reduce beach refuse.

- c. Promote establishment of a predator management endowment to address acute predation of AMOY eggs/ young.

Predators are attracted to shorebird nesting beaches by the presence of eggs, nestlings and human refuse. Predator control programs require a flexible source of funding to address immediate predation issues. Resources for this activity are scarce. NFWF will explore options to establish a trust fund to augment existing programs and generate new resources to fund responsive predator removal work.

**Strategy 4. Support technical exchanges to increase awareness and effectiveness of harvest management strategies between agencies with shared responsibility for shorebird management in Latin America and the Caribbean.**

While primarily focused on the U.S., implementation of the NFWF Plan focuses on two threats that must be addressed – hunting and habitat loss at critical staging and wintering sites (Appendix C) in Latin America and the Caribbean (LAC). Failure to staunch these threats will slow efforts to recover threatened red knot, whimbrel and a host of other species. NFWF will support exchanges of technical expertise with countries in the Caribbean and northern South America to build upon initial efforts to control sport, market and subsistence hunting. Initial investments in Barbados and the French Overseas Departments and Territories has resulted in (a) the creation and implementation of guidelines restricting hunting of certain species like red knot, (b) agreed hunting quotas and bag limits, and (c) the timing and duration of hunting. Further efforts in Brazil and the Guianas are needed to address the subsistence hunting which is believed to be significantly impacting shorebirds.

### **Strategy 5: Monitor and assess progress**

NFWF will invest in monitoring and assessment actions to improve the effectiveness of species conservation and the delivery and reporting of conservation actions over the life of the business plan.

- a. Status of existing and potential WHSRN sites assessed on a regular basis.

Information on the status of important shorebird breeding and stop-over sites is limited, hampering efforts to effectively conserve and manage sites. The WHSRN site assessment tool is used to determine and track the status of sites, identify threats and opportunities, assess effectiveness of management efforts, engage in adaptive management, identify monitoring efforts, and provide standardized information for a network-wide analysis of WHSRN sites. Baseline information gathered from this tool can be used to monitor progress towards management goals for one or more focal species across multiple sites. Along the U.S. component of the Atlantic flyway, over 400,000 acres of shorebird habitat have been formally designated. NFWF will support the implementation of the site assessment tool at up to 100 existing and potential WHSRN sites (with a focus on U.S. sites and sites supporting focal species).

- b. Support ongoing periodic census of wintering populations of focal species.

At least once every 3-4 years over the last decade, NFWF co-funded a flyway-wide census of AMOY along the Atlantic and Gulf coasts. This effort provided the baseline data necessary to set goals and establish benchmarks for determining the effectiveness of efforts to conserve AMOY. NFWF will continue to contribute to this effort over the duration of the NFWF Plan.

Because of their dispersed nature, a flyway-wide census of red knot and whimbrel is difficult and costly. NFWF will support regular monitoring of both species where they concentrate in the Caribbean and along the northern and southern coasts of South America. This ambitious endeavor will build on recent NFWF grants to train in-country technicians capable of carrying out this activity.

- c. Establish a flyway health index to monitor the state of shorebird populations along the Atlantic Flyway



To effectively conserve shorebirds, conservation practitioners need a tool to measure the impacts of their investments. Such a tool does not exist. However, combining data obtained through the “WHSRN Site Assessment” tool (see 5 a) and the International Shorebird Survey, practitioners have a measure of the state of individual sites along the entire flyway. NFWF will partner with other organizations to develop the Flyway Health Index as an adaptive management tool for informing effective conservation of shorebirds throughout the flyway.

- d. Promote the use of species tracking technology along the U.S. Atlantic coast.

Building on previous investments in Florida, Georgia, Delaware, Argentina, Brazil, Chile and Suriname, NFWF will support the establishment of additional infrastructure to track movements of focal species along the Atlantic flyway. Such technology [e.g. MOTUS; see Taylor et al (2018) for detailed information] will help fill major information gaps in flyway connectivity as well as improve an understanding of species’ overall distribution. With this information, managers will be better positioned to make effective decisions on where and when to invest appropriate resources to conserve shorebirds.

- e. Facilitate information sharing on BMPs, species monitoring and site conditions among AFSI partners.

Data sharing is important for assessing the status and trends of species and necessary to inform adaptive management. NFWF will support efforts to strengthen data sharing through partnership exchanges, clearing-house mechanisms (e.g. AFSI portal), and existing data management programs (e.g. Florida Shorebird Database, International Shorebird Survey).

- f. Complete an assessment of the hunting pressure along the north coast of South America.

A survey of hunting pressure on shorebirds in Barbados and French Caribbean territories led to the implementation of harvest management guidelines and the cessation of hunting of red knot. While it is believed the hunting impact on wintering shorebirds along the northern coast of South America is considerable, there is limited information to inform the development of similar guidelines in this geography. NFWF will support a second assessment of actions taken to address hunting pressure on red knot, whimbrel, and other shorebirds in Suriname, the French Guyana and Brazil. The assessment will examine the effectiveness of actions taken to address hunting and where necessary, support adaptive management decisions.

- g. Assess the importance of vital stopover sites used to influence productivity and survivorship.

At present only Delaware Bay is known to influence productivity and survivorship in red knot but preliminary research suggests that the Mingan Islands, Cape Cod and coastal New Jersey may play a similar role in red knot survival during long distance south bound flights (Loring et al 2017). Additional research suggests Lagoa do Peixe is similarly important for northbound migrants. NFWF will support targeted research to determine the importance of each of these sites and based on the results, prioritize these sites for additional conservation (where warranted).

## Risk Assessment

Risk is an uncertain event or condition which, if it occurs, could have a negative effect on an initiative's desired outcome. We assessed several risk event categories to determine the extent to which they would impede progress towards our stated business plan strategies and goals during the next 10 years.

Category	Rating	Risk Description	Mitigating Strategies
<b>Regulatory Risks</b>	<b>Low</b>	Recent changes to MBTA weakens cooperation across borders on shared species that could result in lost resources for migratory bird conservation, including the provision of technical support/ training.	Plan calls for fostering technical exchanges to strengthen cooperation across management agencies on hunting and data sharing.
<b>Financial Risks</b>	<b>Moderate</b>	Resources to fund shorebird conservation and monitoring is very limited; successful full-lifecycle conservation will depend on resources made available to address threats throughout species range.	Cross-cutting nature of plan capitalizes on funding via existing programs. Working to diversify portfolio of funding sources by creating a donor's alliance to secure and sustain funding for Flyway conservation.
<b>Environmental Risks</b>	<b>High</b>	Environmental changes (e.g. sea level rise)/ stochastic events (e.g. hurricanes) impact coastal habitat and species. Asynchronous changes to species arrival and presence of food source threatens survival of arctic breeding shorebirds.	Plan supports efforts to conserve vital habitat for shorebirds through easements, nesting exclusion zones, etc. which establish strongholds for shorebirds, enabling them to better withstand environmental stressors. Resilience strategies will be factored into coastal conservation projects.
<b>Scientific Risks</b>	<b>Moderate</b>	Lack of knowledge about threats to red knot in wintering areas in Latin America and Caribbean.	Plan will establish flyway-wide monitoring protocol using red knot, whimbrel and American oystercatcher as flagship species.
<b>Social Risks</b>	<b>Low</b>	Resolution of actual and/or perceived human-wildlife conflicts usually requires human behavioral change.	Plan includes up-front strategies to advance local community engagement throughout all stages of a project.
<b>Economic Risks</b>	<b>Moderate</b>	Economic interests (e.g., for horseshoe crabs, oysters, sand, shrimp, tourism) can conflict with critical habitat needs of shorebirds.	Plan will fund projects demonstrating alternatives to practices that harm shorebirds (e.g., synthetic horseshoe crab-lysate production, artificial bait for conch fishing, inland sand mining, etc.).
<b>Institutional Risks</b>	<b>Low</b>	Lack of capacity at both the management and policy/ implementation levels outside of the U.S. Poor coordination between countries sharing migratory species.	Plan will help build capacity by fostering partnership efforts between U.S.-based institutions and LAC partners sharing management responsibilities to promote the exchange of data and know-how.

# Monitoring & Evaluating Performance

Business plan performance will be assessed at both project and program scales. At the project scale, individual grants will be required to track relevant metrics from Table 3 for demonstrating progress on project activities and outcomes and to report out on them in their interim and final programmatic reports.

At the program scale, broader habitat and species outcomes will be monitored through targeted grants, existing external data sources, and/or aggregated data from relevant grant projects, as appropriate.

NFWF may conduct an internal assessment or commission a third-party evaluation at a future stage of the program to determine outcomes and adaptively manage. In some cases these course corrections may warrant increased investment; however, it is also possible that NFWF would reduce or eliminate support if periodic evaluation indicates that further investments are unlikely to achieve intended outcomes.

Table 3. Metrics for measuring progress towards conservation goals.

Category	Metrics	Baseline	2028 Goal	Data sources
Red knot	# red knot (Spring population in Delaware Bay)	47,254 individuals	54,342 individuals	DE Bay annual counts, ARM, Atlantic States Marine Fisheries Commission
	Pre-departure body weight (grams)	70% of population > 180 grams	80% of population >180 grams	Delaware Shorebird Project; body weight sampling; project level reporting by grantees
	# red knot (wintering population in TDF)	11,372 individuals	14,783 individuals	TDF annual counts
Whimbrel	# whimbrel	40,000	46,000	Manomet, DNR, Audubon Spring site counts
American oystercatcher	# American oystercatchers	12,400	14,880	AMOY Working Group, Manomet Inc. (3-4 year population wide census)
	# chicks fledged per pair	0.51	0.55	AMOY Working Group, Manomet Inc.

Category	Sub-Strategy	Metrics	Baseline	2028 Goal	Data source (s)	
<b>1. Conserve habitat</b>	<i>Site protection</i>	<i># designated sites</i>	8	16	WHSRN database, Manomet	
		<i># acres included in new mgt plans</i>	0	400,000	projects	
<b>2. Restore habitat</b>	<i>Beach restoration</i>	<i># miles or acre equivalent of restored and undisturbed beach</i>	0	4-5 miles or 500 acres	projects	
	<i>Best management practice in use</i>	<i># acres with BMP being</i>	0	1,000	projects	
<b>3: Improve habitat management through three primary strategies</b>	3a. Reduce human disturbance	<i>Human disturbance</i>	<i>% AMOY breeding sites with BMPs being</i>	0	100	projects
		<i>Awareness raising</i>	<i># people with improved knowledge of shorebird conservation</i>	0	294,000	Florida Audubon, projects
	3b. Increase awareness of incompatible management practices	<i>Awareness raising</i>	<i># people with greater understanding of imcompatible mgt practices</i>	0	100,000	New Jersey Audubon, Wildlife Conservation Foundation NJ, projects
	3c. Reduce predation	<i>Predator control</i>	<i># sites with predator mgt BMPs/ yr</i>	0	26	projects
			<i># funding mechanisms established</i>	0	1	projects
<b>4. Reduce hunting</b>	<i>Harvest management</i>	<i># people trained</i>	6	12	projects	
		<i># guidelines developed and implemented</i>	2	5	projects	
<b>5. Monitoring and assessment</b>	<i>Site assessments</i>	<i># site assessments</i>	0	74	Manomet	
	<i>Remote monitoring</i>	<i># MOTUS installations</i>	12	58	projects	
	<i>Hunting evaluation</i>	<i># evaluations</i>	0	1	projects	

As an innovation, NFWF will pilot the development of a Flyway Health Index to measure the state of the flyway by compiling data gathered from WHSRN site assessments paired with measurements of population and demographic parameters (from ISS and other population surveys) – and combining these annually to report back on how NFWF (and the AFSI network) is advancing towards the NFWF Plan goal of increasing populations of one or more focal shorebird species.

# Budget

The following budget shows the estimated costs to implement the activities identified in this business plan (Table 4). This budget reflects NFWF's anticipated engagement over the business plan period of performance; however, it is not an annual or even cumulative commitment by NFWF to invest. We acknowledge that in many cases the activities laid out in the plan build upon efforts funded by other organizations. This budget assumes that the current trajectory of funding by those other organizations continues over this business plan's time frame.

**Table 4. Budget for Atlantic Shorebird Flyway Business Plan**

BUDGET	Years 1-5 (\$)	Years 5-10 (\$)	Total (\$)
<b>Strategy 1. Conserve habitat</b>			
a. Support designation + mgt of important shorebird habitat	85,000	85,000	170,000
b. Secure shorebird habitat	6,000,000	6,000,000	12,000,000
<b>Strategy 2. Restore habitat</b>			
a. Identify priority habitat for restoration	60,000	0	60,000
b. Implement bmps for restoring sites	5,000,000	5,000,000	10,000,000
<b>Strategy 3. Improve habitat management through three primary strategies</b>			
a. Reduce human disturbance	1,500,000	1,500,000	3,000,000
b. Reduce the impacts of incompatible management	150,000	0	150,000
c. Reduce mortality through predator management	1,500,000	4,250,000	5,750,000
<b>Strategy 4. Support technical exchanges to develop harvest management strategies</b>			
a. Support technical expertise on sport and subsistence hunting	358,000	100,000	458,000
<b>Strategy 5. Monitor and assess progress</b>			
a. Complete site assessments	750,000	750,000	1,500,000
b. Support ongoing periodic census of focal species	225,000	225,000	450,000
c. Establish a flyway health index	250,000	100,000	350,000
d. Establish remote tracking technology along flyway	250,000	250,000	500,000
e. Facilitate information sharing and data mgt	1,000,000	500,000	1,500,000
f. Complete an assessment of harvest pressure	50,000	0	50,000
g. Assess the importance of vital stopover sites	75,000	0	75,000
<b>TOTAL</b>	<b>17,253,000</b>	<b>18,760,000</b>	<b>36,013,000</b>

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# Appendices

## Appendix A:

Focal species selected by the Atlantic Flyway Shorebird working group to represent shorebirds throughout the Atlantic flyway.

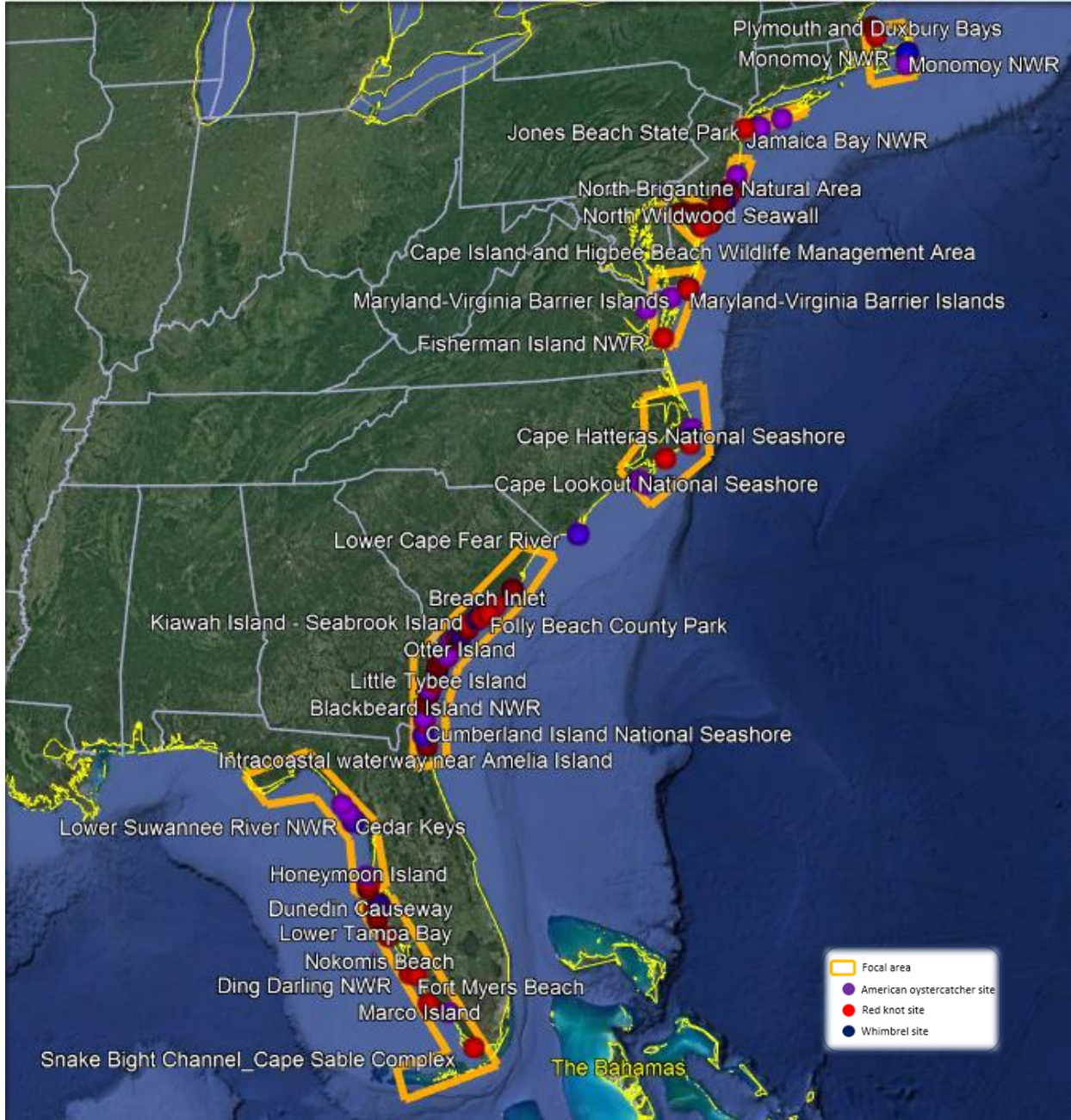
Focal Species					
Species	USSCP Status <sup>2</sup>	Estimated Population <sup>3</sup>	Pop estimate confidence	Population trend (30-year)	Rationale notes
1. American Oystercatcher	High Concern	11,284	95% = 10,700–11,300	↑	Existing NFWF Business Plan; temperate and tropical beach nesting
2. Semipalmated Sandpiper	High Concern	810,000	Moderate	↓↓	Significant recent declines noted in staging locations and some wintering locations; hunted in South America
3. Red Knot ( <i>rufo</i> )	Highly Imperiled	42,000	High	↓↓	Precipitous decline; long-distance migrant
4. Whimbrel	High Concern	40,000	Low	↓	Salt marsh obligate species; measured declines; hunted in Caribbean
5. Wilson's Plover	High Concern	8,600	Moderate	↓	High priority temperate and tropical beach nesting species
6. Marbled Godwit	High Concern	2,000	Moderate	UNK	Small flyway population; grassland/prairie nesting species
7. Piping Plover	Highly Imperiled	3,600	High	↑	Threatened, high priority temperate beach nesting; Piping plover Recovery Plan
8. Purple Sandpiper	High Concern	15,000	Moderate	↓	Small population; NE wintering species; unique rocky shoreline species
9. Red-necked Phalarope	High Concern	2,500,00	Low	↓↓	Unique life history; population reflects phalarope conservation needs
10. Ruddy Turnstone	High Concern	180,000	Moderate	↓↓	Declining species
11. Sanderling	High Concern	300,000	Low	↓	Dispersed migrant; broad wintering distribution
12. Snowy Plover	Highly Imperiled	1,040	95% = 883–1,222	↓	High priority temperate and tropical beach nesting species; FL and Caribbean
13. American Golden Plover	High Concern	500,000	95% = 294,200 – 705,800	↑↓	Representative of grassland migrant and wintering species; Caribbean hunting pressure
14. Greater Yellowlegs	High Concern	137,000	Low	↑	Boreal nester; hunted in Caribbean and South America
15. Lesser Yellowlegs	High Concern	660,000	Low	↓↓	Boreal nester; Birds of Conservation Concern list; hunted in Caribbean and South America

<sup>2</sup> US Shorebird Conservation Plan.

<sup>3</sup> Data (counts, certainty and trends) are from Andres, B.A., P.A. Smith, R.I.G. Morrison, C.L. Gratto-Trevor, S.C. Brown, and C.A. Friis. 2012. Population estimates of North American shorebirds, 2012. Wader Study Group Bulletin 119: 178–194.

Appendix B:

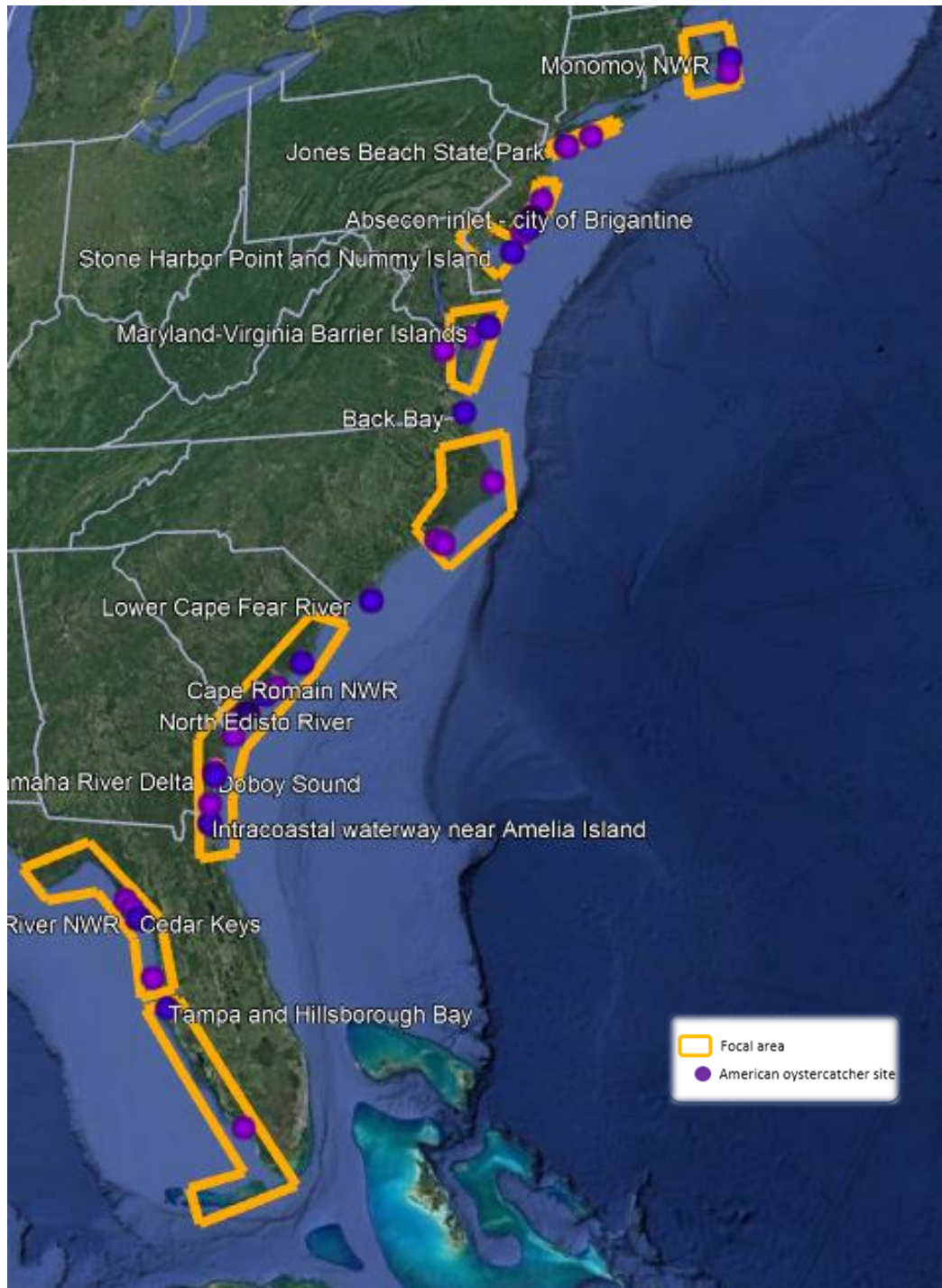
Priority shorebird sites along the U.S. Atlantic Shorebird Flyway.





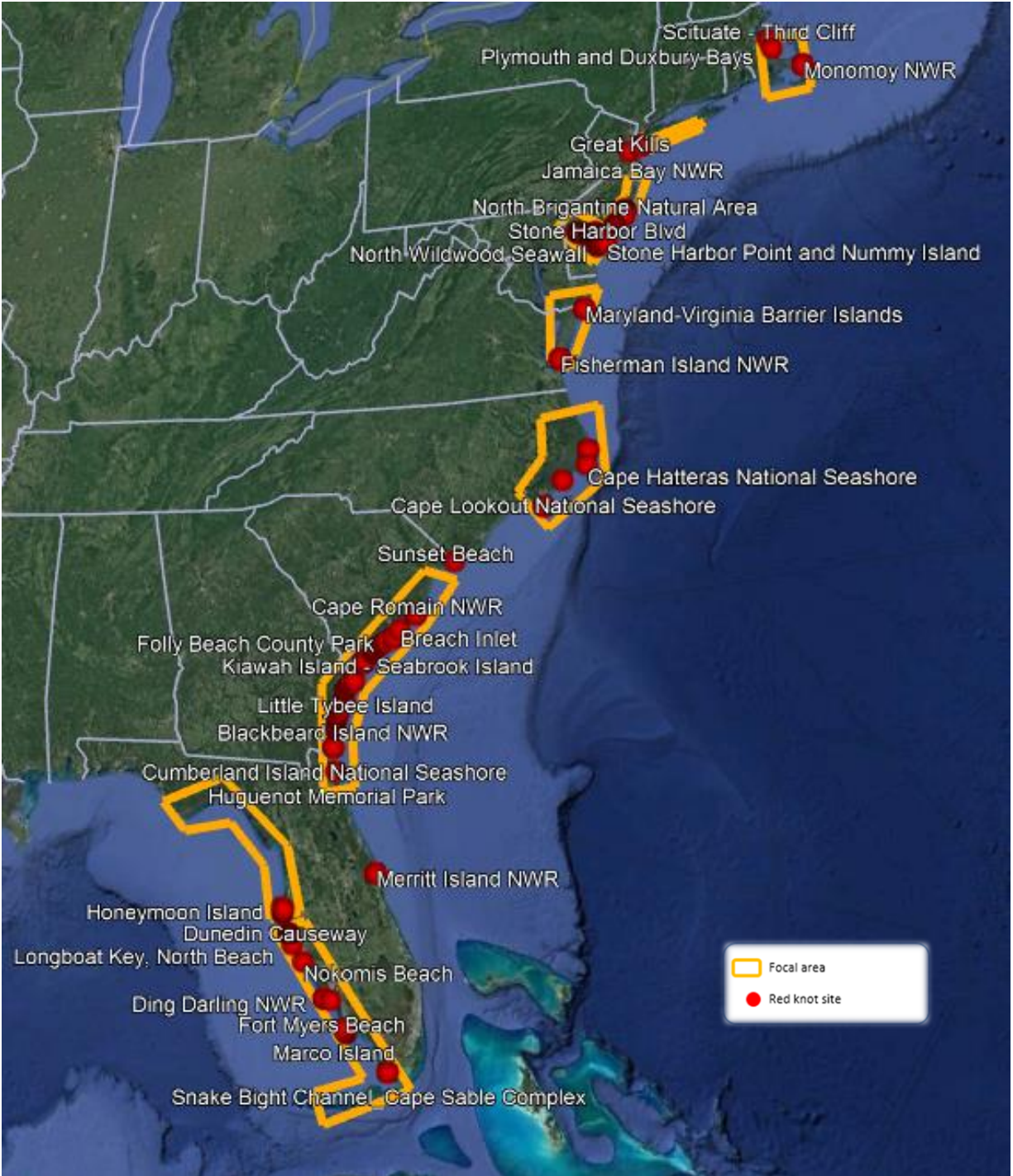
Appendix B (continued):

Priority breeding and wintering sites for American oystercatcher along the U.S. Atlantic Coast.



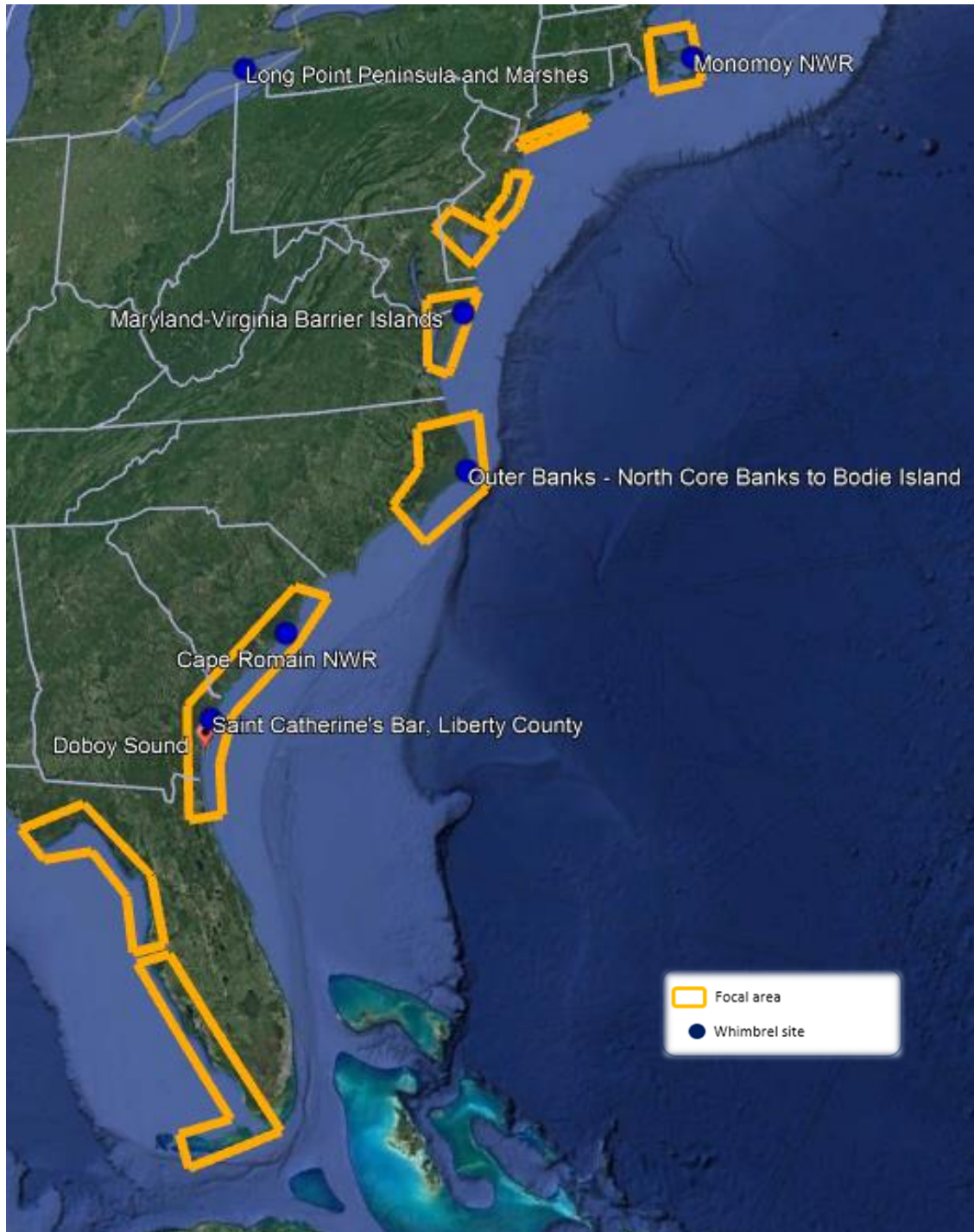
Appendix B (continued):

Priority stopover sites for red knot along the U.S. Atlantic Flyway.



Appendix B (continued):

Priority stopover sites for whimbrel along the U.S. Atlantic Flyway.



## Appendix C:

Priority stopover sites for whimbrel and red knot along the Caribbean/ South American Atlantic Flyway.



## Appendix D:

Criteria for the designation of Western Hemisphere Shorebird Reserve Network sites.

### WHSRN has two qualifying criteria for inclusion in the Network

#### 1. Importance to shorebirds

Sites/Landscapes\*\* of **Hemispheric** Importance:

At least 500,000 shorebirds annually; **OR**

At least 30% of the biogeographic population for a species

Sites of **International** Importance:

At least 100,000 shorebirds annually; **OR**

at least 10% of the biogeographic population for a species

Sites of **Regional** Importance:

At least 20,000 shorebirds annually; **OR**

At least 1% of the biogeographic population for a species

#### 2. Agreement of the landowner(s)

In the case of **WHSRN Sites**, landowners must agree in writing to:

Making shorebird conservation a priority at the site;

Protecting and manage the site for shorebirds; and

Updating the Network at least annually in the event of changes in the site's status (boundaries, degree of protection) or in the contact information of the person responsible.

In the case of **WHSRN Landscapes\*\***, a legally recognized agency or entity (such as a joint venture, landowners' coalition, or watershed council) would agree to the following terms in writing, in lieu of individual landowner agreements, and would accept responsibility for:

Making shorebird conservation a priority;

Working with landowners to protect and manage habitat for shorebirds;

Keeping WHSRN updated on changes in the landscape's status; and

Supplying point-of-contact information.

**Landscape\*\* nominations** must be accompanied by a letter from the nominator:

Demonstrating that there has been adequate public notification and opportunity for comment;  
and

Indicating how the requested landscape recognition from WHSRN will advance the cause of conservation generally, and for the target shorebirds in particular.

\*\* **WHSRN** created the "**Landscape**" category to accommodate vast areas or complex habitats where defining a "site" is not feasible. Such areas often encompass a multitude of landowners that are represented by one or more partner organizations submitting the WHSRN nomination.

## Appendix E:

Known priority breeding sites with high American oystercatcher concentrations along the U.S. Atlantic shorebird flyway.

**Table G.** Important breeding sites (holding 20 or more pairs).

Site name	State / Province	Country	High count	Source
Eastern Shore of Virginia seaward of the Delmarva Peninsula	Virginia	USA	~ 525 pairs	Wilke <i>et al.</i> 2009, Brown <i>et al.</i> 2005
Bay – Western Shore	Virginia	USA	21 pairs	Schulte <i>et al.</i> 2007
Bay – Accomack Shore	Virginia	USA	42 pairs	Wilke <i>et al.</i> 2009
Tampa and Hillsborough Bay	Florida	USA	120 pairs	Brown <i>et al.</i> 2005
Monomoy Island National Wildlife Refuge and South Beach	Massachusetts	USA	30-35 pairs	Schulte <i>et al.</i> 2007
Nantucket Harbor and Great Point	Massachusetts	USA	~ 40 pairs	Schulte <i>et al.</i> 2007
Stone Harbor Point and Nummy Island	New Jersey	USA	38 pairs	Schulte <i>et al.</i> 2007
Island Beach State Park and adjacent Sedge Island Marine Conservation Zone	New Jersey	USA	41 pairs	Schulte <i>et al.</i> 2007
Edwin B. Forsythe National Wildlife Refuge, Holgate Division and adjacent saltmarsh	New Jersey	USA	77 pairs	Schulte <i>et al.</i> 2007
Cape Hatteras National Seashore	North Carolina	USA	~30 pairs	Schulte <i>et al.</i> 2007
Cape Lookout National Seashore	North Carolina	USA	60 pairs	Schulte <i>et al.</i> 2007
Lower Cape Fear River	North Carolina	USA	40-55 pairs	Schulte <i>et al.</i> 2007
Cape Romain National Wildlife Refuge	South Carolina	USA	230 pairs	Sanders <i>et al.</i> 2004, Brown <i>et al.</i> 2005

Clay, R.P., Lesterhuis, A.J., Schulte, S., Brown, S., Reynoldes, D. & Simons, T.R. 2014. A global assessment of the conservation status of the American Oystercatcher *Haematopus palliatus*. *International Wader Studies* 20: 62–82

# Appendix F:

## Atlantic Flyway Evaluation Framework

