

4. Delaware Bay Shoreline

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a. Habitats

The Delaware Bay Shoreline extends from Cape May Canal to Oyster Cove at the western corner of Cumberland County (Figure 15). The shoreline has critical beach, dune, and tidal and freshwater wetland habitats for migratory birds and other wildlife of the Coastal Plain.

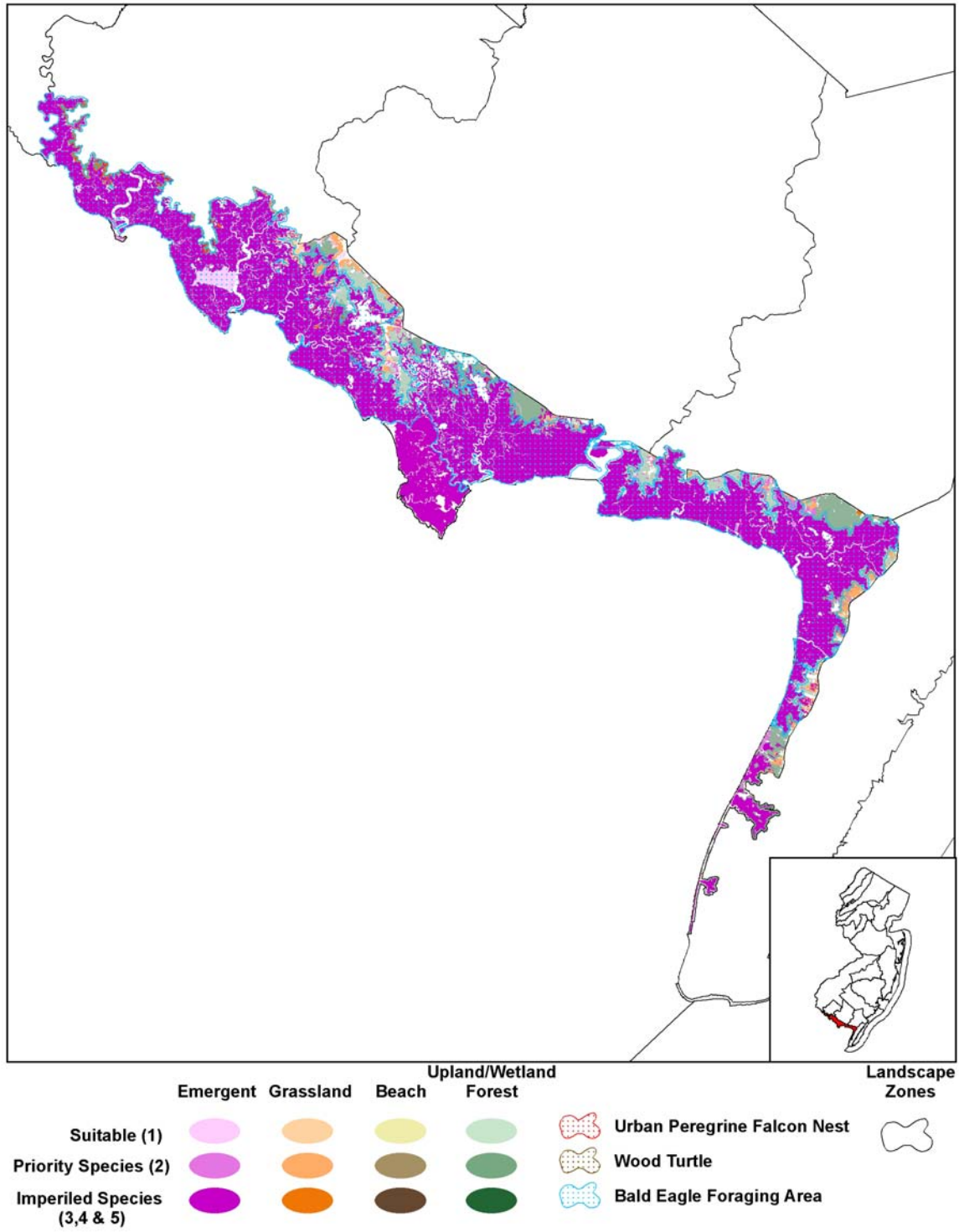
Priority areas along the Delaware Bay Shoreline include (from east to west) Cape May NWR-Delaware Bay Division, Dennis Creek WMA, Dennis Township PSE&G, Heislerville WMA, Maurice River and Commercial townships PSE&G, Egg Island WMA, Fortescue WMA, The Glades natural area, Nantuxent WMA, New Sweden WMA, Dix WMA, and Bayside WMA. Approximately 4,800 hectares (18.5 sq. mi.) of marsh have been restored since 1996 under the PSE&G estuary enhancement program, which converted artificial impoundments of salt hay farms (flooded once or twice a month) to daily-flooded tidal saltmarsh.

b. Wildlife of Greatest Conservation Need

There are six federal threatened, six state endangered, four state threatened, and 23 special concern wildlife species in the Delaware Bay Shoreline zone. The bald eagle, black skimmer, northern harrier, peregrine falcon, and sedge wren are among the state endangered wildlife. The black rail, black- and yellow-crowned night herons, osprey, and red knot are the state threatened species. Special concern wildlife include coastal marsh birds, colonial waterbirds, freshwater wetland birds, migratory raptors, migratory shorebirds, and the northern diamondback terrapin.

The Delaware Bay Shoreline is a critical migratory stopover for Western Hemispheric populations of migratory shorebirds, including red knot, ruddy turnstone, sanderling and semipalmated sandpiper. These migrants depend on the eggs of spawning horseshoe crabs for a major portion of their diets (50 to 90 percent) each spring before migrating from the Delaware Bay beaches to Arctic nesting grounds. The beaches also occasionally support small numbers of beach-nesting birds (such as piping plovers), but these species are primarily found in the Coastal Landscape Region. Coastal marshes and freshwater wetlands are habitat for bald eagles, ospreys, peregrine falcons, the state's black rail population, and northern diamondback terrapins. The Delaware Bay region is a critical migration and wintering area for American black ducks in the Atlantic Flyway. The coastal marsh edge is a habitat line followed by many fall-migrating birds that avoid the open water Delaware Bay crossing and seek a shorter crossing up-bay, a decision that might aid in their survival. Tables DB29 – DB35 identify the species of greatest conservation need within this zone.

Figure 15. Critical landscape habitats within the Delaware Bay Shoreline conservation zone, as identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Delaware Bay Shoreline

Table DB29. Federal Endangered Species*

Common Name	Water	Beach	Wetlands
Reptiles			
Green sea turtle	X		
Leatherback sea turtle	X		
Loggerhead sea turtle	X		
Hawksbill sea turtle	X		
Kemp's ridley sea turtle	X		
Fish			
Shortnose Sturgeon	X		

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife
 X: Species occurs within the identified habitat.

Table DB30. State Endangered Species

Common Name	Water	Beach	Wetlands
Birds			
Bald eagle			X
Black skimmer		X	X
Least tern		X	
Northern harrier			X
Peregrine falcon			X
Sedge wren			X
Short-eared owl			X
Black skimmer		X	X

X: Species occurs within the identified habitat.

Table DB31. State Threatened Species

Common Name	Water	Beach	Wetlands
Birds			
Black rail			X
Black-crowned night heron			X
Osprey			X
Red knot		X	X
Yellow-crowned night heron			X

X: Species occurs within the identified habitat.

Table DB32. Nongame Species of Conservation Concern

Common Name	Water	Beach	Wetlands
Mammals			
Marsh rat			X
Birds			
American oystercatcher			X
Common barn owl			
Common tern			X
Forster's tern			X
Glossy ibis			X
Great blue heron			X
Great egret		X	X
Green heron			X
King rail			X
Least bittern			X
Least tern		X	X
Little blue heron			X
Marsh wren			X
Ruddy turnstone		X	X
Saltmarsh sharp-tailed sparrow			X
Sanderling		X	X
Seaside sparrow			X
Semipalmated sandpiper		X	X
Sharp-shinned hawk			X

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Nongame Species of Conservation Concern (continued)

Common Name	Water	Beach	Wetlands
Birds (continued)			
Snowy egret			X
Willet		X	X
Reptiles			
Northern diamondback terrapin		X	X
Insects			
A geometrid moth, <i>Eusarca fundaria</i>			X
A noctuid moth, <i>Meropleon titan</i>			X
Fish			
Atlantic sturgeon	X		

X: Species occurs within the identified habitat.

Table DB33. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Beach	Wetlands
Birds			
American black duck	X		X
American woodcock			X
Black scoter	X		X
Bufflehead	X		X
Canada Goose (Atlantic population)	X		X
Canvasback	X		X
Clapper rail			X
Greater scaup	X		X
Lesser scaup	X		X
Long-tailed duck	X		X
Northern bobwhite			X
Northern pintail			X
Surf scoter	X		X
Virginia rail			X
White-winged scoter	X		X
Wood duck			X

X: Species occurs within the identified habitat.

Table DB34. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Hickory shad	X

X: Species occurs within the identified habitat.

Table DB35. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Beach	Wetlands
Mammals			
River otter	X		
Birds			
Sora rail			X

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Delaware Bay Shoreline

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Attachment A or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Migratory shorebirds on the Delaware Bay beaches are threatened by limited food availability. The high harvest of horseshoe crabs since 1991 has reduced the crab population and has led to declines in migratory shorebirds including red knots, sanderlings, semipalmated sandpipers, ruddy turnstones and other shorebirds. Human disturbance associated with recreation is a serious threat to migratory shorebirds. A significant threat to habitats here is risk of oil and hazardous materials spills: Delaware Bay is the second largest port for oil transport on the East coast, so oil spills (such as the *Athos I* in 2004) are a real threat to habitats and animal populations. Predation seems to be the limiting factor preventing colonial waterbirds and most beach-nesting birds from nesting on the Delaware Bayshore; their current habitat use is primarily for foraging and post-nesting roosting. Erosion of the shoreline has been an ongoing concern, potentially affecting their suitability and use by spawning horseshoe crabs; to date the decline in horseshoe crab population has masked possible effects of erosion. An increase in the rate of erosion, and changes to the entire marsh-shore system, may be expected with climate change and sea level rise. Shoreline loss due to bulkheads and jetties is a concern, but some beach area has been gained in recent years with restoration of beaches at Moore's and Thompson's beaches. Similarly, tidal marshes have been restored in the PSE&G estuary enhancement program that converted large areas of salt hay farms to tidal saltmarsh. Environmental impacts of aquaculture are largely unmeasured and poorly understood. Also see Section I-E "Threats to Wildlife and Habitats" (page 17) of this document.

d. Conservation Goals

- Identify, protect, enhance and/or restore endangered, threatened and special concern wildlife and fish populations and their habitats through full implementation of Landscape Project.
- Identify, protect, maintain, and enhance critical habitats and resources in the salt marsh complex, beach front, and upland fringe of this zone for migratory shorebirds (including red knot), black rail, northern harrier, osprey, bald eagle, and peregrine falcon populations; migratory songbirds, coastal marsh birds, waterfowl, and colonial waterbird communities.
- Protect and enhance water quality to preserve aquatic ecosystems, particularly for species of conservation concern that rely on high water quality.
- Inventory, determine distribution, and monitor migratory shorebirds in beach and marsh habitats, and black rails, northern harriers, bald eagles, ospreys, peregrine falcons, foraging marsh birds, northern diamondback terrapins, and monitor the aquatic food chain.
- Prevent, stabilize, and reverse declines of migratory shorebirds and resident coastal marsh birds such as black rails and northern harriers, and endangered, threatened, and special concern fish species.
- Maintain bald eagle and osprey populations.
- Restore the horseshoe crab population to above 1990-1991 levels.

- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife
- Protect and enhance important and unique natural communities.
- Assess large-scale habitat change (every five to 10 years).
- Promote public education and awareness, wildlife conservation, and viewing opportunities.

e. Conservation Actions

The actions below are identified as primary (1° or priority) and secondary (2°). Prioritization was determined by the Delaware Bay Regional Landscape stakeholders during a meeting held on September 12, 2007 (see *Attachment J*). These actions, with a focus on the priority actions, should be incorporated in planning and project development in conjunction with the priority state-level objectives (goals) and strategies (actions).

Priority	Conservation Actions
Protect wildlife habitat through implementation of Landscape Project mapping	
1°	Revise existing Landscape Project species occurrence areas through research and, where lacking, develop new species occurrence areas as data on species habitat requirements become available. Develop, review, and improve species-habitat associations as new land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
1°	Identify, prioritize, and reclaim degraded rare species habitats by working with land management agencies to determine the appropriate actions needed to restore habitat value for the documented species. Appropriate actions might include the control of harmful, invasive, vegetation, restoring natural stream flows, revegetation with native plants or restoring habitat structure. (<i>Evaluate restoration – invasives</i>)
2°	Use GIS, other remote sensing tools, and surveys to identify and map significant natural vegetative communities that may host wildlife species of conservation need, particularly on public lands and lands that serve as wildlife corridors. (<i>Conserve wildlife – rare wildlife</i>)
Protect critical habitats for migratory shorebirds, other coastal marsh wildlife	
1°	Develop, implement, and evaluate best management practices and guidelines to maintain and enhance habitats on public and private lands that support foraging bald eagles as well as osprey, shorebirds, peregrine falcon, northern harrier, and black rail on the bayshore, especially with regard to disturbance, mosquito control, and vegetation management in marshes. (<i>Conserve wildlife – rare wildlife</i>)
1°	Use GIS, other remote sensing tools, and surveys to identify critical aquatic and wetland habitats and assess their condition for migrating and wintering waterfowl finfish, and shellfish populations of conservation concern. Take action to minimize habitat loss by restoring, enhancing, and/or protecting habitat on public and private lands through protection strategies (e.g., acquisition, landowner incentives) and to maintain/enhance existing waterfowl habitat where such management complements rare species management. (<i>Conserve wildlife – game species</i>)

Priority	Conservation Actions (continued)
1°	Identify and protect habitat for fish by plotting distributions of special concern fish species, and integrate those data into the Biotics database. <i>(Monitor wildlife – fish; Protect habitat – Landscape Project)</i>
1°	Work with the NJ Division of Fish and Wildlife Bureau of Law Enforcement, the Division of Parks and Forestry’s State Park Police, and the USFWS officers to enforce regulations governing recreational activities (including but not limited to the use of personal watercraft, all terrain vehicles, etc.) in refuges and other sensitive habitats, and discourage activities that cause harm or disturbance to vegetation, wetlands and wildlife. <i>(Protect habitat – recreational vehicles)</i>
1°	Work with NJDEP-OCE, USACE, and other appropriate agencies to develop, implement, and evaluate best management practices for using dredged material to improve habitat for wildlife, particularly for spawning horseshoe crabs and migrating shorebirds. <i>(Conserve wildlife – rare wildlife; Other practices – land management)</i>
1°	Identify and protect critical areas of submerged aquatic vegetation to benefit waterfowl, finfish, and shellfish species through surveys, GIS measures and other remote sensing tools, expert opinion, and historical records. Reestablish/restore historically important submerged aquatic vegetation beds in Delaware Bay tributaries to benefit waterfowl and waterbirds. <i>(Conserve wildlife – game species)</i>
1°	Develop, implement, and evaluate best management practices to protect, enhance and restore marsh habitat, as appropriate. The primary focus is on habitat supporting coastal marsh birds, especially northern harrier and black rail, particularly with regard to mosquito control and vegetation management in marshes. Investigate and promote actions that will restore marshes to pre-grid-ditched hydrology. <i>(Conserve wildlife – rare wildlife; Protect habitat – migratory birds, Landscape Project)</i>
1°	Use GIS, other remote sensing tools, and surveys to identify critical Delaware Bay beach habitats and assess their condition for migratory shorebirds and maintain appropriate information. Identify protection strategies and best management practices to maintain suitable habitat for migratory shorebirds in perpetuity. <i>(Conserve wildlife – rare wildlife, Protect habitat – Landscape Project, Protect habitat – migratory birds)</i>
1°	Develop, implement, and evaluate best management practices to minimize beach loss and preserve optimal shoreline habitats for horseshoe crabs and migratory shorebirds. <i>(Protect habitat – migratory birds)</i>
1°	Investigate the potential for management and creation of migratory shorebird feeding and roosting areas on Cape May peninsula, particularly at Cox Hall Creek, Fishing Creek, and Cape May NWR. <i>(Protect habitat – migratory birds)</i>
2°	Investigate and improve current marsh management techniques to benefit critical wildlife species, in particular high marsh nesting birds and waterfowl, and include in marsh BMPs and species dependent on mudflats and impoundments. <i>(Conserve wildlife – rare wildlife, game species)</i>

Priority	Conservation Actions (continued)
2°	Identify areas that may benefit from marine conservation zone status to protect sensitive habitats and species from human disturbance. Develop and implement protection measures in marine and riverine habitats. <i>(Protect habitat – humans)</i>
2°	Develop, implement, and evaluate habitat management that will promote foraging and roosting of black skimmer and least tern where they are not ultimately limited by development and predators. <i>(Conserve wildlife – rare wildlife)</i>
2°	Protect habitats through innovative public and private partnerships. Promote existing landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant migratory shorebird, bald eagle, migratory songbird, and tidal marsh bird populations. <i>(Protect habitat – migratory birds, Landscape Project; Conserve wildlife – rare wildlife; Enhance habitat – private lands)</i>
2°	Develop, implement, and evaluate best management practices for forest, shrub and field habitats along the upland edge of the shoreline and marshes for raptor and passerine suitability, especially to maintain feeding and roosting habitat for autumn-migrating landbirds. <i>(Protect habitat – migratory birds; Corridors – migratory birds)</i>
Protect water quality and maintain adequate buffers	
1°	Maintain optimal biological buffers (beyond regulatory requirements) around wetlands, riparian, and floodplain areas and minimize destruction per the NJ DEP Wetland Buffer Guidelines for Species of Conservation Concern in New Jersey (in prep). Stabilize wetland buffers and streambanks by encouraging plantings of native vegetation through public education, volunteer programs, and land managers to stabilize wetland buffers and stream banks and prevent erosion. <i>(Protect habitat – Landscape Project, sprawl, rare wildlife, fish; Enhance habitat – private lands)</i>
1°	Protect water quality and aquatic-dependent species by appropriately designating Category One waters. <i>(Protect habitat – rare wildlife, fish)</i>
1°	Seek appropriate classifications for stream segments based on IBI results that do not fulfill Category One requirements. <i>(Protect habitat – rare wildlife, fish)</i>
2°	Investigate impacts of aquaculture on water quality. Determine relative effects of locations and aquaculture techniques. Develop and implement management actions to minimize impacts. <i>(Conserve wildlife – rare wildlife; Protect habitat – rare wildlife, fish)</i>
Inventory and monitor migratory shorebirds and other coastal marsh wildlife and rare fish species	
1°	Survey suitable habitats to determine distribution of wildlife species of greatest conservation need and establish baseline information for monitoring population trends. Maintain shoreline surveys and develop marsh surveys for migratory shorebirds. Identify and record important migratory shorebird foraging and roosting areas. Conduct northern harrier and black rail surveys every two to four years. Develop baseline surveys for listed and special concern rail species, and migratory songbird use. <i>(Conserve wildlife – rare wildlife; Protect habitat – migratory birds; Monitor wildlife – long-term monitoring)</i>

Priority	Conservation Actions (continued)
1°	Conduct concentrated field sampling for listed or special concern fish species (e.g., Atlantic and shortnose sturgeon) at areas indicated by FishTrack Database. <i>(Status – fish; Monitor wildlife - fish)</i>
1°	Conduct surveys to identify migratory pathways of bats in the shoreline zone through telemetry or Radio Detection And Ranging (RADAR). Data to be used in evaluation of potential impacts of wind turbines or other coastal structures on migratory bat populations. Carry out post-construction monitoring of both existing and future wind turbines to assess the actual impacts these structures have on bats. <i>(Protect habitat - humans)</i>
1°	Assess population levels of listed and special concern rails, and determine whether directed management efforts are needed to reach or maintain viable population levels. <i>(Conserve wildlife – rare wildlife)</i>
1°	Monitor red knot movements to identify all habitats used in relation to food (horseshoe crab egg) densities, tide, and habitat conditions. Identify habitat standards to maintain optimal migratory shorebird populations and implement within land acquisition and management plans. <i>(Conserve wildlife – rare wildlife; Protect habitat – migratory birds)</i>
2°	Conduct the annual Mid-Winter Waterfowl Survey to monitor population trends. <i>(Conserve wildlife – game species; Monitor wildlife – long-term monitoring)</i>
2°	Conduct the Atlantic Flyway Breeding Waterfowl Survey annually to monitor population trends. <i>(Monitor wildlife – long-term monitoring)</i>
2°	Determine carrying capacity of area marshes for wintering American black ducks to inform decisions in setting Atlantic Flyway population objectives and to guide management actions. <i>(Conserve wildlife – game species)</i>
2°	Use GIS measures, other remote sensing tools, and surveys to identify important staging areas for red knots and other migratory shorebirds and determine and enforce the necessary restrictions on human activities to minimize disturbance at and destruction of these sites. Obtain necessary approvals from New Jersey Tidelands Council for management actions. <i>(Protect habitat – humans; Corridors – migratory birds)</i>
2°	Continue ground surveys of all known great blue heron rookeries every 3-5 years. Improve census methods to capture population and reproductive success metrics at a finer scale. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)</i>
2°	Establish a formal ground survey for inland colonies of colonial waterbirds, with a particular emphasis on black and yellow-crowned night herons. Once the survey is instituted, continue on a rotation of once every other year. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)</i>

Priority	Conservation Actions (continued)
Prevent, stabilize, and reverse declines of coastal marsh wildlife (e.g., black rail, northern harrier)	
1°	ENSP biologists will be responsible for notifying the NJ Division of Fish and Wildlife's Bureau of Law Enforcement and the Division of Parks and Forestry Bureau of Law Enforcement and managers, where and when appropriate, of critical sites (nesting, basking, gestation, dens, spawning and nursery sites) to implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (northern pine snakes, corn snakes, timber rattlesnakes) and human disturbance (off-road vehicles). <i>(Protect wildlife – humans, recreational vehicles)</i>
1°	Notify wildlife law enforcement agents (and when applicable, conservation organizations and local municipalities) of critical staging areas; identify and enforce the necessary restrictions to human activities. <i>(Protect wildlife - humans)</i>
1°	Reduce the impacts of human disturbance on red knots and other migratory shorebirds that use the intertidal zone of beaches and inlets by posting and/or fencing critical migratory sites, and developing management plans or policies that minimize human impacts. <i>(Protect wildlife - humans)</i>
1°	Control and reduce disturbance to red knots and migratory shorebirds by closing posted areas during peak migration periods and increasing the regular presence of state conservation officers at beach nesting bird sites during the nesting season. <i>(Conserve wildlife – rare wildlife; Protect habitat – migratory birds, Landscape Project)</i>
1°	Reduce the impacts of human disturbance on red knots and other migratory shorebirds that use the intertidal zone of beaches and inlets by posting and/or fencing critical migratory sites, and developing management plans or policies that minimize human impacts. <i>(Protect habitat – humans)</i>
1°	Investigate impacts of aquaculture on migratory shorebirds, waterfowl, finfish, shellfish, and other wildlife species of conservation concern. Determine relative effects of locations and aquaculture techniques. Develop and implement management actions to minimize impacts. <i>(Conserve wildlife – rare wildlife, game wildlife; Aquaculture – land management)</i>
1°	Research the intensity and characteristics of threats to wildlife species of conservation concern and their habitat, including causes and effects of habitat loss, degradation, and alteration, edge, disturbance, impacts of roads, predation, competition by invasive plants and animals, disease, contaminants, food availability, hybridization, and how water quality degradation and contaminants affect rare species. <i>(Protect habitat – sprawl, recreational vehicles, humans; Conserve wildlife – contaminants, invasives, rare wildlife, subsidized predator; Evaluate restoration – roads)</i>

Priority	Conservation Actions (continued)
1°	Develop and implement proactive habitat conservation goals that will meet and maintain the recovery needs of shorebirds, coastal marsh birds, migratory songbirds, colonial waterbirds, waterfowl (consistent with the U.S. Shorebird Conservation Plan and the North American Waterbird Conservation Plan), and finfish and shellfish. <i>(Conserve wildlife – rare wildlife; Protect habitat – migratory birds)</i>
1°	Develop and implement proactive habitat conservation plans that will help meet and maintain recovery goals for northern harrier and other high-marsh species. <i>(Conserve wildlife – rare wildlife; Protect habitat – Landscape Project)</i>
1°	Research the population size, recruitment, habitat requirements, and threats to the northern diamondback terrapin population; and population distribution to determine critical areas for protection. <i>(Conserve wildlife – rare wildlife; Protect habitat – Landscape Project; Monitor wildlife – long-term monitoring)</i>
1°	Assess changes in availability of low and high marsh, directly, and by using indicator species (black rail, northern harrier), and relate habitat changes to marsh management practices. Evaluate management practices and revise as appropriate to benefit species of conservation concern. <i>(Conserve wildlife – rare wildlife)</i>
1°	Collaborate with DOTs, NGOs, and volunteers to identify key road-crossing areas of northern diamondback terrapin and work with appropriate government agencies to install turtle crossing signs and erect turtle barriers or provide safe passage, as appropriate, depending on the habitat and location. <i>(Conserve wildlife – rare wildlife; Protect habitat – roads; Corridors - roads)</i>
1°	Develop strategies to restore horseshoe crab populations to 1990 level, using methods including (but not limited to) harvest restrictions, minimizing beach loss and development, and beach enhancement. <i>(Conserve wildlife – rare wildlife; Protect habitat – migratory birds, Landscape Project)</i>
1°	Protect wildlife species of conservation concern, especially slow moving terrestrial-bound species (e.g. reptiles, amphibians) and sensitive forest nesters (e.g. red-shouldered hawks, barred owls) by prohibiting off-road vehicles from all public and private conservation lands except where authorized by the governing agency by working with law enforcement agencies and implementing other means as they are developed. <i>(Protect habitat – recreational vehicles; Conserve wildlife - recreational vehicles)</i>
2°	Investigate the utility of a marine conservation area to protect sensitive species and habitats in the bayshore area from disturbance and habitat degradation. <i>(Protect habitat - humans)</i>
2°	Enhance northern diamondback terrapin populations by: a) determine the sustainable population goal, b) enforcing compliance with current crab trap regulations (e.g. turtle excluder devices), c) evaluating if current regulations are sufficient, in conjunction with naturally occurring survivorship rates, to protect and reduce mortality of northern diamondback terrapin populations, and d) closing the harvest season until sustainable population levels are reached. <i>(Conserve wildlife – rare wildlife)</i>

Priority	Conservation Actions (continued)
Prevent, stabilize, and reverse declines of rare fish species	
1°	Identify and protect habitat for fish by plotting distributions of special concern fish species, and integrate those data into the Biotics database. (<i>Monitor wildlife - fish; Protect habitat – Landscape Project</i>)
1°	Develop, implement, and evaluate best management practices to enhance and/or restore aquatic and adjacent riparian habitats supporting populations of special concern and rare fish. (<i>Protect habitat – fish; Monitor wildlife - fish</i>)
1°	Develop a fish Index of Biotic Integrity (IBI) to better assess the presence and distribution of fish species, and to restore and protect NJ’s non-trout streams in the Lower Delaware River drainage. (<i>Native wildlife – fish; Status – fish; Monitor wildlife - fish</i>)
1°	Conduct concentrated field sampling for listed or special concern fish species in areas indicated by FishTrack Database queries and incorporate data into the Biotics database. (<i>Status – fish; Monitor wildlife – fish; Native wildlife - fish</i>)
Maintain bald eagle and osprey populations	
1°	Provide the NJ Division of Fish and Wildlife’s Bureau of Law Enforcement with a map of critical sites to implement stringent enforcement of endangered species laws including harassment and human disturbance; update map as additional data become available. (<i>Protect habitat – humans</i>)
1°	Develop and implement proactive habitat conservation plans that will help meet and maintain the recovery goals for bald eagles and ospreys. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
1°	Identify and research water quality parameters for bald eagle and osprey populations. Maintain data on those parameters to track trends and identify potential threats. (<i>Conserve wildlife – rare wildlife; Protect aquatic wildlife - humans, development</i>)
2°	Actively protect, monitor, and manage bald eagle nests and foraging areas, including posting signs in waterways to prevent disturbance by recreational activity, delineating and posting nests and significant roosting areas, building cooperation with private landowners, and working closely with law enforcement and volunteers to minimize disturbance at nest sites. (<i>Conserve wildlife – rare wildlife; Protect habitat – recreational vehicles, humans</i>)
2°	Continue to monitor nest occupancy and reproductive success of bald eagles, osprey, and peregrine falcons, and identify and monitor bald eagle concentration and roosting areas to understand their role in population maintenance. (<i>Conserve wildlife – rare wildlife; Protect habitat – recreational vehicles, humans</i>)
Restore horseshoe crab population to above 1990-1991 level	
1°	Develop strategies to restore horseshoe crab populations to 1990 level, using methods including (but not limited to) harvest restrictions, minimizing beach loss and development, and beach enhancement. (<i>Conserve wildlife – rare wildlife; Protect habitat – migratory birds, Landscape Project</i>)

Priority	Conservation Actions (continued)
1°	Implement or enhance an ecosystem-level (as opposed to single-species level) approach to the conservation of horseshoe crabs in Delaware Bay and the mid-Atlantic region. <i>(Conserve wildlife – rare wildlife; Protect habitat – migratory birds)</i>
1°	Monitor horseshoe crab population and egg densities relative to migratory shorebird needs, and recommend management to increase horseshoe crab populations in the short term (e.g., harvest restrictions) and long term (e.g., habitat enhancement and harvest moratorium). <i>(Conserve wildlife – rare wildlife; Protect habitat – migratory birds)</i>
2°	Develop, implement, and evaluate BMPs for shoreline management to maintain and enhance horseshoe crab spawning habitat. <i>(Conserve wildlife – rare wildlife; Protect habitat – migratory birds)</i>
Maintain natural biodiversity, community integrity and structure, and ecosystem function by controlling invasive and overabundant species	
1°	Use appropriate measures to control the spread of phragmites (common reed) and restore the marshes to native species. <i>(Conserve wildlife – invasives)</i>
1°	Develop, implement, and evaluate management strategies to reduce the impacts of mute swan herbivory on native vegetation in impoundments and marshes of the Cohansey River supporting species of conservation concern. <i>(Conserve wildlife – invasives)</i>
1°	Monitor and evaluate the impacts of snow goose herbivory to the salt marshes of the Delaware Bay shoreline and the native wildlife that rely upon this habitat. Develop, implement, and evaluate management strategies to minimize any unreasonable negative impacts on native wildlife, focusing on areas supporting species of conservation concern. <i>(Conserve wildlife – invasives)</i>
1°	Assess the impact of laughing gull population on habitat used by migratory shorebirds to assess the need for integrated wildlife damage management of gulls is necessary. <i>(Protect habitat – migratory birds)</i>
Protect and enhance important and unique habitats	
1°	Develop and implement long term protection for beaches on the lower bayshore, including Villas, Kimble’s and Reed’s beaches, which are particularly important to migrating shorebirds in spring, as is the vast marsh matrix of Egg Island Wildlife Management Area between Fortescue and the Maurice River. <i>(Protect habitat – migratory birds; Corridors – migratory birds; Conserve wildlife – rare wildlife)</i>
1°	Develop and implement long term protection for habitats along the major rivers of the Cohansey, Back Creek, Nantuxent, and the Maurice, as centers of bald eagle nesting and wintering populations for southern NJ. <i>(Protect habitat – migratory birds; Corridors – migratory birds; Conserve wildlife – rare wildlife)</i>

Priority	Conservation Actions (continued)
2°	Incorporate ENSP approved sightings data from nominated and approved Important Bird Areas into the Biotics database and Landscape Project mapping providing the sightings meet the ENSP Biotics and Landscape Project standards. Recognize the particular importance of the autumn migratory corridor along the upland edge of bayshore marshes. (<i>Corridors – migratory birds; Protect habitat – migratory birds, Landscape Project</i>)
Assess large-scale habitat change every five years	
1°	Collaborate with NJ DEP's Bureau of Geographic Information and Analysis and Rutgers Center for Remote Sensing and Spatial Analysis to develop methods to update DEP's land use/land cover data every five years and perform critical habitat change analysis to assess trend in habitat loss and conversion.
Promote public education and awareness and wildlife conservation	
1°	Develop, maintain, and enhance opportunities for ecotourism on Delaware Bayshore in a manner consistent with wildlife and habitat enhancement including but not limited to the creations of interpretive trails, the creation of viewing areas, and wildlife-related recreational opportunities that do not negatively impact species of conservation concern and their habitats. (<i>Education – humans</i>)
1°	Educate public about the importance of keeping cats indoors through newsletters, press releases, brochures, presentations, web pages, targeting southern (residential) beaches. Work to develop a statewide policy for local communities to discourage managed cat colonies and trap, neuter and release programs; encourage academic research that examines the full range of impacts of feral cat colonies on local wildlife populations and of feral cat colony management (including TNR) on local wildlife populations and local feral cat populations. (<i>Education – humans</i>)
1°	Engage landowners and NJ citizens in protection and survey efforts for endangered species by increasing enrollment in landowner incentives, forest stewardship, backyard habitat management, and Citizen Science Program. (<i>Education – humans; Conserve wildlife – rare wildlife</i>)
2°	Develop and maintain education brochures and posters and viewing opportunities for the public consistent with species recovery goals to enhance public awareness of wildlife conservation and environmental issues by cooperating with federal, state, and local government, and non-governmental organization partners. (<i>Education – humans</i>)
2°	Develop brochures and posters to educate the public education and increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans</i>)
2°	Educate the public about the importance of the habitats within this zone to the Atlantic coast bird, bat, and Lepidopteran species' migration through newsletters, press releases, brochures, presentations, and web pages. (<i>Education – humans</i>)
2°	Develop targeted outreach brochures for pet owners, outdoor-recreation enthusiasts, and local citizens adjacent to critical habitats about the importance of specific habitats to populations of migratory birds and the importance of maintaining disturbance-free areas for them. (<i>Education – humans</i>)

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect bald eagle, osprey, peregrine falcon, high-marsh nesting birds, and coastal marsh-edge nesting areas.
 - Work with landowners to maintain/enhance existing habitats where listed special concern fish species occur.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, Natural Lands Trust, The Nature Conservancy-NJ Chapter, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations (e.g., shorebird surveys in spring and fall and northern diamondback terrapin nesting).
 - Involve Citizen Scientists in management projects and protection projects, such as protecting migratory shorebird feeding areas, shorebird banding and sightings, and building osprey nest structures.
- Promote backyard habitat management for migratory raptors.
- Collaborate with NJ Audubon Society to educate public on the negative effects of feral cats on wildlife species of conservation concern, and the problems unleashed dogs cause migratory shorebirds.

Conservation Organizations

- Partner with watershed groups (such as Delaware Riverkeeper) and conservation organizations such as NJ Audubon Society (NJAS), The Nature Conservancy (TNC) and Natural Lands Trust to protect and enhance habitats for rare species.
 - Protect bald eagle, osprey, peregrine falcon, and coastal marsh bird nesting and foraging sites.
- Consult with conservation organizations to develop educational programs and wildlife festivals.
- Encourage the use of the Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres and local land trusts.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, USDA-NRCS, USFWS, and the DCA, Office of Smart Growth to protect and enhance habitats, and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) to maintain and protect habitats for bald eagle, colonial waterbird, osprey, peregrine falcon, and coastal marsh bird nesting and foraging.
 - DFW to develop a plan with wildlife law enforcement agents to protect all of the important habitats for spring-migrating shorebirds from disturbance.
 - DFW to work with wildlife law enforcement and municipalities to develop a plan to limit public access and disturbance to marsh bird nesting sites, and to maintain

- enforcement of regulations protecting northern diamondback terrapins from crab traps.
- DFW and USFWS to work together at Cape May NWR and WMAs to enhance refuge habitat for forest interior nesters and migratory landbirds.
 - DFW will lead the investigation of establishing marine conservation zone(s).
 - DFW will work with individual municipalities, DPF, the US Fish and Wildlife Service, and other landowning entities to target predators and reduce their effects on ground-nesting bird colonies near Cape May.
 - DFW and conservation organizations will work with the DEP's Land Use Regulation Program (LURP) to protect and appropriately classify wetlands for spotted turtle, carpenter frog, Fowler's toad, and marbled salamander populations.
 - DFW will work with LURP to discourage permitting of bulkheads and other "hardening" of the shoreline and to seek mitigation projects that will enhance shoreline and salt marsh habitats for wildlife.
 - Develop and implement best management practices for marsh habitats to enhance habitat for migratory shorebirds, high and low marsh birds, and migratory raptors and passerines on state lands and with natural resource managers, county and municipal utility authorities and planners.
 - DFW to work with the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers to ensure that beach fill and beach re-nourishment projects include migratory shorebird-horseshoe crab habitat enhancement.
 - DFW to work with the U.S. Fish and Wildlife Service and others to restore tidal wetlands where appropriate for migratory shorebirds, marsh birds, raptors and songbirds.
 - DFW to work with state and county mosquito commissions to implement marsh management that improves marshes for migratory shorebirds, rails and harriers, allowing for moist-soils as well as native salt marsh vegetation.
 - DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
 - DFW to partner with local, county and state authorities to establish best management practices in areas where listed or special concern fish and wildlife species occur.
 - DFW to work with the LURP to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
 - DFW to work with USFWS and other state, federal, and non-governmental partners to implement North American Waterfowl Management Plan as appropriate.
 - DFW to work with USFWS and other state and federal partners to implement the American Woodcock Management Plan as appropriate, seeking areas where such management complements rare species management.
 - DFW to work with federal and state agencies, including USFWS, USCG, National Oceanic and Atmospheric Administration, NJ Bureau of Emergency Response, and NJ Office of Natural Resources Restoration (NRCS) to plan for and assist with emergency oil spill response.
 - DFW and DPF to work with the USFWS to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands that are threatening critical wildlife habitats.

- DFW to determine groundwater recharge areas for Cope's gray treefrog breeding pools with the Division of Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water quality and conduct hydrological monitoring in these areas.
- DFW to lead in the development of educational materials for the public and private landowners about wildlife of greatest conservation need, their habitats, the potential harmful effects of disturbance on beach-nesting and coastal marsh birds, and the importance of the Delaware Bay migratory stopover.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs and wildlife viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee Farmland Preservation, local land trusts, and through mitigation.
- Support the completion of land acquisition in the US Fish and Wildlife Service's Cape May National Wildlife Refuge acquisition boundary, and expansion of that boundary (per Cape May NWR Comprehensive Conservation Plan, 2004).
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at federal, state, and local levels.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time using aerial photography; monitor efficacy of habitat management and restoration efforts, and relate habitat changes to key indicator wildlife species.
- Annually monitor abundance, productivity, distribution, and trends of migratory shorebird, bald eagle, osprey (biannually), peregrine falcon, black rail and northern harrier (biannually or more), colonial waterbird, and coastal rail populations.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Monitor weight gains of red knot and migratory shorebird populations during the stopover period. Monitor horseshoe crab egg density in relation to regulatory and habitat conditions.
- Monitor nesting density and productivity of red knots at Arctic breeding grounds.
- Monitor population trends of red knots at wintering grounds in Bahia Lomas, Chile, and in Argentina.
- Monitor species abundance of migratory raptors at key locations to determine trends in migration counts. Sponsor "Hawk Watches" during the fall migration.
- Measure population changes of reptiles and amphibians through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the vernal pool project, focusing on special concern reptiles, Eastern tiger salamander, Cope's gray treefrog, and vernal pool obligate and facultative species, species that depend wholly or significantly on vernal pools for breeding.
- Employ/implement adaptive management techniques for the goals and conservation actions established for species of greatest conservation need. Review effectiveness of research and management, and improve techniques as necessary.