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Narratives and Best Practices for Federally Listed, Proposed, and Candidate Species in New Jersey

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INTRODUCTION

This document presents the biology, threats, recovery information, and recommended best practices for federally listed, proposed, and candidate species within New Jersey. The best practices component provides typical conservation measures frequently recommended by the U.S. Fish and Wildlife Service's (Service) New Jersey Field Office (NJFO) during consultation or technical assistance. These practices are designed to avoid or minimize adverse effects to listed species as related to projects in New Jersey. Please be aware that, under [Section 7 of the Endangered Species Act](#) (ESA), Federal action agencies are required to consult with the Service for any proposed action that may affect listed species. Both Federal and non-Federal project proponents can find complete information and instructions on when and how to request project review from NJFO in the online [Project Review Guide](#).

The best practices included in this document may not be inclusive of all the conservation measures necessary for project proponents to implement, as developed/discussed through ESA consultation/technical assistance with the Service. To avoid delays, we recommend initiating ESA consultation/technical assistance early in project planning. Through the consultation/technical assistance processes of the ESA, the Service will provide project-specific recommendations to avoid or minimize adverse effects to listed species. Whereas the incorporation of best practices from this document into an action may streamline consultation, it does not constitute official consultation, coordination or authorization with/by the Service.

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
 <u>BIRDS</u>	
EASTERN BLACK RAIL (<i>LATERALLUS JAMAICENSIS JAMAICENSIS</i>).....	3
PIPING PLOVER (<i>CHARADRIUS MELODUS</i>)	8
RUFA RED KNOT (<i>CALIDRIS CANUTUS RUFA</i>).....	13
ROSEATE TERN (<i>STERNA DOUGALLII DOUGALLII</i>).....	20
 <u>MAMMALS</u>	
INDIANA BAT (<i>MYOTIS SODALIS</i>)	23
NORTHERN LONG-EARED BAT (<i>MYOTIS SEPTENTRIONALIS</i>)	28
TRICOLORED BAT (<i>PERIMYOTIS SUBFLAVUS</i>)	32
 <u>REPTILES</u>	
BOG TURTLE (<i>GLYPTEMYS MUHLENBERGII</i>).....	35
 <u>FRESHWATER MUSSELS</u>	
DWARF WEDGEMUSSEL (<i>ALASMIDONTA HETERODON</i>).....	39
GREEN FLOATER (<i>LASMIGONA SUBVIRIDIS</i>)	47
 <u>INSECTS</u>	
MONARCH BUTTERFLY (<i>DANAUS PLEXIPPUS</i>)	55
NORTHEASTERN BEACH TIGER BEETLE (<i>HABROSCELIMORPHA DORSALIS DORSALIS</i>)	59
 <u>PLANTS</u>	
AMERICAN CHAFFSEED (<i>SCHWALBEA AMERICANA</i>).....	62
KNIESKERN’S BEAKED-RUSH (<i>RHYNCHOSPORA KNIESKERNII</i>).....	66
SEABEACH AMARANTH (<i>AMARANTHUS PUMILUS</i>).....	69
SENSITIVE JOINT-VETCH (<i>AESCHYNOMENE VIRGINICA</i>)	74
SMALL WHORLED POGONIA (<i>ISOTRIA MEDEOLOIDES</i>).....	78
SWAMP PINK (<i>HELONIAS BULLATA</i>)	82

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

EASTERN BLACK RAIL (*LATERALLUS JAMAICENSIS JAMAICENSIS*)

Biology, Presence, and Threats

The eastern black rail was federally listed as threatened in 2020 (*Federal Register* Vol. 83, No. 195, pp. 50610-50630). The eastern black rail is a sparrow-sized, secretive marsh bird that is the smallest and rarest rail species in North America. Males and females are similar in size and appearance. Adults are 4 to 6 inches long and generally pale to blackish gray, with small white spots on the back, a small blackish bill, and bright red eyes (Service 2019).



Figure 1: Eastern Black Rail. (Credit: Tom Johnson, Copyrighted, All Rights Reserved, Used by Permission.)

Eastern black rails occur in fresh, brackish, and saltwater wetlands with clumped grasses, rushes, or sedges. The dense vegetation creates an over-arching canopy that is somewhat more open at the base of the clumps where the birds can move around on foot under the overhead cover. Suitable habitat depends more on vegetative structure than plant species' composition (Flores and Eddleman 1995, as cited in Service 2019). In New Jersey tidal marshes, eastern black rail habitat is typically dominated by native cordgrasses (*Spartina* spp.) but may also include the invasive common reed (*Phragmites australis*). Eastern black rails tolerate a few shrubs but are absent from areas dominated by shrubs or trees. This species often occurs in the transition zone between wetter areas and higher ground, or in a matrix of wetlands across the broader landscape (Service 2019).

Eastern black rails forage by gleaning or pecking small (less than 0.5 inch) insects, spiders, snails, crustaceans, and seeds. They breed in tidal or non-tidal wetlands with suitable hydrology, including human-made impoundments, and they usually occur in areas with sheet flow or other moving water. A key feature of eastern black rail habitat is moist to saturated substrates (occasionally dry) interspersed with or adjacent to very shallow water (typically no deeper than 1.2 inches). Eastern black rails prefer areas with varied micro-topography, which allows for the different habitat needs of chicks versus adults. This species also requires adjacent areas of higher elevation (*i.e.*, the wetland-upland transition zone) with dense cover as a refuge during high-water events. Flooding is a frequent cause of nest failure. For nests to succeed, water levels must be below the nests during egg-laying and incubation, which in New Jersey is believed to start in May and possibly continue through August. In tidal wetlands, eastern black rails typically nest in high marsh (above the mean high-water line) to avoid flooding but also forage in the adjacent

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

low marsh (below mean high-water line) (Service 2019, Hill 2022). After hatching, the mobile chicks receive parental care for about 42 days before learning to fly (fledge) (Service 2019).

Eastern black rails seldom fly during the breeding and wintering seasons and will typically flush only a short distance when pursued (Bent 1926, as cited in Service 2019). Instead, the birds typically remain on the ground, running quickly through dense vegetation and likely using paths created by small mammals (Taylor and van Perlo 1998, Armistead 2001, as cited in Service 2019). Because of this behavior, eastern black rails are considered highly secretive and are difficult to detect.

Although little information is available regarding migration, eastern black rails occurring in New Jersey are presumed to be breeding birds because it is currently the northern-most State with confirmed nesting. However, birds are occasionally detected as far north as New Jersey during winter (Root 1988, as cited in Service 2019). The life-history periods of greatest concern for eastern black rails in New Jersey include territory establishment, courtship, nesting, chick-rearing, and a post-breeding molt when adults are flightless. Based on the best available information these times of year are:

- April 1 to April 30: territory establishment/courtship
- May 1 to August 31: nesting/chick rearing
- August 15 to September 15: post-breeding molt

For more information visit:

<https://www.fws.gov/species/eastern-black-rail-laterallus-jamaicensis-jamaicensis>

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of eastern black rail in New Jersey. The eastern black rail range in New Jersey is generally limited to tidal marsh but does include some non-tidal wetlands. Conservation measures recommended by the Service are similar in non-tidal areas but may be adjusted for site-specific factors.

- Avoid permanent changes to emergent wetlands that may reduce their habitat suitability (ACJV 2019). This includes changes to wetland hydrology, substrates, and vegetation. Avoid activities such as filling, draining, ditching, impounding, clearing, or erecting new structures in wetlands, and offsite activities such as new stormwater or wastewater discharges into wetlands. Avoid new upland development immediately adjacent to wetlands and minimize new infrastructure within the likely trajectory of shoreline migration in response to sea level rise (ACJV 2019).
- Avoid work within high and adjacent low marsh areas, and other areas of suitable habitat.
- If work in known or potential eastern black rail habitat cannot be avoided, seasonally restrict activities within suitable wetlands from April 1 to September 15 to avoid

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

disturbing birds (*Federal Register Vol. 83, No. 195, p. 63771*). In coastal areas, eastern black rails typically nest in high marsh areas (areas above the mean high-water line) to avoid tidal flooding, but forage in the adjacent low marsh areas (areas below mean high-water line); thus, both high and low marsh disturbances should be seasonally restricted.

- If a seasonal restriction cannot be implemented, conduct a habitat suitability assessment of wetlands within the action area. Habitat assessments should be completed by qualified individuals familiar with the species and results should be submitted to the Service for review and concurrence.
 - Presence/absence surveys for eastern black rail are generally not recommended at this time due to the low probability of detection and the potential for disturbing birds with excessive survey effort such as playback calls (Service 2019).
 - Seasonally restrict activities within suitable habitat from April 1 to September 15, particularly activities involving vehicles, heavy equipment, or large numbers of personnel.
- For projects with minimal activity within suitable habitat (*e.g.*, small pedestrian teams in the wetland) that cannot be seasonally restricted, the risk of injuring or disturbing the birds may be minimized with the following conservation measures from April 1 to September 15.
 - Minimize entry into high marsh and densely vegetated areas to the extent practicable.
 - Avoid usage of mechanized equipment in suitable nesting habitat (*e.g.*, high marsh).
 - Use the minimum number of people necessary.
 - Avoid excessive noise when operating in the wetland.
 - Use limited and consistent travel pathways to minimize disturbance.
 - Minimize overall time spent in the wetland.
 - Limit the number of workdays during this period (preferably no more than 5).
 - Ensure that all team members walk cautiously and watch out for indications of possible nesting (*e.g.*, nest structures, tunnels, areas from which rails are flushed), avoiding areas of dense or clumped vegetation whenever possible.
 - Ensure that teams are led cautiously through the wetland by a guiding team member who has been trained on eastern black rail nest structure and microhabitat, species vocalization, and other evidence of species presence.
 - Carefully move away from any area where eastern black rails or nests are detected. Report the detection to the Service as soon as possible (*i.e.*, within 24 hours).
 - Avoid all usage of vehicles or heavy equipment in suitable nesting habitat.
- For unavoidable, temporary impacts to emergent wetland vegetation occurring outside the restricted season (*i.e.*, September 15 to March 31), the Service recommends the following to avoid and minimize habitat impacts:

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Use the smallest and lightest equipment practicable, as well as wetland mats or other measures to minimize impact to the substrate.
 - Follow a soil erosion and sediment control plan and use best practices to limit indirect impacts to wetland habitat.
 - Provide the Service with a monitoring and contingency plan to ensure full recovery of the native wetland vegetation within 2 years.
- To avoid the unintended introduction or spread of invasive plants, thoroughly clean construction equipment before use in suitable habitat (Vyas 2008).
- Follow the State's [decontamination protocols](#) for activities in and around New Jersey Waters to minimize the risk of introducing or spreading aquatic invasive species (NJWMC 2024).
- Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (e.g., access roads, parking areas, entry points) (*Federal Register Vol. 83, No. 195, p. 63771*).
- Landowners seeking to benefit eastern black rails can contact the Service for technical assistance. Examples of beneficial actions include:
 - Place suitable wetland habitat and adjacent areas with known eastern black rail presence in permanent conservation ownership or easement.
 - Restore or manage habitat in coordination with the Service
 - Partner with the Service and/or other conservation entities in efforts to maintain suitable tidal marsh habitat from impacts of sea level rise.

Procedures for when an eastern black rail occurrence has been located:

- Report the observation to the NJFO and the New Jersey Department of Environmental Protection's Wildlife Tracker (<https://dep.nj.gov/njfw/conservation/reporting-rare-wildlife-sightings/>)
- Report the observation to eBird via smartphone application or online at: <https://ebird.org/>. Identification tips are available from the [Cornell Lab of Ornithology](#). Reports are most helpful when they include specific locations, as well as comments about the kinds of habitats the birds were using.

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

PIPING PLOVER (*CHARADRIUS MELODUS*)

Biology, Presence, and Threats

Within its Atlantic Coast breeding range, the piping plover was federally listed as threatened in 1986 (*Federal Register Vol. 50, No. 238, pp. 50726-50734*). It is a small shorebird, approximately 7 inches long and a wingspan of about 15 inches. Piping plovers have white underparts with a light beige back and crown. Breeding adults have a single black breast band, which is often incomplete, and a black bar across the forehead. The legs and bill are orange in summer, with a black tip on the bill. In winter, the birds lose the breast bands, the legs fade from orange to pale yellow, and the bill becomes mostly black. Piping plover adults and chicks feed on marine macroinvertebrates such as worms, fly larvae, beetles, and crustaceans (Service 1996).



Figure 2: Piping Plover Adult and Chicks. (Credit: USFWS)

Piping plovers are present on the New Jersey shore during the breeding season, generally March 1 to August 31. These territorial birds nest above the high tide line, usually on sandy ocean beaches and barrier islands, but also on gently sloping foredunes, blowout areas behind primary dunes, overwash areas cut into or between dunes, the ends of sandspits, and deposits of suitable dredged or pumped sand. Piping plover nests consist of a shallow scrape in the sand, frequently lined with shell fragments and often located near small clumps of vegetation. Females lay four eggs that hatch in about 27 days, and surviving chicks fledge (learn to fly) after about 25 to 35 days. The flightless chicks follow their parents to feeding areas, which include the intertidal zone of ocean beaches, ocean overwash areas, mudflats, sandflats, wrack lines (organic ocean material left by high tide), and the shorelines of coastal ponds, lagoons, and salt marshes (Service 1996, Kopec 2022). A few of New Jersey's beaches are also known to support concentrations of migrating piping plovers, where adults and fledged chicks may be present into September and October (Davis et al. 2023, eBird 2024).

Threats to the piping plover include habitat loss, human disturbance of nesting birds, predation, and oil spills and other contaminants. Habitat loss results from development, as well as from beach stabilization, beach nourishment, and other physical alterations to the beach ecosystem. Human disturbance of nesting birds includes foot traffic, sunbathing, use of kites/kiteboards/kitebuggies, pets, fireworks, mechanical beach raking, construction, and vehicle use. These disturbances can result in crushing of eggs, failure of eggs to hatch, and death of chicks. Predation on piping plover chicks and eggs is intensified by development because predators such

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

as foxes (*Vulpes vulpes*), rats (*Rattus norvegicus*), raccoons (*Procyon lotor*), skunks (*Mephitis mephitis*), crows (*Corvus spp.*), and gulls (*Larus spp.*) thrive in developed areas and are attracted to beaches by food scraps and trash. Unleashed and feral dogs (*Canis lupus familiaris*) and cats (*Felis catus*) also disturb courtship and incubation and prey on chicks and adults. Climate-driven changes are also a threat, including accelerating sea level rise, increasing storm intensity, and changing seasonal timing of coastal storms (Service 1996, 2009, 2020, 2024).

For more information visit:

<https://www.fws.gov/species/piping-plover-charadrius-melodus>

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of piping plover in New Jersey:

- Avoid permanent or temporary modification of suitable piping plover nesting habitat (Service 1996, 2009, 2020, 2024, Maslo et al. 2011).
 - Follow best practices for coastal engineering (Rice 2009, Guilfoyle et al. 2019).
 - Avoid creation/expansion of hard shoreline stabilization structures (*e.g.*, jetties, groins, sea walls, sand fencing, stabilized dunes), especially in sparsely developed areas.
 - Avoid adverse changes in elevation and slope, and invertebrate prey populations, such as through sand removal, deposition, or transfers.
 - Apply living shoreline techniques.
 - Design projects to incorporate wide, sparsely vegetated, minimally stabilized beaches and tidal flats.
 - Design projects to preserve natural coastal processes and inlet dynamics.
 - Protect habitat during post-storm management of beaches and recreation.
- Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (*e.g.*, access roads, parking areas, entry points) (Service 1996, Tratalos et al. 2013, DeRose-Wilson et al. 2018).
- Avoid the introduction or spread of dense or invasive vegetation in suitable piping plover habitat. Thoroughly clean construction equipment before use on a beach to avoid unintended spread of invasive plants (Vyas 2008, Service 2009, 2024, Maslo et al. 2011). Contact the Service prior to any beach plantings (Service 2022).

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Avoid disturbance (including noise) during the breeding season by seasonally restricting work from March 1 through August 31, especially work involving use of motorized vehicles or heavy equipment (Service 1994, 1996, 2024, DeRose-Wilson et al. 2018).
 - With careful monitoring and other safeguards, limited activities (*e.g.*, involving pedestrian teams on the beach), may be conducted during March.
 - In breeding areas where no nesting has occurred by July 15, or where all chicks have fledged before August 31, the seasonal restriction may be lifted early.
 - Any work between March 1 through August 31 should be conducted only in close coordination with the Service and the New Jersey Department of Environmental Protection's Endangered and Nongame Species Program (ENSP).
- Avoid mechanical beach raking during the nesting season (March 1 through August 31) to protect birds and habitat characteristics such as wrack material and shell fragments (Service 1996, 2009, 2020).
- Limit the abundance of predators on the beach by minimizing food scraps and fitting trash cans with predator-resistant lids (Service 1996).
- Minimize mortality and disturbance from pets by promoting the [Cats Indoors](#) program and seasonally prohibiting dog walking from March 1 through August 31 (Service 2006).
- Manage recreational activities in accordance with the Service's [Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitat on the U.S. Atlantic Coast to Avoid Take Under Section 9 of the ESA](#) (Service 1994). (Note there is a [2015 addendum](#) to these guidelines.)
- Plan and carry out fireworks displays in accordance with the Service's [Guidelines for Managing Fireworks in the Vicinity of Piping Plovers and Seabeach Amaranth on the U.S. Atlantic Coast](#) (Service 1997).
- Work with the Service and the ENSP to prepare a [Beach Management Plan](#) or keep an existing plan up to date. Plan and execute projects, events, and habitat management in accordance with the provisions of approved plans (Service 2022).

Procedures for when a piping plover occurrence has been located:

- Report the observation to the NJFO and the New Jersey Department of Environmental Protection's Wildlife Tracker (<https://dep.nj.gov/njfw/conservation/reporting-rare-wildlife-sightings/>).
- Report piping plovers with colored leg bands using the information on this web page: <https://www.fws.gov/story/congratulations-spotting-banded-piping-plover-now-what>.

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Report the observation to eBird via smartphone application or online at: <https://ebird.org/>. Identification tips are available from the [Cornell Lab of Ornithology](#). Reports are most helpful when they include specific locations, as well as comments about the habitat characteristics being used.

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

RUFA RED KNOT (*CALIDRIS CANUTUS RUFA*)

Biology, Presence, and Threats

The rufa red knot was federally listed as threatened in January 2015 (*Federal Register Vol. 79, No. 238, pp. 73706-73748*). The Service proposed designating [critical habitat](#) for the rufa red knot in 2021 (*Federal Register Vol. 86, No. 133, pp. 37410- 37668*) and revised the proposal in 2023 (*Federal Register Vol. 88, No. 71, pp. 22530-22693*). The proposed rule includes nine critical habitat units in New Jersey, distributed along the State's southern Atlantic Coast and Delaware Bayshore. See this [FAQ](#) for more information about proposed critical habitat.



Figure 3: Adult and Juvenile Rufa Red Knots. (Credit: USFWS)

At 9-10 inches long, the rufa red knot is a large, bulky sandpiper with a short, straight, black bill (Service 2014). During the breeding season, the legs are dark brown to black, and the breast and belly are a characteristic russet color that ranges from salmon-red to brick-red. Males are generally brighter shades of red, with a more distinct line through the eye. When not breeding, both sexes look alike—plain gray above and dirty white below with faint, dark streaking. As with most shorebirds, the long-winged, strong-flying knots fly in groups, sometimes with other species. Rufa red knots feed on invertebrates, especially small clams, mussels, and snails, but also crustaceans, marine worms, and horseshoe crab eggs. Knots mainly eat insects on their breeding grounds (Service 2014).

Small numbers of rufa red knots may occur in New Jersey year-round, while larger numbers rely on Delaware Bay and Atlantic Coast stopover habitats during the spring (May 1 to June 10) and fall (July 15 to November 30) migration periods (Service 2014, *Federal Register Vol. 86, No. 133, pp. 37436- 37440*, eBird 2024, Perkins 2024). Rufa red knots have also been observed in small numbers during migration along the shores of the Raritan Bay in New Jersey (*Federal Register Vol. 86, No. 133, pp. 37438*, eBird 2024), and small numbers of knots may spend all or part of the winter in southern New Jersey (eBird 2024).

The primary wintering areas for the rufa red knot include the southern tip of South America, northern Brazil, the Caribbean, and the southeastern and Gulf coasts of the U.S. The rufa red knot breeds in the tundra of the central Canadian Arctic (Service 2014). These robin-sized shorebirds may fly up to 9,300 miles from south to north every spring and reverse the trip every fall, making the rufa red knot one of the longest distance migrating animals (Service 2014). Migrating rufa red knots can complete non-stop flights of 1,500 miles or more (Niles et al. 2010,

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

Perkins 2024), converging on critical stopover areas to rest and refuel along the way (Service 2014, 2020). Large flocks of rufa red knots arrive at stopover areas along the Delaware Bay and New Jersey's Atlantic Coast each spring, with many of the birds having flown directly from northern Brazil.

The spring migration is timed to coincide with the spawning season for the horseshoe crab (*Limulus polyphemus*), primarily in Delaware Bay. Horseshoe crab eggs provide a rich, easily digestible food source for migrating birds. Mussel beds on New Jersey's southern Atlantic Coast are also an important food source for migrating rufa red knots. Birds arrive at stopover areas with depleted energy reserves and must quickly rebuild their body fat to complete their migration to Arctic breeding areas. During their brief 10-14 day spring stay in the mid-Atlantic, rufa red knots can nearly double their body weight. New Jersey's Atlantic Coast is also an important stopover for southbound birds in the fall (Service 2014).

Migration habitats in New Jersey include high-energy ocean (*e.g.*, beaches) or bayfront beaches; tidal sand or mud flats in more sheltered bays and lagoon; unimproved tidal inlets; and sparsely vegetated intertidal areas. Dynamic and ephemeral intertidal features such as sand spits, islets, shoals, tidal marsh blowouts/pans, peat banks, sandbars, and features often associated with inlets are important rufa red knot habitats (Service 2014, *Federal Register Vol. 86, No. 133, pp. 37436-37440*).

Threats to the rufa red knot include accelerating rates of sea level rise; coastal development; shoreline stabilization; dredging; reduced food availability at stopover areas; disturbance by vehicles, people, dogs, aircraft, and boats; and climate change (Service 2014, 2020).

For more information visit:

<https://www.fws.gov/species/rufa-red-knot-calidris-canutus-rufa>

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of rufa red knot in New Jersey:

- Avoid noise and disturbances to foraging or roosting rufa red knots (Burger and Niles 2013a, 2013b, Koch and Paton 2014, Service 2014, Watts 2017, Hunt et al. 2018, Barrett and Harkness 2023, Service 2023), which may be present during the following times of year (Service 2014, eBird 2024, Perkins 2024):*
 - Spring migration period from May 1 to June 10. (Use April 15 to June 10 if there will be habitat modification to allow time for habitat recovery)
 - Fall migration period from July 15 to November 30.
 - Wintering period from December 1 to March 15.

*Not all suitable habitats are used by rufa red knots in all of the seasons listed above. A general indication of seasonal occurrence can be determined through observations of the

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

birds within the action area as recorded by *ebird.org*. Contact the Service for additional site-specific information and recommendations.

- If a time of year restriction is not possible, prepare and implement a construction monitoring plan before the start of any work (Service 2023). Rufa red knot monitoring is typically conducted before and during project construction.
 - Contact the Service for necessary next steps to confirm that a monitor is appropriate and to review/establish protocols.
 - Rufa red knot monitors should be qualified individuals who are familiar with the species. Qualifications of the monitor and the monitoring plan should be reviewed by the Service before construction or monitoring begins.
- Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (*e.g.*, access roads, parking areas, entry points) (Tratalos et al. 2013, Watts 2017, Service 2023).
- Avoid new coastal developments in and near rufa red knot habitats (Service 2014, 2020, 2023).
- Avoid permanent or temporary modification of suitable foraging and roosting habitat (Service 2014, 2020, 2023).
 - Follow best practices for coastal engineering (Rice 2009, Guilfoyle et al. 2019).
 - Avoid creation/expansion of hard shoreline stabilization structures (*e.g.*, jetties, groins, sea walls, sand fencing, stabilized dunes), especially in sparsely developed areas.
 - Avoid adverse changes in elevation and slope, and invertebrate prey such as through sand removal, deposition, or transfers.
 - Use living shoreline techniques.
 - Design projects to incorporate wide, sparsely vegetated, minimally stabilized beaches and tidal flats.
 - Design projects to preserve natural coastal processes and inlet dynamics.
 - Protect habitat during post-storm management of beaches and recreation.
- Evaluate development setbacks to allow for habitat migration in response to sea level rise (Service 2014, 2020, 2023).
- Plan beach nourishments to minimize adverse effects to rufa red knots, their prey, and their habitats. Select clean sediment with a comparable grain size to the native beach. To the extent practicable, schedule nourishment at times of year that minimize rufa red knot disturbance and depression of the prey base. (See Rice (2009) and Guilfoyle et al. (2019) for other best practices). Engage local communities in post-nourishment beach management, including maintaining suitable habitat, managing disturbance, and managing predators (Service 2014, 2020, 2022, 2023).

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Avoid or minimize vegetation planting in rufa red knot habitat. When planting is necessary, use only native, non-woody plant species. Use care to avoid accidental introductions of non-native plants (*e.g.*, clean construction equipment off-site before use) (Vyas 2008, Service 2014, 2020, 2023).
- Avoid or minimize beach raking in rufa red knot habitats at those times of year when the birds are typically present (Service 2014, 2020, 2023).
- Minimize and monitor disturbance of rufa red knots from other human activities. Pedestrians should allow a buffer of at least 400 feet around rufa red knots (Koch and Paton 2014), which can occur in single or mixed-species flocks and sometimes as individual birds (Burger and 2013b, Service 2014). Larger buffers may be needed to avoid disturbance from construction activities, large gatherings, fireworks, vehicles, motorized boats, aircraft, and dogs (Service 2014).
- Minimize and monitor disturbance of rufa red knots from predators (Service 2014, 2020, 2023).
- Do not install any nesting structures for avian predators (*e.g.*, peregrine falcons (*Falco peregrinus*)) within 2 miles of important rufa red knot habitats. Coordinate with the Service before installing such structures within 4 miles of suitable habitat (Watts and Truitt 2021).
- Avoid activities likely to impact horseshoe crabs by potentially entrapping, entangling, or blocking adults; entraining larvae; interfering with spawning; or disturbing spawning habitat (Service 2014, 2020, 2023).
- Avoid deliberate introductions of non-native marine species (*e.g.*, avoid aquaculture of nonnative species). Use care to avoid accidental introductions of non-native marine species and marine diseases (*e.g.*, avoid ballast water discharges near rufa red knot habitat). Follow the State's [decontamination protocols](#) for activities in and around New Jersey Waters to minimize the risk of introducing or spreading aquatic invasive species (Seebens et al. 2013, Service 2014, 2020, 2023, NJWMC 2024).
- Site both terrestrial and offshore wind turbines away from important rufa red knot habitats and flight paths. Include rufa red knots in pre- and post-construction monitoring plans (Service 2014, 2020, 2023).
- Include rufa red knots and their habitats in response plans for oil or contaminant spills, storms, and harmful algal blooms, including provisions for [emergency consultation](#) (Service 2014, 2020, 2023).
- Work with the Service and the New Jersey Department of Environmental Protection's Endangered and Nongame Species Program to prepare a [Beach Management Plan](#) or

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

keep an existing plan up to date. Plan and execute projects, events, and habitat management in accordance with the provisions of approved plans (Service 2022).

Procedures for when a rufa red knot occurrence has been located:

- Report the observation to the New Jersey Department of Environmental Protection's Wildlife Tracker (<https://dep.nj.gov/njfw/conservation/reporting-rare-wildlife-sightings/>).
- Report the observation to eBird via smartphone application or online at: <https://ebird.org/>. Identification tips are available from the [Cornell Lab of Ornithology](#). Reports are most helpful when they include specific locations, as well as comments about the habitat characteristics being used.
- Report observations of leg-banded rufa red knots to bandedbirds.org.

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

ROSEATE TERN (*STERNA DOUGALLII DOUGALLII*)

Biology, Presence, and Threats

Within its North Atlantic breeding range, the roseate tern was federally listed as endangered in 1987 (*Federal Register Vol. 52, No. 211, pp. 42064-42068*). The roseate tern is a dove-sized (about 15 inches long), light-colored seabird with a long, forked tail. This species is named for a faint rosy tint to its breast feathers. In summer, adults have a black cap, red legs, and a black bill with dark red at its base. In winter, adults have a black bill, brown legs, and a white forehead with a black mask. Roseate terns feed over open water by plunge-diving from the air to catch small fish (Service 1998, Gochfeld and Burger 2020).



Figure 4: Roseate tern (Credit: Fyn Kynd, Creative Commons Attribution 2.0, <https://www.fws.gov/media/roseate-tern-3>)

Roseate terns may be present along the New Jersey coast from May 1 to September 30. Although roseate terns have not been documented breeding in New Jersey since the 1980s, this species uses certain New Jersey beaches and offshore waters during its spring and fall migrations. Small numbers of juveniles and non-breeding adults may also occur along the New Jersey coast during the breeding season. Most use of New Jersey habitats by this species is transient, but in some areas birds may persist longer at migration stopover or staging areas, often in mixed-species flocks (Gochfeld and Burger 2020, eBird 2024). Roosting habitat for non-breeding roseate terns includes open beaches, coastal inlets, river mouths, sand spits, and tidal flats. Terns may also rest on jetties or other artificial structures and, during migration, on the surface of open water. Foraging areas range from near the shoreline to far offshore (Service 1998, Nisbet personal communication 2019, Gochfeld and Burger 2020).

Threats to the roseate tern include habitat loss on or near coastal barrier islands from development and disturbance from human recreation and other activities in coastal areas. Predation by great black-backed (*Larus marinus*) and herring (*Larus argentatus*) gulls is a threat near nesting gull colonies and in areas where human garbage provides an abundant food supply to attract and support these predator species. Other threats include other avian and mammalian predators, entanglement in marine debris, invasive vegetation in nesting areas, climate change, and reduced food supplies stemming from changes in abundance or distribution of prey fish species (Service 1998, 2020).

For more information visit:

<https://www.fws.gov/species/roseate-tern-sterna-dougallii-dougallii>

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

Best Practices

The following best practices conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of roseate tern in New Jersey:

- Avoid disturbing flocks of terns, even if the exact species present is unknown. Afford roosting terns a 300-foot buffer for pedestrians, and larger buffers for vehicles to avoid flushing the birds (Althouse et al. 2019, Service 2020). Most staging flocks of terns will occur from July through September.
- Enforce rules limiting dogs and cats on/near the beach (Service 1998, 2006).
- Remove all debris following construction or other projects on the beach. Enforce rules and support education efforts to limit/reduce marine debris, including from fishing and aquaculture (Ryan 2018).
- Work with the NJFO to assess proposed projects involving more than 1 week of activity/disturbance on the beach between May 1 and September 30, or involving substantial habitat modification at any time of year (Service 1998, 2020).
- Additional conservation measures and consultation with the Service will be needed if roseate terns are found to be breeding.
- Work with the Service and the New Jersey Department of Environmental Protection's Endangered and Nongame Species Program to prepare a [Beach Management Plan](#) or keep an existing plan up to date. Plan and execute projects, events, and habitat management in accordance with the provisions of approved plans (Service 2022).

Procedures for when a roseate tern occurrence has been located:

- Report the observation to the NJFO and the New Jersey Department of Environmental Protection's Wildlife Tracker (<https://dep.nj.gov/njfw/conservation/reporting-rare-wildlife-sightings/>).
- Report the observation to eBird via smartphone application or online at: <https://ebird.org/>. Identification tips are available from the [Cornell Lab of Ornithology](#). Reports are most helpful when they include specific locations, as well as comments about the habitat characteristics being used.
- Report observations of roseate terns with leg bands to the United States Geological Survey [Bird Banding Lab](#). Reports are most useful when they include a photo and the alpha-numeric code on the colored band.

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

INDIANA BAT (*MYOTIS SODALIS*)

Biology, Presence, and Threats

The Indiana bat was federally listed in 1967 (*Federal Register Vol. 32, No. 48, pp. 4001*) and classified as an endangered species in 1973. The Indiana bat is a small, brown mammal about 1.5-2 inches long. This species closely resembles the little brown bat (*Myotis lucifugus*), from which it can be distinguished by small differences in fur coloration and the structure of the feet. As with all eastern U.S. bat species, Indiana bats feed almost exclusively on insects (Service 2007).



Figure 5: Indiana Bat. (Credit: Ryan Hagerty, USFWS, <https://www.fws.gov/media/indiana-bat-15>)

From April to September in New Jersey, Indiana bats inhabit their summer habitat. Suitable summer habitat consists of a wide variety of forested ecosystems where they roost, forage, and travel and may also include some adjacent and interspersed non-forested areas such as emergent wetlands and adjacent edges of agricultural fields, old fields, and pastures. This includes forests and woodlots containing potential roosts (*i.e.*, live trees and/or snags greater than or equal to 5 inches diameter at breast height [DBH] that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet of other forested/wooded areas. Indiana bats have also been observed roosting in human-made structures, such as bridges and bat houses (Service 2024b).

During the summer, female bats roost together in maternity colonies. On any given day, a maternity colony is spread out among numerous trees, with many bats occupying one or more primary roosts, while individuals and small groups reside in different alternate roosts (Kurta 2004). Females raise a single offspring each year. Adult males usually roost in trees near maternity roosts, but some remain near their hibernation site and use caves and mines during the summer. Research indicates that Indiana bats exhibit interannual site fidelity to their roosting and foraging areas (Service 2007).

Each fall from late August through mid-November in New Jersey, Indiana bats migrate from their summer habitat to congregate in the vicinity of their hibernation sites (hibernacula), which include caves and abandoned mine shafts. During this time, the bats “swarm” in the vicinity of their hibernacula, mating and accumulating final fat reserves for hibernation. The bats may travel relatively long distances from their swarming site during the swarming season (Parsons et al. 2003). The bats then hibernate from late October to April; the precise timing is dependent on

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

climatic conditions. After emerging from hibernation, Indiana bats forage in the vicinity of their hibernacula before migrating to summer habitats (Service 2007).

Threats to the Indiana bat vary during its annual life cycle. The most significant range-wide threats to the Indiana bat have traditionally been habitat loss/degradation, forest fragmentation, winter disturbance, and environmental contaminants (Service 2019). White-nose syndrome (WNS), invasive species, and wind turbines have also emerged as significant threats to the recovery of the Indiana bat (Service 2019). As a fungal disease, WNS has caused an overall estimated 90% decline in hibernating bat populations within the WNS-affected area, threatening regional or range-wide extinction in multiple species (Service 2019).

For more information, visit <https://www.fws.gov/species/indiana-bat-myotis-sodalis>.

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of the Indiana bat in New Jersey:

- Avoid potential direct effects to bats that may be roosting in trees during their active (non-hibernation) season (Service 2024a):
 - Avoid cutting or other means of knocking down, bringing down, or trimming of trees that are greater than or equal to 5 inches diameter at breast height (DBH) from April 1 through September 30 within the geographic summer range of the Indiana bat.
 - Avoid cutting or other means of knocking down, bringing down, or trimming of trees that are greater than or equal to 5 inches DBH from April 1 through November 15 if the action/project is within a municipality with a known Indiana bat hibernaculum. Refer to the [list of New Jersey municipalities](#) with hibernation or maternity occurrence of Indiana bat or northern long-eared bat.
- If tree cutting/clearing is required during the time of-year restrictions described above, a presence/absence survey for Indiana bats may be requested by the Service. Please contact the NJFO for survey protocols and necessary next steps to confirm that a survey is warranted. Surveys for Indiana bats should not be conducted without prior approval from the Service. Additionally, a [recognized and qualified bat surveyor](#) (which the NJFO keeps a list of) must conduct the survey. Acoustic and mist net surveys should be completed between May 15 and August 15.
- From April 1 through September 30 within the geographic summer range of the Indiana bat, avoid removing or modifying bridges, culverts, and other structures that could potentially support roosting bats. Alternatively, a survey or visual inspection of these structures for bats may be possible before construction begins. Because most bridges will contain cracks and crevices that are of suitable size for bat roosting, any bridge that is

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

safe to assess should be considered potential habitat for Indiana bats (see Appendix K in Service 2024b). Culverts that have either an entrance height/diameter of at least 4 feet OR a length of at least 23 feet may be considered suitable for roosting by Indiana bats (see Appendix K in Service 2024b). Bridge surveys should be completed from May 1 to October 31 but may occur outside of this window with permission from the Service. Please contact the NJFO for more information and protocols for structure surveys/visual inspections in New Jersey.

- Avoid or minimize the clearing of highly suitable/preferred roost trees including snags (dead trees) and trees with loose or exfoliating bark (Silvis et al. 2016), such as shagbark hickories (*Carya ovata*)—especially trees >9 inches DBH (Kurta 2004).
- Install bright colored flagging/fencing prior to any tree removal/trimming to ensure contractors stay within clearing limits (Service 2024a).
- Replant areas where trees have been disturbed for temporary activities or workspace (Service 2024a), ideally using tree species preferred by Indiana bats.
- Protect known or potential summer habitat (*e.g.*, roosts, foraging habitat, water sources, and travel corridors) from the threats of disturbance, degradation, or destruction (Service 2019):
 - Avoid or minimize impacts to known roosting/foraging areas at any time of year.
 - Avoid impacts, including disturbance, to known roosts at any time of year.
 - Permanently protect roosting/foraging habitat when possible.
 - Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (*e.g.*, access roads, parking areas, entry points).
 - Maintain forested connections (*e.g.*, hedgerows) between known or potential foraging/roosting areas.
 - Minimize forest fragmentation (*i.e.*, consider the landscape when planning a project).
 - Avoid disturbing riparian areas. Maintain streamside and riparian zones of at least 150 feet around perennial streams and other water bodies to the extent practicable. Within these zones, encourage restoration and maintenance of native species and connectivity to improve roosting and foraging habitat (U.S. Forest Service 2024).
- Protect Indiana bats from pesticide exposure or other chemical exposure (Service 2007):
 - From April 1 through September 30, avoid aerial spraying and ground-based broadcast application of pesticides that are directed into trees and could affect roosting bats (Service 2024a).
 - In suitable bat roosting habitat, use targeted pesticide application methods or ground-based broadcast applications of pesticides that are directed downward

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- (e.g., spot-spraying, hack-and-squirt, basal bark injections, cut-stump, or foliar spraying) to minimize affecting non-target plants and animals (Service 2024a).
 - Avoid contamination or degradation of bat's drinking water sources, aquatic foraging habitat, and/or aquatic invertebrate communities (Service 2024a).
- Minimize potential impacts of artificial lighting/light pollution (Service 2019).
 - Direct temporary lighting away from suitable habitat during the active season (Service 2024a).
 - When installing new/additional permanent lighting or replacing existing permanent lights, use downward-facing, full cut-off lens lights (with same intensity or less for replacement lighting; Service 2024a).
- Coordinate with the Service early in planning for any proposed wind power facilities within the geographic range of the Indiana bat.
- Please be aware that additional conservation measures and ESA consultation requirements may be applicable depending on the following:
 - Project's distance from a known hibernaculum, known maternity roost, or maternity capture site.
 - Extent of cutting, knocking down, bringing down, or trimming of trees proposed.

Procedures for when an Indiana bat occurrence has been located:

- Report the observation to the Service's NJFO and the New Jersey Department of Environmental Protection's Wildlife Tracker
(<https://dep.nj.gov/njfw/conservation/reporting-rare-wildlife-sightings/>)

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*)

Biology, Presence, and Threats

The northern long-eared bat was federally listed as endangered (previously listed as threatened) in March 2023 (*Federal Register* Vol. 88, No. 17, pp. 4908-4910). The northern long-eared bat is a medium-sized bat weighing approximately five to eight grams with females slightly larger than males. It is distinguished from other *Myotis* species by its long ears.



Figure 6: Northern long-eared bat (Credit: Jill Utrup, USFWS, <https://www.fws.gov/media/northern-long-eared-bat>)

Northern long-eared bats use summer habitats in New Jersey

from April to September. Suitable summer habitat for the northern long-eared bat includes a wide variety of forested/wooded habitats where they roost, forage, and travel (Service 2024). Although they may also traverse habitat adjacent to and interspersed with forests, such as emergent wetlands and field edges, they are predominately found in forest/wooded ecosystems. This includes forests and woodlots containing potential roosts (*i.e.*, live trees and/or snags greater than or equal to 3 inches diameter at breast height (DBH) that have exfoliating bark, cracks, crevices, and/or cavities), as well as linear features such as fencerows, riparian forests, and other wooded corridors. Northern long-eared bats are nocturnal foragers and use hawking (catching insects in flight) and gleaning (picking insects from surfaces) behaviors in conjunction with passive acoustic cues (Nagorsen and Brigham 1993, Ratcliffe and Dawson 2003). Northern long-eared bats often prefer intact mixed-type forests with small gaps (*i.e.*, forest trails, small roads, or forest-covered creeks) in forests with sparse or medium vegetation for foraging and commuting rather than fragmented habitat or areas that have been clear cut (Service 2015). These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit characteristics of suitable roost trees and are within 1,000 feet of other forested/wooded areas. The bats have also been observed roosting (although to a lesser degree than forests) in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat (Service 2024).

Northern long-eared bats engage in swarming activities during the late summer to fall (August 16 to November 15) and have a period of increased activity near hibernacula (including foraging, roosting in trees, and mating) prior to hibernation (Service 2024). Swarming activities typically occur within 5 miles of their hibernaculum (typically caves and abandoned mine portals). The bats enter hibernation from November to March. In April, the bats emerge from hibernation and

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

migrate to summer habitat. While information is lacking, short migratory movement between seasonal habitats (summer roosts and winter hibernacula) of 35 to 55 miles have been documented (Griffin 1940, Caire et al.1979, Nagorsen and Brigham 1993, Service 2022).

Threats to the northern long-eared bat include disturbance or killing of hibernating and maternity colonies; vandalism and improper closure of hibernacula; fragmentation, degradation, and destruction of habitats; wind related mortality; and use of pesticides and other environmental contaminants. White-nose syndrome (*Pseudogymnoascus destructans*) is also a major threat to this and other bat species (Service 2022).

For more information visit: <https://www.fws.gov/species/northern-long-eared-bat-myotis-septentrionalis>.

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of Northern long-eared bat in New Jersey:

- Avoid cutting or other means of knocking down, bringing down, or trimming of trees that are greater than or equal to 3 inches diameter at breast height (DBH) from April 1 to September 30 within the geographic summer range of the northern long-eared bat.
- Avoid cutting or other means of knocking down, bringing down, or trimming of trees that are greater than or equal to 3 inches DBH from April 1 to November 15 if the action is within a municipality with a known northern long-eared bat hibernaculum. Refer to the [list of New Jersey municipalities](#) with hibernation or maternity occurrence of Indiana bat or Northern long-eared bat for locations.
- If clearing is required during the time of year restriction described above, a presence/absence survey may be requested by the Service. Acoustic and mist net surveys should be completed between May 15 to August 15. Please contact the Service for survey protocols and necessary next steps to confirm that a survey is required. Surveys for northern long-eared bats should not be conducted without prior approval from the Service. Additionally, [a recognized and qualified bat surveyor](#) (which the Service's NJFO keeps a record of) must conduct the survey.
- Avoid removal or modifications to bridges, culverts greater than or equal to 27 feet in length and 3 feet high, and other structures that could potentially harm roosting bats from April 1 to September 30 within the geographic summer range of the northern long-eared bat. Alternatively, a survey or visual inspection of these structures may be possible for bats before construction begins. Bridge surveys should be completed between May 1 and October 31, but may occur outside of this window with permission from the Service. Please contact the Service for more information and protocols for structure surveys/visual inspections.

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

- Minimize tree clearing, especially of highly suitable roost trees including snags (dead trees), shagbark hickories (*Carya ovata*), other trees with shaggy or exfoliating bark, and trees of any species over 26 inches DBH.
- Avoid impacts to known roosts during any time of year.
- Avoid or minimize impacts to known roosting/foraging areas any time of year.
- Permanently protect known roosting/foraging habitat.
- Maintain forested connections (*e.g.*, hedgerows) between known foraging/roosting areas.
- Minimize forest fragmentation (*i.e.*, consider the landscape when laying out a project).
- Avoid disturbance to riparian areas. Within areas of known fall foraging, summer maternity, and migration route habitats, preserve and restore wooded upland buffers at least 150-foot-wide on wetlands and open waters, and at least 300-foot-wide where possible and/or required by State regulation.
- Use bright flagging/fencing to demarcate trees that will be protected vs. cleared.
- Replant areas where trees have been disturbed for temporary activities or workspace.
- Preferentially replant suitable roost tree species.
- Minimize access to areas of known roost sites to prevent disturbance.
- Minimize discharges of pesticides and other environmental contaminants in areas of known northern long-eared bat habitat. Avoid large-scale use of insecticides throughout the species' geographic range.
- Avoid use of chemicals (*e.g.*, copper sulfate) in stormwater basins.
- Coordinate with the Service early in planning for any proposed wind power facilities within the geographic range of the northern long-eared bat.
- Minimize potential lighting impacts (*e.g.*, downward facing lights, shields, timers).
- Please be aware that additional surveys, conservation measures, and ESA consultation requirements may be needed depending on the following:
 - If the action is proposed within 1.5 miles of a known maternity roost or 3 miles of a known maternity capture site.

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Amount of knocking down, bringing down or trimming of trees proposed.
- Project distance from a hibernaculum.
- Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (e.g., access roads, parking areas, entry points).

Procedures for when a northern long-eared bat occurrence has been located

- Report the observation to the Service's NJFO and the New Jersey Department of Environmental Protection's Wildlife Tracker
(<https://dep.nj.gov/njfw/conservation/reporting-rare-wildlife-sightings/>)

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U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

TRICOLORED BAT (*PERIMYOTIS SUBFLAVUS*)

Biology, Presence, and Threats

On September 14, 2022, the Service published a proposal to list the tricolored bat as endangered under the ESA (*Federal Register Vol. 87, No. 177, pp 56381-56393*). A final determination to either list the tricolored bat under the ESA or to withdraw the proposal is anticipated in the future.



Figure 7: Tricolored bat (Credit: Pete Pattavina, USFWS, <https://www.fws.gov/media/tricolored-bat-cluster>)

The tricolored bat is a small insectivorous bat that typically overwinters in caves, abandoned mines and tunnels, and road-associated culverts (southern portion of the range). They spend the rest of the year in a wide variety of forested/wooded areas where they roost and forage, including adjacent and interspersed non-forested areas such as emergent wetlands, shrublands, grasslands, and adjacent edges of agricultural fields, old fields, and pastures. Roosting habitat includes forests, woodlots, and linear features (*e.g.*, fencerows and riparian corridors) containing trees with potential roost substrate (*e.g.*, live and dead leaf clusters of live and recently dead deciduous trees, Spanish moss [*Tillandsia usneoides*], beard lichen [*Usnea trichodea*], and clusters of dead pine needles of large live pines) (Service 2025). Tricolored bats will roost in a variety of tree species, especially oaks, and often select roosts in tall, large diameter trees, but will roost in smaller diameter trees when potential roost substrate is present (Leput 2004). They may also roost in human-made structures, such as bridges and culverts, and occasionally in barns or the underside of open-sided shelters (*e.g.*, porches, pavilions) (Service 2024).

The Service determined this bat species faces extinction primarily due to the range-wide impacts of white-nose syndrome, a deadly fungal disease affecting cave dwelling bats across North America. Since tricolored bat populations have been greatly reduced due to white-nose syndrome, surviving bat populations are now more vulnerable to other stressors such as human disturbance and habitat loss. Other threats include wind power related mortality and habitat loss/degradation (Service 2021).

For more information visit: <https://www.fws.gov/species/tricolored-bat-perimyotis-subflavus>.

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO in the course of consultation or technical assistance for actions within the range of tricolored bat in New Jersey:

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Avoid cutting or other means of knocking down, bringing down, or trimming of trees with potential roost substrate during the pup season from May 15 to July 31 at minimum (recommended from April 1 to September 30) within the geographic summer range of the tricolored bat. If clearing is required during this time period, a presence/absence survey may be requested by the Service. Please contact the Service for survey protocols and necessary next steps to confirm that a survey is required. Surveys for tricolored bats should not be conducted without prior approval from the Service. Additionally, a [recognized and qualified bat surveyor](#) (which the Service's NJFO keeps a record of) must conduct the survey.
- If tricolored bat is found during the survey, effects to it should be avoided or minimized as much as possible. The Service will also work with organizations through ESA consultation to provide conservation measures for avoiding effects.
- Please be aware that additional surveys, conservation measures, and ESA consultation requirements may be required depending on the following:
 - If the action is proposed within the vicinity of a known maternity roost or maternity capture site.
 - Amount of knocking down, bringing down or trimming of trees proposed.
 - Project distance from a hibernaculum.
- Avoid removal or modifications to bridges, culverts greater than or equal to 27 feet in length and 3 feet high, and other structures that could potentially harm roosting bats during the pup season from May 15 to July 31 (recommended from April 1 to September 30) within the geographic summer range of the tricolored bat. Alternatively, survey or visibly inspect these structures for bats before construction begins. Please contact the Service for more information and protocols for structure surveys/visible inspections.
- Avoid impacts to known roosts during any time of year.
- Avoid or minimize impacts to known roosting/foraging areas any time of year.
- Permanently protect known roosting/foraging habitat.
- Maintain forested connections (*e.g.*, hedgerows) between known foraging/roosting areas.
- Minimize forest fragmentation (*i.e.*, consider the landscape when laying out a project).
- Avoid disturbance to riparian areas. Within areas of known fall foraging, summer maternity, and migration route habitats, preserve and restore wooded upland buffers at least 150-foot-wide on wetlands and open waters, and at least 300-foot-wide where possible and/or required by State regulation.
- Use bright flagging/fencing to demarcate trees that will be protected vs. cleared.

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Replant areas where trees have been disturbed for temporary activities or workspace.
- Preferentially replant suitable roost tree species.
- Minimize access to areas of known roost sites to prevent disturbance.
- Minimize discharges of pesticides and other environmental contaminants in areas of known tricolored bat habitat. Avoid large-scale use of insecticides throughout the species' geographic range.
- Avoid use of chemicals (e.g., copper sulfate) in stormwater basins.
- Coordinate with the Service early in planning for any proposed wind power facilities within the geographic range of the tricolored bat.
- Minimize potential lighting impacts (e.g., downward facing lights, shields, timers).
- Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (e.g., access roads, parking areas, entry points).

Procedures for when a tricolored bat occurrence has been located:

- Report the observation to the Service's NJFO and the New Jersey Department of Environmental Protection's Wildlife Tracker
(<https://dep.nj.gov/njfw/conservation/reporting-rare-wildlife-sightings/>)

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

BOG TURTLE (*GLYPTEMYS MUHLENBERGII*)

Biology, Presence, and Threats

The bog turtle was federally listed as a threatened species in 1997 (*Federal Register* Vol. 62, No. 213, pp. 59605-59623). At approximately 4 inches long, it is one of North America's smallest turtles (Klemens 1990). This species typically shows a bright yellow, orange, or red blotch on each side of the head. The nearly parallel sides of the carapace (upper shell) give bog turtles an oblong appearance when viewed from above. These small, semi-aquatic turtles have a varied diet including insects, snails, worms, seeds, and carrion.



Figure 8: Bog turtle (Credit: USFWS, Gary Peeples.
<https://www.fws.gov/media/bog-turtle-8>)

Bog turtles usually occur in small, discrete populations, generally occupying open-canopy, herbaceous sedge meadows and fens bordered by wooded areas. These wetlands are a mosaic of micro-habitats that include dry pockets, saturated areas, and areas that are periodically flooded. Bog turtles depend on this diversity of micro-habitats for foraging, nesting, basking, hibernating, and sheltering. Unfragmented riparian (river) systems that are sufficiently dynamic to allow the natural creation of open habitat are needed to compensate for ecological succession. Beaver (*Castor canadensis*), white-tailed deer (*Odocoileus virginianus*), and cattle (*Bos taurus*) may be instrumental in maintaining the open-canopy wetlands essential for this species' survival (Service 2001).

Bog turtles inhabit open, unpolluted emergent and scrub/shrub wetlands such as shallow spring-fed fens, sphagnum bogs, swamps, marshy meadows, and wet pastures. These habitats are characterized by soft, muddy (often "mucky") bottoms, interspersed wet and dry pockets, vegetation dominated by low grasses and sedges, and a low volume of standing or slow-moving water which often forms a network of shallow pools and rivulets. Bog turtles prefer areas with ample sunlight, high evaporation rates, high humidity in the near-ground microclimate, and perennial saturation of portions of the ground. Eggs are often laid in elevated areas, such as the tops of tussocks. Bog turtles generally retreat into more densely vegetated areas to hibernate from mid-September through mid-April (Service 2001).

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

The greatest threats to the bog turtle are the loss, degradation, and fragmentation of its habitat from wetland alteration, development, pollution, invasive species, and natural vegetational succession. The species is also threatened by collection for illegal wildlife trade (Service 2001).

For more information visit:

<https://www.fws.gov/species/bog-turtle-glyptemys-muhlenbergii>.

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of bog turtle in New Jersey:

- Avoid direct modifications to wetlands that may support bog turtles (*e.g.*, clearing, flooding, filling, draining, ditching, tiling, excavating), and to streams that flow to bog turtle habitat (*e.g.*, channelizing, diverting, stabilizing, impounding, dredging) (Service 2001).
- Provide adequate upland buffers around wetlands that may support bog turtles, often at least 300 feet of native vegetation. A site-specific buffer design is often necessary (Dodds 1996, Service 2001).
- Provide at least 150-foot buffers of native vegetation along streams that flow to wetlands that may support bog turtles (Dodds 1996).
- For activities throughout the watershed, avoid permanent changes to the hydrology or sedimentation rates of wetlands that may support bog turtles (Service 2001). For example:
 - minimize net increases in impervious surface;
 - minimize soil compaction;
 - design storm water management plans to minimize long-term hydrologic changes to bog turtle habitat (often by maximizing infiltration);
 - avoid storm and wastewater discharges in or upgradient of bog turtle habitat; ensure adequate recharge of groundwater; and
 - evaluate proposed surface or groundwater withdrawals to ensure bog turtle habitat is not affected.

See Low Impact Design Techniques in the New Jersey Stormwater Best Management Practices Manual (https://www.nj.gov/dep/stormwater/bmp_manual2.htm).

- For activities within 500 feet of suitable bog turtle habitat, take particular care to avoid permanent changes to the hydrology or sedimentation rates (Service 2001). For example:
 - Implement all the measures listed above for activities throughout the watershed.

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Use Appendix A of the New Jersey Stormwater Best Management Practices Manual to complete a thorough alternatives analysis of nonstructural storm water management measures.
 - Seek to mimic the pre-development 2 and 10-year hydrographs.
 - Seek to recharge 100% of the site's pre-development annual average recharge amount.
 - Seek a score of 100% or greater in the Nonstructural Stormwater Strategies Point System regardless of Planning Area or project size.
 - Grade lawn and landscaped areas with lightweight equipment (maximum equipment load of 8 PSI).
- Avoid temporary changes to the hydrology or sedimentation rates of wetlands that may support bog turtles from ground disturbances within 500 feet of bog turtle habitat, or within 150 feet of streams that flow to that habitat (Dodds 1996, Service 2001). For example:
 - locate temporary work areas and access routes outside of wetlands;
 - construct storm water management infrastructure prior to all other components of a development project to control storm water and sediment during the remaining construction;
 - install two rows of silt fencing around work areas, with daily inspection and maintenance;
 - minimize the duration of exposed soils;
 - use jute matting or other erosion control blankets on disturbed areas immediately after project completion to minimize sedimentation; and
 - promptly re-vegetate areas of temporary disturbance with native species.
- Avoid injuring or disturbing bog turtles during construction. For example:
 - Survey work areas to determine if bog turtles or their habitat is present before construction begins. [A recognized, qualified bog turtle surveyor](#) should be used (list maintained by the Service's NJFO). Phase 1 surveys may be conducted during any month of the year (except when snow, ice cover, drought and/or flooding conditions are present). Phase 2 and 3 surveys must be conducted from April 15 to June 15 (Service 2020). Please contact the Service for necessary next steps to confirm that a survey is required, survey protocols, and an active list of surveyors. Surveys for bog turtle should not be conducted without prior approval of the survey plan and surveyor qualifications from the Service. Contact the Service immediately if a bog turtle is found - do not move the animal except to avoid imminent injury.
 - Conduct inspections of active construction sites that have bog turtles present. A recognized, qualified bog turtle surveyor is necessary to conduct inspections for any such work between April 1 and October 15 (Erb 2019).
 - Seasonally restrict certain activities. The need and specific dates for seasonal restrictions depend on the nature and location of the activities (Erb 2019).

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Avoid introductions of invasive species to wetlands that may support bog turtles (Service 2001). For example:
 - thoroughly wash construction equipment offsite before use within 500 feet of bog turtle habitat; and
 - use only native plant species and weed-free mulches and soils for landscaping within 500 feet of bog turtle habitat.
- Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (*e.g.*, access roads, parking areas, entry points) (Dodds 1996).
- Place wetlands supporting bog turtles and associated upland buffers in permanent conservation ownership or easement (Service 2001).

Procedures for when a bog turtle occurrence has been located:

- Report the observation to the Service's NJFO and the New Jersey Department of Environmental Protection's Wildlife Tracker (<https://dep.nj.gov/njfw/conservation/reporting-rare-wildlife-sightings/>).

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

DWARF WEDGEMUSSEL (*ALASMIDONTA HETERODON*)

Biology, Presence, and Threats

The dwarf wedgemussel was federally listed as an endangered species in 1990 (*Federal Register Vol. 55, No. 50, pp. 9447-9451*). The Service (1993) explains that it is a small, freshwater mussel that rarely exceeds 1.5 inches in length. A key feature to identify the species is that it has two lateral teeth on the right valve, but only one tooth on the left. The outer shell is dark brown or yellowish brown and often exhibits greenish rays in young mussels. The shell also has a well-defined posterior ridge. The nacre (inner shell) is bluish or silvery white. Dwarf wedgemussels feed by filtering small particles from the water (Service 1993). Unless indicated otherwise, the biology, presence, and threats information below is from the Service (1993 and 2019).



Figure 9: Dwarf wedgemussel (Credit: Susi Von Oettingen, USFWS, <https://www.fws.gov/media/dwarf-wedgemussel-0>)

Within New Jersey, the dwarf wedgemussel is mostly distributed in streams and rivers of various sizes that contain sand as a predominant substrate. However, it may also occur in substrates consisting of mixed sand, pebble, gravel, cobble, and boulder or in areas of mud or silt mixed with firmer substrates, such as sand or gravel (Galbraith et al. 2016). In parts of its range, it has also been found embedded in clay banks, which is not commonly observed in New Jersey. The species requires substrate suitable for digging into and watercourse velocities low enough to prevent dislodging and relocation. As such, watercourses that contain substrates that are purely bedrock or other hard surfaces are not suitable. The species requires areas with a slow to moderate current, little silt deposition, and well-oxygenated, unpolluted water. Its life expectancy is estimated at 10-12 years (Michaelson and Neves 1995).

Like other freshwater mussels, dwarf wedgemussel eggs are fertilized in the female as sperm passes over the gills. They are long term brooders with fertilization typically occurring in mid-summer and fall, with release of larvae (glochidia) occurring the following spring and summer (Michaelson and Neves 1993). Upon release, the glochidia attach to a fish host to encyst and metamorphose, later dropping to the streambed as juvenile mussels. Studies have shown the tessellated darter (*Etheostoma olmstedi*), slimy sculpin (*Cottus cognatus*), and mottled sculpin (*Cottus bairdi*) to be glochidial host fishes for the dwarf wedgemussel. Others such as brown trout (*Salmo trutta*), banded killifish (*Fundulus diaphanus*), striped bass (*Morone saxatilis*), and shield darter (*Fundulus diaphanus*) are also possible host fishes (St. John White et al. 2017).

Threats to the dwarf wedgemussel include habitat destruction or impacts from damming, river channelization, pollution, contaminants, sedimentation, invasion by exotic species, floods and

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

droughts, and fluctuations in water level or temperature. Freshwater mussels, including the dwarf wedgemussel, are sensitive to potassium, ammonia, nitrogen, zinc, copper, cadmium, and other elements associated with industrial pollution. Industrial, agricultural, and domestic pollution are largely responsible for the disappearance of the dwarf wedgemussel from much of the species' historic range.

For more information visit:

<https://www.fws.gov/species/dwarf-wedge-mussel-alasmodonta-heterodon>

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of dwarf wedgemussel in New Jersey:

- As possible, avoid activities that will directly or indirectly impact watercourses that contain suitable dwarf wedgemussel habitat. This includes:
 - Permanent and temporary disturbances or modifications to watercourses (*e.g.*, channelizing, diverting, stabilizing, impounding, dredging, new fill or structures, construction access within streams, changes in hydrology, erosion and sedimentation causing activities, wastewater and stormwater discharges). While dwarf wedgemussels only occur in perennially flowing watercourses, activities that impact ephemeral or intermittent streams (*e.g.*, erosion and sedimentation, potential spill of contaminants, water diversions, reduction in water quality) may also impact those areas. Watercourse activities that inhibit or adversely affect passage of host fishes should also be avoided.
 - Activities on land within the riparian zone and greater watershed area if they cause reduction in water quality, turbidity/sedimentation increases, and increased pollution. For example:
 - Large increases in impervious surfaces for new developments, stormwater changes, urban runoff, municipal wastewater, salting roads, and clearing of riparian zones (Poole and Downing 2004, Brown et al. 2010, Gillis 2012, Gillis et al. 2013, Haag et al. 2019, Lu et al. 2024, Skorupa et al. 2023).
 - If they are in locations where they can cause contaminants to enter a watercourse: gas stations; using/storing motor fuels, lubricants, the isopropylamine salt of glyphosphate, the surfactant MON 0818, fertilizers, pesticides, and products containing adverse levels of ammonia, copper, chlorothalonil, aluminum, nickel, zinc, chloride, and potassium (Augsburger et al. 2007, U.S. Department of the Interior 2023).
- Actions that impact watercourses where dwarf wedgemussel are or may be present will likely require a freshwater mussel survey. Please contact the Service for necessary next steps to confirm that a survey is required, survey protocols, and an [active list of surveyors](#). Contact the Service immediately if a dwarf wedgemussel is found - do not

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

move the animal except to avoid imminent injury. Guidance for federally listed or proposed freshwater mussel surveys in New Jersey can be found at:
<https://www.fws.gov/media/freshwater-mussel-surveys-new-jersey-guidance-project-review>.

- Initiate early coordination with the Service if existing road or utility crossings must be replaced or constructed near or upstream of dwarf wedgemussel habitat and consider the following recommendations:
 - Design replacement bridges to span the stream (as to avoid permanent fill).
 - If possible, eliminate deck drains on new bridges to avoid contaminants from the road entering the watercourse. Work with the Service in the design and location of bridge drainage outlets.
 - Remove piles/footings by cutting at the height of the stream bed or natural ground elevation.
 - As necessary, use granular material in fill areas immediately adjacent to the bridge to reduce sediment from reaching the stream and to prevent scouring.
 - Minimize the number of utility crossings and design them perpendicular to the stream to avoid directly impacting it.
 - As possible, avoid debris from falling into the water.
 - For activities such as pipelines, waterlines, and other utility line crossings: horizontal directional drilling (HDD) or trenchless methods are generally preferred. If HDD is proposed, the risk level of discharge of drilling materials (inadvertent returns) to the watercourse should be assessed.
- Ensure compliance with New Jersey Department of Environmental Protection's Flood Hazard Area Control Act Riparian Zone regulations, which may regulate riparian zones within 300 feet of a watercourse (New Jersey Department of Environmental Protection Accessed 2024).
- As possible, preserve and/or restore existing riparian ecosystems. Place riparian zones around dwarf wedgemussel populations in permanent conservation ownership or easement. Riparian zones greater than 100 feet from the top of the streambank is recommended to be protective of water quality and aquatic habitats (Sweeney and Newbold 2014, Lu et al. 2024). Native, woody vegetation is often recommended for riparian zone restoration, enhancement, or creation (Sweeney and Newbold 2014, Cole et al. 2020).
- Avoid creation of surface or groundwater withdrawals upstream or up-gradient of dwarf wedgemussel populations, as well as those that may impact the watercourse bottom. Withdrawals may affect the watercourse hydrology (Canace and Hoffman 2009) and could lead to dewatering, which can reduce habitat suitability (Galbraith et al. 2015, Randklev et al. 2018).

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

- Implement the strictest standards for storage, transport, and handling of hazardous materials and other potential pollutants within watersheds that support dwarf wedgemussel habitat to prevent contact with watercourses, as they can be harmful to freshwater mussels. As possible, use/store these materials outside of the floodplain and in areas where exposure to watercourses cannot occur. Use secondary containment structures around chemical/fuel storage tanks and buildings that may leak contaminants into watercourses.
- For pesticides and fertilizers:
 - Avoid using, storing, or mixing them and other potential pollutants where they might spill or leak into a watercourse. This should be at least 100 feet away from surface waters (PennState Extension Accessed 2024) located adjacent to and upstream of known or potential dwarf wedgemussel habitat.
 - Always adhere to label restrictions for use near aquatic ecosystems.
 - Minimize usage within watersheds that may contain dwarf wedgemussel habitats and implement the highest standards for controlling agricultural runoff.
- Although additional study is needed, some herbicides may impact the species if it enters a watercourse where the species is present (Drewak et al. 2024). As such, the recommendations above for pesticides and fertilizers should also be adhered to for herbicide usage.
- Do not allow raw concrete to encounter watercourses as it can be toxic to aquatic life. Cover exposed fill materials when not in use or when rain is forecasted to prevent it from entering watercourses.
- Sedimentation of freshwater mussels can harm them and may be lethal (Service 1993, Zhu et al. 2024). Sediment exposure or burial impacts to freshwater mussels from construction activities may occur greater than 1 mile downstream from those activities, depending upon watercourse conditions (Zhu et al. 2024). As such, to prevent sedimentation, implement the strictest erosion and sedimentation control standards upstream and up-gradient of dwarf wedgemussel habitat, including but not limited to (New Jersey Department of Agriculture 2017, Zhu et al. 2024):
 - As possible, avoid activities below the ordinary high-water mark and install streamside soil erosion and sediment controls to prevent sedimentation in watercourses.
 - Perform activities during typically low flow seasons to reduce the likelihood of sedimentation traveling downstream.
 - Construct storm water management infrastructure and soil erosion/sediment controls prior to all other components of a development project to control storm water and sediment during the remaining construction.
 - Install storm drain inlet filters to prevent sedimentation or other construction related pollutants from being transported to watercourses.

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

- Do not stockpile sediment or other materials in areas where it will obstruct natural drainage, cause further environmental damage (*e.g.*, in wetlands, watercourses), and in areas where stormwater/runoff may transport it into watercourses.
 - Manage runoff in upslope locations before downslope locations.
 - As possible, utilize natural-based soil erosion and sediment control methods (*e.g.*, seed and mulch) before using engineered products. In areas where this will not be effective in controlling sediment, employ silt fencing or in-water turbidity barriers.
 - Limit the duration of exposed soil by delaying vegetation removal and ground disturbances to only that required for construction activities. Do not clear the entire site at the beginning of the project if a portion will not be needed until later in the project.
 - Installing silt fencing or silt bags (or in combination with hay bales) around work areas.
 - Using jute matting or other erosion control blankets on disturbed areas. immediately after project completion to minimize sedimentation.
 - Promptly re-vegetate areas of temporary disturbance with native species.
 - Using turbidity curtains or other appropriate in-water sediment control measures.
 - Ensure that all soil erosion and sediment controls are functioning properly with daily inspection and, if necessary, maintenance/replacement. Establish a plan outlining preventative actions (*e.g.*, what, where, and when) that will be taken when a large precipitation event is anticipated/has begun.
 - Ensure any necessary compliance/review of the soil erosion and sediment control plan by the applicable New Jersey Soil Conservation District (New Jersey Department of Agriculture Accessed 2024). Review the standards for soil erosion and sediment control in New Jersey for additional possible protection to freshwater mussel habitat (New Jersey Department of Agriculture 2017).
- Avoid introductions of invasive or non-native species to dwarf wedgemussel streams and riparian corridors (Service 1993), for example through:
 - Thoroughly washing construction equipment offsite before use in watercourses. Ensure that the equipment is washed on land in locations where runoff cannot transport the washed off materials into watercourses (recommended at least 500 feet landward from the top of the watercourse bank).
 - Using only native plant species and weed-free mulches and soils for landscaping within the riparian zone.
 - For individual work crew members that will be entering the watercourse: follow the New Jersey Water Monitoring Council's Decontamination Protocols to minimize the risk of introducing or spreading aquatic invasive species (available at: <https://www.nj.gov/dep/wms/docs/NJWMC-DecontaminationProtocol-March2024.pdf>).
 - Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (*e.g.*, access roads, parking areas, entry points).

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

Procedures for when a dwarf wedgemussel occurrence has been located:

- Report the observation to the Service's NJFO and the New Jersey Department of Environmental Protection's Wildlife Tracker
(<https://dep.nj.gov/njfw/conservation/reporting-rare-wildlife-sightings/>)

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U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

GREEN FLOATER (*LASMIGONA SUBVIRIDIS*)

Biology, Presence, and Threats

On July 26, 2023, the Service published a proposal to list the green floater as threatened with a proposed 4(d) rule under the ESA (*Federal Register* Vol. 88, No. 142, pp. 48294-48349). A final determination to either list the green floater under the ESA or to withdraw the proposal is anticipated in the future. The Service (2021) explains the biology, presence, and threats information below.



Figure 10: Green floater (Credit: Ryan Hagerty, USFWS, <https://www.fws.gov/media/green-floater-mussel>)

The green floater is a small (up to 2.8 inches), greenish brown freshwater mussel historically native to the District of Columbia and 10 states including Alabama, Georgia, Maryland, New Jersey, New York, North Carolina, Pennsylvania, Tennessee, Virginia, and West Virginia. In New Jersey, the green floater was previously known to occur in the Stony Brook and within/tributaries to the Raritan, Delaware, and Pequest rivers, but the species has not recently been documented in the state. It is unknown if the species is extirpated within New Jersey (Service 2021).

Green floaters are typically found in small streams to large rivers with stable sand and gravel substrate. They prefer areas with slow to moderate flows (not flashy or high currents) that provide flow refugia (*i.e.*, eddies and ponded areas in streams), good water quality, and appropriate temperatures for survival. Areas with strong currents are not likely to contain habitat for the species. Connectivity between populations (free flowing streams and rivers without barriers) is necessary for periodic genetic exchange (Service 2021).

Green floaters are relatively short lived with variable annual recruitment, suggesting population growth is maximized during periods of favorable conditions. Green floaters are hermaphroditic and can self-fertilize which increases the probability of fertilization. Spawning and reproduction likely occur during the late summer or early fall. Over the winter months, they have the unique ability to directly metamorphose larvae (called glochidia), releasing juveniles into the water column during the spring without requiring an intermediate host. Like most freshwater mussels, green floater glochidia can exploit fish hosts, including mottled sculpin (*Cottus bairdii*), rock bass (*Ambloplites rupestris*), central stoneroller (*Camptostoma anomalum*), blacknose dace (*Rhinichthys atratulus*), and margined madtom (*Noturus insignis*). In these cases, after being expelled into the water, glochidia attach to gills or fins of these fish where they undergo metamorphosis to the juvenile life stage. Like all freshwater mussels, the green floater is an omnivore that presumably feeds on a wide variety of microscopic particulate matter (*i.e.*, bacteria and algae) (Service 2021).

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

Green floaters need multiple resilient populations distributed widely across its range for species persistence. Several factors determine sufficient green floater population health to withstand stochastic events (*e.g.*, flooding and drought), including water quality, temperature, and flow; stable substrates; food availability; chemistry of interstitial spaces; and presence of fish hosts. Primary stressors that influence their current status include habitat loss or fragmentation, changes in water flows, and degraded water quality. These stressors are primarily attributed to development, but also energy production, and agriculture (Service 2021).

For more information visit: <https://www.fws.gov/species/green-floater-lasmigona-subviridis>.

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance:

- As possible, avoid activities that will directly or indirectly impact watercourses that contain suitable green floater habitat. This includes activities such as:
 - Permanent and temporary disturbances or modifications to watercourses (*e.g.*, channelizing, diverting, stabilizing, impounding, dredging, new fill or structures, construction access within streams, changes in hydrology, erosion and sedimentation causing activities, wastewater and stormwater discharges). While green floaters are only found in perennially flowing watercourses, activities that impact ephemeral or intermittent streams (*e.g.*, erosion and sedimentation, potential spill of contaminants, water diversions, reduction in water quality) may also impact those areas. Watercourse activities that inhibit or adversely affect passage of host fishes should also be avoided.
 - On land within the riparian zone and greater watershed area if they cause reduction in water quality, turbidity/sedimentation increases, and increased pollution. For example:
 - Large increases in impervious surfaces for new developments, stormwater changes, urban runoff, municipal wastewater, salting roads, and clearing of riparian zones (Poole and Downing 2004, Brown et al. 2010, Gillis 2012, Gillis et al. 2013, Haag et al. 2019, Service 2021, Skorupa et al. 2023, Lu et al. 2024).
 - If they are in locations where they can cause contaminants to enter a watercourse: gas stations; using/storing motor fuels, lubricants, the isopropylamine salt of glyphosphate, the surfactant MON 0818, fertilizers, pesticides, and products containing adverse levels of chlorothalonil, ammonia, aluminum, copper, nickel, zinc, chloride, and potassium (Augsburger et al. 2007, Service 2021, U.S. Department of the Interior 2023).
- Actions that impact watercourses where green floaters are or may be present will likely require a freshwater mussel survey. Please contact the Service for necessary next steps to confirm that a survey is required and to receive survey protocols and an active list of

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

qualified surveyors. Contact the Service immediately if a green floater is found - do not move the animal except to avoid imminent injury. Guidance for federally listed or proposed freshwater mussel surveys in New Jersey can be found at:

<https://www.fws.gov/media/freshwater-mussel-surveys-new-jersey-guidance-project-review>.

- Initiate early coordination with the Service if existing road or utility crossings must be replaced or constructed near or upstream of green floater habitat and consider the following recommendations:
 - Design replacement bridges to span the stream (as to avoid permanent fill).
 - If possible, eliminate deck drains on new bridges to avoid contaminants from the road entering the watercourse. Work with the Service in the design and location of bridge drainage outlets.
 - Remove piles or footings by cutting them at the stream bed or natural ground elevation.
 - As necessary, use granular material in fill areas immediately adjacent to the bridge to reduce sediment from reaching the stream and to prevent scouring.
 - Minimize the number of utility crossings and design them perpendicular to the stream to avoid directly impacting it.
 - As possible, avoid debris from falling into the water.
 - For activities such as pipelines, waterlines, and other utility line crossings: horizontal directional drilling (HDD) or trenchless methods are generally preferred. If HDD is proposed, the risk level of discharge of drilling materials (inadvertent returns) to the watercourse should be assessed.
- Ensure compliance with New Jersey Department of Environmental Protection's Flood Hazard Area Control Act Riparian Zone regulations, which may regulate riparian zones within 300 feet of a watercourse (New Jersey Department of Environmental Protection Accessed 2024).
- As possible, preserve and/or restore existing riparian ecosystems (Service 2021). Place riparian zones around green floater populations in permanent conservation ownership or easement. Riparian zones greater than 100 feet from the top of the streambank is recommended to be protective of water quality and aquatic habitats (Sweeney and Newbold 2014, Lu et al. 2024). Native, woody vegetation is often recommended for riparian zone restoration, enhancement, or creation (Sweeney and Newbold 2014, Cole et al. 2020).
- Avoid creation of surface or groundwater withdrawals upstream or up-gradient of green floater populations, as well as those that may impact the watercourse bottom. Withdrawals may affect the watercourse hydrology (Canace and Hoffman 2009, Service 2021) and could lead to dewatering, which can reduce habitat suitability (Galbraith et al. 2015, Randklev et al. 2018; Service 2021).

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

- Implement the strictest standards for storage, transport, and handling of hazardous materials and other potential pollutants within watersheds that support green floater habitat to prevent contact with watercourses, as they can be harmful to freshwater mussels. As possible, use/store these materials outside of the floodplain and in areas where exposure to watercourses cannot occur. Use secondary containment structures around chemical/fuel storage tanks and buildings that may leak contaminants into watercourses.
- For pesticides and fertilizers:
 - Avoid using, storing, or mixing them and other potential pollutants where they might spill or leak into a watercourse. This should be at least 100 feet away from surface waters (PennState Extension Accessed 2024) located adjacent to and upstream of known or potential green floater habitat.
 - Always adhere to label restrictions for use near aquatic ecosystems.
 - Minimize usage within watersheds that may contain green floater habitats and implement the highest standards for controlling agricultural runoff.
- Although additional study is needed, some herbicides may impact the species if it enters a watercourse where the species is present (Drewak et al. 2024). As such, the recommendations above for pesticides and fertilizers should also be adhered to for herbicide usage.
- Do not allow raw concrete to encounter watercourses as it can be toxic to aquatic life. Cover exposed fill materials when not in use or when rain is forecasted to prevent it from entering watercourses.
- Sedimentation of freshwater mussels can harm them and may be lethal (Service 2021, Zhu et al. 2024). Sediment exposure or burial impacts to freshwater mussels from construction activities may occur greater than 1 mile downstream from those activities, depending on watercourse conditions (Zhu et al. 2024). As such, to prevent sedimentation, implement the strictest erosion and sediment control standards upstream and up-gradient of green floater habitat, including but not limited to (New Jersey Department of Agriculture 2017, Zhu et al. 2024):
 - As possible, avoid activities below the ordinary high-water mark and install streamside soil erosion and sediment controls to prevent sedimentation in watercourses.
 - Perform activities during typically low flow seasons to reduce the likelihood of sedimentation traveling downstream.
 - Construct storm water management infrastructure and soil erosion/sediment controls prior to all other components of a development project to control storm water and sediment during the remaining construction.
 - Install storm drain inlet filters to prevent sedimentation or other construction related pollutants from being transported to watercourses.

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

- Do not stockpile sediment or other materials in areas where it will obstruct natural drainage, cause further environmental damage (*e.g.*, in wetlands, watercourses), and in areas where stormwater/runoff may transport it into watercourses.
 - Manage runoff in upslope locations before downslope locations.
 - As possible, utilize natural-based soil erosion and sediment control methods (*e.g.*, seed and mulch) before using engineered products. In areas where this will not be effective in controlling sediment, employ silt fencing or in-water turbidity barriers.
 - Limit the duration of exposed soil by delaying vegetation removal and ground disturbances to only that required for construction activities. Do not clear the entire site at the beginning of the project if a portion will not be needed until later in the project.
 - Installing silt fencing or silt bags (or in combination with hay bales) around work areas.
 - Using jute matting or other erosion control blankets on disturbed areas. immediately after project completion to minimize sedimentation.
 - Promptly re-vegetate areas of temporary disturbance with native species.
 - Using turbidity curtains or other appropriate in-water sediment control measures.
 - Ensure that all soil erosion and sediment controls are functioning properly with daily inspection and, if necessary, maintenance/replacement. Establish a plan outlining preventative actions (*e.g.*, what, where, and when) that will be taken when a large precipitation event is anticipated/has begun.
 - Ensure any necessary compliance/review of the soil erosion and sediment control plan by the applicable New Jersey Soil Conservation District (New Jersey Department of Agriculture Accessed 2024). Review the standards for soil erosion and sediment control in New Jersey for additional possible protection to freshwater mussel habitat (New Jersey Department of Agriculture 2017).
- Avoid introductions of invasive or non-native species to green floater streams and riparian corridors (Service 2021), for example through:
 - Thoroughly washing construction equipment offsite before use in watercourses. Ensure that the equipment is washed on land in locations where runoff cannot transport the washed off materials into watercourses (recommended at least 500 feet landward from the top of the watercourse bank).
 - Using only native plant species and weed-free mulches and soils for landscaping within the riparian zone.
 - For individual work crew members that will be entering the watercourse: follow the New Jersey Water Monitoring Council's Decontamination Protocols to minimize the risk of introducing or spreading aquatic invasive species (available at: <https://www.nj.gov/dep/wms/docs/NJWMC-DecontaminationProtocol-March2024.pdf>).
 - Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (*e.g.*, access roads, parking areas, entry points).

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

Procedures for when a green floater occurrence has been located:

- Report the observation to the Service's NJFO and the New Jersey Department of Environmental Protection's Wildlife Tracker
(<https://dep.nj.gov/njfw/conservation/reporting-rare-wildlife-sightings/>)

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

MONARCH BUTTERFLY (*DANAUS PLEXIPPUS*)

Biology, Presence, and Threats

On December 12, 2024, the Service published a proposal to list the monarch butterfly as threatened under the ESA (*Federal Register Vol. 89, No. 239, pp. 100662-100716*). A final determination to either list the monarch butterfly under the ESA or to withdraw the proposal is anticipated in the future.

Adult monarch butterflies are large and conspicuous, with bright orange wings surrounded by a black border and covered with black veins. The black border has a double row of white spots, present on the upper side of the wings.

Adult monarch butterflies are sexually dimorphic, with males having narrower wing venation and scent patches (CEC 2008). Each spring, monarch butterflies disperse from overwintering grounds to areas across the United States, including New Jersey. During the breeding season, monarch butterflies lay eggs on their obligate milkweed host plant (primarily *Asclepias spp.*), and larvae emerge after 2-5 days (Zalucki 1982; CEC 2008). Larvae develop through five larval instars (intervals between molts) over a period of 9-18 days, feeding on milkweed and sequestering toxic chemicals (cardenolides) as a defense against predators (Parsons 1965). The larva then pupates into a chrysalis before emerging 6-14 days later as an adult butterfly. There are multiple generations of monarch butterflies produced during the breeding season, with most adult butterflies living approximately 2-5 weeks; overwintering adults enter reproductive diapause (suspended reproduction) and live 6-9 months (Cockrell et al. 1993, Herman and Tatar 2001). Monarchs cannot develop in temperatures lower than 53°F or higher than 91°F (Zalucki 1982). Monarchs at all life stages are impacted by diseases and natural enemies (Service 2024).



Figure 11: Monarch butterfly (Credit: Jim Hudgins, USFWS, <https://www.fws.gov/media/monarch-butterfly-purple-coneflower-3>)

Monarch butterflies are likely present during migration and breeding in New Jersey from April 1 to October 31 or May 1 to September 30 (depending on location in New Jersey; Monarch Joint Venture 2019). Monarch butterfly habitat requires suitable shelter from poor weather such as fallen logs and leaf litter; food from plants such as milkweed and other nectar plants to support them throughout the breeding season; and water within brief flying range (New Jersey Department of Environmental Protection 2017). Suitable breeding habitat requires all the same conditions but also their obligate milkweed host plant. In the fall, surviving monarch butterflies migrate from and through New Jersey to their respective overwintering sites which is generally in the mountains of central Mexico (Service 2024).

The primary drivers affecting the health of the two North American migratory populations are: habitat loss and degradation (from conversion of grasslands to agriculture, widespread herbicide

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

use, logging/thinning at overwintering sites in Mexico, senescence, and incompatible management of overwintering sites in California, and urban development) extreme storm events, drought, disease, wildfire, and continued exposure to insecticides (Service 2024).

For more information visit: <https://www.fws.gov/species/monarch-danaus-plexippus>.

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of monarch butterfly in New Jersey:

- Identifying and avoiding impacts to suitable monarch butterfly habitat. If avoiding impacts to suitable monarch habitat is not possible, avoid impacts during times of year monarch butterflies may be present (April 1 to October 31 or May 1 to September 30). Review the "Mowing and Management: Best Practices for Monarch's" handout at: <https://monarchjointventure.org/blog/revised-handout-mowing-and-management-best-practices-for-monarchs> to see if any other conservation measures are applicable to future projects/can be implemented.
- Review the Services website at: <https://www.fws.gov/initiative/pollinators/monarchs>, New Jersey Department of Environmental Protection's (2017) Monarch Butterfly Conservation Guide, and the Monarch Joint Venture website at: <https://monarchjointventure.org/mjvprograms/science/roadside-habitat-for-monarchs/best-management-practices-resources> for possible conservation measures to implement for future projects.
- Incorporate planting for monarch and other pollinators into landscape designs. This would include plants such as native milkweed (*Asclepias* spp.) and other native nectar plants such as goldenrod (*Solidago* spp.) to supplement milkweed during the breeding season. A guide to monarch butterfly nectar plants in the region can be found at: https://xerces.org/sites/default/files/2018-05/16-042_01_XercesSoc_MonarchNectarPlants_Mid-Atlantic_web-3page_0.pdf.
- The following actions developed in the United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) monarch butterfly Landowner Guide (2020) and referenced at the link below:
 - Provide habitat restoration such as:
 - Converting agricultural land to spring blooming shrubs and trees.
 - Enhancing native meadows or native warm season grass plantings with forbs.
 - Enhancing suitable nectar or larval habitat with spring-blooming trees and shrubs.

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Maintain existing monarch habitat through actions such as mowing in the winter and applying herbicides in spot or stump treatments.
- The following actions developed in the New Jersey Department of Environmental Protection's New Jersey Monarch Butterfly Conservation Guide (2017):
 - Plant native milkweed species. The United States Department of Agriculture's (USDA) Natural Resource Conservation Service (NRCS) PLANTS Database at <https://plants.usda.gov/home> can be used to find milkweed species that are native within New Jersey.
 - Plant nectar plants to supplement native milkweed during the breeding season. The Pollinator Partnership has developed a *Selecting Plants for Pollinators* Guide (located at: <https://www.pollinator.org/PDFs/EasternBroadleaf.Oceanic.rx18.pdf>) that can be used to help determine what species to plant.

More information about habitat restoration, conservation, and maintenance of habitat for the monarch butterfly can be found at the USDA's NRCS (2020) monarch butterfly Landowner Guide referenced below.

Procedures for when a monarch butterfly occurrence has been located:

- Since the monarch butterfly is not currently listed pursuant to the ESA and is also not a New Jersey state listed species, the Service recommends reporting to iNaturalist via smartphone application or online at: <https://www.inaturalist.org/>.

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

NORTHEASTERN BEACH TIGER BEETLE (*HABROSCELIMORPHA DORSALIS DORSALIS*)

Biology, Presence, and Threats

The northeastern beach tiger beetle was federally listed as threatened in 1990 (*Federal Register Vol. 55, No. 152, pp. 32088-32094*). At about 0.5 inch long, the northeastern beach tiger beetle has a bronze-green head and thorax, and white to light tan wing coverings (elytra) often with dark lines. Tiger beetles are often the dominant invertebrate predators in habitats where they occur. Adults use their long mandibles to capture small amphipods, flies, and other invertebrates along the water's edge.

Adults have also been observed scavenging on dead amphipods, crabs, and fish. Larvae are “sit and wait” predators that feed mainly on amphipods. Larvae dig vertical burrows in the sand and wait at the burrow mouth to capture passing prey, mainly amphipods (Service 1994).



Figure 12: Northeastern Beach Tiger Beetle. (Credit: USFWS)

In New Jersey, northeastern beach tiger beetles inhabit wide, sandy, ocean beaches from the intertidal zone to the upper beach. Eggs are deposited in the mid- to above-high tide drift zone. Larval beetles occur in a relatively narrow band of the upper intertidal to high drift zone, where they can be regularly inundated by high tides. This zone may be wider in areas of overwash or where the upper beach is flat and periodically wetted by the tides. Northeastern beach tiger beetle larvae pass through three developmental stages (instars) over two years, over-wintering twice as larvae, pupating at the bottom of their burrows, and emerging as winged adults during their third summer (Service 1994).

The northeastern beach tiger beetle was found historically along New Jersey's undeveloped Atlantic coastal beaches from Sandy Hook to Holgate, but was extirpated from the State sometime between the 1950s and 1990s (Service 1994, Knisley and Gwiazdowski 2021). In 1994 and 1995 a population of the northeastern beach tiger beetle was re-established at the Gateway National Recreation Area, Sandy Hook Unit (Sandy Hook) and persisted until the mid-2000s (Knisley et al. 2005). Additional translocations were carried out in 2006 (Knisley 2006), but by 2017 the species was again extirpated from Sandy Hook and from New Jersey (Gwiazdowski and Knisley 2019). A newer reintroduction effort at Sandy Hook began in 2020 and is in progress. To date, numbers remain low and the species remains limited to a small area within Sandy Hook (Gwiazdowski and Knisley 2023).

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

The primary threats to the northeastern beach tiger beetle are habitat disturbance and destruction from development, beach stabilization, and recreational beach uses including pedestrian and vehicle traffic, all of which affect both larvae and adults. Other threats include spills of oil or other contaminants, pesticide use, natural or human-induced beach erosion, predation, and climate-driven changes such as accelerating sea level rise and increasing storm intensity (Service 1994, 2019).

For more information visit:

<https://www.fws.gov/species/northeastern-beach-tiger-beetle-habroscelimorpha-dorsalis-dorsalis>

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of northeastern beach tiger beetle in New Jersey:

- Avoid direct and indirect modifications to suitable northeastern beach tiger beetle habitat, as well as activities within suitable habitat that may injure or kill beetles (*e.g.*, driving, use of heavy equipment, sand moving or grading) (Service 1994).
- If work within suitable northeastern beach tiger beetle habitat is proposed, the Service recommends coordinating with a qualified surveyor to determine if beetles are present in the action area.
 - Contact the Service for survey protocols and necessary next steps to determine if a survey is needed. Surveys for northeastern beach tiger beetle should not be conducted without prior Service concurrence with the survey work plan.
 - If found during the survey, effects to northeastern beach tiger beetles and their habitat should be avoided or minimized to the extent practicable. The Service will provide project-specific recommendations.
- Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (*e.g.*, access roads, parking areas, entry points) (Service 1994, Tratalos et al. 2013).

Procedures for when a Northeastern beach tiger beetle occurrence has been located:

- Report the observation to the NJFO and the New Jersey Department of Environmental Protection's Wildlife Tracker (<https://dep.nj.gov/njfw/conservation/reporting-rare-wildlife-sightings/>)

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

AMERICAN CHAFFSEED (*SCHWALBEA AMERICANA*)

Biology, Presence, and Threats

American chaffseed was federally listed as an endangered species in 1992 (*Federal Register Vol. 57, No.189, pp. 44703-44708*). It is a hemiparasitic perennial plant that grows 12 to 24 inches high. The stems are unbranched or branched only at the base (Service 1995). The large, purplish-yellow, tubular flowers are 1-1.5 inches long and form a spike-like cluster (raceme). Flowering occurs from June to mid-July in the northern part of the species' range (Service 1995).

American chaffseed occurs in sandy (sandy peat, sandy loam), acidic, seasonally-moist to dry soils (Service 1995). It is generally found in early successional ecosystems described as open, moist pine flatwoods, fire-maintained savannas, ecotonal areas between peaty wetlands and xeric (dry) sandy soils, bog edges, and other open grass-sedge systems (Kral 1983). American chaffseed is dependent on factors such as fire, mowing, or fluctuating water tables to maintain the crucial open to partly open conditions that it requires (Kral 1983). The species appears to be shade intolerant (Service 1995).

Plant species commonly associated with American chaffseed in New Jersey include little bluestem (*Schizachyrium scoparium*), broomsedge bluestem (*Andropogon virginicus*), Maryland golden-aster (*Chrysopsis mariana*), flax-leaved stiff-aster (*Ionactis linariifolia*), gray goldenrod (*Solidago nemoralis*), and rattlesnake weed (*Hieracium venosum*) (Kelly and Denhof 2022).

Threats to the American chaffseed include loss of open habitat due to development and natural vegetational succession, trampling, herbicide application, and herbivory (Service 1995).

For more information visit:

<https://www.fws.gov/species/american-chaffseed-schwalbea-americana>.

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of American chaffseed in New Jersey:

- Avoid direct and indirect disturbance to suitable American chaffseed habitat.



Figure 13: American chaffseed (Credit: USFWS)

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- If work that will impact suitable American chaffseed habitat is proposed, the Service may recommend conducting a survey within that area to determine if the species is present. Surveys should be conducted from June 1 to August 15 when plants are in flower or fruiting. Surveys strictly for suitable habitat may be permitted to occur outside of this window when conditions permit. Please contact the Service to discuss survey protocols and necessary next steps to confirm that a survey is required. Surveys for American chaffseed should not be conducted without prior approval from the Service.
- If American chaffseed plants have been documented in the action area, or if the project proponent wishes to presume presence, consider the following measures to minimize impacts to plants, seed, and habitat:
 - Have a qualified botanist mark the edge of the suitable habitat and include a protective buffer that is scaled to the proposed activity/potential impact. When permanent impacts are proposed, the buffer should include enough contiguous unoccupied habitat to allow for dispersal, natural colonization, and expansion of the species. Buffer distances vary per action and may be 500 feet (Service 1995).
 - Buffer markers should be easily visible to crews and equipment operators (*e.g.*, signs or rebar posts with symbolic string fencing).
 - Ensure removal of all buffer markers after activities are completed.
 - Avoid permanent, direct modification of suitable habitat (Service 1995).
 - Avoid new permanent development in locations that could hinder/preclude the use of prescribed fire for habitat management within suitable habitat (Service 1995).
 - During construction, restrict entry into suitable habitat and buffer areas to the maximum extent practicable. When access into suitable habitat or buffer area cannot be avoided:
 - Have a qualified botanist designate access points, staging areas, waste collection areas, and travel corridors for vehicle and foot traffic that are located away from known plant locations and optimal habitat.
 - Keep all personnel, vehicles, and equipment within the designated work area/project footprint and access corridors.
 - Limit vehicle and heavy equipment use in suitable habitat to the minimum number of passes needed to accomplish the work to minimize disturbance to plants and topographic alterations.
 - Develop and implement a Service-approved erosion and sediment control plan. Implement erosion and sedimentation control measures (*e.g.*, silt fencing, hay bales, soil stabilization matting) where appropriate to avoid increased erosion that could directly or indirectly impact plants. Erosion and sediment control measures must strictly adhere to State and Federal guidance that has been provided for your project area and project type. Inspect erosion and sediment control devices regularly during construction to ensure efficacy and prevent failure of devices. Inspect devices prior to expected high rainfall occurrences. Ensure removal of all materials after the construction activity ends.

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Ensure materials used (*e.g.*, soil, gravel, rock) at project site are free of invasive species before placement on-site. Implement invasive species control measures to reduce the presence of invasive species on site. Ensure all vehicles, machinery, and equipment, including technical gear and personal protective equipment, are clean and free of invasive species before use at the project site.
 - Avoid use of pesticides (*e.g.*, herbicides, insecticides) and surfactants at a location where application or runoff could result in these chemicals contacting American chaffseed plants and/or their host plant species (Service 1995). Consider mechanical removal (hand-pulling) of target vegetation in lieu of herbicide use.
 - If necessary, use a highly selective manual herbicide application technique to ensure that American chaffseed is not impacted directly or indirectly.
 - Minimize and remediate temporary habitat modification.
 - Submit a post-construction restoration plan to the Service.
 - Restore the project area to original or ecologically improved condition using native, non-invasive plant mixes.
 - Plant with native, non-invasive seed mixes. Ensure new plantings will not outcompete or adversely affect American chaffseed.
 - Avoid planting/reseeding vegetation that may attract herbivores such as white-tailed deer (*Odocoileus virginianus*) (Service 1995).
 - Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (*e.g.*, access roads, parking areas, entry points) to minimize risk of trampling American chaffseed (Service 1995).
- Landowners seeking to benefit sensitive American chaffseed can contact the Service for technical assistance. Examples of beneficial actions include:
 - Placing suitable habitat and adjacent areas with known American chaffseed occurrence in permanent conservation ownership or easement (Service 1995).
 - Implementing a prescribed fire regime to maintain native grassland habitat (Service 1995).

Procedures for when an American chaffseed occurrence has been located:

- Report the observation to the Service's NJFO and the New Jersey Department of Environmental Protection's Natural Heritage Program
(https://www.nj.gov/dep/parksandforests/natural/docs/NHRPSR_Form.pdf)

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

KNIESKERN'S BEAKED-RUSH (*RHYNCHOSPORA KNIESKERNII*)

Biology, Presence, and Threats

The Service (1993) explains most of the biology, presence, and threats information below.

Knieskern's beaked-rush was federally listed as a threatened species in 1991 (*Federal Register Vol. 56, No. 138, pp. 32978-32983*). It is a grass-like semi-perennial member of the sedge family that grows 0.6-24 inches tall and is distinguished from other species by its fruit (achene). Fruiting typically occurs from July to September.

Knieskern's beaked-rush is found only in (*i.e.*, endemic to) New Jersey. An obligate wetland species, Knieskern's beaked-rush occurs in early successional wetland ecosystems, often on bog-iron substrates adjacent to slow-moving streams in the Pinelands region. In the past, fire may have played an important role in creating and maintaining suitable habitat for Knieskern's beaked-rush. This species is also found in human-disturbed wet areas that exhibit similar early successional stages due to water fluctuation or periodic disturbance from vehicles, mowing, or fire. These human-influenced habitats include abandoned borrow pits, clay pits, ditches, rights-of-way, and unimproved roads. Knieskern's beaked-rush is often associated with other sedge and grass species. However, it is intolerant of shade and competition, especially from woody species, and is sometimes found on relatively bare substrates.



Figure 14: Knieskern's beaked-rush (Credit: USFWS)

Threats to Knieskern's beaked-rush include habitat loss from development, agriculture, hydrologic modification, and other wetland alterations; excessive disturbance from vehicle-use, trash dumping, and other activities; and natural vegetative succession of the open, sparsely vegetated substrate preferred by this species.

For more information visit: <https://www.fws.gov/species/knieskerns-beaked-rush-rhynchospora-knieskernii>.

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of Knieskern's beaked-rush in New Jersey:

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Avoid direct modifications to wetlands supporting Knieskern's beaked-rush (*e.g.*, clearing, flooding, filling, draining, ditching, tiling, excavating), and to waterbodies with hydrologic connection to Knieskern's beaked-rush habitat (*e.g.*, channelizing, diverting, stabilizing, impounding).
- If work that will impact suitable Knieskern's beaked-rush habitat is proposed, the Service may recommend conducting a survey within that area to determine if the species is present. Surveys should be conducted from June 1 to September 30 when achenes are mature. Surveys strictly for suitable habitat may be permitted to occur outside of this window when conditions permit. Please contact the Service for survey protocols and necessary next steps to confirm that a survey is required. Surveys for Knieskern's beaked-rush should not be conducted without prior approval from the Service.
- If Knieskern's beaked-rush is found during the survey, effects to it should be avoided or minimized as much as possible. The Service will also work with organizations through ESA consultation to provide conservation measures for avoiding effects.
- Provide adequate upland buffers around wetlands supporting Knieskern's beaked-rush, often at least 300 feet of native vegetation. A site-specific buffer design is often necessary.
- Provide at least 150-foot buffers of native vegetation along waterbodies with hydrologic connection to wetlands supporting Knieskern's beaked-rush.
- Implement Low Impact Design Techniques in the New Jersey Stormwater Best Management Practices Manual (https://www.nj.gov/dep/stormwater/bmp_manual2.htm).
- Avoid reforestation or landscaping within 150 feet that would increase shading of Knieskern's beaked-rush habitat.
- Avoid planting of native vegetative competitors within 150 feet of Knieskern's habitat. Where possible (*e.g.*, where erosion is not a concern), allow natural re-vegetation of bare mineral wet soils within 300 feet of Knieskern's sites.
- Avoid temporary impacts to wetlands supporting Knieskern's beaked-rush, for example through:
 - locating temporary work areas and access routes outside of wetlands;
 - constructing storm water management infrastructure prior to all other components of a development project to control storm water and sediment during the remaining construction;
 - installing two rows of silt fencing around work areas, with daily inspection and maintenance;
 - using jute matting or other erosion control blankets on disturbed areas immediately after project completion to minimize sedimentation; and

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- controlling invasive vegetation following temporary disturbance.
- Avoid introductions of invasive species to wetlands supporting Knieskern's beaked-rush , for example through:
 - thoroughly washing construction equipment offsite before use within 500 feet of Knieskern's beaked-rush habitat; and
 - using only native plant species and weed-free mulches and soils for landscaping within 500 feet of Knieskern's beaked-rush habitat.
- Avoid public access or other human activities in and around wetlands supporting Knieskern's beaked-rush.
- Place wetlands supporting Knieskern's beaked-rush and associated upland buffers in permanent conservation ownership or easement.
- Work with the Service to design and implement a management plan that will maintain early successional vegetative conditions.
- Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (e.g., access roads, parking areas, entry points).

Procedures for when a Knieskern's beaked-rush occurrence has been located:

- Report the observation to the Service's NJFO and the New Jersey Department of Environmental Protection's Natural Heritage Program
(https://www.nj.gov/dep/parksandforests/natural/docs/NHRPSR_Form.pdf).

References

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

SEABEACH AMARANTH (*AMARANTHUS PUMILUS*)

Biology, Presence, and Threats

Seabeach amaranth was federally listed as a threatened species in 1993 (*Federal Register Vol. 58, No. 65, pp. 18035-18042*). It is an annual member of the amaranth family (Amaranthaceae) and has reddish stems and small, rounded, notched, spinach-like leaves. In New Jersey, these low-growing plants are typically about 4 inches across by late summer, but can occasionally reach 2 or 3 feet in diameter. The small white flowers and dark seeds are located in inconspicuous clusters along the stems. Germination begins in May and continues through the summer. Flowering begins as soon as plants reach sufficient size (June or July) and continues until the plants die between September and December. Some seeds are dispersed long distances by winds and water, while others remain at the site of the parent plant or within about 300 feet (Service 1996, 2004).

Seabeach amaranth is native (and endemic) to Atlantic Coast beaches and barrier islands. The primary habitat of seabeach amaranth consists of overwash flats at accreting ends of islands, lower foredunes, and upper strands of non-eroding beaches (landward of the wrack line), although the species occasionally establishes small temporary populations in other habitats, including sound-side beaches, blowouts in foredunes, inter-dunal areas, and on sand and shell material deposited for beach replenishment or as dredge spoil. Seabeach amaranth usually grows in nearly pure sand substrate, occasionally with shell fragments mixed in (Service 1996).

Seabeach amaranth occupies elevations from 8 inches to 5 feet above mean high tide. The plant grows in the upper beach zone above the high tide line and is intolerant of even occasional flooding during its growing season (May 15 to November 30). The habitat of seabeach amaranth is sparsely vegetated with annual herbs and, less commonly, perennial herbs (mostly grasses) and scattered shrubs. Vegetative associates of seabeach amaranth include sea rocket (*Cakile edentula*), seabeach spurge (*Chamaesyce polygonifolia*), and other species that require open,



Figure 15: Seabeach amaranth mature plant (top, credit: U.S. Army Corps of Engineers); seedlings with penny (middle, credit: USFWS); seedlings with key (bottom, credit: Conserve Wildlife Foundation of NJ)

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

sandy beach habitats. However, this species is intolerant of competition and does not occur on well-vegetated sites. Seabeach amaranth is often associated with beaches managed for the protection of beach nesting birds such as the piping plover (*Charadrius melodus*) and least tern (*Sterna antillarum*) (Service 1996, 2004).

Threats to seabeach amaranth include beach stabilization (particularly the use of beach armoring, such as sea walls and riprap), intensive recreational use, mechanical beach raking, beach driving, and herbivory by insects. Plants and seeds can also be buried by beach nourishment, bulldozing, and other mechanized sand movements in the beach and dune environment (Service 1996, 2023, Kelly 2014).

For more information visit:

<https://www.fws.gov/species/seabeach-amaranth-amaranthus-pumilus>

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance.

As used in the Service recommendations listed below, "suitable habitat" is defined as dry, sandy, ocean beach between the mean high-water line and the landward limit of the beach (Service 1996).

- The landward limit of the beach may be a seawall, revetment, bulkhead, boardwalk, roadway, etc., or the toe of a densely vegetated dune.
- Suitable habitat includes the wrack line as well as low, sparse, unstabilized dunes and interdune areas.
- Unsuitable habitat includes steep, stabilized dunes; densely vegetated areas; scarped areas, "wet sand" (intertidal) areas; and hard-packed unpaved roadways or beach entry points.

For actions within the range of seabeach amaranth in New Jersey, the Service recommends the following:

- Avoid permanent or temporary modification of suitable seabeach amaranth habitat (Service 1996, 2023).
 - Follow best practices for coastal engineering (Rice 2009, Guilfoyle et al. 2019).
 - Avoid creation/expansion of hard shoreline stabilization structures (*e.g.*, jetties, groins, sea walls, sand fencing, stabilized dunes), especially in sparsely developed areas.
 - Avoid adverse changes in elevation and slope, and seedbank burial such as through sand removal, deposition, or transfers.
 - Preferentially use living shorelines techniques.
 - Design projects to incorporate wide, sparsely vegetated, minimally stabilized beaches.

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Design projects to preserve natural coastal processes and inlet dynamics.
- Protect habitat during post-storm management of beach habitat and beach recreation.
- Avoid the introduction or spread of dense or invasive vegetation in suitable seabeach amaranth habitat. Thoroughly clean construction equipment before use on a beach to avoid unintended spread of invasive plants (Vyas 2008, Service 2023). Contact the Service prior to any beach plantings (Service 2022).
- Seasonally restrict work that might damage seabeach amaranth plants during the growing season of May 15 to November 30, particularly work involving use of motorized vehicles, heavy equipment or large numbers of personnel (Service 1996, 2004, 2023). Alternatively, in consultation with the Service, fence and avoid any plants in the work area as follows.
 1. For any area of suitable habitat where disturbance will begin between May 15 and July 31, survey the area for seabeach amaranth no more than one week before the start of the disturbance.
 - a. The entire area should be thoroughly searched, not just transects. Survey by walking slowly and carefully in a zig-zag pattern from the high-water line to the landward limit of the beach, ensuring complete survey coverage of the area of disturbance.
 - b. Additional reference photos of mature plants are available at <https://www.fws.gov/species/seabeach-amaranth-amaranthus-pumilus> (under Information & Media).
 - c. Please note that seedlings can be quite small (less than 1 inch); additional photos are available from NJFO upon request.
 - d. Surveys may be conducted by any natural resource professional or other qualified person familiar with this species. The Service requests a copy of the surveyor's qualifications before the start of the survey.
 - e. Provide survey results to the Service before the start of project activities.
 2. If disturbance will begin between August 1 and November 30, the Service may be contacted to inquire if plant locations are available from a coastwide survey effort carried out by New Jersey Department of Environmental Protection (in the absence of available data, the above survey protocol should be followed).
 3. If any plants are found to occur in the work footprint, use symbolic (string-and-post) fencing to encircle each plant or group of plants, allowing a 3-meter buffer on all sides.
 - a. DO NOT use sand/snow fencing for this purpose (Service 1996).
 - b. Mark the fencing with flagging and signs.

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- c. Instruct all work crews to avoid fenced areas (*e.g.*, do not enter on foot or via motor vehicle, do not stage or store materials or equipment in or near fencing, locate access routes away from fenced areas, do not stockpile or grade sand within 50 feet of fencing or as needed to avoid inducing sand erosion or deposition within the fenced area).
 - d. Remove symbolic fencing upon completion of work.
- Avoid mechanical beach raking during the growing season of May 15 to November 30 to protect seedlings and mature plants (Kelly 2014) and habitat characteristics such as wrack material (Service 1996, 2004, 2023).
 - Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (*e.g.*, access roads, parking areas, entry points).
 - If applicable, plan and carry out fireworks displays in accordance with the Service's [*Guidelines for Managing Fireworks in the Vicinity of Piping Plovers and Seabeach Amaranth on the U.S. Atlantic Coast*](#) (Service 1997).
 - Work with the Service and the New Jersey Department of Environmental Protection's Endangered and Nongame Species Program to prepare a [Beach Management Plan](#) or keep an existing plan up to date. Plan and carry out projects, events, and habitat management in accordance with the provisions of approved plans (Kelly 2016, Service 2022).

Procedures for when a seabeach amaranth occurrence has been located:

- Report the observation to the Service's NJFO and the New Jersey Department of Environmental Protection's Natural Heritage Program (https://www.nj.gov/dep/parksandforests/natural/docs/NHRPSR_Form.pdf).

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

SENSITIVE JOINT-VETCH (*AESCHYNOMENE VIRGINICA*)

Biology, Presence, and Threats

Sensitive joint-vetch was federally listed as a threatened species in 1992 (*Federal Register Vol. 57, No. 98, pp. 21569-21574*). It is an annual plant and a member of the pea (*Leguminosae*) family. This species can grow up to 6 feet tall, with clusters (racemes) of yellow, pea-type flowers growing on short, lateral branches. Leaves are divided into smaller leaflets that branch out from a central stalk (pinnate). Germination takes place from late May to early June. Plants flower from July through September, and into October in some years (Service 1995).

Sensitive joint-vetch inhabits the intertidal zone of fresh to slightly salty (brackish) tidal river segments, typically where sediments accumulate and extensive marshes are formed. These tidal marshes are subjected to a cycle of twice-daily flooding that most plants cannot tolerate. Such habitats occur only along stretches of river close enough to the coast to be influenced by the tides, yet far enough upstream that river water is fresh or only slightly brackish. Bare or sparsely vegetated substrate is a typical habitat feature for this species, which usually grows on riverbanks within 6 feet of the low water mark. Plants can also occur on accreting point bars and in sparsely vegetated microhabitats of tidal marsh interiors, such as low swales and areas of muskrat (*Ondatra zibethicus*) eat-out. This species is typically found in areas where plant diversity is high and dominated by annual species (Service 1995). However, in North Carolina and Virginia, sensitive joint-vetch has been found in habitats affected by human disturbances, such as pocket marsh wetland created by excavation in uplands, edges of soybean fields, and a mowed grassy strip between a manmade drainage channel and dirt road.



Figure 16: Sensitive joint-vetch (credit: USFWS)

Threats to sensitive joint-vetch include dredging and filling of marshes, shoreline stabilization, commercial and residential development, sedimentation, impoundments, water withdrawal projects, invasive plants (e.g., *Phragmites*), introduced insect pests, pollution, recreational activities, agricultural activities, timber harvest, effects of sea level rise (e.g., saltwater intrusion, erosion), and other climate-driven changes (Service 1995, 2013).

For more information visit: <https://www.fws.gov/species/sensitive-joint-vetch-aeschynomene-virginica>.

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

Best Practices

The following best practices are conservation measures frequently recommended by the NJFO during consultation or technical assistance for actions within the range of sensitive joint-vetch in New Jersey:

- Avoid effects to suitable sensitive joint-vetch habitat and maintain the integrity of the freshwater tidal system upon which it depends (Service 1995, 2013).
- If proposed work may impact suitable sensitive joint-vetch habitat, the Service may recommend conducting a survey within that area to determine if the species is present. Surveys for sensitive joint-vetch should be conducted from July 15 to September 15 when plants are in flower or fruiting. However, habitat assessments may occur outside of this window when conditions permit. Please contact the Service to discuss survey protocols and necessary next steps to confirm that a survey is required. Surveys for sensitive joint-vetch should not be conducted without prior approval of the plan and review of surveyor qualifications from the Service.
- If sensitive joint-vetch plants have been documented in the action area, or if the project proponent wishes to presume presence, consider the following measures to minimize impacts to plants, seeds, and habitat (Service 1995, 2013).
 - Mark the edge of the suitable habitat and include a protective buffer (usually around 500 feet).
 - Examples may include signs or rebar posts.
 - Ensure removal of all materials after activities are completed.
 - Restrict entry into marked habitat areas to the maximum extent practicable.
 - Ensure that potential seed banks surrounding the plants are not buried or adversely affected by the proposed action.
 - Limit vehicle and heavy equipment use in suitable habitat to the minimum number of passes needed to accomplish the work to minimize disturbance to plants and topographic alterations (Hannaford and Resh 1999, Kelleway 2005).
 - Designate access points, staging areas, waste collection areas, and travel corridors away from known populations and suitable habitat (Hannaford and Resh 1999, Kelleway 2005).
 - Keep vehicle and foot traffic away from the plant populations or from suitable habitat features.
 - Keep all personnel, vehicles, and equipment within the designated work area/project footprint and access corridors.
 - Maintain a clean worksite. Remove all trash and work-related debris daily.
 - Develop and implement a Service-approved erosion and sediment control plan. Implement erosion and sedimentation control measures (*e.g.*, silt fencing, hay bales, soil stabilization matting) where appropriate to avoid increased erosion that could directly or indirectly impact plants. Erosion and sediment control measures

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

must strictly adhere to State and Federal guidance that has been provided for your project area and project type. Inspect erosion and sediment control devices regularly during construction to ensure efficacy and prevent failure of devices. Inspect devices prior to expected high rainfall occurrences. Ensure removal of all materials after the end of project activities.

- Ensure materials used (*e.g.*, soil, gravel, rock) at the project site are free of invasive species before placement on-site. Implement control measures to avoid the introduction or spread of invasive species on site. Ensure all vehicles, machinery, and equipment, including technical gear and personal protective equipment, are clean and free of invasive species before use at the project site (Vyas 2008).
 - Avoid use of pesticides (*e.g.*, herbicides, insecticides) and surfactants at a location where application, overspray or runoff could result in these chemicals contacting plants or habitat components.
 - If herbicide use in the habitat cannot be avoided (*e.g.*, to manage invasive species), spot-apply (*e.g.*, via backpack sprayer) to ensure that sensitive joint-vetch is not impacted directly or indirectly. Preferentially use hand-pulling when feasible.
 - Avoid permanent, direct modification of suitable habitat.
 - Minimize indirect habitat modification (*e.g.*, from offsite changes to hydrology, sedimentation, development).
 - Minimize and remediate temporary habitat modification.
 - Submit a post-construction restoration plan to the Service, including provisions for monitoring and, if necessary, corrective actions.
 - Restore the project area to its original or ecologically improved condition using native, non-invasive plant mixes that are appropriate to the habitat and compatible with sensitive joint-vetch.
 - Restore any temporary impacts to hydrology and substrate.
 - Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (*e.g.*, access roads, parking areas, entry points) (Hannaford and Resh 1999, Kelleway 2005).
- Landowners seeking to benefit sensitive joint-vetch can contact the Service for technical assistance. Examples of beneficial actions include:
 - Place suitable habitat and adjacent areas with known sensitive joint-vetch occurrence in permanent conservation ownership or easement.
 - Partner with the Service and/or other conservation entities in efforts to maintain suitable habitat in light of sea level rise.

Procedures for when a sensitive joint-vetch occurrence has been located:

- Report the observation to the NJFO and the New Jersey Department of Environmental Protection's Natural Heritage Program (https://www.nj.gov/dep/parksandforests/natural/docs/NHRPSR_Form.pdf).

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

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**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

SMALL WHORLED POGONIA (*ISOTRIA MEDEOLOIDES*)

Biology, Presence, and Threats

Small whorled pogonia was federally listed as an endangered species in 1982, and reclassified as a threatened species in 1994 (*Federal Register* Vol. 59, No. 193, pp. 50852-50857). It is a perennial member of the orchid family (Orchidaceae) and produces a smooth, hollow stem from 2-14 inches tall and topped by five or six leaves in a circular arrangement (false whorl). One or two flowers stand in the center of the whorl of leaves. The leaves are milky green or grayish-green, and the flower is yellowish-green with a greenish-white lip. In the northern part of the species' range, plants with flowering buds emerge from the leaf litter in May and bloom in June (Service 1992).



Figure 17: Small whorled pogonia. (Credit: Gary Peeples, USFWS, <https://www.fws.gov/media/small-whorled-pogonia-0>)

Small whorled pogonia grows in a variety of upland, mid-successional, wooded ecosystems, usually mixed-deciduous or mixed-deciduous/coniferous forests that are in second or third-growth successional stages. Canopy trees are typically 40-75 years old and 8-18 inches in diameter (Service 1992).

Characteristics of this species' habitat include a sparse herb and shrub layer, a relatively open understory canopy, thick leaf litter on the forest floor, and gently sloping ground. Soils in which small whorled pogonia grows are generally acidic and dry during most of the growing season. Many sites where this plant occurs are underlain by soils with a hardpan layer that impedes the downward flow of water and leads to the formation of shallow braided channels on the ground surface. Small whorled pogonia is almost always found in proximity to features that create long persisting breaks in the forest canopy; light availability could be a limiting factor for this species (Service 1992).

Typical canopy species associated with small whorled pogonia include red maple (*Acer rubrum*), eastern hemlock (*Tsuga canadensis*), northern red oak (*Quercus rubra*), white oak (*Q. alba*), black oak (*Q. velutina*), scarlet oak (*Q. coccinea*), white pine (*Pinus strobus*), American beech (*Fagus grandifolia*), sweet-gum (*Liquidambar styraciflua*), and tulip poplar (*Liriodendron tulipifera*). Typical ground layer species associated with small whorled pogonia include: partridge berry (*Mitchella repens*), Indian cucumber root (*Medeola virginiana*), New York fern (*Thelypteris noveboracensis*), sweet lowbush blueberry (*Vaccinium pallidum*), rattlesnake plantain (*Goodyera pubescens*), red maple seedlings, oak seedlings, Canada mayflower (*Maianthemum canadense*), wintergreen (*Gaultheria procumbens*), starflower (*Trientalis*

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

borealis), running cedar (*Lycopodium digitatum*), Virginia creeper (*Parthenocissus quinquefolia*), cat-brier (*Smilax glauca*), and Christmas fern (*Polystichum acrostichoides*) (Service 1992).

Habitat destruction is the primary threat to the small whorled pogonia. Residential or commercial development, both directly and indirectly, is a primary factor in the destruction of habitat for this species. Other threats include recreational use of the habitat, herbivory, collection, and inadvertent damage from research activities (Service 1992, 2022).

For more information visit: <https://www.fws.gov/species/small-whorled-pogonia-isotria-medeoloides>.

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of small whorled pogonia in New Jersey:

- Avoid direct and indirect modifications to suitable small whorled pogonia habitat.
- If work that will impact suitable small whorled pogonia habitat is proposed, the Service may recommend conducting a survey within that area to determine if the species is present. Surveys should be conducted from May to mid-September. This period is when stems emerge (late April to early May), and flowering occurs (June). Surveys strictly for suitable habitat may be permitted to occur outside of this window when conditions permit. Some types of projects may require multiple years of surveys for this species to demonstrate likely absence. Please contact the Service for survey protocols and necessary next steps to confirm that a survey is required. Surveys for small whorled pogonia should not be conducted without prior approval from the Service.
- If small whorled pogonia plants have been documented in the action area, or if the project proponent wishes to presume presence, consider the following measures to minimize impacts to plants, seed, and habitat:
 - Mark the edge of the suitable habitat and include a protective buffer, which differs depending on the project type (Service 1992):
 - Examples may include signs or rebar posts.
 - Ensure removal of all materials after activities are completed.
 - Restrict entry into marked habitat areas to the maximum extent practicable.
 - Limit vehicle and heavy equipment use in suitable habitat to the minimum number of passes needed to accomplish the work in order to minimize disturbance to plants and topographic alterations.

U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

- Designate access points, staging areas, waste collection areas, and travel corridors away from known populations and suitable habitat.
 - Keep vehicle and foot traffic away from the plant populations or from optimal habitat features.
 - Keep all personnel, vehicles, and equipment within the designated work area/project footprint and access corridors.
 - Maintain a clean worksite. Remove all trash and work-related debris daily.
 - Develop and implement a Service-approved erosion and sediment control plan. Implement erosion and sedimentation control measures (*e.g.*, silt fencing, hay bales, soil stabilization matting) where appropriate to avoid increased erosion that could directly or indirectly impact plants. Erosion and sediment control measures must strictly adhere to State and Federal guidance that has been provided for your project area and project type. Inspect erosion and sediment control devices regularly during construction to ensure efficacy and prevent failure of devices. Inspect devices prior to expected high rainfall occurrences. Ensure removal of all materials after the construction activity ends.
 - Ensure materials used (*e.g.*, soil, gravel, rock) at project site are free of invasive species before placement on-site. Implement invasive species control measures to reduce the presence of invasive species on site. Ensure all vehicles, machinery, and equipment, including technical gear and personal protective equipment, are clean and free of invasive species before use at the project site (Vyas 2008).
 - Avoid use of pesticides (*e.g.*, herbicides, insecticides) and surfactants at a location where application, overspray or runoff could result in these chemicals contacting plants or habitat components.
 - If herbicide use in the habitat cannot be avoided (*e.g.*, to manage invasive species), spot-apply (*e.g.*, via backpack sprayer) to ensure that small whorled pogonia is not impacted directly or indirectly. However, consider hand-pulling instead.
 - Avoid permanent, direct modification of suitable habitat.
 - Minimize and remediate temporary habitat modification.
 - Submit a post-construction restoration plan to the Service, including provisions for monitoring and, if necessary, corrective actions.
Restore the project area to original or ecologically improved condition using native, non-invasive plant mixes that are appropriate to the habitat and compatible with sensitive joint-vetch.
 - Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (*e.g.*, access roads, parking areas, entry points).
- Landowners seeking to benefit sensitive small whorled pogonia can contact the Service for technical assistance. Examples of beneficial actions include:
 - Place suitable habitat and adjacent areas with known small whorled pogonia occurrence in permanent conservation ownership or easement.

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

Procedures for when a small whorled pogonia occurrence has been located:

- Report the observation to the Service's NJFO and the New Jersey Department of Environmental Protection's Natural Heritage Program
(https://www.nj.gov/dep/parksandforests/natural/docs/NHRPSR_Form.pdf).

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U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY

SWAMP PINK (*HELONIAS BULLATA*)

Biology, Presence, and Threats

Swamp pink was federally listed as a threatened species in 1988 (*Federal Register Vol. 53, No. 175, pp. 35076-35080*). It is a perennial plant in the trillium family (Melanthiaceae) with smooth, oblong, dark green leaves that form an evergreen rosette (Service 1991). In spring, some rosettes produce a flowering stalk that can grow over 3 feet tall. The stalk is topped by a 1-3 inch-long cluster of 30-50 small, fragrant, pink flowers dotted with pale blue anthers (Sutter 1982). The evergreen leaves of swamp pink can be seen year round, and flowering occurs between March and May (Service 1991).

Supporting over half of the known populations, New Jersey is the stronghold for swamp pink (Service 2021). An obligate wetland species, swamp pink occurs in a

variety of palustrine forested wetlands including swampy forested wetlands bordering meandering streamlets, headwater wetlands, sphagnum Atlantic white-cedar swamps, and spring seepage areas (Service 1991). Specific hydrologic requirements of swamp pink limit its occurrence within these wetlands to areas that are perennially saturated, but not inundated (Service 1991). The water table must be at or near the surface, fluctuating only slightly during spring and summer months (Sutter 1982). Groundwater seepage with lateral groundwater movement are common hydrologic characteristics of swamp pink habitat (Service 1991).

Swamp pink is a shade-tolerant plant that occurs in wetlands with canopy closure varying between 20-100% (Sutter 1982). Sites with minimal canopy closure are less vigorous due in part to competition from other species (Service 1991). Common vegetative associates of swamp pink include Atlantic white-cedar (*Chamaecyparis thyoides*), red maple (*Acer rubrum*), pitch pine (*Pinus rigida*), American larch (*Larix laricina*), black spruce (*Picea mariana*), red spruce (*P. rubens*), sweet pepperbush (*Clethra alnifolia*), sweetbay magnolia (*Magnolia virginiana*), sphagnum mosses (*Sphagnum* spp.), cinnamon fern (*Osmunda cinnamomea*), skunk cabbage (*Symplocarpus foetidus*), and laurels (*Kalmia* spp.) (Service 1991). Swamp pink is often found



Figure 18: Swamp pink. (Credit: Hannah Leddy, USFWS)

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

growing on the hummocks formed by trees, shrubs, and sphagnum mosses, and these micro-topographic conditions may be an important component of swamp pink habitat.

The primary threats to swamp pink are the indirect effects of off-site activities and development, such as pollution, introduction of invasive species, and subtle changes in groundwater and surface water hydrology (Service 1991). Hydrologic changes include increased sedimentation from off-site construction, groundwater withdrawals or diversion of surface water, reduced infiltration (recharge) of groundwater, increases in erosion, increases in the frequency, duration, and volume of flooding caused by direct discharges to wetlands (such as stormwater outfalls), and increased runoff from upstream development. Other threats to this species include direct destruction of habitat from wetland clearing, draining, and filling; collection; trampling; and climate change (Service 1991).

For more information visit: <https://www.fws.gov/species/swamp-pink-helonias-bullata>.

Best Practices

The following best practices are conservation measures frequently recommended by the Service's NJFO during consultation or technical assistance for actions within the range of swamp pink in New Jersey:

- Avoid direct modifications to wetlands that may support swamp pink (*e.g.*, clearing, flooding, filling, draining, ditching, tiling, excavating), and to streams that flow to swamp pink habitat (*e.g.*, channelizing, diverting, stabilizing, impounding, dredging) (Service 1991).
- If work is proposed that could impact suitable swamp pink habitat, the Service may recommend conducting a survey within that area to determine if the species is present. The ideal survey window for swamp pink is April 15 to May 31, when plants are in flower or fruiting. Surveys may be permitted to occur during other times of year (June 1 to April 14) when basal leaves are present and site conditions permit (no thick understory, extensive leaf litter, or snow/ice cover that would obscure plants). Please contact the Service for survey protocols and necessary next steps to confirm that a survey is required. Surveys for swamp pink should not be conducted without prior approval from the Service.
- Provide adequate upland buffers around wetlands that may support swamp pink, often at least 300 feet of native, woody vegetation (Dodds 1996). Upland areas with greater than 15% slope or impervious surface do not support buffering functions and should not be credited to the buffer width; extend the minimum buffer width by the width of any steeply sloped (>15%) or impervious surface area that falls within its limits. A site-specific buffer design is often necessary (Dodds 1996).

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- Provide at least 150-foot buffers of native, woody vegetation along streams that flow to wetlands that may support swamp pink to minimize transport of silt, sediment, and other pollutants into the habitat (Dodds 1996).
- For activities throughout the watershed, avoid permanent changes to the hydrology or sedimentation rates of wetlands that may support swamp pink (Service 1991, 2008). For example:
 - minimize net increases in impervious surface;
 - minimize soil compaction;
 - design storm water management plans to minimize long-term hydrologic changes to swamp pink habitat (often by maximizing infiltration);
 - avoid storm or wastewater discharges in or upgradient of swamp pink habitat;
 - ensure adequate recharge of groundwater; and
 - evaluate proposed surface or groundwater withdrawals to ensure swamp pink habitat is not affected.

See Low Impact Design Techniques in the New Jersey Stormwater Best Management Practices Manual located at: https://www.nj.gov/dep/stormwater/bmp_manual2.htm

- For activities within 500 feet of swamp pink habitat, take particular care to avoid permanent changes to the hydrology or sedimentation rates of wetlands supporting swamp pink (Service 1991, 2008). For example:
 - Implement all the measures listed above for activities throughout the watershed.
 - Use Appendix A of the New Jersey Stormwater BMP Manual (Low Impact Development Checklist) to complete a thorough alternatives analysis of nonstructural stormwater management measures.
 - Seek to mimic the pre-development 2 and 10-year hydrographs.
 - Seek to recharge 100% of the site's pre-development annual average recharge amount.
 - Grade lawn and landscaped areas with lightweight equipment (maximum equipment load of 8 PSI).
- Avoid temporary changes to the hydrology or sedimentation rates of wetlands supporting swamp pink from ground disturbances within 500 feet of swamp pink habitat, or within 150 feet of streams that flow to swamp pink habitat (Service 1991, 2008). For example:
 - locate temporary work areas and access routes outside of wetlands;
 - construct storm water management infrastructure prior to all other components of a development project to control storm water and sediment during the remaining construction;
 - install two rows of silt fencing around work areas, with daily inspection and maintenance;
 - minimize the duration of exposed soils;

**U.S. FISH AND WILDLIFE SERVICE NEW JERSEY FIELD OFFICE
NARRATIVES AND BEST PRACTICES FOR FEDERALLY LISTED, PROPOSED, AND
CANDIDATE SPECIES IN NEW JERSEY**

- use jute matting or other erosion control blankets on disturbed areas immediately after project completion to minimize sedimentation; and
 - promptly re-vegetating areas of temporary disturbance with native species.
- Avoid introductions of invasive species to wetlands supporting swamp pink (Service 2014). For example:
 - thoroughly wash construction equipment offsite before use within 500 feet of swamp pink habitat; and
 - use only native plant species and weed-free mulches and soils for landscaping within 500 feet of swamp pink habitat.
- Avoid or remediate project features that may increase post-project human intrusion into areas of suitable habitat (e.g., access roads, parking areas, entry points) (Dodds 1996).
- Place wetlands supporting swamp pink and associated upland buffers in permanent conservation ownership or easement (Service 1991).

Procedures for when a swamp pink occurrence has been located:

- Report the observation to the Service's NJFO and the New Jersey Department of Environmental Protection's Natural Heritage Program (https://www.nj.gov/dep/parksandforests/natural/docs/NHRPSR_Form.pdf).

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