

Section 6 Federal Aid to Endangered Species

E-1-41

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Endangered & Threatened Wildlife Conservation

Final Report, Project Year

September 1, 2018 – August 31, 2019

NJ Department of Environmental Protection

**DIVISION OF FISH AND WILDLIFE
ENDANGERED AND NONGAME SPECIES PROGRAM
P.O. BOX 420
TRENTON, NJ 08625**



PERFORMANCE REPORT

STATE: New Jersey PROJECT NO.: E-1-41

PROJECT TITLE: Endangered & Threatened Wildlife Conservation

STUDY TITLE: IV. Vertebrate Wildlife Conservation

JOB NUMBER AND TITLE: 2-B Piping Plover Threat Assessment and Management

PERIOD COVERED: September 1, 2018 to August 31, 2019

PREPARED BY: Christina Davis and Emily Heiser

JOB OBJECTIVE: To determine statewide and site-specific piping plover populations, nesting success, and productivity.

SUMMARY: The New Jersey Division of Fish and Wildlife (NJDFW)-Endangered and Nongame Species Program monitored 48% (13) of the state's 27 active nesting sites. NJDFW-monitored sites accounted for nearly a third (29%) of the state's overall nesting pairs (33 of 114 pairs). NJDFW also regularly monitored 10 additional sites and several others less regularly, although no nests were found at those sites. Other sites in the state were monitored by cooperators including the National Park Service (Gateway National Recreation Area-Sandy Hook Unit); the Conserve Wildlife Foundation of New Jersey (Holgate and Little Beach Units of the Edwin B. Forsythe National Wildlife Refuge, National Guard Training Center, as well as various sites throughout the state in conjunction with NJDFW); New Jersey Audubon Society (Stone Harbor Point); Cape May National Wildlife Refuge (Two-Mile Beach and Coast Guard Loran Support Unit); the U.S. Coast Guard (Loran Support Unit and Cape May Training Center); and The Nature Conservancy (Cape May Migratory Bird Refuge). NJDFW worked closely with those cooperators to implement standardized monitoring and data collection methods. The cooperators provided data on population and reproductive success from their sites to NJDFW so that it could be compiled and analyzed for the entire state. A statewide cooperators meeting was held before the breeding season to review recent statewide trends, ongoing research, predator management initiatives, and other relevant management needs to better coordinate recovery efforts.

A total of 114 pairs of piping plovers nested in New Jersey in 2019, a 19% increase compared to 2018 (96 pairs). The 2019 population is slightly below the long-term average (117 pairs) and well below the peak of 144 pairs in 2003. Regionally, the northern Monmouth County region remained the stronghold of the state's population with the largest percentage of pairs (56 pairs or 49% of the statewide total). Sandy Hook maintained the highest number of pairs per site (41) in the state and showed a small increase in pair number for the first time in three years. Sea Bright maintained the highest number of pairs per municipal beach in the state (10) for the fourth year in a row. The region consisting of southern Monmouth County and central Ocean County accounted for 10% of the statewide total (11 pairs) and saw the revival of three historic nesting

sites. The Holgate and Little Beach units of E.B. Forsythe National Wildlife Refuge, combined with the state's North Brigantine Natural Area, maintained a significant portion of the statewide total (42 pairs or 37%). Cape May County, the regions consisting of Ocean City to Cape May, saw a small increase this season (five pairs in 2019, three pairs in 2018) but is still well below its peak of 43 pairs in 2002. Pair numbers increased in nearly every region in the state in 2019.

The number of active nesting sites statewide increased significantly compared to recent years (27 sites in 2019 versus 18 in 2018 and 20 in 2017). It was just below the peak number of sites recorded in the state (30 sites in 2004 and 2005). Much of this increase can be explained by the revival of historic nesting sites in Monmouth, Ocean, and Cape May counties.

Statewide pair nest success (pairs that hatch at least one chick) was high this season at (83%) and is above the long-term average (69%) but did drop considerably from 2018 (91%).

Statewide productivity (1.24 fledges/pair) was high for the sixth consecutive year but fell below last year's historic record of 1.51 fledges/pair. However, productivity was above the statewide average since federal listing (1.03 fledges/pair) and on par with the range-wide level (1.245 fledges/pair) believed necessary to maintain a stationary population (USFWS, 1996).

SIGNIFICANT DEVIATIONS: None.

RECOMMENDATIONS: Continue intensive monitoring of populations and reproductive success.

BACKGROUND

The piping plover (*Charadrius melodus*) was listed as endangered by the New Jersey Department of Environmental Protection in 1984. In January 1986, the U.S. Fish and Wildlife Service (USFWS) included the piping plover on the Federal Endangered Species list and classified the Atlantic coast population as "Threatened." NJDFW has directed local and statewide assessment of population trends since 1976. Statewide surveys were conducted in 1980 and 1984-2019, with limited surveys in 1976 and 1983.

PROCEDURES

Starting in March, NJDFW began visiting coastal beaches to assess the suitability of nesting habitat. Nesting activity was then monitored at all identified nesting sites (with emphasis on areas where nesting had occurred in recent years) following nesting survey guidelines published in the Atlantic Coast Piping Plover Recovery Plan (USFWS, 1996). Starting in mid-April, NJDFW visited nesting areas at least 4-5 times a week, and typically more frequently, to search for active nests and pairs on territories. Once located, nests, and then broods, were checked 5 to 7 times/week to monitor breeding progress and outcome. Some sites, such as the Monmouth County sites (outside Sandy Hook), Holgate, Little Beach and Stone Harbor Point were monitored daily or near daily. In addition to regular monitoring, a statewide, date-restricted count was conducted between June 1 and 9. All sites where piping plovers had nested the past 10 years (if suitable habitat still existed), as well as any newly created habitat that could potentially

support nesting plovers were checked using methodology established by the USFWS (1996) for the Atlantic coast breeding population. NJDFW adjusted the date-restricted count to include pairs discovered after the survey window that, based on nesting phenology, were present during the survey period. Additionally, because NJDFW surveyed individual sites more than once during the census period, identification of pairs at NJDFW surveyed sites was based on breeding and territorial behavior noted during the entire survey period (rather than from one specific visit).

FINDINGS

One hundred fourteen pairs of piping plovers nested in New Jersey in 2019, a 19% increase compared to 2018 (96 pairs, the third lowest since federal listing in 1986). The 2019 population is slightly below the long-term average (117 pairs) and well below the peak of 144 pairs in 2003. State-wide productivity (1.24 fledglings/pair) remained above the long-term average (1.03 fledglings/pair) for the sixth consecutive season but falls short of the federal recovery goal (1.50 fledglings/pair) and below last season's record high productivity (1.51 fledglings/pair). The total number of adults recorded for the entire nesting season (239) was moderately higher than the number of adults recorded during the date-restricted Atlantic Coast census survey conducted June 1-9 (231). The final number of pairs for the season (114) was only a slight increase to the pair number tallied during the date-restricted census (110). Additionally, an unusually high number of unpaired adults were recorded this season (10) compared to 2018 (three).

The northern Monmouth County region remained the stronghold of the state's population with the largest percentage of pairs (56 pairs or 49% of the statewide total). Sandy Hook maintained the highest number of pairs per site (41) in the state and showed a small increase in pair number for the first time in three years. Sea Bright maintained the highest number of pairs per municipal beach in the state (10) for the fourth year in a row. The region consisting of southern Monmouth County and central Ocean County accounted for 10% of the statewide total (11 pairs) and saw the revival of three historic nesting sites. The Holgate and Little Beach units of E.B. Forsythe National Wildlife Refuge, combined with the state's North Brigantine Natural Area, maintained a significant portion of the statewide total (42 pairs or 37%). Cape May County, the regions consisting of Ocean City to Cape May, saw a small increase this season (five pairs in 2019 versus three pairs in 2018) but is still well below its peak of 43 pairs in 2002. Pair numbers increased in nearly every region in the state in 2019.

Looking at individual sites, the most significant shift in 2019 occurred at the Holgate Unit of E.B. Forsythe NWR. Pair number increased 61% compared to 2018 (29 in 2019, 18 in 2018) and was the highest recorded pair number at Holgate since federal listing in 1986. Slight gains and losses were made elsewhere in the state and several historic nesting sites were revived. Notable nesting sites include Seven President's Park (last active in 2017), Sea Girt – Wreck Pond (last active in 2012), Sea Girt – National Guard Training Center (last active in 2007), Loveladies (last active in 1996), and Corson's Inlet State Park (last active in 2009).

Pairs nested at 27 sites statewide in 2019 with nine sites gained and one site lost. Up significantly from just 19 sites in 2018, it also reverses a decade-long trend of hovering in the mid-to-low 20's. NJDFW monitored 13 of the active nesting sites (48% of the sites statewide).

NJDFW-monitored sites accounted for 33 nesting pairs (29% of the nesting pairs statewide). This is up slightly from 27 pairs in 2018 but is well-below the peak of 70 pairs monitored by NJDFW in 2003. Although pair numbers at state and municipal beaches appear to be back on the rise, the majority (71%) of the state's population remains on federal property.

Pair-nest success (the percentage of pairs that successfully hatch at least one nest) across the state was high this year (83%) but did drop considerably from 2018 (91%) which was the highest recorded since federal listing. Statewide pair-nest success also remained above the long-term average (69%). At NJDFW-monitored sites, pair-nest success (73%) was also down from 2018 (96%) but remained above the long-term average (66%).

The cause of nest failure was determined in 53 of the 65 failed nest attempts statewide (82%). Depredation remains the leading cause of nest failure (29 or 45%) in the state for the seventh consecutive year. Of the depredated nests, more than half (17 or 58%) were lost to mammals and the majority of those (13 or 76%) were lost to red fox. The remainder of mammalian depredated nests were lost to American mink (two or 12%), opossum (one or 6%), and raccoon (one or 6%). Avian depredation by crow and gull was found to be the cause of four nest losses (14%). The remaining depredated nests were lost to ghost crab (two or 7%) or unknown predator species (six or 21%). Flooding (11 or 17%) and nest abandonment (10 or 15%) contributed to about equal nest loss statewide. Nest abandonment was markedly higher this season than in previous years and is typically attributed to an adult mortality at a nest enclosure. Nest loss due to eggs being sand-covered by wind contributed to three failures (5%). The cause of nest failure could not be determined in 12 (18%) nest losses. Identifying factors contributing to chick mortality remains difficult as chicks are precocial and typically scant evidence is left behind.

The statewide fledgling rate, which includes data collected and provided by all state cooperators, was 1.24 fledglings/pair. Compared to 2018 (1.51 fledglings/pair), productivity dropped significantly and was below the productivity recovery goal (1.50 fledglings/pair) established by the USFWS Recovery Plan for Atlantic Coast Piping Plovers. Additionally, 2019 productivity was the lowest recorded in the last six years. Looking at long-term trends, statewide productivity was much higher in 2019 than in previous seasons and remains well above the long-term average since listing (1.03 fledglings/pair). Statewide productivity fell in line with the 1.245 fledglings/pair range-wide threshold for population maintenance also established in the Recovery Plan. NJDFW-monitored sites fell well below 2018 (1.59 fledglings/pair) with a productivity of 1.09 fledglings/pair but remains above the long-term average (0.94 fledglings/pair).

Productivity varied considerably by individual site and region. Monmouth County produced 1.23 fledglings/pair and contributed to 49% of the total chicks fledged this season. Sandy Hook's productivity decreased this season (1.29 fledglings/pair in 2019 versus 1.55 fledglings/pair in 2018) as was similar in almost all the Monmouth County sites this season. Sea Bright continues to maintain the highest number of pairs per municipal beach (10 pairs) but struggled to meet the site's prior high productivity levels (1.30 fledglings/pair in 2019 versus 1.86 fledglings/pair in 2018 and 2.60 fledglings/pair in 2017). Ocean County municipal and state properties (Island Beach State Park, Barnegat Light, and Loveladies) had the highest productivity statewide this season with 1.63 fledglings/pair. The Holgate, Little Beach, and

North Brigantine Natural Area region fell slightly in productivity this season (1.29 fledglings/pair versus 1.42 fledglings/pair in 2018) but had a significant 27% increase in pair numbers (42 pairs in 2019 versus 33 pairs in 2018) attributed almost exclusively to increases at Holgate. Cape May County observed a small decrease in productivity (0.60 in 2019 versus 0.67 in 2018) but did revive a historic nesting site that had not been active since 2009. Pair numbers continue to be depressed in the southern portion of the state and productivity was again well below the long-term statewide average of 1.03 fledglings/pair.

DISCUSSION and CONCLUSION:

New Jersey's statewide piping plover breeding population saw a dramatic 19% increase in pair number in 2019 (114 pairs) compared to 2018 (92 pairs). Historic norms have attributed population increases to high productivity and this is likely no exception as 2018 was a record year for productivity. However, statewide productivity was also relatively high for five years prior to that but pair numbers continued to plateau or decrease. While it is encouraging that pair numbers increased in 2019, the unexplained declines are still cause for concern. Additionally, even with relatively high productivity, the statewide pair number has remained well below the peak of 144 pairs in 2003. Identifying and addressing factors contributing to habitat suitability and pair recruitment must be forefront for New Jersey to move towards recovery.

The state recorded its sixth consecutive year of moderate to high productivity at 1.24 fledglings/pair. This is a 21% decrease from 2018's productivity but remains well-above the statewide average of 1.03 fledglings/ pair. When compared to historic productivity numbers (0.64 in 2008, 0.67 in 2007, 0.84 in 2006, 0.77 in 2005, 0.61 in 2004), productivity has remained high over the last several years. This, however, is likely the byproduct of lower recruitment to the area and the concentration of pairs to federally protected lands.

Gateway National Recreation Area's Sandy Hook Unit and E.B. Forsythe National Wildlife Refuge's Holgate and Little Beach Units maintain 71% of the statewide population. The importance of these federal lands in New Jersey is paramount. They provide the state's premiere nesting and foraging habitats and recreational use can be better managed than elsewhere in New Jersey. However, recovery can only be achieved when pairs are equally distributed throughout the state because federal sites at full capacity are still not enough to create a stable population. Suitable habitat *does* exist outside of federal lands throughout the state. These sites are much more susceptible to human disturbance, stabilization efforts, and beach grooming. Through beach management plans, portions of municipal and state beaches are being managed to mimic natural conditions as much as possible, encouraging current pairs to remain fidelic to them and laying the groundwork for future colonization.

A mark-recapture study of banded plovers in New Jersey has allowed researchers to track individuals that are recolonizing historic breeding sites in the state and have highlighted the importance of federal lands as a springboard for dispersal from natal sites. Sites such as Sea Bright, National Guard Training Center, Wreck Pond, Island Beach State Park, and Corson's Inlet State Park have benefited from successes on federal lands tracked through marked individuals. The federal sites are not only carrying the majority of the state's pairs, they are also playing a critical role in pair increases observed elsewhere in the state. It is through this

dispersal that a more even distribution of the state's population, and thus increases to pair numbers, will be achieved. In addition to mark-recapture, a chick mortality research study deployed transmitters/loggers on plover adults and juveniles. The project is ongoing and final results are not yet available. The leg harness GPS logger deployment appeared to be a success in terms of safety, but the overall results mixed with such a high degree of transmitter failure.

The 2019 breeding season showed an alarming 67% increase in abandonments and many of those were attributed to an adult mortality at a nest enclosure. Predator enclosures have been an important and effective tool in the recovery of piping plovers across all populations in the United States and Canada, providing a refuge for a nest from ground and avian predators. From 2008-2012, New Jersey enclosed approximately 70% of all nest attempts. In 2013, the depredated remains of at least one marked adult were found on a nest enclosure. Falcons and other avian predators (such as owls and crows) and even keen mammals (such as red fox) are quick to key into enclosures as an easy and reliable food source. NJDFW-monitored sites, along with E.B. Forsythe NWR, have been reducing enclosure use over the last several years while increasing focused predation management. However, enclosure use continued at sites that had not experienced issues with adult mortalities. Unfortunately, it is impossible to predict when an issue may arise, and such was the case in 2019 with several Monmouth County sites plagued by persistent red fox. At least one adult was confirmed killed at an enclosure this year and it is suspected that an additional three adults were killed or left the breeding site. The decision to use enclosures to increase hatch success versus the potential loss of a breeding adult continues to plague species managers throughout the state and is perhaps, the most difficult decision that is made on a regular basis.

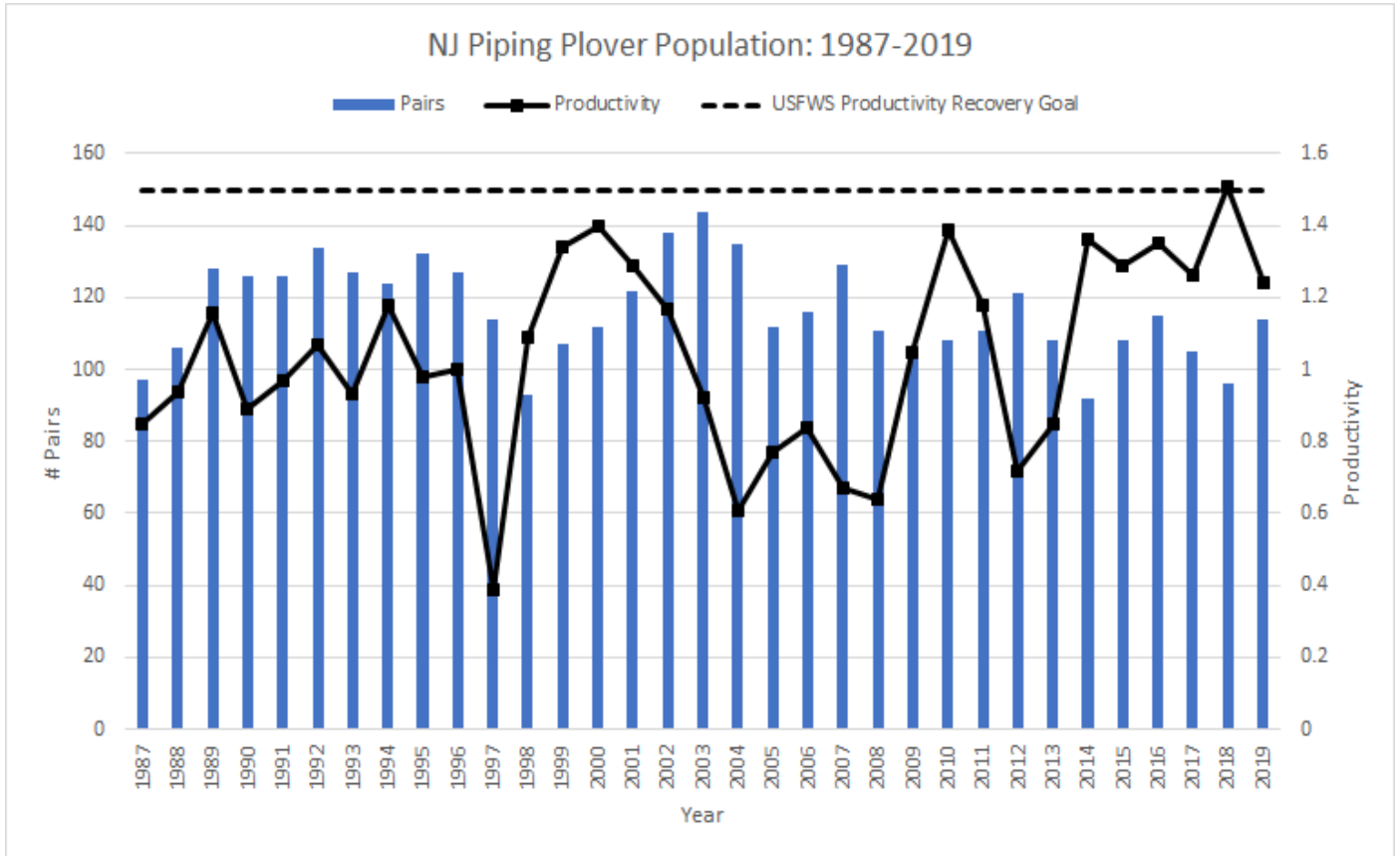
Strong partnerships on the state, federal, non-profit and university levels continue to lead to effective and efficient species management throughout the state. Sustained productivity over the last six years is partly attributed to species managers working together and thinking outside the box in the protection of this species. Many uncertainties remain in the recovery of piping plovers in New Jersey including whether the increase in pair number will be sustainable over time. While it is encouraging to see a small distribution shift to a few sites, species managers remain cautious as the impact of many other factors such as sea-level rise, habitat loss, human alteration of the coastline, and human subsidized predators continue to accelerate. Addressing these issues in a dynamic coastal system while managing habitat suitability and increasing pair recruitment will continue to challenge species managers. Despite these challenges, NJDFW is confident that a sustainable population may be achieved through a strong foundation of partnerships on which research, management, and monitoring needs are met.

FAIRS ACTIVITY CODES: 1450, 1460.

LITERATURE CITED

U.S. Fish & Wildlife Service. 1996. Piping Plover (*Charadrius melodus*), Atlantic Coast Population, Revised Recovery Plan. Hadley, MA. 258 pp.

Figure 1. New Jersey piping plover population: 1987-2019.



PERFORMANCE REPORT

STATE: New Jersey PROJECT NO.: E-1-41

PROJECT TITLE: Endangered & Threatened Wildlife Conservation

STUDY TITLE: IV. Vertebrate Wildlife Conservation

JOB NUMBER AND TITLE: 2-C Piping Plover Threat Assessment and Management

PERIOD COVERED: September 1, 2018 to August 31, 2019

PREPARED BY: Christina Davis and Emily Heiser

JOB OBJECTIVES: To determine the nature and level of threats to piping plover populations and reproductive success and to reduce threats through management.

SUMMARY: The New Jersey Division of Fish and Wildlife (NJDFW) - Endangered and Nongame Species Program tracked the nest outcome and causes of nest failure, as well as brood loss (where possible), for 33 pairs of piping plovers nesting at 13 active breeding sites. This accounted for nearly a third (29%) of the state's nesting population at 48% of the active nesting sites.

NJDFW staff was able to determine nest outcome for nearly all (98%) of the known nests (55) at the sites it monitored. Less than half (45%) of the nests hatched and more than half (53%) failed. NJDFW was able to determine the cause of failure for nearly all (93%) of the failed nests it monitored. Nest failure was high in 2019 and depredation remained the leading cause among nests that did fail at NJDFW-monitored sites, accounting for 62% of the failed nests. Flooding accounted three (10%) nest failures, two nests were blown over (7%), and four (14%) nests were abandoned. Two nest attempts (7%) were known failures, but the cause was undetermined.

Fencing and signage were erected at all NJDFW-monitored nesting sites to minimize human disturbance. As chicks hatched, foraging areas were posted with signage alerting beachgoers that chicks were present, in order to limit disturbance, and, where possible, restrict human access into preferred foraging areas (i.e., Barnegat Light, North Brigantine Natural Area, Corson's Inlet State Park, and Stone Harbor Point). Limitations on municipal/landowner vehicle use were in place at all active sites (although there is still room for improvement) and recreational vehicle closures were implemented prior to or during the chick rearing stage at active state-owned sites (Island Beach State Park, North Brigantine Natural Area, and Corson's Inlet State Park). Nesting areas were patrolled on a regular basis, most intensively on weekends and holidays. Additional signage and barriers related to dog walking restrictions and ethical wildlife observing and drone photography were also posted. Pre-season vegetation removal was implemented at various sites to keep existing nesting habitat viable.

All NJDFW-monitored sites where active breeding occurred were managed to some degree to reduce depredation of nests, including through focused predator removal, where necessary. Predator exclosures were used on 49% of the nests that NJDFW monitored/managed. Hatching success was moderately high for exclosed nests, as 74% hatched. Less than a quarter (18%) of the unexclosed nests hatched. Nest abandonment, which has been closely scrutinized by NJDFW in recent years in relation to predator exclosure use, was cause for alarm in 2019 with four abandonments. The exact cause of abandonment was determined in three cases; two exclosures were repeatedly harassed by fox and one exclosure experienced loss of an adult at the exclosure by an avian predator. The fourth abandonment was caused by a suspected mortality of an adult but the remains were never found.

NJDFW continued to work with the U.S. Fish and Wildlife Service (USFWS)-New Jersey Field Office (NJFO) to assist municipalities and other landowners in developing comprehensive management plans for the protection of federally and state-listed beach dependent species, in particular piping plovers. NJDFW continues to take the lead role in implementation of those plans as part of its routine management activities on municipal, county, and state lands.

SIGNIFICANT DEVIATIONS: None.

RECOMMENDATIONS: Maintain current monitoring frequency to ascertain causes of nest failure and brood loss. Continue use of predator exclosures (and electric fence) where they are likely to reduce depredation without leading to adult mortality. Continue to closely monitor the effectiveness of predator exclosures, especially as it relates to the rate of nest abandonment and possible adult mortality. Continue increased levels of targeted predator removal measures where needed. Continue to closely coordinate management efforts with municipalities, as well as county, state, and federal landowners. Continue working with the USFWS-NJFO to develop, revise, and implement beach management plans. Continue to support research projects that elucidate factors leading to adult and chick mortality including mark-recapture studies contributing to the creation of a long-term dataset.

BACKGROUND: NJDFW has actively managed nesting piping plovers in the state for 34 years using the basic techniques described in “Procedures” below. Funding provided through the B. T. Nautilus oil spill natural resource damage settlement from 1995-2000 and the M.T. Anitra oil spill settlement from 2006-2011, as well as ongoing funding provided by the U.S. Army Corps of Engineers and/or the NJDEP Division of Engineering and Construction has resulted in increased monitoring and management intensity throughout the state since 1995. An intern project initiated with Monmouth University in 2001 has provided students to assist NJDFW with stewardship and management programs in the Monmouth County region. Expanding that intern program in 2019 with Stockton University was highly successful. Overall project logistics including daily scheduling, monitoring, stewardship, and education & outreach were shared through a long-term partnership with the Conserve Wildlife Foundation of New Jersey.

PROCEDURES:

Nest/brood checks: Through regular (5-7 times/week) monitoring, NJDFW attempted to examine the relationship between adverse factors and nest outcome (i.e. nest success and fledging rates). Observers attempted to determine the cause of all nest failures (destruction and

abandonment), including evidence of predator activity, weather factors, and human disturbance. Brood monitoring, included assessing factors that might be involved in chick loss, was also undertaken, but rarely resulted in direct observations of chick mortality. Increased monitoring at the time of hatching did appear to have a positive result on initial chick survival when regular harassment of crows is observed leading up to the hatch date.

Field management techniques: Specific methods NJDFW applied to protect nesting piping plovers and increase breeding success vary from site to site, although certain basic measures are used at most locations. Signs and fencing, most commonly string-and-post “symbolic” fencing, restrict public access to nesting areas. Site managers erect fencing either prior to the nesting season in areas with a well-established nesting history (“pre-fencing”) or as nesting activity is discovered. NJDFW staff regularly patrols all major sites on weekends and holidays to monitor human and predator activities, to help reduce human disturbance and to perform on-site education and outreach. Predator exclosures are the primary field technique used to reduce nest depredation by large avian and mammalian predators. Exclosures are constructed and erected as outlined in the USFWS recovery plan (USFWS, 1996). Due to the higher rate of nest abandonment associated with predator exclosures and the elevated risk of human vandalism and predator harassment at “identified” nests, as a general practice NJDFW historically used exclosures on a selective basis, only at sites with a recent history of nest losses due to depredation or where managers have observed ongoing predator activity. By 2004 or so, predator activity has been identified at nearly all active nesting sites, and as a result NJDFW started using predator exclosures more routinely at most sites (vs. a more selective approach). However, because of persistently higher rates of nest abandonment with exclosed nests and more recent concerns over the potential of adult mortality in association with exclosure use, NJDFW scaled back exclosure beginning in 2014. NJDFW increased their use again in 2016 and continued this in 2019. Attempts were made to employ them judiciously but unfortunately problems with fox and avian predators arose at sites with no prior history of exclosure issues. An exclosure decision support tool (PiperEx) was used to help managers weigh the decision and rates of loss of adults versus loss of nests, but enough data to feed the model was only available for one site. Managers weighed exclosure use heavily on a case by case basis for the remainder of the nesting season. Other management techniques used include: the use of electric fence where exclosures alone are not an effective means of deterring mammalian (bottom line of electric) or avian depredation (top line of electric); erection of fenced and/or posted “feeding corridors” to protect foraging areas at beaches with high levels of human activity and/or where human activity is not already seasonally restricted; and implementation of seasonal public ORV closures. In addition, although not funded through this or any other federal grant, NJDFW conducted targeted predator removal at sites with acute predator problems. Intensity of predator removal has been elevated since 2015, especially in southern New Jersey through a cooperative effort with the USFWS-NJFO.

Long-term and field-support management: NJDFW, in conjunction with USFWS-NJFO, has developed, updated/revised or is developing comprehensive management agreements with municipalities and other landowners to minimize the detrimental effects of their activities (e.g., beach maintenance, vehicle use, etc.) on nesting success. During the nesting season, NJDFW issued weekly (and in some cases daily) updates via emails to municipalities and county landowners and interested state and federal agencies outlining current nesting activity and applicable management restrictions. NJDFW also met directly with individuals or departments

(including public works, beach patrol, administrative staff, law enforcement, etc.) within municipalities or other agencies to review management issues, as needed. More generalized public outreach has included the distribution of informational brochures and stickers, placement of interpretive signs at nesting sites, informal on-site contact with the public, formal group presentations, social media, and informational booths at festivals and local events. Organized volunteer programs continued in 2019 at Seven President's Oceanfront Park, Belmar, and Island Beach State Park. Volunteers were regularly on site during peak weekend hours which helped keep recreational disturbances to a minimum and allowed monitors to visit more sites during regular working hours.

FINDINGS

NJDFW monitored nest outcomes and cause of nest failure and brood loss, where possible, at 13 active sites (48% of the active piping plover nesting sites in the state). Data was collected for 33 nesting pairs, representing 29% of the state's pairs.

NJDFW was able to determine nest outcome for nearly all (98%) of the known nesting attempts at the sites it monitored. Of the 55 known nesting attempts, 25 (45%) hatched, 29 (53%) failed, and one (2%) was unknown to have hatched or failed. NJDFW determined the likely cause of nearly all (93%) of the failed nests. Depredation was the leading cause of nest failures (18) at NJDFW-monitored sites (62% of failures, 33% of nesting attempts). Depredation related to mammals accounted for 61% of depredated nests while avian depredation accounted for 17%, ghost crabs accounted for 5%, and the remaining 17% of depredation events could not be attributed to a specific predator. Flooding accounted for three nest losses (10% of failures, 5% of attempts). Two nests were blown over/buried (7% of failures, 4% of attempts). The cause of nest failure could not be determined in two nest losses (7% of failures, 4% of attempts). Abandonment was the cause of four nest losses (14% of failures, 7% of attempts).

Identifying factors contributing to chick mortality remains difficult as chicks are precocial and scant evidence is typically left behind.

NJDFW employed predator exclosures on 49% of the 55 nests it managed in 2019. Nearly three quarters of the exclosed nests successfully hatched (74%) compared to 18% of the unexclosed nests (5 of 28). The fledge rate from successfully hatched exclosed nests was much higher than that of successfully hatched unexclosed nests (1.30 fledges/pair vs. 0.60 fledges/pair, respectively).

DISCUSSION AND CONCLUSIONS:

In 2019, the statewide breeding population of piping plovers increased 19% compared to 2018 (114 pairs in 2019, 96 pairs in 2018). This is likely attributed to the record high productivity of 2018; however, statewide productivity was high for five years prior to that and pair numbers plateaued or decreased. While the increase in pair numbers in 2019 is a welcome shift, identifying and addressing the causes of these unexplained declines should be forefront for New Jersey to move towards recovery.

Considering 45% of all known failures are attributed to depredation (and likely the cause of some of the undetermined failures) and that depredation was the leading cause of nest failure for the seventh consecutive year, targeted predation management remains paramount in New Jersey's efforts to recover piping plovers. NJDFW, with additional support from USFWS-NJFO, continues to implement intensive, targeted predation management efforts at many of the state's breeding sites. Managers continue to be transparent about the necessity and methods of targeted predation management as public outcry mounts. It remains difficult to absolutely correlate this work to breeding success and given the extent of other limiting factors, but data suggests that this increased effort is an important factor in reducing nest loss and increasing fledge rates at some sites. Securing funding and resources for continued targeted predation management, as well as exploring alternative methods such as aversive conditioning, is central to recovery for the foreseeable future.

The 2019 breeding season showed an alarming 67% increase in abandonments and many of those were attributed to an adult mortality at a nest enclosure. Predator enclosures have been an important and effective tool in the recovery of piping plovers across all populations in the United States and Canada, providing a refuge for a nest from ground and avian predators. From 2008-2012, New Jersey enclosed approximately 70% of all nest attempts. In 2013, the depredated remains of at least one marked adult were found on a nest enclosure. Falcons and other avian predators (such as owls and crows) and even keen mammals (such as red fox) are quick to key into enclosures as an easy and reliable food source. NJDFW has been reducing enclosure use over the last several years while increasing focused predation management. However, enclosure use continued at sites that had not experienced issues with adult mortalities. Unfortunately, it is impossible to predict when an issue may arise, and such was the case in 2019 with several Monmouth County sites plagued by persistent red fox. At least one adult was confirmed killed at an enclosure this year and it is suspected that an additional three adults were killed or left the breeding site. The decision to use enclosures to increase a nest hatch success versus the potential loss of a breeding adult continues to plague managers throughout the state and is perhaps, the most difficult decision that is made on a regular basis.

New Jersey must remain adaptable in its approach to recover piping plovers. Each year, new challenges are met on the monitoring and management level. Strong partnerships on the state, federal, non-profit and university levels continue to lead to effective and efficient species management throughout the state. Sustained productivity over the last six years is partly attributed to species managers working together and thinking outside the box in the protection of this species. Continued implementation of an adaptive comprehensive management strategies by all partners is the best hope for New Jersey to move towards the recovery of piping plovers.

FAIRS ACTIVITY CODES: 1450, 1460.

LITERATURE CITED

U.S. Fish & Wildlife Service, 1996. Piping Plover (*Charadrius melodus*), Atlantic Coast Population, Revised Recovery Plan. Hadley, MA. 258 pp

PERFORMANCE REPORT

STATE: New Jersey

PROJECT NO: E-1-41

PROJECT TITLE: Endangered and Threatened Wildlife Conservation

STUDY TITLE: Vertebrate Wildlife Conservation

STUDY NUMBER: V

JOB TITLE: Bog Turtle Habitat Assessment & Survey and Habitat Restoration

PERIOD COVERED: September 1, 2018 - August 31, 2019

JOB NUMBER: 14A

PREPARED BY: Brian Zarate, Senior Zoologist

OBJECTIVE: To monitor and conserve populations of the federally threatened and state endangered bog turtle (*Glyptemys muhlenbergii*) on public and private lands.

SUMMARY: The Division has been using these funds, in combination with State Wildlife Grant funds, to contract post-construction turtle monitoring during the spring-summer of 2019 of a bog turtle road crossing project that was fully constructed by March 2019. Section 6 funds were used to support monitoring of turtles using radio-telemetry in 2019.

SIGNIFICANT DEVIATIONS: None

COST: \$10,950 (\$9,850 federal and \$1,095 state)

BACKGROUND: Encompassed entirely on NJ wildlife management area (WMA) property, a priority bog turtle colony located in Upper Freehold Twp., Monmouth County, is bisected by a two-lane WMA road. The Division of Fish and Wildlife are the owners of both the bog turtle wetlands and the roadway itself. Working with the Division's Bureau of Land Management, we constructed an under-road passage system to allow bog turtles to safely move between the wetland areas that the road has split. Division staff, volunteers, and members of the public have reported bog turtles, spotted turtles (state special concern), and woodland box turtles (state special concern) on the road in the wetland area, among other amphibians and mammals. In the last six years alone, four bog turtles have been found on the roadway. The construction of a turtle passage system, including tunnels and "funnel" fencing, is anticipated to minimize or prevent target species from entering the roadway, and allow for species movement under the roadway to access different parts of the larger wetland complex. Both pre- and post-construction monitoring will be employed to establish habitat usage by the turtles before and after the tunnels and fencing are in place.

PROCEDURES: Funding under E-1-41 supported a portion of the pre-construction monitoring at the WMA. Post-construction monitoring included radio telemetry. Techniques followed recommendations consistent with FWS-Region 5 and FWS-NJFO guidance and with procedures being implemented in the recently finalized grant, "Competitive SWG Multistate Recovery

Actions for the Bog Turtle and Associated Headwater Wetland Species of Greatest Conservation Need.”

An existing WMA road bisects wetland habitat occupied by bog turtles into two core activity areas. Field procedures and findings were designated by which side of the road they occurred, in this case WMA North or WMA South. Baseline information on bog turtle and other turtle species presence and habitat use was collected both for WMA North and WMA South.

Each detected bog turtle, spotted turtle (state special concern), or eastern box turtle (state special concern) was measured, weighed, and given a unique marginal scute notch code, unless already marked in which case the existing code was recorded. Turtles weighing approximately 100g or greater were affixed with a Wildlife Materials SOPR radio-transmitter on site using a two-part quick-set epoxy and released at the point of capture. Relocations using radio-telemetry occurred twice per week, with each relocation event separated by at least two days.

FINDINGS: Funding under E-1-41 supported a portion of the post-construction monitoring at the WMA. Post-construction radio-telemetry 2019:

Bog Turtles: Eight tracked

- Five 2019 turtles missing or failed transmitters. We plan to attempt recapture of these and other individuals for 2020 monitoring.

Spotted Turtles: Five tracked

- One died during study, likely from road mortality outside of the crossing area.
- One died during study from unknown causes.
- Several found using habitat on both sides of the road.

Eastern Box Turtles: None tracked in 2019.

DISCUSSION AND CONCLUSIONS: Procedures reported here, partially funded by E-1-41, are part of the baseline data collection and post-construction monitoring on bog turtle and SGCN turtle habitat use and occupancy after the construction of a turtle passage system was finalized in March 2019. In April 2020, visual surveys and radio-telemetry efforts will be replicated to provide a comparison of habitat use in a second year of post-construction with 2019 post-construction data and earlier pre-construction data.

Our collective data of telemetered turtles has shown many movements of bog turtles and other SGCN turtle species between WMA North and WMA South. Following the 2020 monitoring season, we will compile all years of telemetry data to create habitat use and home range maps and analyze for year, gender, and species. The goal of introducing the turtle tunnels to the area is to encourage safe passage of bog turtles and other wildlife from one wetland area to the other, to promote increased breeding, foraging, and nesting opportunities, along with offering a habitat option in the event one side of the road becomes less suitable for the species over time. Over the years, the public and Division staff have documented several bog, spotted, and box turtles on the road, both alive and dead. Since 2013 alone, four bog turtles have been opportunistically found alive on the road by Division staff.

In addition to this segment's work, monitoring of the road transect for alive and dead animals has been ongoing during the turtle tracking seasons in 2017, 2018, 2019, and will continue in 2020, to quantify the levels of vehicle-wildlife collisions at WMA North, WMA South, and a nearby control transect. In replicating pre-construction road transect surveys in 2019 and 2020, after the turtle tunnels and fencing are in place, we hope to see a decrease in the number of roadkill animals between WMA North and WMA South. In 2019, we also installed wildlife cameras in the two tunnels to monitor wildlife movements through the tunnels. This camera monitoring work is not funded by this Section 6 grant, but will help judge the project's effectiveness for bog turtles.

Cumulatively, we believe our pre- and post-construction monitoring efforts (visual surveys, radio-telemetry, road transect surveys, and camera monitoring) will allow us to objectively assess the effectiveness of the installed turtle tunnels and fencing for 1) allowing for under-road movement of bog turtles between WMA North and WMA South, and 2) reducing the number of vehicle-wildlife collisions along the road transect between WMA North and WMA South.

FAIRS ACTIVITY CODES:

LITERATURE CITED

Competitive State Wildlife Grant: Multistate Recovery Actions for the Bog Turtle and Associated Headwater Wetland Species of Greatest Conservation Need, Regional Population Monitoring Protocol for the Bog Turtle. 2015. Administered by Pennsylvania Fish & Boat Commission, Harrisburg.