

**Interim Report
Federal Aid in Wildlife Restoration
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**“Species of Greatest Conservation Need (SGCN)
Research and Management”**

**Interim Report for
September 1, 2016 – September 30, 2017**

NJ Department of Environmental Protection

**DIVISION OF FISH AND WILDLIFE
ENDANGERED AND NONGAME SPECIES PROGRAM
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Project 1. SGCN Birds Conservation and Management, grant organization:

Job A. Birds

Subjob A.1. Shore & Marsh Birds (was 1. Colonial Waterbirds, 2. Migratory Shorebirds, 4. Secretive/Coastal Marsh Birds)

Subjob A.2. Raptors (was Woodland Raptors)

PROJECT 1: SGCN BIRDS

Job Number and Title: A.1. SHORE AND MARSH BIRDS

Beach nesting Birds (Piping Plover, Black Skimmer and Least Tern)

Prepared by: Christina Davis, Environmental Specialist II

Beach nesting Birds (Piping Plover, Black Skimmer and Least Tern)

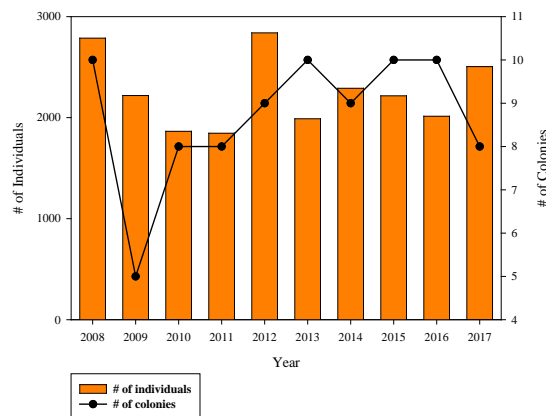
Project Leaders: Christina Davis

The portions of this job applying to Piping Plover are jointly supported by ESA Section Six funding.

Key Findings:

Black Skimmer

NJ Black Skimmer Population 2008-2017



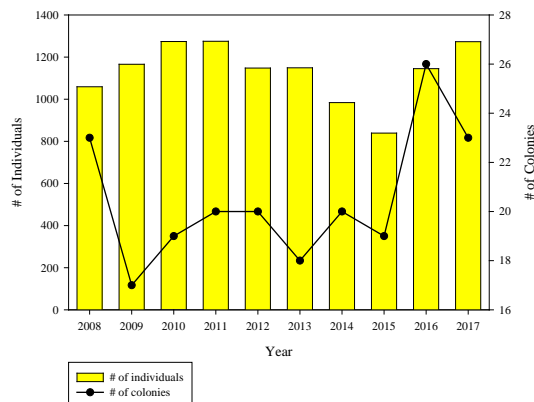
- Black skimmer breeding bird counts were conducted approximately every two weeks at active sites from arrival (generally mid-May) until nesting ceased (mid-October was the latest) on beaches along the entire Atlantic coast and marsh islands from Barnegat Bay south. Surveys took place at 15 sites and active nesting (at least one nest with eggs) was observed at eight sites. These eight sites were also visited 3-5x/week for management and outreach for the duration of the nesting season. A total of 2,505 adults were present at the active sites. This figure is the cumulative total of site counts that occurred in the peak survey period, which took place 16-31 July. The cumulative peak adult number from each site was 2,811. A large the difference between these two numbers can suggest failure at any given colony and then relocation/re nesting to another colony. The difference in these two numbers in 2017 appears to be related to relocation/re nesting occurring at small colonies but not at the state's largest colony, which was relatively stable throughout the season. As has now been the case since 2010, the majority (86%) of the state's known population was present at just one site, which continued to be Seaview Harbor Marina in Longport (2,152 peak adult count). For the first time,

skimmers were documented nesting on the sandy restored areas of marsh islands (Ring Island and Mordecai Island).

- A peak count of 575 incubating adult black skimmers was tallied in the 16-31 July survey period. The incubation number was lower than might be expected given the number of adults present and was likely lower than what actually nested. As is generally the case, the vegetation at the largest colony blocked observers from garnering an accurate count of these ground nesters and walk through colony counts have not shown to be effective in NJ.
- Black skimmer statewide productivity appeared to be moderate, with 457 fledglings produced statewide. This translates to 0.79 chicks per pair, a figure that is likely an overestimate given the issues in the pair count numbered detailed above. If we simply halve the total adult number and use that as pair count, the productivity is 0.37. The true rate is likely somewhere in the middle. Just two sites fledged young and they were almost all were produced at one site, Seaview Harbor Marina (99%). Depredation was the primary factor responsible for nest and chick loss on beach strand sites. For the marsh nesting birds, the lower number of observations at these sites meant it was difficult to ascertain reasons for failures but it was likely a combination of flooding and depredation.
- The Wetlands Institute, in partnership with NJDFW, banded four Black Skimmer chicks at Ring Island in a follow-up to 2016's pilot project, using improved, easier to read bands. Long-term goals of banding include better understanding of site fidelity and inter-state movements (particularly with New York breeding birds). There were plans to band additional chicks, but colony collapse at study sites (Belmar and Ring Island) prevented this on any large scale.
- Over the course of fall 2016-summer 2017, seven of the 35 chicks banded in Belmar in 2016 were observed either on migration or wintering grounds, an excellent resight rate. An eighth individual was observed in summer 2017 at two NJ breeding sites –skimmers do not breed in their first year so it was valuable to capture scouting behavior.

Least Tern

Least Tern Population: 2008-2017

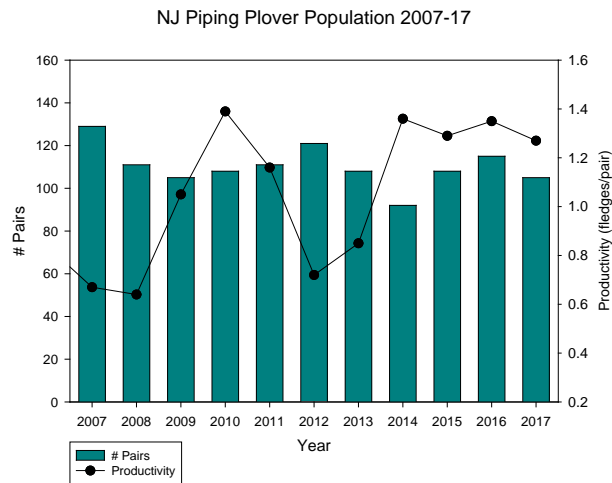


- Least tern breeding bird surveys were conducted approximately every two weeks from mid-May until the end of August at beaches along the entire Atlantic coast. Colonies were located at 22 sites and observations were made at these locations for the duration of the season. These 22 sites were also visited 3-5x/week for management and outreach for the duration of the nesting season. A total of 1,273 adults were present at these sites (based on a cumulative total of peak site counts that occurred in the 16-30 June survey period). The cumulative peak adult number from each site was 1,687. A large difference between these two numbers can suggest failure at a given colony and then relocation/re nesting to another colony, which given the data and on-the-ground observations appears to have happened in 2017.
- The population was distributed fairly evenly throughout the state and six colonies had >100 adults (two others had just below 100) with one colony 300+. The largest colony was in Monmouth Beach - North, with 317 adults on its peak count followed by Strathmere - Natural Area with 272 adults at its peak. A second marsh nesting colony was detected this year (Mordecai Island joined Ring Island), also the result of a restoration

project. The statewide adult number was higher than recent years and more in line with the longer-term trend. As always, there was some difficulty tallying birds in dense vegetation.

- A peak (census period of 1-30 June) of 588 adult least terns were observed incubating. Productivity was moderate for least terns with 221 fledglings produced statewide (0.38 chicks per pair, based on the peak number of incubating adults). The fledge rate represents a dip from last year and illustrates an increase issue with depredation and flooding.

Piping Plover (Full Piping Plover reporting can be found in NJ E-1-39)



- One hundred five (105) pairs of piping plovers nested in New Jersey in 2017, a 9% decrease from 2016 (115). This decrease was not expected given the strong reproductive rate in 2014-16 and is both alarming and without explanation.
- The total number of adults recorded for the entire nesting season (227) was somewhat higher than during the date-restricted survey conducted June 1-9 (222). Likewise, the number of pairs tallied during the entire nesting season (105) was very similar to the pairs recorded during the date-restricted census (104). There were a higher than average number of unpaired adults tallied in 2017 (14 during census, 16 for end of season).
- Pairs nested at 20 sites statewide, same as 2016, but well below the peak count of 30 sites recorded in both 2004 and 2005. Much of this loss has been sustained at Cape May County sites.
- Statewide pair-nest success (the percentage of pairs that successfully hatch at least one nest) decreased in 2017 compared to 2016 (78% vs. 90%, respectively), but still above-average for the period since federal listing (69%). Looking at just NJDFW-monitored sites, 2016 pair-nest success (86%) was higher than the state-wide tally and when compared to the period since federal listing (67%) but lower than 2016 (93%).
- The statewide productivity rate was 1.29 fledges/pair, a slight decrease from 2016 (1.35 fledges/pair). Productivity at NJDFW-monitored sites (1.79 fledges/pair for 29 pairs) was below the 2016 metric (1.89 fledges/pair) but above the 2017 statewide tally, an unusual occurrence.
- NJDFW continued to use predator exclosures judiciously in 2017 with 60% of nesting attempts were exclosed (statewide was 69%). The exclosed hatch rate for NJDFW nests was 88% (statewide was 73%). The NJDFW unexclosed hatch rate was 25% (statewide was 17%) and of the NJDFW nests not exclosed, 19% were lost to depredation (statewide was 33%).
- NJDFW purchased radio transmitters and GPS data loggers in support of the State University of New York (SUNY)–Syracuse’s piping plover chick mortality research project. In 2017, 21 chicks were equipped with traditional VHF tags and 11 adult males were outfitted with GPS data loggers using a novel attachment method for this species (leg harness). No problems were detected with this method.

Conclusions:

- Although NJDFW is less concerned about the small number of nesting colonies than it was in the first decade of the 2000s (down to five colonies in some years), the fact that the majority of black skimmers are at just one

site continues to be a cause for concern, especially since erosion and vegetation encroachment are making the site less suitable. Regional coordination efforts have highlighted the importance of New Jersey's population in the Atlantic coast's breeding population since this state supports a relatively large number of birds when compared to surrounding areas. Therefore, this one site is critical on both the state and regional levels.

- The impact of sea-level rise in the marsh islands may be affecting occupied nesting areas. The largest colonies are located either on the beach strand or on large, relatively stable marsh islands with a sandy substrate. Whether this represents a true move away from wrack nesting marsh colonies or is temporary change is yet to be determined but something NJDFW will be closely tracking in future years. However, the use of sandy restored areas in the marsh (Ring Island and Mordecai Island) by skimmers (and terns) may signal an opportunity to reestablish some nesting in this area. Not enough data currently exists to assess long-term viability of this technique.
- The effort to band black skimmer chicks, though scarce this year, continued to show the viability of a NJ banding program. The resight rate of 2016's fledges was especially notable and provides confidence that this effort will lead to useful data for the recovery and management of this species.
- The statewide **least tern** breeding population was at a seven-year high but reproductive success was not strong. This species tends to exhibit inter-year shifts in distribution and the largest colonies in 2017 were in different areas than 2016, perhaps leading to site specific differences that negatively influenced reproductive success.
- The number of active least tern colonies (22) decreased in 2017 but was still higher than recent years. The species is distributed rather fairly across sites and the state, in terms of location and number of individuals in colonies.
- The state recorded its fourth consecutive year of strong productivity for **pipin plover**, above the long-term average in New Jersey (1.01 fledges/pair) and well above the levels believed necessary to maintain a recovery unit-wide stationary population (~1.00 fledges/pair). The discouraging, and unexpected, result in 2017 was that the previous year's robust productivity did not lead to an increase in pair numbers in 2017. It is not well understood why this occurred but it is also notable that there were a larger number than average of "bachelor" or unpaired adults as well as pairs where a nest was never detected (a pair is not counted to the state total unless nesting is confirmed).
- There continued to be an increase in pairs on state and municipal sites, reducing the concentration of pairs on federal sites. However, the majority of plovers (72%) are still nesting at two federal sites (Gateway NWA – Sandy Hook and EB Forsythe NWR) and the severe decline of nesting plovers in Cape May County continues to be of dire concern (four pairs in 2017, compared to 43 pairs in 2002).
- After a period of relatively weak influence, flooding and storm related issues (such as eggs being buried by high winds and sand) were once again a major contributor to nest failure among colonial nesting birds and a larger factor in Piping Plover productivity than in the years since Hurricane Sandy. This may be part of the reason that productivity was not as strong as 2016 for all three species.
- This chick mortality project for which transmitters/loggers were deployed on plover adults and juveniles is ongoing and final results are not yet available. The leg harness GPS logger deployment, however, appeared to be a success, adding another tool to the tracking tool box.
- Seaview Harbor Marina's importance to beach nesting species continued unabated this year. In addition to housing the vast majority of the black skimmer adults and fledges, it also hosted a least tern colony, a common tern colony and American oystercatchers.

Recommendations:

- Increase frequency of counts of population and productivity at least tern and black skimmer nesting sites along the Atlantic Coast (beach strand and marsh islands) to weekly (versus every two weeks) during the breeding season to improve the statewide assessment of population trends.
- Periodically monitor other back-bay island complexes within the coastal region of the state to ensure that large numbers of skimmers are not nesting in these areas. When sites are identified through this or other means, such as the long-legged wader aerial survey, include them in the ground surveys.
- Continue intensive monitoring of piping plover populations and reproductive success, and continue monitoring to ascertain causes of nest failure and brood loss. Encourage research projects focusing on

improving reproductive success for all three species by reaching out to potential collaborators, supporting their proposals and providing technical guidance as needed.

- Continue to incorporate management strategies for piping plovers, black skimmers and least terns into comprehensive beach management plans for municipalities in the coastal zone. Develop similar plans for state managed parks and natural areas.
- Continue to refine a comprehensive predator control plan as it is the primary way forward to recovery for these species. Work within and among DEP Divisions to obtain permission and create action plans for state lands, continue to encourage federal partners to do the same and work on initiatives to complete more aggressive predator control on municipal lands.
- Lead and/or coordinate large-scale restoration efforts to improve beach nesting bird habitat. Targeted sites include Barnegat Light, Malibu Beach WMA, Cape May Point State Park and carefully selected marsh islands. Conduct smaller efforts to control vegetation as needed (for example, at Seven Presidents Oceanfront County Park and Belmar – Shark River Inlet).
- Continue to make every effort to allow Seaview Harbor Marina’s beach nesting birds to flourish. This includes continuing intense predator control but also considering undertaking vegetation thinning to ensure the habitat stays suitable for as long as possible.
- Continue to work with regional partners, through in-person meetings and conference calls, to ensure that NJ is making the best decisions possible when it comes to predator exclusions.
- Continue to follow the piping plovers that were banded in 2012-13 and 2015-17 (though the aforementioned SUNY research project). Monitor arrival and departure dates and local movements of all banded birds. Peruse records of observations of birds on their migratory stopover and wintering grounds through birding listservs, eBird, social media and other online documentation tools. Enlist volunteers to help with survey efforts.
- Continue to work with partners to play an active role in regional coordination, research and protection efforts for black skimmers. Formalize research questions to be answered by banding and participate in the creation of a database where band resightings can be entered, accessed and stored.
- Continue to coordinate management with municipalities, as well as county, state and federal landowners.
- Continue to incorporate breeding data into NJ DEP’s Landscape Project and Biotics database.

Colonial Waterbirds

Prepared by: Christina Davis, Environmental Specialist II

Job Objective: Census long-legged wading birds nesting on Atlantic coastal marsh islands, via aerial survey.

Inactive during reporting period. An aerial survey is planned for 2018.

Job Number and Title: A.1. SHORE AND MARSH BIRDS

Migratory Shorebirds & Red Knot Management

Prepared by: Amanda Dey, Principal Zoologist

OBJECTIVES: 1) Monitor recovery of red knot and other shorebirds (ruddy turnstone, sanderling) on the Delaware Bay migration stopover: monitor mass gain; estimate population size and survival rates; monitor stopover population size through two methods: baywide aerial and ground survey and mark-and-recapture/resighting methods; 2) monitor horseshoe crab egg densities as an index of shorebird foraging conditions; 3) protect critical habitats to improve foraging conditions for migratory shorebirds.

Key Findings:

Mass Gain and Peak Abundance from Aerial Survey: In 2017, the proportion of red knots reaching ≥ 180 grams was 0.20, down from 0.56 in 2016 and 0.77 in 2017 (Figure 1). In 2017, cooler water temperature at the peak of shorebird stopover reduced crab spawning to a few protected creek mouths with warmer waters. This reduced overall food availability and increased competition for patchy egg resources. Few red knots achieved 180 g, some knots left the bay early in search of alternate foods, and many remained in Delaware Bay past normal departure time of May 26-28.

Stopover Population Size from Aerial Surveys: The peak count in 2017 was 17,969, which likely reflects the early departure of some red knots from Delaware Bay possibly in response to observed low food resources. The average peak abundance of the last six years was 21,832 (SD=4,890) (Table 1), which is 23% of historic peak of 94,460 in 1989. Peak abundance counts are taken from a combination of aerial and ground surveys, and are single-day counts that do not account for the turnover of red knots on the Delaware Bay stopover in May. However, the decline in red knot peak counts over the last three years warrants attention.

Surveys and resightings of marked birds, in Delaware Bay and elsewhere, indicate some red knots left Delaware Bay early to seek alternate food resources while many remained in the bay into early June. Two marked birds, observed in Delaware Bay in May 2017, were also observed in Jamaica Bay, NY, on May 24 with $\sim 1,000$ red knots (D. Reipe, pers. comm.).

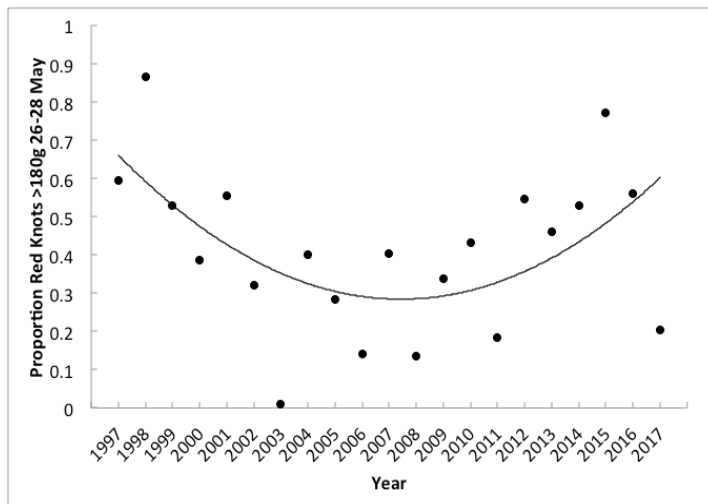


Figure 1. Proportion of Red Knots in the >180 g body-mass category in Delaware Bay near the usual departure time (26-28 May), 1997–2017. The line shows a significant quadratic trend (the trend line $\pm 95\%$ CI in respect of the line, not the variation in the data). Trend line was fitted using binary logistic regression of body mass >180 g (1=yes, 0=no) on year (negative, $P < 0.001$) and year² (positive, $p < 0.001$). The strength of the quadratic trend owes much to the very low proportion recorded in 2003, but remains significant if 2003 data are omitted. Sources: DE Division of Fish & Wildlife and NJ Division of Fish & Wildlife.

Population Estimate from Resightings of Marked Birds: As a result of a 2009 Structured Decision Making process led by the USFWS/USGS, an Adaptive Resource Management Model was developed to predict maximum horseshoe crab harvest that should not cause further red knot declines. One component of the model

is the red knot stopover population estimate, derived from resightings of individually-marked birds, which accounts for the throughput of red knots during the stopover period (Lyons 2016a). Since 2011, the mark-resighting stopover population estimate has remained relatively stable except for 2015 (Table 1), and averaged 48,103 birds.

Table 1. Stopover population estimate using mark-resight methods compared to peak-count index using aerial- or ground-survey methods. The mark-resight estimate of stopover (passage) population accounts for population turnover during migration; peak-count index is a single-day count and does not account for turnover (Lyons 2017).

Year	Stopover population ^a (mark-resight N^*)	95% CI Stopover pop- ulation N^*	Peak-count index [aerial (A) or ground (G)]
2011	43,570	(40,880–46,570)	12,804 (A) ^b
2012	44,100	(41,860–46,790)	25,458 (G) ^c
2013	48,955	(39,119–63,130)	25,596 (A) ^d
2014	44,010	(41,900–46,310)	24,980 (A) ^c
2015	60,727	(55,568–68,732)	24,890 (A) ^c
2016	47,254	(44,873–50,574)	21,128 (A) ^b
2017	49,405 ^e	(46,368–53,109)	17,969 (A) ^f

^a estimate for entire season, including population turnover
^b 23 May
^c 24 May
^d 28 May
^e Data management procedures to reduce bias from recording errors in the field not the same as previous years; see text at section 3 Mark-resight data.
^f 26 May

Shorebird food availability: Horseshoe crab egg densities on NJ beaches were lower in 2017 (2,796 eggs/m²) than the previous two years. Although commensurate with low densities observed during the time series (Figure 2), the interruption in spawning in 2017 occurred during peak shorebird abundance on Delaware Bay (May 16–May 28). Eggs available from earlier spawns were rapidly depleted leaving scant and patchy food resources. Crab spawning restarted on May 25 and surface eggs increased thereafter, but the observations that several thousand knots remained on the bay longer (into early June) than normal; that $\geq 1,000$ red knots left Delaware Bay early (before May 24); and that the majority of knots captured at the time of normal departure (May 26–28) had not achieved adequate departure weight (180 grams) (Figure 1) are consistent with inadequate food resources.

The implications of a food shortage are lower survival and lower probability of successful reproduction for lower-weight knots (Baker et al. 2004, Duijns et al. 2017). Knots that remained in Delaware Bay into early June may have achieved 180 grams and completed Arctic migration; however, there may be a cost for late-arrival in the Arctic (reduced opportunity for high quality territories, mates, timely nesting, adequate food resources for young, etc.).

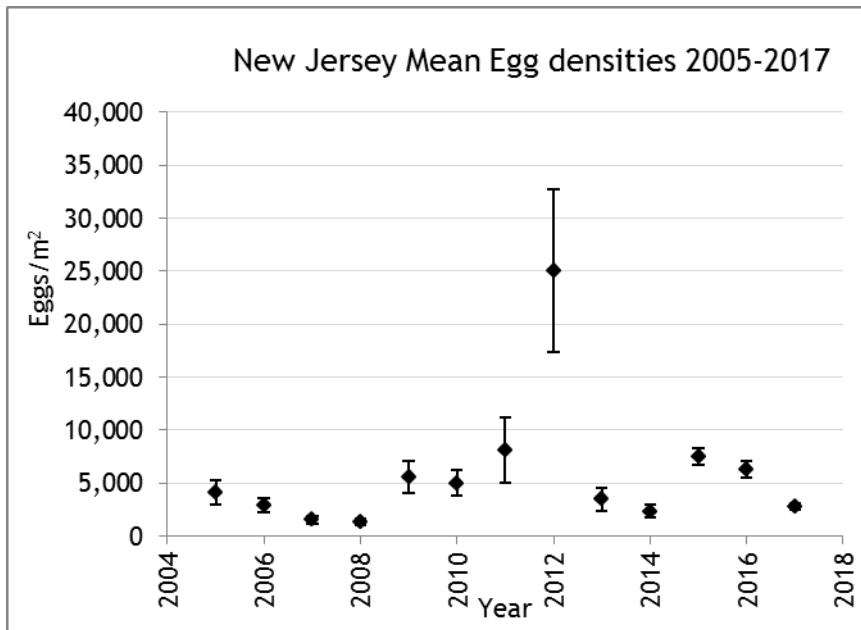


Figure 2. Mean density of horseshoe crab eggs in the top 5 cm of sand during May and early June 2005-2017 on bay beaches of New Jersey. Error bars are 90% CI. High egg abundance in 2012 was due to high egg densities on one site (Moore's Beach). Source: New Jersey Division of Fish Wildlife, American Littoral Society. Note: 2016 are preliminary and lack 90% CI.

Habitat Management: To improve shorebird access to limited egg resources, New Jersey restricted beach access on 13 sites on Delaware Bay during May. ENSP and staff from Conserve Wildlife Foundation of NJ (CWF) trained and fielded shorebird beach stewards. The reduction or elimination of human disturbance allows shorebirds to forage, dawn to dusk, on limited egg resources over a wide geographic area, which reduces interspecific and gull competition and risk from aerial predators.

In 2015 and 2016, we saw the beginning of expansion of intertidal structural oyster aquaculture on Delaware Bay. The planned expansion into red knot foraging areas poses a new threat by covering intertidal foraging habitat with growing structures and introducing disturbance from tending activity (on foot, with ATVs and power-washers), obstruction/impedance of crab passage to spawning beaches, and impact to benthic invertebrate prey of horseshoe crabs from intertidal driving. ENSP's technical guidance on this issue was carried out under NJ T-11-T and is reported there.

Discussion and Conclusions:

Red knot peak stopover abundance in Delaware Bay has declined over the last two years. This may be due, in part, to early departures (as in 2017). A lower number of knots reached adequate weight over the last two years, especially in 2017. The proportion of red knots that achieve body mass ≥ 180 grams by the time of normal departure from the Delaware Bay (May 26-28) is statistically related to foraging conditions (horseshoe crab egg densities in the top 5 cm of sand). Knots that leave the bay at ≥ 180 g have a higher survival than birds departing at lower weights (Baker et al. 2004), and heavier knots may be more likely to be detected post breeding than knots departing Delaware Bay at lower weights (Duijns et al. 2017). Therefore reduced numbers of knots reaching ≥ 180 grams is likely to contribute to population decline, but the extent of this impact and the role of, and interaction with, other factors is unknown. Counts in the main wintering area in Tierra del Fuego (by others), are scheduled for early 2018 and will aid in surveillance of annual population trend.

The mark-resighting method of estimating population size relies on several assumptions that may or may not hold true in Delaware Bay. In particular, the assumption of homogeneity of resighting probability must be tested. Shorebird use of the bay is affected by 1) distribution of eggs, which changes with annual conditions; 2) changes in bird behavior as they gain weight and departure period approaches (e.g., knots staging in more remote areas making them less observable); 3) and differences in how long individuals remain in the stopover. These factors, and how they may affect the mark-resighting population method, will be explored over the next several years.

Habitat management, mainly seasonal beach closures by volunteer Shorebird Stewards and spawning beach restoration, have been a major method to maintain red knot stability by improving shorebird access to egg resources. The Shorebird Steward program continues to enjoy wide support from bayshore communities, visitors and conservation partners. However, without increases in crabs and egg resources, this program alone cannot stave off further declines of red knots and other shorebirds.

Recovery of red knots and the migratory stopover will rely on increasing the capacity of the entire bayshore for both crabs (recruitment of spawning animals) and shorebirds (availability of eggs). This is important to improve resilience in the bayshore and counter other negatives in the system.

The objective of horseshoe crab harvest management has been to optimize bait harvest while allowing for red knot recovery rather than to maximize recovery of crabs and red knots (ASMFC 2016). Years of harvest management have not resulted in a long term increase in any age class (2001-2013; Hata and Hallerman 2013) or in spawning crab densities (1999-2016; Zimmerman et al. 2016). Since 2006, under Addendum IV, the ASMFC has reduced harvest quotas of Delaware Bay origin crabs. The ARM Model, implemented in 2013, was a positive management development. However, the lack of positive response in horseshoe crab numbers calls into question the adequacy of the ARM model, which only considers bait harvest mortality. The Model, and subsequent management, would be improved by including of other sources of mortality (lysate bleeding, bycatch, and illegal harvest).

Recent modest expansion and the potential for greater expansion of intertidal structural aquaculture has the potential to reduce shorebird foraging habitat in NJ, and deserves continued study to minimize impacts to horseshoe crab spawning and shorebird foraging.

Recommendations:

- Maintain data collection on shorebird body condition and shorebird abundance in the Delaware Bay stopover as it is crucial information in the context of models of shorebird populations, and habitat and forage management.
- Shift the goal of horseshoe crab management to the rapid recovery of red knots, which would support reduced or suspended horseshoe crab harvest to more quickly increase crabs and available egg resources.
- Improve the understanding of the significance to the Delaware Bay horseshoe crab population from other mortality sources, including all sources of mortality associated with lysate industry harvest, bycatch and illegal harvest.
- Maintaining data collection on horseshoe crab surface eggs (an index of foraging conditions).
- Continued management of beach habitats to reduce human disturbance in important shorebird foraging areas. Increasing such management on important foraging beaches in Delaware would help provide improved foraging and increase the number of birds reaching adequate departure weight.
- Identify habitat restoration opportunities to improve habitat for spawning horseshoe crabs and foraging shorebirds.
- Funding to conduct study of impacts of oyster aquaculture structures on horseshoe crab and red knot habitat to focus and manage this activity in a manner that to reduces impacts.
- Encourage full and stable funding of the Virginia Tech Atlantic Coast Benthic Trawl, potentially via reasonable permit fees assessed on the lysate industry.

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Secretive and Coastal Marsh Birds

Prepared by: Christina Davis, Environmental Specialist II

Job Objectives: 1) To determine the relative abundance and distribution of New Jersey's marsh birds, particularly those that are state-listed and of regional and continental concern (black rail, Virginia rail, king rail, sora, common moorhen, least bittern and American bittern); 2) To determine the efficacy of the acoustic monitoring of secretive marsh birds in New Jersey.

Key Findings:

- The project leader participated in Atlantic Flyway regional planning and USFWS status assessment activities that included data-gathering and setting population goals for the Eastern black rail. We contributed New Jersey data including the results of 2016 surveys that discovered some previously-unknown occupied sites.
- Some field surveys were conducted in 2017 by NJ Audubon (NJA) to complete their survey obligation begun in 2016. The NJA surveys were road-based only, compared to the boat-based surveys by NJDFW. No black rails were detected in the NJA surveys.

Discussion and Conclusions:

- The Atlantic Coast Joint Venture has identified black rail, saltmarsh sparrow, and American black duck as three "flagship" species that are highly vulnerable to coastal habitat changes. NJDFW hopes to participate in the Flyway-wide planning and monitoring for black rails in 2017-18, which will include additional surveys of suitable marsh habitats as funding allows.

Job Number and Title: A.2. RAPTORS

Bald Eagle

Prepared by: Kathleen Clark, Supervising Zoologist

Job Objective: To conserve and manage a self-sustaining bald eagle population in New Jersey; to determine the threat of environmental contaminants to survival of bald eagles along the lower Delaware River and upper Delaware Bay; and to monitor and conserve the wintering population of bald eagles in New Jersey.

Key Findings:

Population monitoring:

- ENSP biologists monitored all nesting pairs known and continued the tracking in list format. Eighty eagle project volunteers conducted most of the monitoring in the state and reported on nests on a weekly or bi-weekly basis from January through fledging in July.
 - In 2017, 178 eagle nests were monitored during some or all of the season, of which 153 were active (exhibiting incubation), and 25 were territorial (maintaining a nest area). Thirty-seven more territories remained on our list but were unknown (pair or nest could not be found, or we lacked observation effort). These figures represent a 2% increase from 2016, and the fourth consecutive year of the eagle population with about 150 active pairs.
 - During the 2017 nesting season, 118 of 152 known-outcome nests produced 190 young, for a productivity rate of 1.25 young per known-outcome, active nest (Fig.1). This is the same as the 10-year median productivity rate. Overall nest success rate was 78%, close to the average of 75%. These results suggest a continuing growing population and indicate this was an average season for eagles in NJ.
 - Although 21 new eagle nests were discovered this season, the total number of known active nests (153) was very similar to the 150 nests documented the last few years. This is a result of losing track of some nests (those in the “unknown” category) and because some known nests had territorial pairs that did not lay eggs
 - We documented 34 (22%) nest failures, which is about average in NJ.
- ENSP biologists went to fewer nests than usual to band young and take blood samples. In 2017 we banded 9 eaglets at 6 nests; we banded one additional juvenile who was found grounded in Camden and successfully released nearby. We took blood from all of the banded eaglets and stored it for future analyses. A portion of some samples will be used for DNA analysis by a cooperating researcher who will be analyzing the genetic heritage of eagles across the country.
- Relationships with landowners, whether private citizens, conservation organization, or public agencies, all required attention and directed management to ensure protection from disturbance or significant habitat alterations. Most nests (68%) were located on private, non-conserved land, with the balance on state, federal, and conservation-organization lands.
- The ENSP did not participate in the standard, national, Midwinter Eagle Survey in January, 2014-2017 because the limitations of the survey transects and lack of funding for survey coordinators. Instead, we directed our Eagle Project volunteers to record eagles in likely communal roosting areas. Documented roost areas will be entered into the DEP’s Biotics database.

Nest site protection:

- Nest areas were posted against trespassing in all cases where the nest is highly visible and where law enforcement officers specifically recommended.
- Staff provided technical assistance to owners and clients of cell towers, and distributed guidelines for managers of man-made structures (especially cell and transmission towers), who must deal with osprey and eagle nests on those structures. Staff worked regularly with NJ power companies to identify high-risk power infrastructure for mitigation; power supply and distribution lines pose dangers of electrocution and collision, which can be addressed when the particular risk is high.

- ENSP staff worked with Bureau of Law Enforcement to address specific problems at nest sites; most problems arose from people approaching nests that are highly visible. Law Enforcement officers were included in the pre-season eagle project orientation meeting held February 4, 2017, attended by approximately 50 project volunteers.
- Staff worked regularly with USFWS-NJFO and Region 5 offices to address issues related to USFWS Bald Eagle Management Guidelines and BGEPA permits in NJ.

Habitat protection and planning:

- New nests were GPS'd in the non-nesting season and added to the database. Revised Landscape Project mapping that included new nests was provided to DEP offices for use in environmental review.
- Site-specific habitat management plans were provided to the NJDEP permit reviewers for a few sites due to pending development applications. ENSP also worked with the USFWS regional office to condition permits granted under BGEPA.
- The status assessment portion of the proposed Bald Eagle Recovery Plan was not conducted due to time limitations. However, bald eagle was one of the species considered in the status assessment of birds conducted by ENSP during 2017. The status assessment will go through one more round before results are complete in spring 2018.

Conclusions:

- The population of “active” eagle nests has remained fairly stable since 2015, even though new pairs have been found each year. Therefore the population appears to be stabilizing and growing at a much slower rate. New pairs are getting established, but other forces, such as competition among eagles, are popping up to reduce nesting in some areas. Eagles that establish new nests in particularly busy human environments may be subject to disturbances that keep them from nesting in a territory, although there is a general tendency for eagles that settle in busy area to show a higher than usual tolerance for human activity.
- New Jersey maintains a “list” approach to monitoring the population, largely thanks to the highly skilled volunteer force; however, it is difficult to maintain all nests “on the radar” when some pairs move to remote locations. ENSP and partner Conserve Wildlife Foundation of NJ have been successful in determining the location and outcome of approximately 85% of eagle pairs, which has been important for maintaining our database and meeting the eagle protection requirements under NJ regulations. We would need one additional staff to expand the volunteer program and help survey and document new nests. Eagles change nest trees between 5% and 10% each year, and keeping track of those changes is important to using the list method. Still, it is difficult to maintain all current locations, and in 2016 the number of pairs with “unknown” status increased to 35, up from 27 in 2015.
- Maintaining the eagle recovery depends on cooperation from private landowners, where most of the nests are located. Nest site protection is accomplished with a combination of local landowners and nest observers, Division law enforcement, and land use regulatory protection, all essential ingredients in the current recovery and necessary to sustain it. With federal delisting and strengthening of the federal Bald and Golden Eagle Act, we have expanded our coordination with the USFWS in select cases to minimize disturbance and habitat loss to development and other activities.
- As the eagle population has increased, it has become more challenging to maintain the “list” of eagle nests and territories that is the basis for reporting the population to the USFWS under requirements of the post-delisting monitoring plan (USFWS 2009). With declining funding and an eagle population reaching recovered status, it is unlikely we will be able to continue this level of population monitoring far into the future.
- Disturbance is a major management issue at about 8% of NJ nests, especially those most visible and near roads. Posting and regular surveillance by staff and nest observers have been essential to ensuring or maintaining nest success.

Recommendations:

- Maintain efforts to monitor population size, nest activity and productivity through weekly or bi-weekly observations of nests by volunteers. Continue coordination with the U. S. Fish and Wildlife Service in accordance with the post-delisting monitoring recommendations, via conference calls and regional/subregional meetings.

- We ended our participation in the Mid-winter Eagle Survey in favor of deploying volunteers to identify winter roosts and concentration areas. We need to continue to map those areas that may be significant to maintaining the local and regional populations of bald eagles, and prioritize them for protection through management and acquisition.
- Seek partnerships to continue eagle telemetry that helps identify suitable habitats in migration and wintering areas to support long term planning for eagle population recovery.
- Continue to monitor population health indicators by visiting a representative sample of nests to band nestlings with USFWS bands and state color bands, take measurements and blood samples. Seek assistance with contaminant analysis from researchers interested in any and all aspects of contamination issues.
- Continue to work with law enforcement, private landowners, nest observers, conservation organizations, and local governments to ensure protection of nesting and foraging sites.
- Work with the NJ Field Office of the USFWS to maintain essential nesting habitat free from disturbance, in accordance with state law and the federal Bald and Golden Eagle Act. Develop proactive planning to identify and conserve suitable bald eagle habitat in anticipation of a fully recovered eagle population.

Literature cited.

U.S. Fish and Wildlife Service. 2009. Post-delisting Monitoring Plan for the Bald Eagle (*Haliaeetus leucocephalus*) in the Contiguous 48 States. U.S. Fish and Wildlife Service, Divisions of Endangered Species and Migratory Birds and State Programs, Midwest Regional Office, Twin Cities, Minnesota. 75 pp.

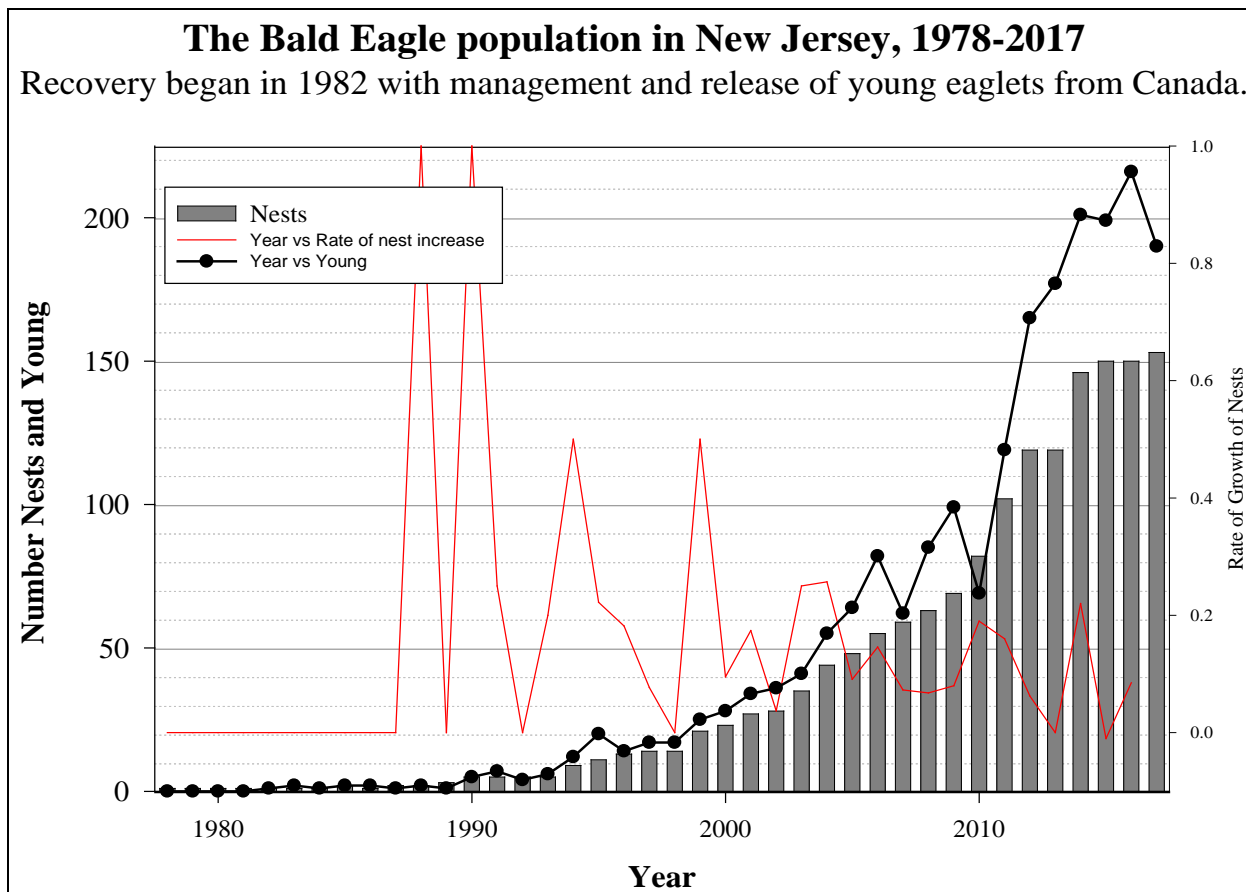


Figure 1. Bald eagle nesting population and productivity in NJ, 1978-2017.

Peregrine Falcon

Prepared by: Kathleen Clark, Supervising Zoologist

Objective: To conserve and manage the New Jersey Peregrine Falcon (*Falco peregrinus anatum*) population at a self-sustaining level.

Key Findings:

- The 2017 New Jersey peregrine falcon population remained stable with 34 known pairs (32 active) occupying suitable nesting habitat across the state. There was average success overall with 22 pairs successful in producing 51 young, for a productivity rate of 1.72 young per active nest and a success rate of 69% (Table 1). However, when we account for known young lost around fledging, the productivity rate dropped to 1.59 young per active nest. A brief summary of data collected during the 2017 nesting season follows.
 - Seventeen pairs nesting on towers and buildings continued to be the core of the nesting population, producing 31 young, for a productivity rate of 1.82 young per active nest (1.76 fledged young/nest). This is close to the long term average. We used bird-lice spray at nests in the winter, and treated <2-week old hatchlings at two sites to reduce infestations of parasitic flies (*Carnus hemapterus*), but suspect that these flies were responsible for chick mortality at ≥ 1 nest. These flies have caused mortality of young hatchlings in recent years.
 - Six pairs were known to occupy territories in natural cliff habitat in northeastern NJ. Four young were produced but just two fledged for a productivity rate of 0.67 (0.33 fledged) young per active nest.
 - Nine pairs of falcons were known to nest on bridges this year. Five of those bridges lie completely within the boundaries of NJ, while four span the Delaware River between NJ and PA and were monitored by NJ. All bridge pairs produced a total of 20 young (19 fledged) for a productivity rate of 1.75 (1.59 fledged) young per active nest. Nesting can be difficult to confirm, as the nest sites are often located out of sight or on inaccessible sections of the bridge. Some previously occupied bridges (e.g., Trenton and Newark Bay) were not tracked due to insufficient staff or volunteers. Other bridges may have been occupied, but the program lacked monitors in northern NJ to document all possible sites.
- There was drama caught on webcam at the Union County court house nest: the resident pair were in the midst of egg-laying when an intruder female (a 2-year-old, banded 91/BA) fought with the resident female over a period of a week. The intruder won, and within two weeks began laying her own eggs and brooding the first female's two eggs, ending up incubating five eggs total. Two of her eggs hatched, but only the first hatchling survived, before succumbing to lead poisoning at 10 days of age, likely the result of a lead-contaminated pigeon meal. This is the first time we have observed this kind of mortality at a peregrine falcon nest. The freshly-dead nestling was examined and tested by Dr. Erica Miller with NJDFW and UPenn.
- We banded 40 of the 51 young produced this year, using both a federal band and an auxiliary, bicolor band with an alpha-numeric code following USGS Bird Banding Lab protocol.
- Eight addled eggs were collected from five different nest sites this season, and were held in the freezer at NJDFW-Tuckahoe. Addled eggs from 2000-2015 were submitted for contaminant analysis to Dr. Da Chen at Southern Illinois University. Dr. Chen's research focuses on the accumulation and effects of flame retardants.
- We continued to use remote, motion-activated cameras to photograph peregrines at nests. Using this method we read the leg bands on 16 breeding adults at nine nest sites. An additional 15 adults were identified using optics. A minimum of 9 adults (29%) were unbanded. The oldest female identified was a 19-year old Atlantic City bird that failed to lay eggs a fifth consecutive year, and we fostered one nestling successfully at this site. The oldest known male was 13 years, at the Burlington-Bristol Bridge where he routinely perches closely to people near the nest. The median age of males and females was 8.0 and 6.0, respectively. The information that these identifications provide is valuable for relating peregrine origin and age to nest success, site fidelity and turnover rate in the population.
- In addition to the resightings we recorded at NJ nest sites, we received reports of peregrines sighted here and elsewhere:

- *8/*D Betsy Ross Bridge 2005 male was confirmed nesting at the Commodore Barry Bridge in 2017 (and likely, earlier years).
- 09/AC Brigantine 2010 male nested in Atlantic City-Taj Mahal/Hard Rock in 2017. He was photographed last year at the Atlantic City water tower site.
- 08/AM Stone Harbor 2011 male nested at Marmora WMA. He had previously nested in Wildwood Crest.
- 10/AM Brigantine 2011 male nested in Atlantic City (Atl Club) in 2017, as he has since 2014.
- 14/AM Atlantic City 2012 male nested on the Rt. 72 Bridge in Manahawkin in 2017.
- 36/AM Drag Island 2013 male was resighted at an Absecon Bay channel marker in June 2017.
- 37/AM Drag Island 2013 male nested on an osprey nest near Ocean City in 2017.
- 42/AM Burlington-Bristol Bridge 2013 male was resighted in Columbus, NJ in January 2016, and at a bridge nest site on I-95 in Bristol, PA in 2016-2017.
- 74/AM Logan Generating Plant 2015 male was resighted at U. Penn Hospital in Phila, PA in Aug-Sept 2017.
- 86/AM Sedge Island 2015 male was found dead of unknown causes in Toms River in spring 2017.
- 96/AM Burlington-Bristol Bridge 2016 male was resighted in Thornbury, PA, in July 2017.
- BE/13 Tuckahoe 2017 male was resighted at Great Bay Blvd, Tuckerton, in July 2017.
- BE/26 Forsythe 2017 male was sighted at the ACUA landfill in Sept 2017.
- *Y/*4 Betsy Ross Bridge 2006 female continued to nest at Possum Point power plant in VA.
- A/15 Dividing Creek 2009 female continued to nest on a marsh in VA, where she's been since 2013.
- 42/AN Manahawkin 2012 female nested at Tuckahoe in 2017 for the first time.
- 82/AN Wildwood Crest 2014 female nested on the Rt. 72 Bridge in Manahawkin for the first time.
- 83/AN Manahawkin 2014 female nested in Atlantic City-Taj Mahal/Hard Rock building in 2017.
- 90/AN Marmora WMA 2015 female nested unsuccessfully on an osprey platform in Ocean City.
- 76/AN Paulsboro Refinery 2014 female was resighted in Middlesex in November 2016.
- BD/47 Logan 2017 female was recaptured at the Assateague banding station in October 2017.
- BD/48 Logan 2017 female was resighted in Bronx, NY in November 2017.
- BD/61 Stone Harbor 2017 female was recaptured at the Assateague banding station in Sept 2017.
- BD/62 Jersey City 2017 female was resighted in DeKorte Park in Sept 2017.

Conclusions:

- The peregrine population remained stable in 2017 with just average nest success and productivity, but dismal success at natural/cliff nest sites. Across all sites – towers, buildings, bridges and cliffs – nest success was 69% and 1.72 (1.59 fledged) young per active site, figures that are average and below recent years' results. The tower and building nest sites are the consistent core of the population in NJ, without which the population would fluctuate widely year to year. Management of nest sites, mainly to provide safe, undisturbed nesting environments for the birds, continues to be the predominant factor in a stable and productive population.
- Nest success at cliff sites declined in 2017, where just two of six sites fledged young, and another site may have lost its fledgling two weeks later. We had documentation on six occupied territories and just two fledged young for a dismal 0.33 productivity rate. Observations continued to be difficult in the more remote locations and where nest sites cannot be viewed after leaf-out. The highly variable nest success at the cliff territories is a problem if we consider occupancy of historic habitat important to a fully recovered population. Targeted investigations and site improvements are necessary to improved management.
- Management of nesting pairs and nest sites is essential to maintain peregrines in New Jersey. Bridge-nesting birds are especially vulnerable to nest-site problems, and many other pairs occupy human-constructed sites. With site management and the cooperation of bridge and building staff, these sites can contribute to population viability and stability, but proper site management takes staff time and attention. Managers of buildings, in particular, are key partners in improving some nest sites and expanding the potential peregrine population.

Recommendations:

- Continue to monitor the peregrine falcon nesting population to maintain the database of nest site occupancy and nest success.
- Investigate cliff-nesting sites to determine causes of nest losses and improve nest sites where possible. Deployment of cameras would be the best means of getting a better level of monitoring.
- Continue the identification of adult nesters to track breeding population turnover, age structure and origin of successful nesters. The relation of the age structure to nest success and contaminant levels will inform conservation decisions regarding species status and recovery planning.
- Continue the investigation of contaminants in unhatched, salvaged eggs, as well as the close monitoring of nesting pairs to detect problems. Our partnership with Dr. Da Chen at Southern Illinois University to characterize the threat of organochlorine pesticides and brominated fire-retardant chemicals (polybrominated diphenyl ethers) is a cost-effective means of adding to the science concerning peregrine falcons.
- Conduct nest maintenance to reduce or eliminate parasitic flies from nests by cleaning nest substrate during the non-nesting season. Reduce mortality of nestlings by monitoring nestlings in their first two weeks and treating infested young with an anti-lice spray.

Table 1. Site-specific results of peregrine falcon nesting in New Jersey, 2017.

Site Name	Occupied	Active	Eggs	Young Hatched	Young @ Band Age	Young Fledged	2017 Comments
101 Hudson, Jersey City	Y	Y	3	1	1	1	
Atlantic City – ACUA water tower	Y	N	0				New nest box available.
Atlantic City –Hard Rock-new	Y	Y	?	2	2	1	One died at fledging.
Bayside Prison Water Tower	Y	Y	?	2	2	2	Box amended for space.
Drag Island	Y	Y	4	4	3	3	
Egg Island WMA/Dividing Cr	Y	Y	4	0	0	0	Eggs lost during incubation.
Elizabeth-Union County C.H.	Y	Y	2+3	2	0	0	1 st female replaced; 2 nd female laid +3 eggs. Two hatched but both died in the nest.
Forsythe NWR/Barnegat	Y	Y	4	4	4	4	
Forsythe NWR/Brigantine	Y	Y	?	1	1	1	Box and tower removed 11/20/17
Great Bay WMA/Water Twr	N	N	-	-	-	-	
Hilton/Casino/Atl Club	Y	N	0	0	1	1	19 year old F. Fake eggs provided; 1 fostered chick.
Logan Generating Plant	Y	Y	4	4	4	4	
Ocean City marsh (osp nest)	Y	Y	4	3	0	0	Rain caused death of <1 wk old nestlings.
Marmora WMA	Y	Y	5	4	4	4	
Newark: Unknown site	U	U					
Ocean Gate	Y	Y	?	?	0	0	Apparently eggs hatched then failed.
Paulsboro Refinery	N	N					Pair moved off-site to unk location.
Sedge Island WMA	Y	Y	4	4	0	0	Failed by 5/19, unk cause.
Sewaren Generating Station	N	N					No sign of nesting adults.
Stone Harbor	Y	Y	3	3	2	2	One of 3 hatched was fostered to AC.
Swan Bay WMA	Y	Y	3	3	3	3	
Trenton-Roebling Bldg (box 2015)	N						
Tuckahoe WMA	Y	Y	4	4	4	4	New female.
Wildwood Crest-Grand Condo	Y	N					
SUBTOTAL: TOWERS & BUILDINGS	19	17			31	30	Young/Active=1.82, Fledged/Active=1.76
Delaware Water Gap	N	N					
Natural Site C-1	Y	Y	?	?	1	1	
Natural Site C-2	Y	Y	?	?	0	0	
Natural Site C-3	N	N					
Natural Site C-4	N	N					
Natural Site C-5	Y	Y	?	?	?	0	
Natural Site C-6	Y	Y	?	?	?	?	
Natural Site C-7	N	N					
Natural Site C-8	Y	Y	?	?	0	0	
Natural Site C-9	Y	Y	?	0	0	0	
Natural Site C-10	Y	Y	?	?	1	1	
Natural Site C-11	Y	Y	?	?	2	0	Both died around fledging
SUBTOTAL: NATURAL SITES	6	6			4	2	Young/Active=0.67 Fledged/Active=0.33
Ben Franklin Br. (Del R)	PA						
Betsy Ross Bridge (Del R)	Y	Y	?	2	2	2	
Brigantine Bridge (A.C.)	U	U					
Burlington-Bristol (Del R)	Y	Y	4	4	4	4	In west tower
Commodore Barry (Del R)	PA						
G. Washington Br (Hudson R)	NY						
Newark Bay Br. (NJTP or Conrail)	U	U					
NJ-PA Turnpike Br. (Del R)	PA						
Ocean City-Longport Bridge	U	U					
Pulaski Skyway Bridge	Y	Y	?	?	1	1	Activity obs by NJDOT
Route 1/Raritan-New Brunswick	Y	Y	?	3	3	3	
Route 3/Hackensack NJDOT	Y	Y	?	4	4	3	One died at fledging.
Route 35 Bridge-Belmar	Y	Y	?	?	0	0	Failed in May.
Route 46 Br./Little Ferry-Ridgefield	N	N					
Route 72 Br (2015 old, 2016 new)	Y	Y	3	0	0	0	Eggs removed by NJDFW 5/15.
Scudders Falls Bridge	PA						
Secaucus-Kearny NJTP Bridge	U	U					
Tacony-Palmyra Br. (Del R)	Y	Y	4	2	1	1	
Trenton RR Br	U	U					
Vince Lombardi – NJTP Bridge	U	U					
Walt Whitman Bridge	Y	Y	?	3	3	3	On NJ tower during PA construction.
NJTP Bridge/Rahway River	Y	Y	?	?	3	3	Found 2017, possibly active since 2015.
SUBTOTAL: NJ BRIDGES	9	9			20	19	Young/Active=2.22 Fledged/Active=2.11
TOTALS (NJ Only)	34	32			55	51	Young/Active=1.72, Fledged/Active=1.59

Osprey

Prepared by: Kathleen Clark, Supervising Zoologist

Job Objective: To conserve and manage the New Jersey osprey population at a self-sustaining level.

Key Findings:

- In 2017, biologists and volunteers surveyed 638 nests and determined outcome at 500 nests (78%) across 12 major colonies on the Atlantic and Delaware Bay coasts and the Delaware River (Table 1). During ground surveys nestlings were banded with USGS leg bands by licensed bird banders.
- Biologists and volunteers conducted ground surveys in June and July to document nest occupancy and productivity at 500 nests (Table 1). We grouped nests by watershed or water-body areas to which they were closest. Nest success averaged 1.76 young per active nest, which is close to the ten-year average of 1.80 young per active nest. Weather was mostly favorable with average temperatures and precipitation. Nest productivity varied by geographic area, with the lowest productivity (1.34 young/active) at 85 Barnegat Bay nests. Data were also submitted by citizen scientists who reported on nests using www.osprey-watch.org.
- 408 young were banded with USGS leg bands for future tracking. In addition, we continued to use an alpha-numeric color band on nestlings banded in Barnegat Bay nests (including Sedge Islands). One hundred-six red auxiliary bands were deployed this summer to add to the 140 deployed in 2014-16. A re-sighting project was advertised to help determine nest site fidelity, foraging habitat, and to engage the public in osprey conservation.
- Eight volunteer banders checked nests across ten colonies and donated approximately 250 hours in accomplishing this work. Orientation/training covered data filing using an Excel format, and reviewing survey and handling methods.
- All nest locations were maintained in Excel and GIS databases, tracking all occupied nests. Those databases will be used to update the state's Biotics database, which is the basis for the Landscape Project critical habitat mapping. Data from banders were compiled via Excel that most people provided electronically.
- Nest locations are also maintained in the Center for Conservation Biology's "Osprey-Watch.org" website. This website facilitates citizen reports that help us census and maintain data on the population.
- CWF organized volunteers to install 15 new nest platforms along the Atlantic Coast. CWF also worked to maintain many of the existing platforms throughout New Jersey.

Conclusions:

- This year's ground surveys by volunteers and cooperators documented continued good nesting success rate for ospreys all along the coast for a population estimated at 650 pairs. While productivity varied among watersheds, none had a particularly low rate.
- The coordination of volunteers and licensed banders by CWF-NJ has made it possible to accurately track occupied nests and nest success as a measure of population stability.
- ENSP's partnership with the Conserve Wildlife Foundation of NJ has improved the availability of functional nest platforms for ospreys, which directly supports the stability and growth of the osprey population in the state. The population is approximately 90% reliant on unnatural or man-made structures for nesting, so maintenance of those structures is essential to a stable population.

Recommendations:

- The osprey population is estimated to be about 650 nesting pairs, which is probably the pre-DDT population for NJ. This species benefits from regulatory protections (e.g., MBTA and NJDEP land use regs) that avoid take and disturbance during the nesting season. Maintaining a database of nest locations is necessary to provide these nesting season protections for NJDEP permitting purposes.
- Continue to employ trained volunteers to measure annual productivity of ospreys to monitor regional conditions and trends (e.g., Atlantic vs. Delaware Bay regions, and Atlantic subregional comparisons), as nest success is one of the most accurate means of monitoring threats and population stability. Recruit and train additional volunteers to conduct nest checks.

- Use the data on population size, distribution, and productivity to assess the conservation status of ospreys in NJ. Use these same data to assess the condition of prey resources, particularly because NJDFW is concurrently involved in marine fisheries management.
- Continue to refine the data-reporting system to improve data handling.
- Continue to collect addled and unhatched eggs to archive for monitoring contaminant levels regionally and statewide.

Table 1. Osprey nesting and productivity in 2017 in all NJ nesting areas. Productivity determined by aerial and ground surveys in May-July. Productivity rates in 2016-2013 provided for comparison.

Nesting Area	# Nests	Known-Outcome Nests	# Young	# Banded	Productivity 2017	Previous Years			
						2016	2015	2014	2013
Delaware River & N. Jersey	9	8	13	0	1.62	2.00	2.00	n/a	n/a
Hackensack River/s	5	3	4	0	1.33	0.75	1.00	1.20	1.50
Raritan Bay & Cheesequake	31	18	37	5	2.06	1.73	1.93	1.92	1.74
Monmouth County	62	52	76	0	1.46	1.82	1.27	2.00	2.00
Barneget Bay	111	85	114	63	1.34	1.78	1.33	1.48	1.88
Sedge Islands WMA	29	27	55	43	2.04	2.18	1.65	1.05	2.00
Great Bay to Atlantic City	81	48	70	24	1.46	2.05	1.46	1.84	1.79
Great Egg Harbor/Ocean City	77	71	135	89	1.90	2.16	1.83	2.30	2.09
Sea Isle City	31	21	41	20	1.95	1.29	1.87	2.43	1.68
Avalon/Stone Harbor Bays	72	61	113	56	1.85	1.54	1.75	2.12	1.79
Wildwood Bays & Cape May	59	37	67	2	1.81	1.33	1.88	2.46	2.00
Maurice River & Estuary Marshes	71	69	140	106	2.03	1.93	2.15	2.30	2.12
Salem Co./ Artificial Island / Delaware	-	-	-	-	-		1.60	2.50	1.90
Total of Study Areas	638	500	865	408	1.73	1.79	1.74	2.02	1.92
Atlantic Coast only	553	431	725	302	1.68	1.77	1.66	1.97	1.88
Delaware Bay only	71	69	140	106	2.03	1.93	2.11	2.32	2.09

American Kestrel

Prepared by: William Pitts, Senior Zoologist

Job Objectives:

Objective 1: To halt and reverse the decline of the American kestrel through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection, management, research and education.

Objective 2: Gather and analyze data to inform conservation status and recovery plan actions of this species.

Key Findings:

- 2017 was another banner year for the American kestrel nest box project. Of the 12 years, this was the most productive season ever; a total of 72 nesting attempts produced 218 fledglings. Over the course of the project, 1,266 fledglings have been banded, and 289 adults have been captured.
- ENSP monitored the fewest boxes in the last five years in 2017. We removed nest boxes from suboptimal locations, or where volunteer help or landowner support was lacking. In a few cases, nest boxes or their supporting structures had simply broken or fallen down and were not replaced. In all, ENSP selected 132 nest boxes for monitoring in 2017 (Figs. 1 and 3), focusing on the most productive boxes from our original study areas. Partners from Natural Lands Trust (NLT) monitored 50 boxes that they installed in Salem, Cumberland, and Cape May counties. This new study area expanded the study to include important habitat areas while maintaining representation within all previous study areas (Clinton, Amwell Valley, Assunpink, and Southern NJ). New study areas will be reassessed after four more years, when plans for continued monitoring will be based on kestrel activity (or lack thereof) and partner/volunteer support.
 - Five new volunteer monitors were recruited and trained in 2017. One volunteer in Hunterdon County installed an additional two boxes.
 - A total of 132 nest boxes were monitored every 12-15 days from April through early August. Fifteen volunteers monitored 108 nest boxes and staff monitored 24 boxes.
 - Of the 132 nest boxes that ENSP actively monitored, 56 (42%) were occupied by American kestrels. Sixteen of Natural Lands' 50 boxes (32%) were active and fifteen had nestlings that were banded by ENSP in 2017.
 - Of the total nesting attempts (n=72), 54 (75%) were successful, as defined by nestlings that reached the bandable age of 14-22 days. Eighteen nests or nesting attempts (25%) failed. ENSP boxes had a 70% success rate (39 out of 56) while Natural Lands boxes had a 94% success rate (15 out of 16).
 - Volunteers and staff entered nest-check data online through a Google documents interface.
 - ENSP nesting success was higher in 2017 (70%) than the previous year (63%) but still below the project best of 77% (Figure 2). Total nesting attempts was the second highest for this project (n=56; Fig. 3). The additional sixteen nest attempts from NLT's active boxes made the total nest attempts 62. Average productivity per successful nest was 4.04 in 2017, and productivity for all occupied nests was 3.03 (Fig. 2). When looking only at ENSP boxes these figures are slightly reduced at 3.92 young per successful box and 2.73 young across all active boxes.
 - We have not updated the predictive American kestrel habitat patch model (patch sizes 0-250 ha, 250-1,000 ha, and >1,000 ha) with the 2012 LULC source for patches. This model may be revisited in the future, but currently there are no plans for this update.
 - Based on the existing habitat-patch model, 73% of the 2017 nest boxes were placed in the top two patch categories, 250-1,000 ha, and >1,000 ha, which is consistent with previous years' findings.

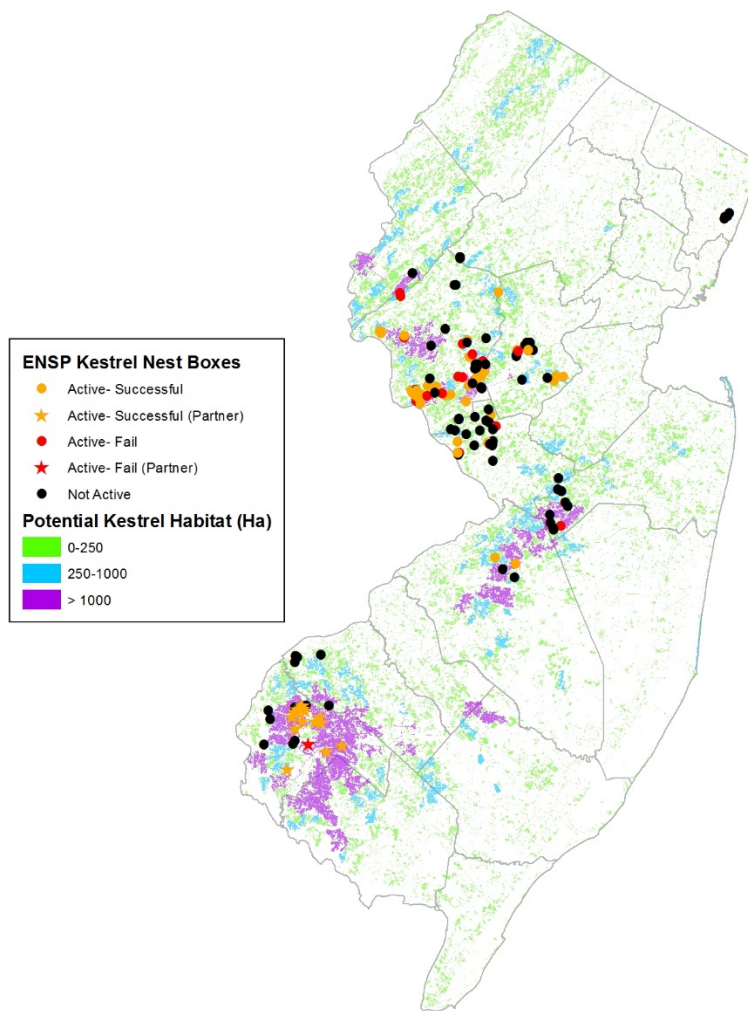


Figure 1. American kestrel nest boxes monitored in 2017

- The 2017 banding season resulted in the following:
 - 249 kestrels were newly banded in total: 218 young (116 females, 111 males, 1 unknown sex) and 31 adults (24 female, 7 male) were banded at 56 nest boxes. All banding data was supplied to the Bird Banding Lab via Bandit. 2017 marked the sixth consecutive year in which >100 fledglings were banded and the first year where >200 fledglings were banded (Figure 4).
 - 29 previously banded adults were recaptured (25 females, 4 males). This total accounts for 48% of all adults captured in 2017, which is about three times the average number of recaptures over the past five seasons. Nineteen (65%) of the recaptured adults (15 females, 4 males) were previously banded in ENSP monitored boxes, while 8 females (28%) were banded as young in Bucks or Northampton, PA, and 2 females (7%) were relocated off airports by USDA.
- In 2017 ENSP provided feather samples to the Bird Genoscape Project led by researchers from Boise State University. This project is mapping the population-specific migratory flyways of 100 species of birds using DNA from known populations. ENSP contributed samples from 22 locations in 2016 and 20 locations in 2017; six of the sites were sampled both seasons.

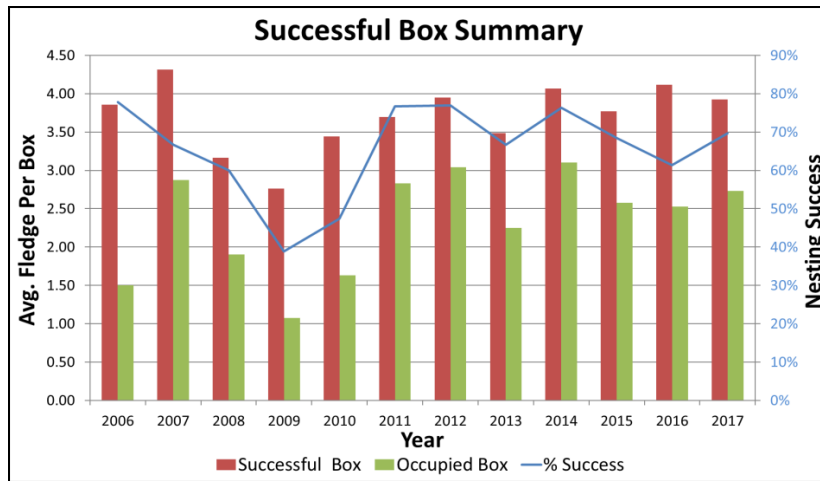


Figure 2. Average number of fledglings per occupied versus successful boxes (ENSP boxes only), and overall success of occupied boxes, 2006-2017.

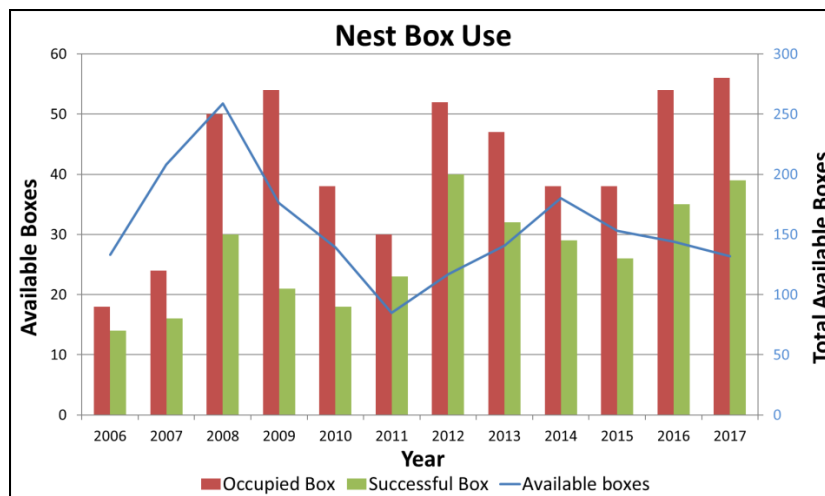


Figure 3. American kestrel nest box use (ENSP boxes only), 2006-2017.

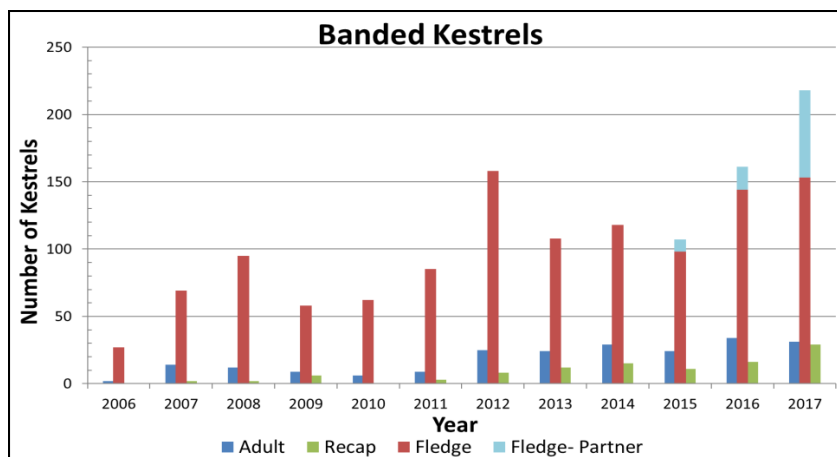


Figure 4. American kestrels banded, 2006-2017.

Conclusions:

- Nest box placement has been successful; we have determined and maintain that open habitat patches >250 ha are the most suitable and should be the priority for kestrel management.
- Volunteers are a critical component for successful monitoring and data collection. ENSP must work on maintaining volunteer relationships because we do not have the staff resources to adequately monitor the current nest box program.
- Banding chicks and adults provides good baseline data for tracking survival, turnover and breeding territory fidelity in the NJ population. This data may help identify problems related to population declines.
- Except for the 2009 breeding season, productivity of successful nest boxes has consistently been >3.0 young per box for the duration of the project, and when factoring in NLT boxes, three of the past four years have seen productivity at >4.0 young per box. This data suggests that incubation issues or low hatchling survival are not likely to be the primary reason for the American kestrel decline in NJ.
- 2017 had the highest percentage of recaptured adults (48.3%) since the inception of the project. This suggests that there was a high degree of survivorship over the 2016-2017 winter. This coupled with a high rodent population over the winter undoubtedly had a positive effect on this breeding season.
- Even with the continued reduction in nest boxes monitored, ENSP again had its most productive kestrel nesting season in 2017. The continued refinement of box movement and removal has allowed us to maximize staff and volunteer time as well as the number of kestrel pairs monitored. We will continue to refine our approach based on occupancy data.
- Natural Lands Trust continued its nest box program in 2017 and continued to increase their productivity, going from three active boxes in 2015, to five active boxes in 2016, to sixteen active boxes in 2017. As was the case last year, they have found that the most productive areas in Salem and Cumberland Counties for American kestrels tend to be closer to farmlands that are less intensively farmed (smaller scale operations) and/or areas of grazed pasture. Given this continued success, and ENSP's lack of success in South Jersey we will likely remove most of our boxes in this region.
- The urban study area in Bergen County had no known nesting attempts in 2017. We will reevaluate the placement of these boxes this winter to see if they could be placed better, if not we will remove them.
- Despite all the positive data from the NJ kestrel nest box project, Breeding Bird Survey (BBS) data from the USGS (Fig. 5) still show a consistent decline in NJ. This suggests that nest site limitations are not likely to be the sole reason for the kestrel decline in NJ.

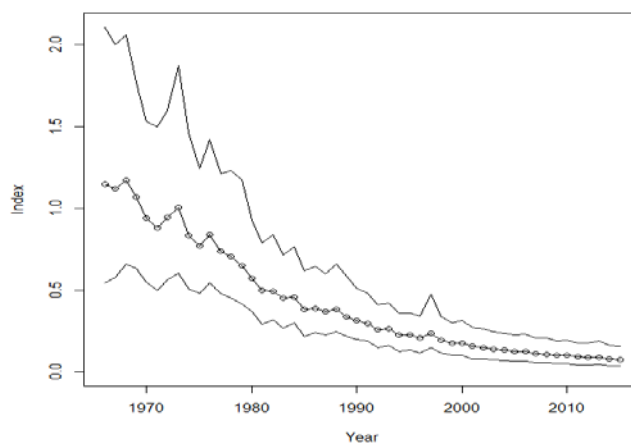


Figure 5. North American BBS kestrel population change per year within New Jersey 1966-2015 (Sauer et al. 2017)

Recommendations:

- Identify a sample of nest boxes in our most productive areas to determine occupancy by kestrels and competitors, kestrel productivity, and causes of mortality and nest failures. Attempt to quantify starling nesting competition.

- Review historical data to further identify and characterize unproductive nest boxes, and relocate them to locations in the largest patch size categories and to properties that are permanently protected from development in order to maximize use by kestrels.
- Investigate the possible effects of pesticides, cultivation practices, and other factors on kestrel success.
- Continue to evaluate the effectiveness of the nest box program in aiding kestrel recovery.
- Recruit and train additional Citizen Scientist volunteers to monitor nest box activity throughout the breeding season.
- Increase efforts to capture and band adult kestrels and maintain efforts to band all nestlings to enable evaluation of survival and site fidelity.
- Develop a framework and funding for investigating kestrels' use of habitats along their migration routes, and the significance of habitat loss along those routes, using geolocator data as examples.
- Draft an update to the comprehensive report and create a preliminary geolocator report with current findings to add to Raptor Webpage.
- Build relationships with other researchers across the northeast via the American Kestrel Northeast Working Group, and continue relationships with the Peregrine Fund's Kestrel Program.
- Continue to contribute feather samples to The Bird Genoscape Project.

References:

Sauer, J. R., D.K. Niven, J.E. Hines, D.J. Ziolkowski, Jr, K.L. Pardieck, J.E. Fallon, and W.A. Link. 2017. The North American Breeding Bird Survey, Results and Analysis 1966 - 2015. Version 2.07.2017 USGS Patuxent Wildlife Research Center, Laurel, MD

Woodland Raptors

Prepared by: Kathleen Clark, Supervising Zoologist

Objective: Gather and analyze data to inform conservation status and recovery plan actions of woodland raptor species.

Key Findings:

- Analysis of transect survey data was suspended after the preliminary analysis suggested that the data were not reliable enough to provide trends due to changes made in routes in response to habitat loss. The next step is to revisit the analyses for other conclusions and for informing redesigned survey methods. Additional work on the survey data was not completed due to time constraints that came with other work, including the barred owl research study and the NJ State Wildlife Action Plan revision.
- Staff plan to work on revised survey protocols that can make use of historic survey data as well as create useful information going forward. The distribution and abundance of woodland raptors (barred owl, red-shouldered hawk, Cooper's hawk, northern goshawk) are important data with which to monitor forest change and design forest management for SGCN species.
- ENSP staff had purchased a GPS telemetry system from Telemetry Solutions in 2013 when they were the only company offering a GPS transmitter that was small enough (<20g) for a barred owl. As reported in annual reports in 2013 and 2014, we had poor success with those tracking devices. We sent the units back after season one and asked that they be checked and tested; in season two, we had similar, poor success with the GPS units successfully recording location coordinates in about 20% of attempts. The manufacturer, Telemetry Solutions, could not explain the poor rate of recording location coordinates. A further problem was the battery life that was limited to about five weeks; that is a more common problem that tends to go along with small transmitter size and lack of solar-power recharge option.
- The data that was recorded by the GPS units showed a home range on two separate female barred owls, during the nesting season, that varied from ~250 acres (northern NJ, one 5-week period with 20% recording success) to ~600 acres (southern NJ, two 5-week periods with 20% recording success). We cannot,

therefore, make any conclusions about the home range and habitat use by barred owls based on this study to date.

Conclusions:

- Technology for telemetry is improving all the time, so in the near future it is likely that tracking devices will be available in the size range for barred owls. The project leader has discussed these issues with other researchers and with a different manufacturer who is developing a local, base-station system that can work on the limited home-range areas in which we are interested.
- ENSP has not had the staff time to devote to completing the analysis of raptor transect surveys, but we will be evaluating multiple survey techniques before adopting a method for future surveys.

Recommendations:

- We recommend pursuing the goals of this study, to adopt a survey protocol for woodland raptors for long term trend and distribution monitoring, and to identify the types of forest that will lead to beneficial forest management for these species.
- Seek to implement best management practices for forest-dependent SGCN birds within the state's forestry management system.