

Delaware Kestrel Partnership

2021 Nest Box Monitoring Annual Report

By: Abigail McBride & Jacque Williamson

OVERVIEW

The Delaware Kestrel Partnership (DKP) was created in response to state-wide and regional declines in American Kestrel populations. This partnership aims to create American Kestrel nesting opportunities by installing and monitoring nest boxes to document and assess nesting activity, productivity, and success of breeding populations of this state-endangered bird throughout Delaware.

Brandywine Zoo's Conservation & Education Department coordinates the data collection and field work efforts for the project. The data collected is shared with various research partners involved with the Delaware Kestrel Partnership. This program is a local, in-situ conservation project run by the Zoo that is concentrated in New Castle county and in recent years has grown to encompass all of Delaware. The project provides the Zoo, its staff, partners, and dedicated volunteers many opportunities to contribute to national research projects while directly studying a local endangered species.

2021 SEASON SUMMARY

Through the 8th season of DKP's American Kestrel nest box monitoring program, nesting activity (defined as at least one egg laid) occurred at seven out of 61 nest boxes. Seven adult Kestrels were successfully banded at the following nest locations: the University of Delaware farms in Newark (1), Winterthur garden (1), Delaware Nature Society Coverdale Farm property (2), Mount Cuba Center (2), and one box in Kent County on a private farm (1). As part of the study, a small aluminum leg band that is uniquely numbered from the USGS Bird Banding Lab (BBL) is placed on each Kestrel, both chicks and adults. This helps researchers know about the age, movement/migration, disbursement (leaving the area they were banded), nesting success, and other important data any time a Kestrel is recovered or re-sighted with its aluminum USGS leg band.



This was the first year that colored leg bands, or "auxiliary bands" were used in the project. The purpose of these is to help better identify Kestrel individuals from afar. The color bands used in 2021 were bright yellow with a black three digit number that is regionally unique to the project. Blood samples were also taken from all of the adults and chicks banded this year by Dr. Erica Miller, and will be sent to Hawk Mountain to be tested for Avian Influenza, West Nile, lead, rodenticides, and pesticides. Three unhatched eggs were collected from the project during the 2021 season that will be sent to Hawk Mountain for analysis. Chicks at 6 locations, with the University of Delaware box failing due to eviction by European starlings. In total, this season, 31 birds were captured - 24 chicks (14 females and 10 males), and 7 adult females. Chicks were color banded for the first time with 18 chicks receiving color bands on their right leg. Of these birds, 3 of the adult females were recaptured (1893-22619, 1893-23038, and 1363-81549) and one bird that was banded in 2019 was recaptured this season on a nest in New Jersey.



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

COVID-19

The COVID-19 pandemic continued through this year's nesting season and still proved to be a challenge for the project. Fortunately, monitoring was able to continue successfully after social distancing protocols were implemented for both monitors and banders. Banding events were reduced to only necessary banding personnel, the monitor, and the landowner/manager. Many of the staff and volunteers received COVID-19 vaccinations and face masks were required as well as maintaining at least a 6-foot distance between banders and others present whenever possible. Special thanks to all the monitoring volunteers and personnel for helping make this difficult season another successful one, and their dedication truly highlights that conservation doesn't stop- even in a global pandemic.

Kestrels in Decline and History of the Project

In 2013, North America's smallest falcon was down-listed to the Endangered status in Delaware. In response to that, the Brandywine Zoo began a monitoring program for American Kestrels in Delaware in 2014. This listing comes with classification of Species of Greatest Conservation Need in the state, due to Kestrels being found in less than 1% of their predicted distributions occurring within protected natural lands in the three state region include (Delaware Department of Natural Resources and Environmental Control & Delaware Division of Fish and Wildlife, 2015). Kestrels are also listed as Threatened in New Jersey (since 2012), Pennsylvania (since 2017), and Connecticut (since 2004).



For unknown reasons, Kestrel populations are falling across the continent. The Mid-Atlantic region has experienced a decline of more than 93% from their levels in the 1960s, the greatest of any region in North America. Varying theories accompany the Kestrel's coast-to-coast decline, with the main culprits likely a combination of loss of suitable nesting habitat, invasive species, pesticide accumulation, climate change, or new zoonotic diseases, however more research is necessary. Like many grassland bird species, American Kestrels require large, contiguous habitat patches to maintain viable breeding populations. The *2019 State of the Birds* report concludes that grassland birds are among the fastest and most consistently declining groups of birds in North America, with 53% of species declining significantly from the 1970s (North

American Bird Conservation Initiative, 2019). The goal of long-term monitoring of populations in Delaware will hopefully provide a reliable picture on population trends that will advance Kestrel demographics and influence conservation planning.

This project's presence/absence monitoring will provide insight into preferred nest sites as well as the Kestrel's demographics in Delaware. In cases where nest boxes are used by Kestrels, the DKP will band adults and fledglings under the Zoo's Curator of Education and Conservation's Master banding permits in order to further research of this small falcon's migratory movements, nest site fidelity, local territories, as well as taking biometric data, blood samples to screen for disease and harmful chemicals, and feather samples to contribute to research needs such as the Genoscape Project (more on this project below), and more projects as collaborative opportunities arise.



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

About the American Kestrel

The American Kestrel, *Falco sparverius*, is the smallest and most widespread of falcons in North and South America and is found from Nova Scotia to Tierra del Fuego. While populations in North America are abundant, overall their population has been steadily declining (Smallwood et al., 2009). This is especially observed in the Mid-Atlantic region of the United States, with current figures showing a decline of about 93% since the 1960s (The Peregrine Fund, 2019). Delaware has seen such great declines, 88% since the 1980s, that this once common bird was listed as “Endangered” in 2013 in the State after the completion of the 2012 Breeding Bird Atlas confirmed their presence in only 61 of 156 survey blocks (Patuxent Wildlife Research Center, 2012). Varying theories accompany the Kestrel’s nationwide decline, with the main culprits likely a combination of loss of suitable nesting and foraging habitat through both changes in land use (agricultural, residential, and urbanization) as well as competition for resources (by screech owls, northern flickers, or the invasive European Starlings), changes or increases in agricultural practices and the use of pesticides, climate change, or new pathogens and zoonotic diseases (such as West Nile Virus). However, none of these theories have yet been supported empirically (McClure, Schulwitz, Van Buskirk, Pauli, & Heath, 2017), leaving Kestrel researchers still searching for the elusive “smoking gun.”



Kestrels are secondary cavity nesters, meaning they do not build their own nests and rely on vacant cavities left by woodpeckers, squirrels, and other animals, or they will take up residence in any other available, similar-sized openings. Because of this reproductive trait, Kestrels will readily use man-made nest boxes and, therefore, are an easier raptor to study both under human care and in the wild.

Since Kestrels are cavity nesters, they do not bring in nesting material themselves but will “scrape” a cup into the substrate in the cavity. The man-made nest boxes used in DKP’s projects provide pine shavings in the box similar to what would be found in a natural nest cavity. A typical clutch size for Kestrels is five eggs, with one egg laid every 1 to 1.5 days. Though Kestrels lay eggs asynchronously, they don’t incubate until clutch completion, so asynchronous hatching is uncommon, though not unheard of.

Incubation is typically 30 days from clutch completion. Typically, all chicks hatch within one day of each other, and generally are banded between ages 14-22 days old, for DKP’s project banding typically occurs as close to day 22 as possible.

American Kestrels are arguably one of the most studied birds of prey, with research on this species conducted now for over half a century focusing on migration, reproductive and propagation studies, toxicity, development, genetics, habitat selection, and more. However, despite the wealth of studies conducted on them, Kestrel populations continue to decline for uncertain reasons.



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

The Delaware Kestrel Partnership

The Brandywine Zoo's American Kestrel nest box program started in 2014 and was the first in-situ field conservation project conducted by the Zoo in its 100+ year history. These efforts have included working with multiple partners, including nonprofit and governmental organizations, landowners and managers, and those with specific expertise specific to Kestrels as this project has grown. In 2016, we created a more formal, collaborative group with compatible goals called the Delaware Kestrel Partnership (DKP).

All of our partners bring different experience and knowledge bases to the table, and DKP partners and volunteers work with us in all project areas, help monitor boxes, lend expertise and guidance, advise on protocols, or collaborate on collected data.

This project is highly community-based, both with our local community here in Delaware as well as the Kestrel research community. With 61 nest boxes being monitored by 13 volunteers and one research intern donating more than 300 hours for this past 2021 season, this project has given the Zoo many opportunities to form relationships with public and private landowners and land managers across the state with appropriate Kestrel habitat. Many of these landowners did not know about the plight of the Kestrel or that they had preferable nesting locations prior to our approaching them for a nest box location, but we have found them to not only be amenable to our boxes but highly enthusiastic about the prospects of hosting a nest of these perky little falcons. Additionally, the Zoo does a fair amount of public outreach and education for the project on grounds at the zoo and in our local community to spread awareness and continue to recruit collaborators.



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

The Delaware Kestrel Partnership

Affiliation	Representative(s)	Title	Contact Information
Program Leader			
Brandywine Zoo	Jacque Williamson	Curator of Education & Conservation	Jacque.Williamson@delaware.gov
Program Partners – Steering Committee			
DE Fish and Wildlife	Jordan Terrell	Environmental Scientist II – Wildlife Biologist	jordan.terrell@delaware.gov
Delaware Nature Society	Jim White	Senior Fellow for Land	jim@delawarenatureociety.org
	Ian Stewart	Biodiversity Management Ornithologist	ian@delawarenatureociety.org
Project Landowner Partners			
Delaware Wildlands	Kate Hackett	Executive Director	khackett@dewildlands.org
Delaware State Parks	Chris Bennett	Environmental Stewardship Program Manager	Chris.Bennett@delaware.gov
Winterthur Museum & Gardens	Madeline Banks	Natural Resources Technician	mbanks@winterthur.org
Mount Cuba Center	Nate Shampine	Natural Lands Manager	nshampine@mtcubacenter.org
Longwood Gardens	Dr. Lea Johnson	Associate Director, Land Stewardship and Ecology	ljohnson@longwoodgardens.org
Waste Management	Adrienne Fors	Senior Community Relations Specialist	afors1@wm.com
Delaware Nature Society	Jim White	Senior Fellow for Land	jim@delawarenatureociety.org
Project Advisors			
American Kestrel Partnership (The Peregrine Fund)	Dr. Sarah Schulwitz	Director, American Kestrel Partnership	schulwitz.sarah@peregrinefund.org
University of Pennsylvania - Wildlife Futures Program	Dr. Erica Miller	Veterinarian	erica@jfrink.com
Delaware Ornithological Society	Matt Sarber	Liaison	matt@sarbereco.org



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

Nest Box Locations

As of 2021, the Zoo and DKP partners have installed and monitored, through a combination of volunteers, interns, and partners, 61 nest boxes across the state. The Brandywine Zoo has nest boxes installed on both private and public lands across the state, ranging from parks to conservation tracts. New Castle County, Delaware, currently has 50 nest boxes, Kent County has 1 box, Sussex County has 5 boxes, and 5 boxes in southern Pennsylvania. No new boxes were added to be monitored prior to the start of the 2021 season.



Project Goals

Our goal is to monitor populations long-term to hopefully provide a reliable picture of trends and identify premium habitat that will hopefully advance Kestrel demographics and influence conservation planning.

The Brandywine Zoo's overall research goal is to gain a better understanding for Kestrel populations and demographics in the Delaware Valley, but also to additionally contribute its data to multiple, ongoing national research projects. Ultimately, the goal of the Zoo and the DKP is to identify definitive causes for population decline in Delaware and work toward providing measurable solutions to alleviate regional population issues.

We make every effort to share our data as much as possible to continue to help this species on a national level. Since American Kestrels are found across two continents, are variably migratory depending on location, and issues causing their decline have yet to be determined, it is important to us that we share our data as much as possible, to whomever it will be valuable. We submit data annually to the American Kestrel Partnership (AKP), a project of The Peregrine Fund, and continue to collaborate with or share data with various researchers from tenured professors to doctoral students wherever possible.

Monitoring and Banding



This project has required fairly minimal input from a staff and budget standpoint. It is primarily funded by mini-grants and most of the monitoring in 2021 was done by a research apprentice from the Zoo and volunteer community scientists. Our year-long research intern and volunteers from the Zoo monitored the nests from late February through July in 2021. Monitoring in 2021 occurred every 8-14 days using a least-intrusive manner, where monitors use a GoPro-style camera on a telescoping pole to check boxes for nesting activity or observe from a distance for activity by the nest box. This allows our volunteers to check nest boxes without needing a ladder and without having to open the box and potentially stress nesting birds.

Box monitors:

- Look for Kestrels present in the box area, particularly presence of pairs and courtship behavior
- Monitor for evidence that Kestrels are using the nest boxes
- Record dates of nest establishment (appearance of a scrape or presence of eggs)
- Document Kestrel hunting and feeding behavior, if present



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

- Document fledging of nestlings
- Record weather and habitat changes each visit

Box monitors also:

- Monitor for European Starling presence or use of nest boxes, abating if requested by the landowner or by volunteer preference, by removing nesting material or eggs.
- Recording other site-specific data or presence of other species, specifically the presence of Eastern Bluebirds, Red-winged Blackbirds, European Starlings, Tree Swallows, Barn Swallows, American Robins, and other raptors present when visiting their boxes.
- In 2021, box monitors were asked to note the average ground cover/vegetation height in the four cardinal directions 50 yards from their box.

All data is recorded using an online Google form, and is accessible on mobile phones to be completed at the site.

2021 Kestrel Banding

Since 2017, this program has banded 124 birds;

- 17 birds total in 2017 - 11.6 chicks (11.6 denoting number of individual male to females/M.F ratio);
- 28 birds in 2018 – 11.11 chicks and 0.6 adults;
- 28 birds in 2019 – 9.13 chicks and 2.4 adults;
- 20 birds banded in 2020 – 4.9 chicks and 2.5 adults
- and 31 birds banded in 2021 - 10:14 chicks and 0.7 adults

In 2021, six nests produced chicks, with two of these nests having produced chicks in 2019 and 2020 (Delaware Nature Society [DNS] Ashland Clinton Road and Winterthur East Barn) and two of these nests were new successful nesting occurrences (Calhoun 1 and Mt. Cuba 5).



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

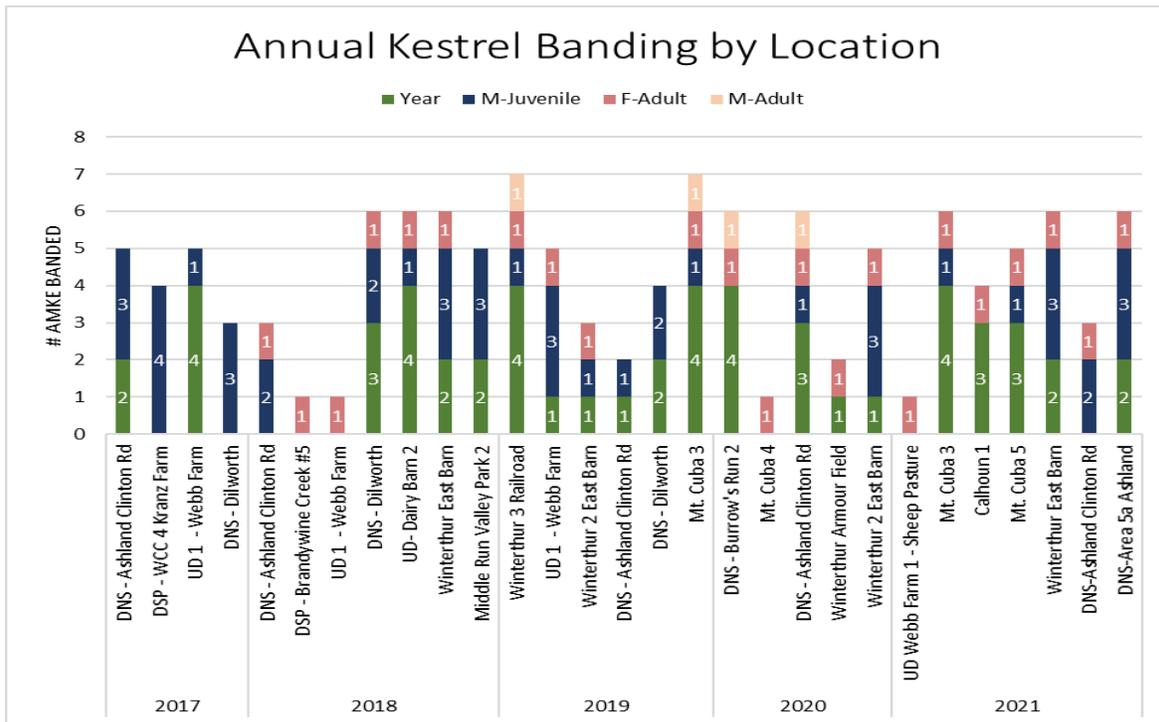


Figure 1 shows banding by location and year, documenting banding by gender and age.

Three of the adults captured in 2021 were previously banded (recaptures): one at DNS Ashland Clinton Rd box, one at Winterthur East Barn box, and one at DNS Area 5a box. All of the recaptures were adult females.

A bird that was banded in 2019 at the DNS Dilworth box as a juvenile that was recaptured in June 2021 in Somerset County, New Jersey and she was sitting on five eggs.

In 2021, we continued banding adult Kestrels by hand-grabbing birds from nest boxes while incubating eggs. This is a critical part of our project, as understanding adult demographics and behavior is an important focal area for Kestrel conservation and research. Moving forward, it is a project goal to begin banding Kestrels outside of nesting season, as the bulk of the data on Kestrels currently available is focused largely on nesting season.

To begin to further expand our knowledge on what Kestrels are doing once they leave the nest, we began preliminary surveys of active Kestrel boxes after fledging in 2020. Juveniles were seen nearby at all fledged boxes in the month following fledging at each box. To expand on these surveys and identify individual birds to better study site fidelity and dispersal, we aim to begin color banding adults and chicks in 2021.

EUST Abatement

Since 2016, the protocols of this program have included abating European Starlings (*Sturnus vulgaris*) from American Kestrel nest boxes in the hopes that these activities would decrease competition by Starlings for nest cavities or increase likelihood of nesting by Kestrels. European Starlings have a well-documented history as a persistent, invasive nest competitor for American Kestrels. They have been documented to occupy an average of 62% of Kestrel nest boxes in any



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

given study area (McClure et al., 2015), and Delaware is no different (we've averaged 60-65% since beginning the program). Historically with our project, abatement typically included visitation to nest boxes once every 7-14 days to check for Kestrel or Starling nesting activity, remove nesting material, addle or remove eggs, or euthanize chicks (if necessary). Starlings will dismantle the nests of competitors (Pearson 1942) and will renest even after researchers repeatedly remove their eggs and nesting material (Heusmann and Bellville 1978), and while Starling nests have been found on top of crushed Kestrel eggs, the reverse is also true (McClure et al., 2015). American Kestrels will sometimes prey on Starlings (e.g., Smith and Murphy 1973), and Koenig (2003) speculated that because of the Kestrel's larger size, it was unlikely that it could be evicted by a Starling. Balgooyen (1976) observed seven aggressive encounters between American Kestrels and European Starlings in California, presumably regarding nest sites, and stated that American Kestrels "take easy command" during those encounters. Kestrels will even prey on Starlings, and McClure et al. (2015) suggest that the "physical dominance of a female Kestrel over a European Starling suggests that if a Kestrel decides to fight a Starling for a nest box, the Kestrel will likely win, perhaps resulting in the death of the Starling." After reviewing preliminary data in 2019 showing that Starling abatement activities had little correlation to the presence of American Kestrels utilizing our nest boxes, as well as the process of abatement itself being a time intensive endeavor. We have allowed landowners to decide if they would like abatement to occur at their boxes since 2020. Landowners were notified they were "opted out" of abatement automatically and would need to "opt in" if they would prefer that we abate on their property. Volunteers were also allowed to abate if they had a preference to but were no longer required to abate unless specified by the landowner. In 2021 one Kestrel was evicted from a nest (UD-Webb Farm 1) where the clutch was destroyed by Starlings. To counter that, there was another instance during the 2021 season where a Kestrel evicted a Starling nest, took over, and laid a clutch that was successful. This one anecdote leaves a question whether Starling eviction by Kestrels varies from individual to individual.



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

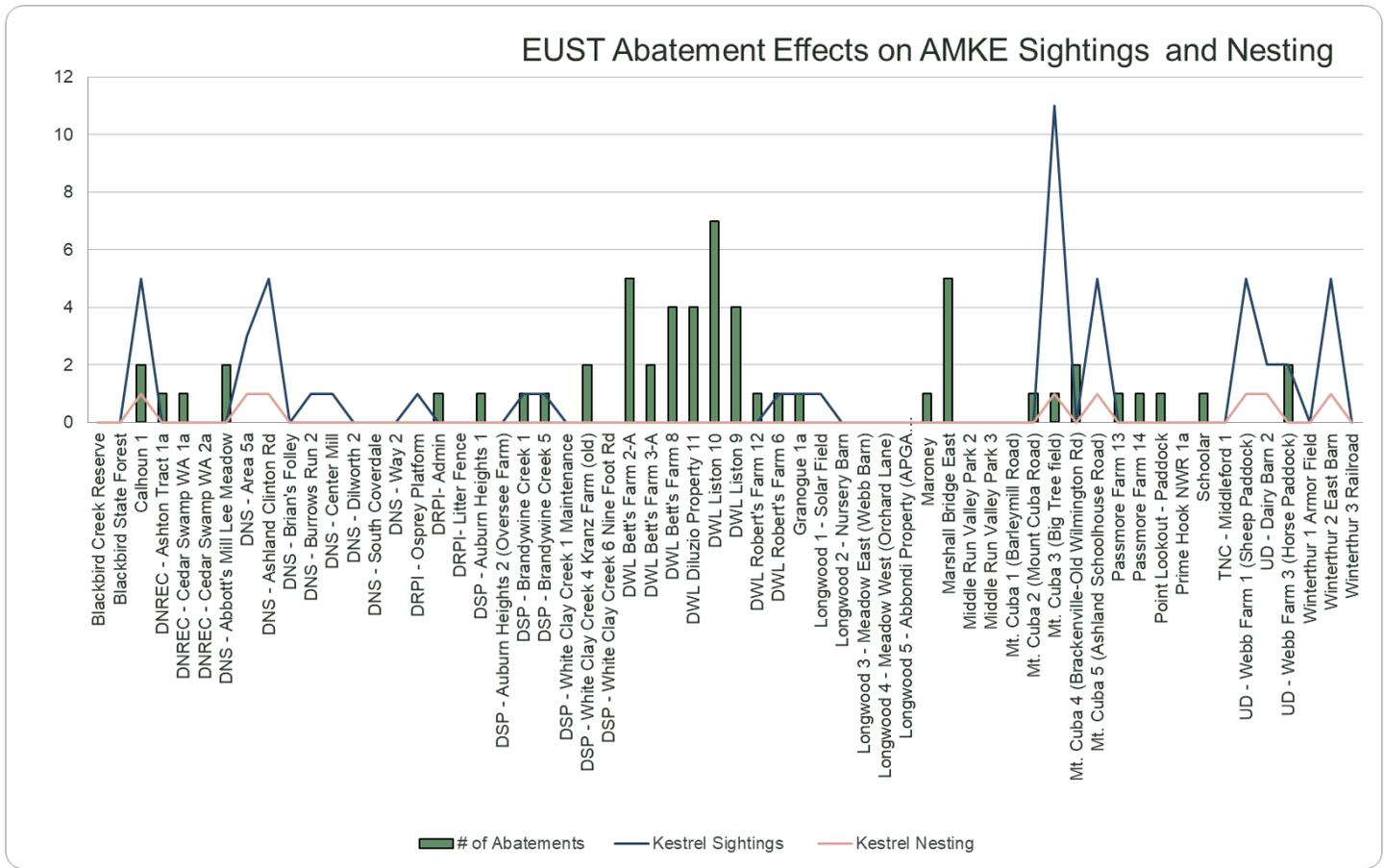


Figure 2 shows Starling abatement activities at all sites, as well as Kestrel sightings at these locations, between March 7 and June 27, 2021.

Other Target Species Presence

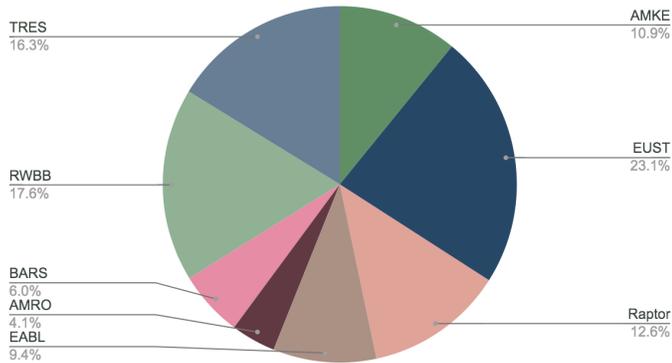
In 2021, we asked nest box monitors to continue to record sightings of other birds at nest box locations. These observations focused on 1) Eastern Bluebirds (EABL), as their highly insectivorous diet may be a predictor of adequate invertebrate prey for Kestrels and therefore a good indicator of quality habitat, they will also occupy Kestrel nest boxes, and may occasionally be predated upon by Kestrels; 2) European Starlings (EUST), documentation for this species is ongoing in the project, as they are nest box parasites and competitors for Kestrels; 3) Tree Swallows (TRES) and Barn Swallow (BARS), these species are also insectivorous and TRES will occupy Kestrel nest boxes, both may also harass and mob Kestrels, or may be predated upon by Kestrels; 4) Red-winged Blackbird (RWBB), noted due to their territorial behavior and high tendency to mob and harass Kestrels, potentially indicating why a nest box in otherwise seemingly appropriate habitat may be unoccupied; 5) American Robins (AMRO), who may also indicate adequate invertebrate prey; 6) Raptors, any raptor species noted in the vicinity of the box; 7) other species were noted by some monitors, but were not specifically targeted for identification purposes. 2021 provided a more thorough examination of the target species at our Kestrel box sites, as seen in Figure 3. Although we can see in 2020 that Kestrel activity and Kestrel nesting sites are quite similar, but more apparent differences are present in species such as Starling and swallows between Kestrel activity sites and no Kestrel activity sites, we will need more



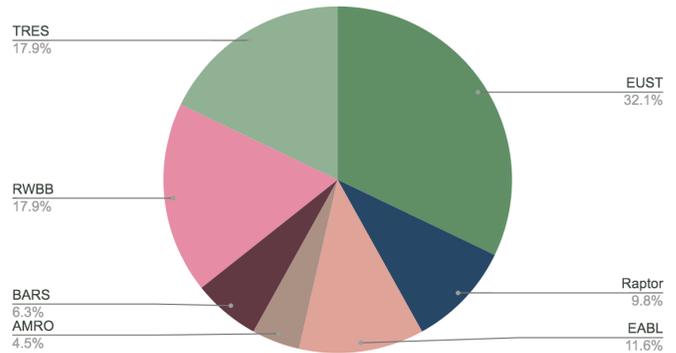
American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

years of data to properly conclude any correlations between the presence of specific target species and the presence (and nesting) or absence of Kestrels.

Species Sightings at all Boxes



Species Present at Boxes with AMKE Sightings



Species Present with AMKE Nesting

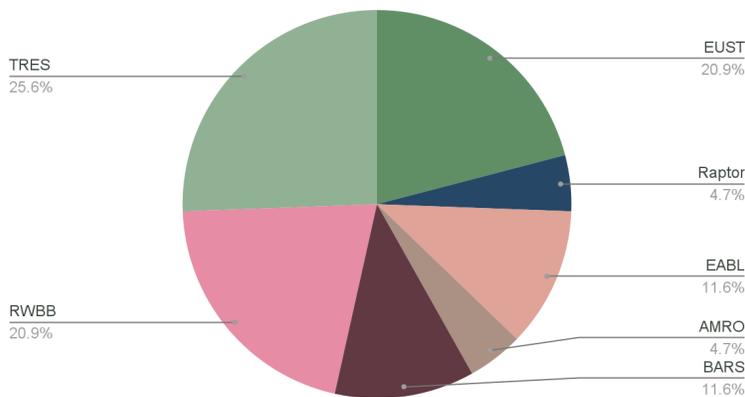


Figure 3-5: Starting from left to right and then to bottom, Figure 3 demonstrates the percentage of avian species sightings at all boxes, Figure 4 demonstrates avian species present at boxes with Kestrel sightings, and Figure 5 demonstrates avian species present at sites where there was Kestrel nesting.

Groundcover Height

DKP has been collecting the average height of the ground cover vegetation in each cardinal direction, 50 yards away from the box during each survey since 2020. This procedure was carried on in 2021 in hopes of learning more about American Kestrel habitat selection. As Kestrels are a grassland reliant species for both nesting and foraging, we would like to begin monitoring how drastic changes to the landscape each season could affect the nesting potential of a site. Sites such as Calhoun frequently see cuts to the fields adjacent to the Kestrel box in most years, and 2021 was no different as seen in Figure 6. More subsequent years of data will be needed to assess how a changing landscape could potentially be affecting overall Kestrel activity and nesting in our monitoring area.



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

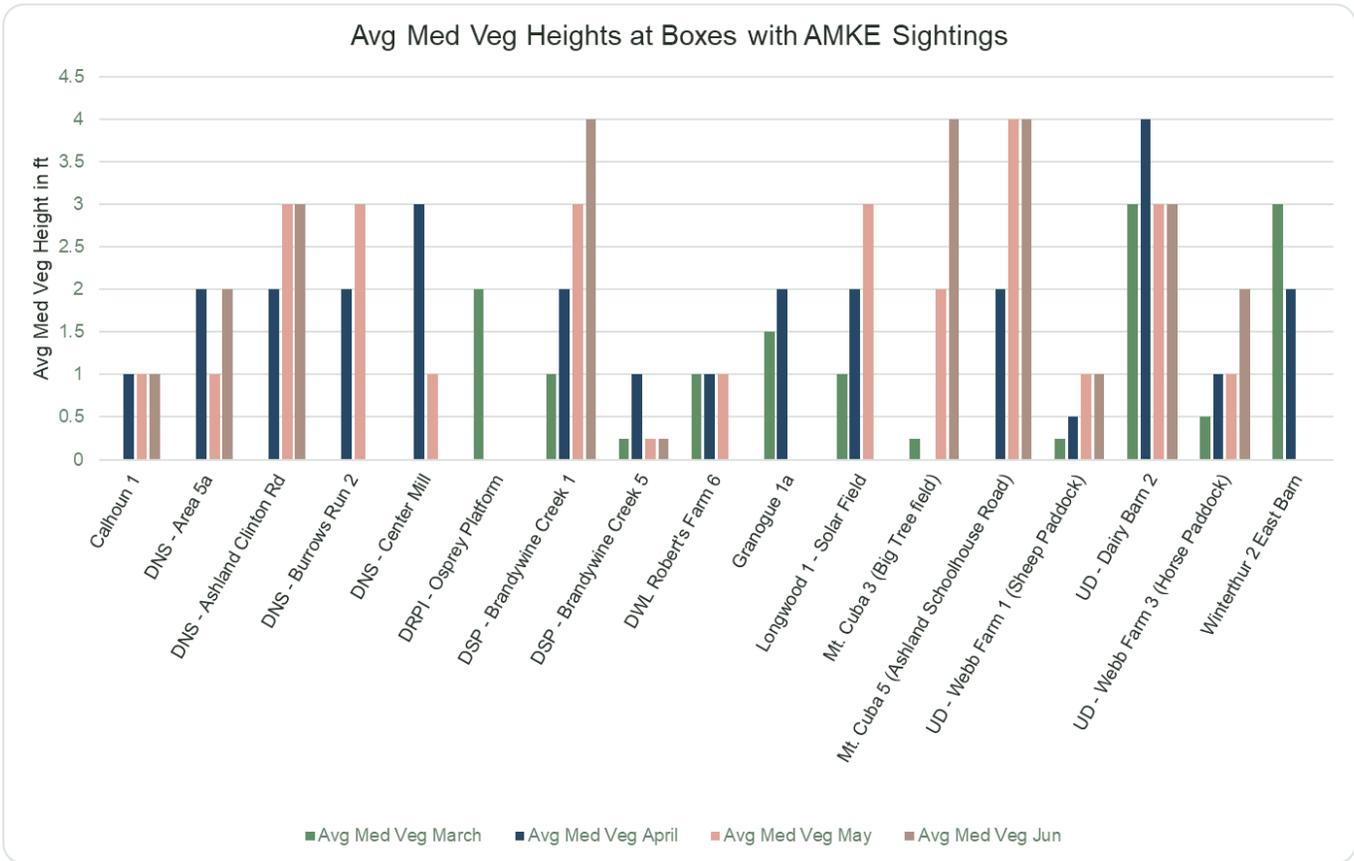


Figure 6 shows the average median vegetation height by month for sites that had American Kestrel sightings.

The story of Female American Kestrel 1363-81549.

One of the reasons American Kestrels are banded is in hope that the birds will be recaptured in following years. Every time a bird is recaptured, it tells a little more of the story about the species, their survival rates, their migration behavior, territories, or fidelity (faithfulness) to a nesting location. In 2018, an adult female was banded incubating 5 eggs at a nest box installed on Winterthur’s gardens in northern New Castle County. Three male and two female chicks successfully fledged from this box. In 2019, she was recaptured in a nest box at Mount Cuba Center, about four miles away, again on five eggs - all of which hatched. In 2020, female 1363-81549 was recaptured at Delaware Nature Society’s Coverdale Farm property in Hockessin at a nest box dubbed “Burrow’s Run,” which is about 2.25 miles northeast of the Mount Cuba box. There, she produced and fledged five chicks again- four females and one male. This year, we found her in yet another nest box! She was recaptured this time only about 0.4 miles away, really just on the other side of a large treeline, again at Coverdale Farm at a box named “Area 5a.” This June, three male chicks and two females of her’s were banded and they have all successfully fledged.

Female 1363-81549’s movement story, and nest box success, are only some of the stories we can tell. The more data we collect, we’ll be able to look at nestling success and survival rates from this particular female, who herself is considered very old for a Kestrel, whose average lifespan in the wild is 1-2 years. Since she was banded as an adult in 2018, we don’t know exactly how old she is, but it can be estimated she’s at least five years old this year! In years we are also able to capture the males, we can get a better idea about mate movement between our nests, too. As we dig into the data, and collect over the years, we are beginning to see what life on an annual scale looks like for Kestrels nesting in Delaware.



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

2021 Data

Summaries

Federal and State Lands (Delaware State Parks, DNREC properties, Prime Hook NWR)

American Kestrel Nest Box Summary:	2017	2018	2019	2020	2021
Nest boxes on State/Federal Lands:	16	27	13	13	13
Nest boxes installed for the 2021 Breeding Season:	8	6	0	0	0
American Kestrel sightings:	21	33	9	3	0
American Kestrel nesting attempts documented:	2	1	0	0	0
Eggs laid	4	5	0	0	0
Chicks hatched	4	5	0	0	0
Successful nesting attempts documented:	1	0	0	0	0
Number of American Kestrel chicks banded	4	0	0	0	0
Number of American Kestrel Adults banded	0	1	0	0	0
Number of American Kestrels banded:	4	1	0	0	0

Universities

	2017	2018	2019	2020	2021
Nest boxes on University land:	4	5	5	3	3
Nest boxes installed for the 2021 Breeding Season:	0	1	0	0	0
American Kestrel sightings:	23	30	16	5	9



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

American Kestrel nesting attempts documented:	2	2	1	0	1
Eggs laid	5	10	5	0	5
Chicks hatched	5	5	4	0	0
Successful nesting attempts documented:	1	1	1	0	0
Number of American Kestrel chicks banded	5	4*	4	0	0
Number of American Kestrel Adults banded	0	2	1	0	1
Number of American Kestrels banded:	5	6	5	0	1

Private Landowners

American Kestrel Nest Box Summary:	2017	2018	2019	2020	2021
Nest boxes on Private Lands:	6	7	7	8	8
Nest boxes installed for the 2021 Breeding Season:	2	2	0	1	0
American Kestrel sightings:	7	6	0	4	4
American Kestrel nesting attempts documented:	3	0	0	0	1
Eggs laid	0	0	0	0	5
Chicks hatched	0	0	0	0	3
Successful nesting attempts documented:	0	0	0	0	1
Number of American Kestrel chicks banded	0	0	0	0	3
Number of American Kestrel Adults banded	0	0	0	0	1



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

Number of American Kestrels banded:	0	0	0	0	4
--	----------	----------	----------	----------	----------

Municipal Landowners

American Kestrel Nest Box Summary:	2017	2018	2019	2020	2021
Nest boxes on Municipal Land:	7	7	5	2	2
Nest boxes installed for the 2021 Breeding Season:	3	0	0	0	0
American Kestrel sightings:	0	0	0	0	0
American Kestrel nesting attempts documented:	0	0	0	0	0

Private Organizations

	2017	2018	2019	2020	2021
Nest boxes on Private Organization Land:	19	33	27	36	36
Nest boxes installed for the 2021 Breeding Season:	1	9	0	15	0
American Kestrel sightings:	59	52	52	45	0
American Kestrel nesting attempts documented:	4	3	5	7	5
Eggs laid	8	15	23	26	25
Chicks hatched	8	11	18	13	21
Successful nesting attempts documented:	2	3	5	4	5
Number of American Kestrel chicks banded	0	11	18	13	21
Number of American Kestrel Adults banded	0	3	6	7	5



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

Number of banded American Kestrels Hacked:	n/a	6	n/a	n/a	0
Number of American Kestrels banded:	8	20	24	20	26

Grand Total

	2017	2018	2019	2020	2021
Nest boxes monitored:	52	79	71	62	61
Nest boxes installed for the 2021 Breeding Season:	14	18	0	16	0
American Kestrel sightings:	110	121	77	57	46
American Kestrel nesting attempts documented:	11	6	6	7	7
Eggs laid	17	30	28	26	35
Chicks hatched	17	21	22	13	24
Successful nesting attempts documented:	4	4	6	4	6
Number of American Kestrel chicks banded	9	15*	22	13	24
Number of American Kestrel Adults banded	0	6	6	7	7
Number of banded American Kestrels Hacked:	n/a	6	n/a	n/a	n/a
Total Number of American Kestrels banded:	17	27	28	20	31



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research

References

- Balgooyen, T.G. 1976. Behavior and ecology of the American Kestrel (*Falco sparverius* L.) in the Sierra Nevada of California. University of California Press, Berkeley, CA U.S.A.
- Bechard, M. J. and J. M. Bechard. 1996. Competition for nest boxes between American Kestrels and European Starlings in an agricultural area of southern Idaho. In D. M. Bird, D. E. Varland, and J. J. Negro (editors), *Raptors in Human Landscapes*, Academic Press, London. Pp. 155-162.
- Full Cycle Phenology. Who We Are: Boise State University, the American Kestrel Partnership, HawkWatch International, St. Mary's University, Environmental Laboratory of the U.S. Army Engineer Research and Development Center, and the University of California, Los Angeles; from <https://fullcyclephenology.com/whoweare/>
- Hawk Mountain Sanctuary Association. "Nestboxes for American Kestrels." Hawk Mountain, <https://www.hawkmountain.org/science/raptor-research-programs/american-kestrel-reproductive-ecology/page.aspx?id=3469>
- Heusmann, H.W., Bellville, R. 1978. Effects of nest removal on Starling populations. *Wilson Bulletin* 90: 287–290.
- Hilleary, Delora. "American Kestrels: A Guide to Biology and Nest Box Monitoring." Peregrine Fund, <http://hub.peregrinefund.org/system/files/posts/DmH%20-%20American%20Kestrel%20Packet%20March%202016.pdf>
- Kluscarits, J. R., J. J. Rusbuldt. "A Photographic Timeline of Hawk Mountain Sanctuary's American Kestrel Nestlings." Peregrine Fund, <http://hub.peregrinefund.org/system/files/posts/Klucsarits%20and%20Rusbuldt.pdf>
- Koenig, W.D. 2003. European Starlings and their effect on native cavity-nesting birds. *Conservation Biology* 17: 1134–1140
- Lutmerding, J. A. and A. S. Love. (2020). Longevity records of North American birds. Version 2020. Patuxent Wildlife Research Center, Bird Banding Laboratory 2020.
- McClure, Christopher J.W., Hilleary, Delora M., and Spurling, D. Paul, "American Kestrels Actively Exclude European Starlings from Using a Nest Box," *Journal of Raptor Research* 49(2), 231-233, (1 June 2015). <https://doi.org/10.3356/0892-1016-49.2.231>
- New Jersey Department of Environmental Protection. "American Kestrel Nest Box Survey Protocol." North American Bird Conservation Initiative, U.S. Committee. 2009. *The state of the birds United States of America 2009*. U.S. Department of Interior, Washington, DC. <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1397&context=usfwspubs>
- Pearson, T.G. 1942. *Birds of America*. Garden City Publishing Company, Garden City, NY U.S.A.
- Sexual Segregation by Habitat in American Kestrels Wintering in Southcentral Florida: Vegetative Structure and Responses to Differential Prey Availability Author(s): John A. Smallwood Source: *The Condor*, Vol. 89, No. 4, (Nov., 1987), pp. 842-849 Published by: University of California Press. Cooper Ornithological Society
- Smith, D.G., Murphy, J.R.. 1973. Breeding ecology of raptors in the eastern Great Basin of Utah. *Brigham Young University Science Bulletin*, Biological Series 18:1–76.
- Parrish, J. W. 2000. Possible prevention of European Starling nesting by southeastern American Kestrels at a power substation in southern Georgia. *Journal of Raptor Research*, 34:152.



American Kestrel Partnership of The Peregrine Fund, Delaware Division of Fish and Wildlife, Delaware Division of Parks and Recreation, Delaware Nature Society, Delaware Zoological Society, Delmarva Ornithological Society, Tri-State Bird Rescue and Research