AMERICAN KESTREL NEST BOX MANAGEMENT PROGRAM IN NORTHERN NEW YORK STATE

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Abstract—An American Kestrel nest box study was started in 2002 in northern New York State. The purpose of the study was to increase this species' local breeding population in the area, to educate the public on the importance of raptors and this species' plight in the region, and to act as an environmental monitor. The project was linked with a college accredited biology course at Brasher Falls Central High School in Brasher Falls, New York, and with the Raptors of the Adirondacks course at Paul Smiths College in Paul Smiths, New York. Approximately 130 nest boxes were maintained each season across 292 square miles in northern St. Lawrence and Franklin Counties. Chicks and adults were hand grabbed from the boxes or captured with bal chatris and were banded, aged, sexed, and their health was assessed. During the eight year study, the breeding population of kestrels increased from 51 to 297 kestrels on the study area. It appears that lack of availability of suitable nesting cavities has been a major limiting factor for our breeding population.

American Kestrel (*Falco sparverius*) is the smallest falcon in North America and a widespread breeder throughout New York (Spahn 1998). The kestrel is a cavity nester that breeds primarily in open country, especially in agricultural districts, along roadsides, and wherever there are fields, meadows or even swampy areas with dead trees (Smallwood and Bird 2002). In recent years its populations have declined in the Northeastern United States (Katzner et al. 2005). Nye (2008) noted in the second Breeding Bird Atlas of New York State that the breeding kestrel population in New York State has declined since the first Breeding Bird Atlas 20 years earlier. Lack of suitable habitat and a dearth of nesting cavities have contributed to the species' decline (Askins et al. 2007), and Bildstein (pers. comm.) has suggested that increasing Cooper's Hawk (*Accipiter cooperii*) populations in the Northeast may have negative impacts on kestrel populations. Kestrels require open habitat with a wide variety of perches to hunt from (Smallwood and Bird 2002) coupled with cavities for nesting. Balgooyen (1976) stated that the availability of suitable nesting cavities could limit its population in many parts of its range.

Nest boxes have been used to increase kestrel populations in the United States since the 1950s (Kratzner et al. 2005, Steenhof and Peterson 2009, Bloom and Hawks 1983, Hamerstrom et al. 1973 and Griggio et al. 2002). In 1995, very few nesting kestrels were observed in northern St. Lawrence and Franklin Counties in New York State. One pair of kestrels was observed nesting in a

fence post cavity about four feet off the ground, with the chicks stacked tightly on top of each other (pers. obs.). Hamerstrom et al. (1973) determined that the lack of cavities was a major limiting factor to her breeding birds in central Wisconsin and it appears that the lack of cavities is limiting the size of our local breeding kestrel population. The goals of the study were to increase the kestrel population on the study area by placing and maintaining at least 130 nest boxes annually, use the project as a long term environmental monitor, and educate those who worked on the project in ecology and conservation. Because working with these tiny falcons provided a great environmental educational opportunity, I linked the project with my biology classes at Brasher Falls Central High School in Brasher Falls, New York and Paul Smiths College in Paul Smiths, New York.

FIELD SITE AND METHODS

Field Site The study area is located in northern New York in northern St. Lawrence and Franklin Counties and encompasses 186,814 acres (292 square miles) (Fig. 1). The area falls mainly within the St. Lawrence River Transition Zone with a small percentage falling within the St. Lawrence River Plains and the Malone Plain (Andrle and Carroll 1988). The area is composed of 45,956 acres (25.7%) of open lands, including pastures, fallow fields, and croplands; 102,098 acres (54.6%) of forest; 26,882 acres (14.3%) of wetlands; 498 acres (0.2%) of successional lands; 7,933 acres (4.3%) of open water; 1339 acres of roads; and 107 acres of urban lands. These percentages were determined using GIS and aerial photographs taken in 2000.

Nest Boxes and Placement In 2002, 112 nest boxes were built in class by students and installed throughout the study area on utility poles, trees (both live and dead), and old buildings or barns. Several more boxes were added through the years, and as of the 2009 breeding season, the number had risen to 144 nest boxes and one artificial cavity in an old barn. During the study, 107 students helped build boxes and position nest boxes on the study area. Since the 2007 breeding season, 130 of the 144 nest boxes (90%) were mounted on utility poles. All nest boxes were placed on private lands and landowner permission was obtained before placement. Generally the nest boxes were oriented to face in a southeastern direction and were between 12 and 14 feet above the ground. Nest boxes are positioned at varying distances from each other with the closest boxes positioned 0.2 miles from each other. The nest box style that was used has been described and used by Hawk Mountain Sanctuary (www.hawkmountain.org). Nest boxes that did not have any kestrel activity for five consecutive years were relocated to another area with more potential for usage by kestrels.

We tried to place all new boxes and replace all boxes in disrepair before March 31st of each year. Early preparation of nest boxes was done during the season so the boxes were ready for the next breeding season and not disturbed while breeding adults had returned to territories. All nest boxes were examined to determine their integrity and boxes that had fallen down or been damaged

during the winter were replaced and/or repaired. Boxes used during the previous season were cleaned out and wood chips placed in the box for nesting materials. We attempted to maintain at least 130 usable nest boxes annually.

Nest Box Visits All nest boxes were visited during a 5-6 day period starting on or near 24 June. The status of each box and its contents were recorded. Upon arrival, a researcher quickly blocked the opening to the nest box with the end of an extendable fiberglass pole. Once the opening was blocked, a second researcher would position a ladder under the box and climb up to observe what was in the box. To minimize mammalian predation, no scent trails led directly to the base of the poles (Griggio et al. 2002). All chicks 10 days old or older and all parents caught in the box were banded. Each bird was also sexed (Pyle 2008) and their health was assessed by searching for injuries, feeling for muscle and fat mass around the keel, and feather condition. If any parasites were found on the birds, they were sprayed with Scalex Mite and Lice Spray for birds. Adult birds were also sexed by examining the color of the wings (Pyle 2008). All birds were returned to boxes before we left. Adults with very young chicks or eggs

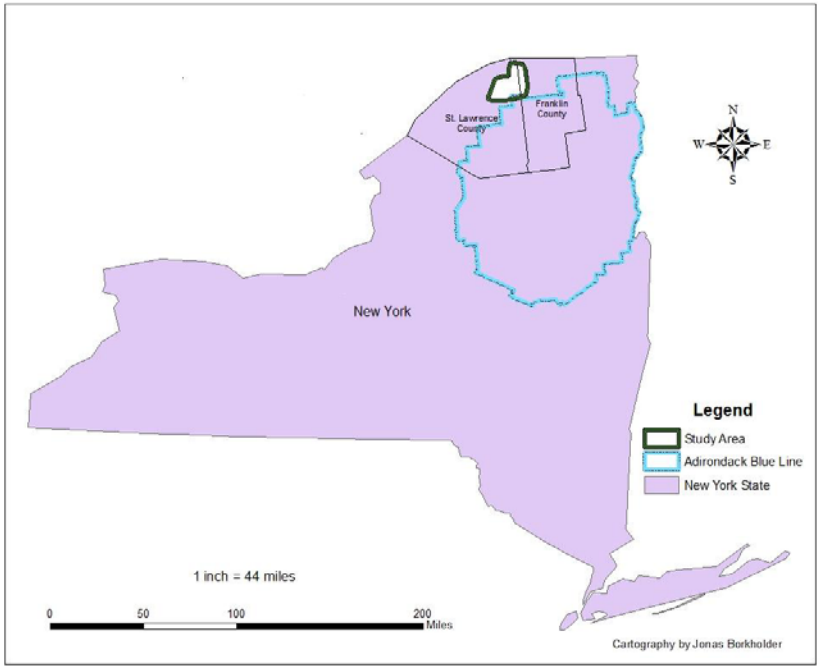

Figure 1. American Kestrel Study Area. This region has a temperate climate with an average maximum temperature and precipitation during the breeding season (May through August) of 24.2° C and 64.8 mm, respectively. The area extends north to the Mohawk Territory at Akwesasne and south to the Adirondack State Park (Fig. 2). The village of Potsdam is on the southwestern corner and the villages of Winthrop and Brasher Falls are in the center of the area.

were not allowed to leave for several minutes after being banded by blocking the hole for a period of time, to discourage them from deserting their nests. If eggs or chicks younger than 10 days old were found, the boxes were revisited when the chicks were expected to be large enough to band. To minimize disruptions, the nest boxes were visited only enough times to ensure that all chicks within the box were banded.

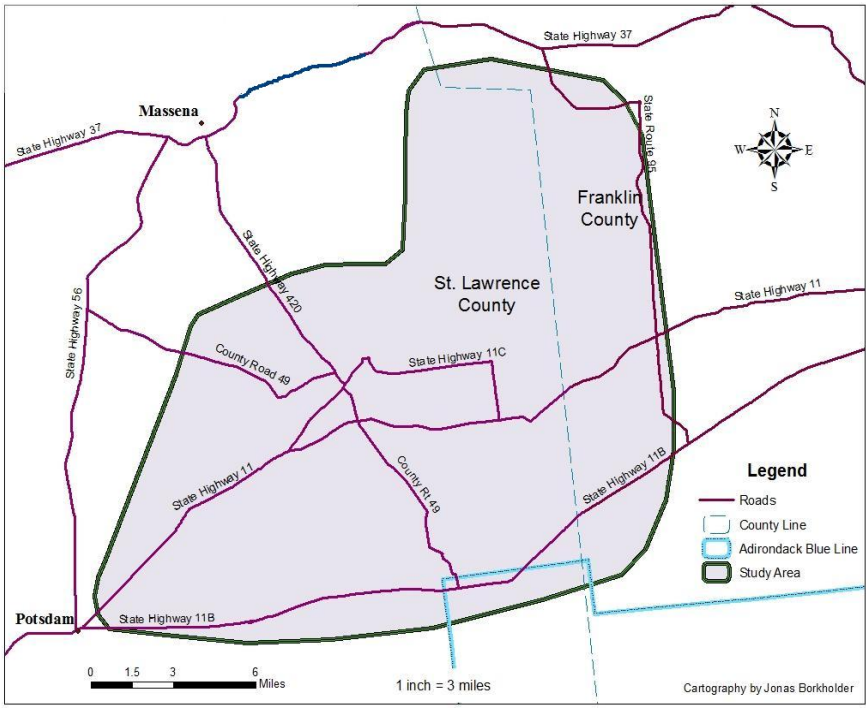

Figure 2. Kestrel Study Area with Adjacent Villages and Main Roads. Land use in the study area has changed dramatically over the last 50 years. According to the US Census of Agriculture Department the number of farms in Franklin County decreased 53% from 1293 farms encompassing 244,054 acres in 1959 to 605 farms encompassing 131,300 acres in 2007. During the same period the farms in St. Lawrence County decreased 61% from 3426 farms encompassing 718,418 acres to 1335 farms encompassing 348,500 acres. Acreage farmed in both counties decreased 50% from 1959 to 2007 (USDA 2010). These changes in land use likely reduced the open foraging habitat required by American Kestrels and may have also reduced available nesting sites.

Trapping Adults and Fledged Chicks We attempted to capture all adults and fledged chicks that were not hand grabbed from boxes using bal chatris baited with mice and left near the nest boxes or dropped out of a moving vehicle while passing a perched bird (Berger and Mueller 1959). Kestrels caught by this method were then associated with the nest box that they frequented. Birds that

frequented natural cavities and structures other than the boxes were also found and their locations noted.

Overall Population in Study Area American Kestrels observed within the study area were counted during surveys between 24 June through 15 August and an estimate of population size was made. To be counted, the kestrels needed to be banded from an active nest or counted at least three times in the same location during the breeding season. Chicks were only included in the estimate of total kestrel numbers if they were banded or counted from an occupied nest. All roads in the study area were driven at least five times and potential nest sites were investigated throughout the season before kestrel activity was assessed at each location. We focused on areas where kestrel activity was detected until the source of the kestrel activity was determined. By 15 August, all researchers on the project independently determined how many kestrels were on the study area, numbers were compared, and an average total value calculated and agreed upon. The total number of kestrels on the study area had to be agreed upon by all researchers before the number was accepted as that year's total.

RESULTS

Nesting Attempts and Success Rates The number of nesting attempts, defined as nests with at least one egg in the nest box, increased fairly consistently from 10 attempts during 2002 to 68 attempts in 2009. These values correspond to occupancy rates of 8.9% in 2002 and 46.9% in 2009 (Fig 3).

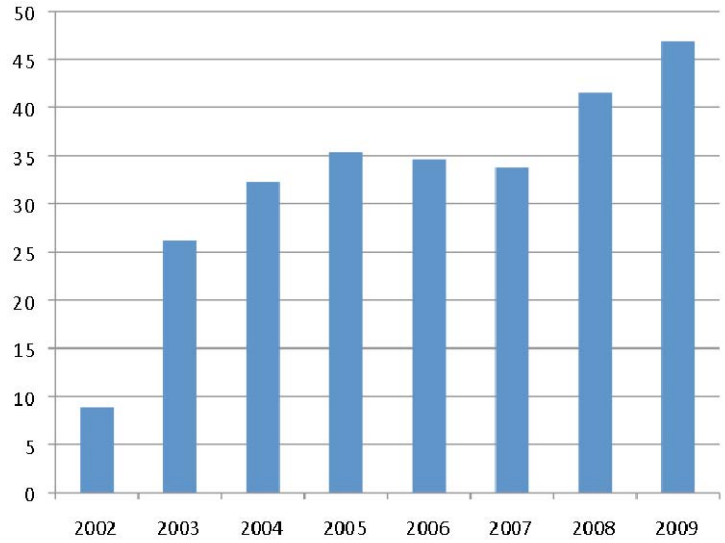

Figure 3. Percentage of nest boxes used in nesting attempts.

Of 342 nesting attempts observed throughout the study, 181 produced chicks (52.9%). Among 161 boxes that had young when they were checked, brood size averaged 3.5 chicks per nest box. Annual values for brood size were consistently about 3.5-4.0 during seven of the eight years, but during 2006 there were only 2.4 chicks per nest (Fig. 4). These numbers are consistent with those found in other studies: Balgooyen (1976) found the mean brood size from 42 natural sites in California was 3.6 and Bloom and Hawks (1983) found the mean of 65 nest boxes in California was 4.0. The lower value in 2006 was probably due to excessive heat during the incubation period that year, as daily high temperatures averaged 90° F during May 2006, and several clutches of eggs were found to be addled that season. In 20 other nests, brood size was not determined because chicks fledged before we checked the boxes.

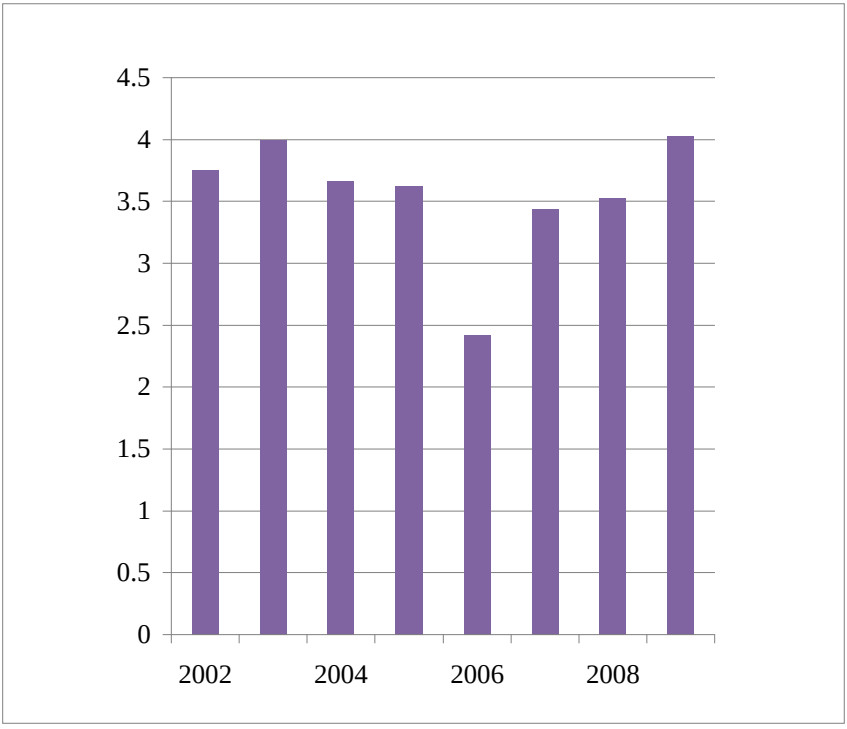

Figure 4. Average Brood Size per Successful Nest.

The percentage of nesting attempts that fledged at least one chick varied from 36% in 2003 to 61% in 2007 and averaged 50.6% (173 out of 342) over the eight years of the study (Table 1). Actual numbers of chicks fledging each season are unknown because nests in which chicks were banded were rarely revisited until after the chicks would have fledged.

Table 1. Summary of nesting success.

	2002	2003	2004	2005	2006	2007	2008	2009	Avg
Nest Boxes	112	126	130	130	130	130	130	145*	129.1
Attempts	10	33	42	46	45	44	54	68	43.5
# Successful	4	12	17	26	18	27	32	37	22.5
% Successful	40	36	40	56	40	61	57	54	50.6
# Failed	6	21	25	20	27	16	22	31	21.0
% Failed	60	64	60	44	60	39	43	46	49.3

* One nesting attempt occurred in a barn structure and is counted as a nest box.

Nesting success was affected by raccoon (*Procyon lotor)* predation on three nests, by extreme heat during incubation during the 2006 season, and by wet cooler weather during the 2009 season. One nest box lost a chick to cat (*Felis catus*) predation and metal flashing was attached to the pole to stop any additional losses from mammalian predation. Metal flashing spray painted to blend in and dull the shine has been attached to certain poles to discourage predation. Dead mice were left at nests where the parents and chicks were under nourished.

Two pairs of orphaned chicks were fostered out to other nests with chicks of comparable age and size. The first pair of orphans was brought to us in 2008 by a New York State licensed wildlife rehabilitator. The second pair came from a nest box on the study area and were fostered out to a new family when both parents were discovered drowned in a horse trough. A third brood, consisting of four chicks, was found in very poor condition during the 2009 season. One chick was dead and partially eaten and the other three were extremely emaciated and dehydrated. The surviving chicks were taken to a local wildlife rehabilitator. During the night, two of the remaining chicks died. The surviving chick become imprinted on humans, was not able to be released, and is now a falconry bird.

It is unknown how many failures are caused by human activity, but one nest failed in 2009 when the nest box containing eggs was shot with a shotgun. The status of the adults was unknown. Disruption of adults on eggs undoubtedly has caused some desertions. To minimize nest desertions caused by our research activities, we attempted to visit nests only after eggs had hatched.

Other Uses of Nest Boxes by Wildlife Kestrels used nest boxes not only as nest sites, but also as roosting sites and feeding and hunting platforms. If pellets or feathers were found at a nest box, or if kestrels were seen in or on the boxes, the box was considered used by kestrels. Other wildlife also used the nest boxes during the breeding season, and the presence of any species of wildlife inside the boxes during visits was recorded.

Kestrel use peaked during the 2009 season when 68 of 145 boxes (46.9%) were used (one nest was in a barn structure but was counted as a nest box). Overall use of boxes by American Kestrels and other wildlife was lowest during the initial season, when 29 of 112 boxes were utilized (25.9%), and highest during the 2008 season, when 94 of 130 boxes (72.3%) were utilized. Other species that were found in nest boxes included Wood Duck (*Aix sponsa*),

Northern Flicker (*Colaptes auratus*), Great Crested Flycatcher (*Myiarchus crinitus*), Tree Swallow (*Tachycineta bicolor*), European Starling (*Sturnus vulgaris*), Common Grackle (*Quiscalus quiscula*), House Sparrow (*Passer domesticus*), an unidentified bird's nest, White-footed Mouse (*Peromyscus leucopus*), Red Squirrel (*Tamiascurus hudsonicus*), Gray Squirrel (*Sciurus carolinesis*), as well as ants (*Camponotus spp.*), and bees (*Bombus spp.*).

Kestrel Numbers The number of chicks banded annually has risen drastically during the first eight years of the study. During the initial season, only 15 chicks were banded, whereas by 2009, 145 chicks were banded (Table 2). There have been relatively few natural nests found throughout the years. In 2009, there were 37 successful kestrel nests in natural cavities and buildings and 66 young produced from these nests. Two pairs of kestrels were found to have nested in the same barn at the same time during the 2009 season. One pair used a cavity on the north side of the barn and hunted lands north of the barn and the other used a cavity on the south side of the barn and hunted lands south of the barn.

A total of 1372 total kestrels were judged to be present on the study area over eight years. These consisted of 564 banded chicks and 808 adults, of which 91 (11.3%) were banded. Of the 564 chicks banded from the nest boxes, 256 (45.4%) were males and 308 (54.6%) females.

Table 2. Chicks and Adults Banded and Total Kestrels Present on the Study Area.

	2002	2003	2004	2005	2006	2007	2008	2009	Avg
Chicks banded	15	49	55	76	29	86	109	145	56.4
Total banded	17	52	56	79	31	90	151	179	81.9
Total present	51	108	156	200	131	186	243	297	171.5

DISCUSSION

Through the first eight years of this study, the number of kestrels on the study area has risen to almost 600% of the initial level. Suitable nesting cavities appear to be a major limiting factor of the American Kestrel on the study area. Predation and over-heating remain as obstacles to nesting success in the boxes and need to be addressed. The addition of flashing near the base of each pole and a thicker entrance hole may eliminate some losses due to both mammalian and avian predators. The addition of side vents may also mitigate the effects of excessive heat. The nest boxes have also been effectively used by other species of wildlife throughout the nesting season, and we regard this as a strength of the program. Prey abundance and availability should be monitored to determine if this factor influences clutch size or fledging success.

During the past season, two adult kestrels returned to breed in the same nest boxes where they had fledged chicks the previous year, and a chick fledged last

year returned to breed successfully in a box eight miles northwest of its natal box and which previously had been used just once before (a failed attempt seven years earlier). Steenhof and Peterson (2009) states that returning breeders tend to return only if successful the previous year. Both returning kestrels had been successful the previous year and were again successful after returning. A box used by one of these returning adults was the most successful box on the study and had seven nesting attempts during the eight years (87.5%). Five of the seven attempts were successful and 13 banded chicks and an unknown number of fledged chicks were produced. The other returning adult nested in a box that was less than 0.5 miles from the other repeat breeder. This box was used in a total of three nesting attempts over eight years (37.5%) and produced nine chicks in the past two years. The availability of these nest boxes may have been a major contributing variable that brought these birds back to breed. It is obvious from this study that nest boxes can and do contribute to the growth and maintenance of American Kestrel populations in this region.

Another benefit of this program involves the sense of ownership of the kestrel breeding population that has developed in the 107 students that have worked on the project. The level of commitment to the study displayed by the students has varied from just assisting in the building of the nest boxes during class to devoting an entire summer on the project. All students, regardless of level of commitment, have become more aware and protective of the American Kestrel throughout the region. Several students have been employed in other raptor research projects due to the interest and experience they developed while participating on the kestrel study.

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