The Raptor Population Index (RPI) Project Update

The Case of the American Kestrel

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New Jersey's Cape May Bird Observatory reported a seasonal total of 5,255 American Kestrels during the autumn hawkwatch of 2006. This count is more than 40% below the 30-year average of 9,271 typically reported for the period of September-November each year.

In other eastern hawkwatches, a similar tally is reported: Hawk Mountain had 412 kestrels, roughly 30% less than its 40-year average; Holiday Beach, Ontario, recorded 2,113 kestrels, also nearly 30% less than its 30-year average. I could present a similar picture for many of the monitoring sites across the continent.

What is happening to American Kestrel populations? The red flags have been raised for several years now, and the search for the reason, or reasons, why the smallest falcon in North America is declining are still unclear.

I prepared this short note to present the available evidence of American Kestrel declines and to briefly discuss the four hypotheses that are currently being explored in order to solve this mystery.

Is the American Kestrel Declining?

The answer is a sound yes. Available data on kestrel populations comes from several different data sources: migration counts, the Breeding Bird Survey (BBS), Christmas Bird Count (CBC), and also from regional nest box programs.

The validity of the information that originates from different survey types to support this statement was discussed earlier. Migration counts were used in the past to determine population trends of this and other species (e.g. Bednarz et al. 1990, Hoffman and Smith 2003). However, the use of BBS data to monitor populations of most species of raptors has been questioned. Although the purpose of this paper is not to discuss the comparative value of different surveys and their adequacy for various species, I should say in this case (and for other species that inhabit open habitats and are easily detected along survey routes), the data have considerably more value than for raptors that occupy forested habitats and are consequentially less easily seen or detected.

Because the American Kestrel is a partial migrant, a species whose winter range largely overlaps its breeding range and which also falls largely within the well-sampled area of southern Canada and the United States, using CBC data to support these statements has considerable value.

Raptor Population Index Project Data

Here I use migration count data recently analyzed by Chris Farmer, the North American bird monitoring coordinator at Hawk Mountain, to present a more accurate picture of the current situation of the American Kestrel (Farmer 2007).

In the east, data analyzed by Farmer originates from seven long-term data sets in five states and provinces. The time series analyzed includes the last 30 years of counts, in which a long-term reference of those declines is presented. However, the sharpest declines in kestrel populations were reported within the last 10 years, so a second estimate of change is presented in a column that contains the most recent decade of data.

Table 1. Percentage of annual change (decrease [-] or increase [+]) in seven raptor migration monitoring sites from eastern North America (source: Farmer 2007). Statistically significant trends (not likely due to chance) are marked with an asterisk.

Raptor Migration Monitoring Site	Annual Change 1974-2004	Annual Change 1994-2004
Lighthouse Point, CT	-3.1*	9.2*
Cape May, NJ	-4.5*	-4.5*
Montclair, NJ	-3.3*	-3.3*
Hawk Mountain, PA	-1.6*	-4.8*
Waggoner's Gap, PA	-0.3	+0.9
Holiday Beach, ON	-0.4	-4.1*
Hawk Ridge, MN	+3.2*	-0.7

Thirty-year declining trend estimates based on migration counts are robust in most cases, with the exception of Hawk Ridge. However, a look at the most recent decade shows significant declines in most sites, including Hawk Ridge. The single exception is Waggoner's Gap, which shows an increasing trend in the most recent decade (which is not statistically significant).

If such widespread declines are a true population change, then one might expect a strong correspondence with the demographic "signal" detected in other surveys from the American Kestrel's breeding or winter ranges. Data from BBS routes in Connecticut, Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, New Brunswick, Nova Scotia, Ontario and

Québec, where kestrels presumably originate, show a negative trend of 1.4% per year in the period 1976-2003 (Sauer et al. 2004).

CBC data from the same states and provinces listed above, and for the same time period, show a statistically significant, decreasing trend of 4.6% per year. This rate of decline is not as alarming in CBC data from the kestrel's winter range in Delaware, Florida, Georgia, Kentucky, Maryland, North Carolina, South Carolina, Tennessee, Virginia and West Virginia, which shows a decline of 1.4% per year in the period 1974-2004 (National Audubon Society 2002).

Western migration count data offers a picture with a few more complications to interpret, in part because the overall migration coverage is shorter (only two sites have data that extends 17 years or more), but also because it is geographically more extensive.

Data comes from eight sites located in eight states, where only the most recent decade of data has a similar coverage for all the western sites. The result of Farmer's analyses (which, in the case of western sites was developed in close collaboration with Jeff Smith, science director of HawkWatch International), emerge with a similar general pattern: declines in most sites, in the majority of cases of a larger magnitude, and with statistical significance in four of the sites (Table 2). The one site that is an exception to this statement, the Manzano Mountains, shows an increase that is not statistically significant.

Table 2. Percentage of annual change (decrease [-] or increase [+]) in eight raptor migration monitoring sites from western North America (source: Farmer 2007). Statistically significant trends are marked with an asterisk. [a]Long-term trend data from the Manzano Mountains is from the period 1985-2005, and data from the Goshute Mountains is from the period 1983-2005.

Raptor Migration Monitoring Site	Annual Change 1987-2004[a]	Annual Change 1995-2005
Wellsville Mountains, UT	-3.6*	—
Manzano Mountains, NM	+0.1	+0.1
Goshute Mountains, NV	+3.4*	-5.9*
Bonney Butte, OR	—	-7.9*
Lipan Point, AZ	—	-4.1*
Wellsville Mountains, UT	—	-8.6*
Chelan Ridge, WA	—	-11.7
Yaki Point, AZ	—	-2.7

On the other hand, the corresponding BBS data from the presumed breeding region of the western American Kestrel in Arizona, California, Idaho, Nevada, Oregon, Utah, Washington, Montana, Wyoming, Colorado, New Mexico and British Columbia report annual decreases of 1.7% per year in the period 1983-2004 (Sauer et al. 2004).

Similarly, CBC data for over two decades (1983-2005) show a decrease of 1.5% per year in the states and provinces of Alaska, Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming, Alberta, British Columbia, Northwest Territories and the Yukon Territory. The trends for the same states for the period 1995-2005 are decreases of 2.3% per year (National Audubon Society 2002).

It is worth noticing that both estimates (migration count and CBC data) tend to increase its values when the time period under analysis is only 10 years, as supposed to 20 or 30 years. The estimates of annual change from migration counts tend to report a higher percentage of annual change than both the BBS and CBC data.

The Four Hypotheses

There is no simple answer to the question of why American Kestrels are declining. Evidence is starting to emerge, and ornithologists have stated four main hypotheses to explain the declines. David Bird, a professor of natural resources at McGill University in Québec and a renowned kestrel specialist, is organizing a one-day symposium this September to address this question during the joint Raptor Research Foundation HMANA conference in Fogelsville, Pennsylvania.

One of the objectives of this symposium is to discuss the extent and nature of American Kestrel declines as reported by different surveys and to explore the possible reasons of such declines. In his recent Conservation Status Report, Farmer (2007) offers insight into four possibilities:

Contamination. The effects of DDT in the reproductive success of American Kestrels has been widely discussed and documented in the literature (Porter and Wienemeyer 1969, Lincer 1975). As Farmer writes, these effects may have been carried into the late 1970s, and although DDT has been banned for use within the United States, other sources of contamination could also have negative effects.

Forest Succession. The American Kestrel occupies a "wide variety of open and semi-open habitats" (Smallwood and Bird 2002), a habitat type that has reduced its total area due to the maturing of forests and forest fire suppression. Eastern forest habitats have undergone a dramatic change over the last decades, resulting in a net loss of open habitats at a regional scale (Hall et al. 1991).

The process of secondary succession has been responsible for declines of other species of birds (e.g. the Rufous-sided Towhee, Hagan 1993), and it has been hypothesized to be in part responsible for kestrel declines.

Increased Predation. According to Farmer (2007), populations of the larger Cooper's Hawk, which has experienced increases in the northeast and other regions, may contribute to kestrel declines, since "studies at Hawk Mountain and elsewhere have demonstrated that this species regularly preys upon American Kestrels."

West Nile Virus (WNV). This introduced virus has had impacts on the populations of birds of several species. Although researchers do not know if exposure to WNV has fitness consequences in the American Kestrels, from nest monitoring programs some regional studies show that exposure to this virus is high. According to Rusbuldt et al. (2006) and Farmer (2007), nest productivity in southeastern Pennsylvania has decreased 57% between 2000 and 2004, and 95% of the adults using nest boxes were exposed to the virus.

How definitive is this presentation of the case of the American Kestrel? I can confidently say the migration count data from multiple sites analyzed as part of the Raptor Population Index Project activities has made an important contribution to document and quantify its decline across many points of its range. Unlike other species of raptors, there exists data from other surveys to support the findings of many hawkwatches.

The use of RPI Project data as an early warning system allows the conservation community to better hypothesis on the reasons behind the observed declines. Although the answer to these questions will still require a considerable amount of effort to be fully understood (Sullivan and Wood 2005), these results are essential to help us take action now, while the American Kestrel is still common.

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