

With An Eye On Raptors

Do Raptors Feed on Migration?

Preliminary Results and a Proposal for New Data Collection for Raptor Watchsites

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Introduction

Migration is the most challenging period in the life cycle of a migratory raptor, yet there remains much we do not fully understand. In total, 66% of all raptor species worldwide undergo some kind of migration (Bildstein 2006). Raptors are not known to put on much additional fat prior to migration (Bildstein 2006), and yet long-distance migrant raptors have been suggested to feed very little, if at all, during their migration (Hofslund 1973, Smith et al. 1986). If they do feed, there is little known about how often they do so during migration and how important that might be for their survival, or how long they can migrate without feeding.

Flapping flight uses up more energy than soaring, so soaring migrants, such as buteos and eagles, could need to feed much less than falcons and accipiters (Kerlinger 1989). Smith et al. (1986) suggests that Broad-winged Hawks would require only a fat deposit of 20-25% lean body mass to complete an entire flight from southern United States to northern South America. If Broad-winged Hawks have large fat reserves, it has been suggested these birds could potentially accomplish all or most of their migration without feeding (Nicoletti 1997). Knowledge of feeding frequency during migration and the habitat use by migrants could be highly important in developing conservation plans for migration corridors, yet few studies exist on either question. If hawks are not feeding regularly en route, perhaps habitat quality is less important and all they need is a place to roost during nights or inclement weather.

Recent research on satellite-tagged raptors such as the Broad-winged and Swainson's hawks suggests that long-distance soaring migrants will stop regularly during their migration for an average of several days or more and display movements suggestive of hunting (McCabe et al in prep, Kochert et al 2011). Goodrich (2010) tagged 48 Sharp-shinned and Cooper's hawks with VHF transmitters in eastern Pennsylvania during 2003 and 2004 and documented accipiters stopped for an average of three to five days each, used forest primarily, and they moved around in a behavior consistent with foraging. These studies and others begin to indicate that foraging may occur more than previously thought.

The amount of energy that the birds need for long-distance migration can differ in both fall and spring. Lipids are essential nutrients for many songbird migrants and are plentiful in insects. Some raptors are seen catching insects in flight on migration, which may help fuel their migration as well (Nicoletti 1995).

Currently, there are few scientific studies on how long food will remain in a crop of an active bird but we assume, based on the measures of sedentary birds at Hawk Mountain, that a visible crop in a raptor migrant would not last more than 12 hours. An unpublished small study conducted on two Hawk Mountain captive education Red-tailed Hawks showed that food weighing less than 100 grams took between four to five hours to pass through the crop. Larger meals that were greater than 100g took an average of 7.2 hours to pass through the crop (Ricker, S. 1989 Hawk Mountain unpubl. report). If we assume that the metabolism of a wild, migrating hawk may be higher and their digestion may be faster than captive birds then any distended crop observed in wild raptors, we can assume represents feeding that occurred within the prior eight-hour period.

Some feeding may not cause crop distension. Nicoletti (1997) demonstrated that American Kestrels feed regularly on Green Darner dragonflies during migration at Hawk Ridge in Duluth, Minnesota. The kestrels showed peak migration during the same hours that were the peak migration hours of the Green Darner each day. Nicoletti (1997) noticed that even though some of the kestrels ate large numbers of dragonflies, they never showed a crop.

Shelley and Benz (1985) conducted a similar study in 1981 at Hawk Mountain and reported that 8% of 623 Broad-winged Hawks observed during one fall migration at Hawk Mountain Sanctuary showed a visible crop while 25 broadwings (4%) were documented catching dragonflies without showing a crop. Shelley and Benz (1985) also reported 36% of 817 Sharp-shinned Hawks and 41% of 56 Red-tailed Hawks examined showed full crops in that year.

Because documenting feeding during migration could inform long-term conservation of migratory raptors and their habitats, Hawk Mountain counters collected crop frequency data on autumn-migrating raptors at Hawk Mountain Sanctuary in eastern Pennsylvania between the years 2011 and 2017. Here we present a preliminary summary of these data, review conservation implications, and make suggestions on how other watch sites could contribute to our further understanding of raptor feeding behavior in migration.

Study Area

Hawk Mountain Sanctuary, Kempton Pennsylvania, has the longest raptor migration count in the world with data collection initiated in 1934 (Bednarz et al. 1990). Hawk Mountain is located on the Kittatinny Ridge within the Central

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Appalachians in Pennsylvania. The Kittatinny Ridge is a key corridor for migrating raptors and songbirds in eastern North America and is designated a state, national and global Important Bird Area (Goodrich in Crossley 1999, Kittatinnyridge.org). Raptors concentrate along the mountain to take advantage of the thermals and updrafts that develop along the mountain, and perhaps the ribbon of rural habitats for resting and feeding. Autumn migration counts at Hawk Mountain occur between 15 August and 15 December.

Methods

To better understand the frequency of feeding behavior in migrating raptors, we collected data on the percentage of raptors that had full and empty crops every fall migration period from 2011 to 2017, between August 15 and December 15. Because we did not have personnel to dedicate a person to this task, the regular counters conducted the assessment of crop presence when they were able to do so or when there was an extra counter present. On days when time allowed, Hawk Mountain counters recorded presence or absence of distended crops in as many of the passing migrants as possible for a couple hours or an entire day. It was important to record both distended and undistended crops for a species over a period of time so that a proportion could be calculated. Data was collected on migrant raptors during the entire official migration count period.

Data was collected on all *buteos*, *falcons*, *accipiters*, *osprey* or northern harrier but not vultures and rarely eagles. Because determining a crop presence requires a good view of the bird, we recorded data on the raptors that could be well-observed and were not too distant or passing too high. A “full crop” was defined as having a noticeable bulge in the throat area (see Figure 1 on back cover of journal), while no noticeable bulge in the throat was considered an empty crop. On at least three days a week, volunteer counters were assigned to the count in pairs, and if not too busy the second counter collected data on age of migrant raptors and crop presence on birds flying close enough to evaluate. Because not all migrants counted were able to be evaluated by the counter team, the “crop assessed” count per day was lower than the total count for a species on any one day.

Although 16 species of raptors commonly migrate during the fall migration, we only present data for 11 of the 16 species: Broad-winged Hawk, Red-shouldered Hawk, Sharp-shinned Hawk, Cooper’s Hawk, Northern Goshawk, Red-tailed Hawk, American Kestrel, Merlin, Peregrine Falcon, Northern Harrier and Osprey.

Results

Short Distance Migrants

Sharp-shinned, Cooper’s and Red-tailed Hawk are short-distance migrants that are frequently seen migrating past North Lookout at Hawk Mountain. Sharp-shinned and Red-tailed Hawks are two of the most numerous migrants sighted along the Kittatinny Ridge corridor and migrants seen at Hawk Mountain may winter from Pennsylvania through Texas (Goodrich, L. in Crossley 1999).

During the six-year study, Sharp-shinned Hawks were assessed a total of 2648 times on a total of 232 days (Table 1). A total of 16,185 hawks were counted on the same 232 days, with 11.4% of all migrants observed on these days being evaluated for presence of a crop and of those, 31.2% showed a full crop. Sharp-shinned Hawks will frequently fly very close to North Lookout and even dive on the owl decoy which gives counters very close views increasing the ease of assessing crop status.

Similar to Sharp-shinned Hawks, Cooper’s Hawks fly close to North Lookout, which gives the counters close views to assess crop status. However, Cooper’s Hawk crop status was assessed only 347 times on the 100 days representing 3.5% of the birds (Table 1). However, of the migrants assessed, 31.7% of Cooper’s showed a full crop.

Red-tailed Hawks are soaring migrants and do not always fly close to the lookout but they will hug the ridgeline on windy days, which gives counters an opportunity to assess crop presence. A total of 608 Red-tailed Hawks were assessed during 168 days of counts in the six years of the study which represents 1.7% of all migrant red-tails on those days. Out of these 608 raptors, 14.8 % showed a full crop (Figure 2).

Other short-distance migrants assessed during our preliminary study included Northern Goshawk, Red-shouldered Hawk, Northern Harrier, and American Kestrel. Low numbers of migrants were assessed for some of these species, however crops were sighted in 22.5% of goshawks, 5.6% of red-shoulders, 16.2% of harriers and 1.5% of kestrels (Table 1)

Long Distant Migrations

Broad-winged Hawks are complete migrants, spending their winters in Central and South America primarily. In total, Broad-winged Hawks were assessed 215 times on 70 days (3.1%) during the six years (Table 1). Despite their usual penchant for soaring, crops were observed in 11.6% of migrants suggesting regular foraging may occur (Figure 3).

Peregrine Falcons also are long-distance migrants with some Kittatinny migrants originating in the Arctic. At Hawk Mountain, these raptors will frequently glide close to North Lookout in early October, which gives the counters close

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observations but often these fast moving birds are hard to study. We observed only 36 Peregrine Falcons for crop presence during 26 days of the six years (Table 1). Out of the 36 migrants, 33.3% showed a distended crop, the highest proportion of the falcons (Figure 3).

Another long-distance migrant, the Osprey was assessed on 146 times in the 61 days of data collection (Table 1). Of the Osprey counted on these days, only 2.4% were assessed, and of these 11.0% showed a distended crop or evidence of recent feeding. And the Merlin, another long-distance yet partial migrant, was assessed for crop presence on 43 days with 12.1% of the 99 birds assessed showing crops (Table 1)

All Raptors

When all species are pooled together, we assessed 5.2% of the raptor migrants passing on days of the study and 26.4% of all migrating raptors assessed (n=4509) showed evidence of having fed recently, i.e. displayed a distended crop (Table 1, Figures 2, 3). In this study we did not include data on eagles or vultures or rare species. Hence, approximately one in four migrant raptors passing Hawk Mountain appear to have fed recently.

Discussion

Sharp-shinned and Cooper's Hawks along with Peregrine Falcon showed the highest frequency of crop distension or feeding during the six years. As all are bird-eating raptors and tend to move south during peak periods for songbird migration along the Kittatinny Ridge (Hawk Mt. unpublished data), they may have abundant opportunities for catching prey along the ridge. Crops may be more easily detected in these slender birds as well, possibly giving a more accurate estimate of proportion feeding. Crop assessment occurred more frequently for sharp-shins than any of the other species studied (11.4% assessed), lending some weight to the validity of the results showing more than 30% having distended crops or having fed recently.

Lower rates of crop presence were observed for Merlin, another bird-eating raptor, 12.1%, however their small size and quick flight may have reduced the potential to evaluate crop presence as only 2.3% were assessed. Northern Goshawk, which feeds on both mammals and birds, also showed high rates of distension, though few birds in total were assessed.

Red-tailed Hawks were the second most numerous raptor assessed, which could be because they are large and easy to observe and often fly close to Hawk Mountain's North Lookout. Of the more than 600 birds examined only 15% of the birds displayed a full crop in this study. Because they feed on small mammals, snakes and only occasionally birds, they may be more likely to feed away from the highly forested ridgeline of the Kittatinny Ridge, and rather hunt in farmland of the nearby valley. Redtails are often observed hunting along the slopes

of the ridge late in the day, but rarely are observed carrying or catching prey (LG pers. obs.). In addition, small prey items captured by redtails, such as a small mouse, may not cause crop distension and might go unnoticed by counters below, reducing the proportion detected relative to proportion feeding.

Because short distance migrants do not have to travel as far as long-distance migrants, the numbers of birds with a full crop might be higher than the other species, as they may have more time to linger to replenish their fuel. This was true for two long-distance migrants, the Broad-winged Hawk and Osprey, where crop distension was observed in 11.1% of the migrants compared to the 22 to 30% in accipiters. In addition to crops, counters occasionally saw broadwings catching dragonflies or Osprey carrying fish, although that behavior was not quantified in this study. Shelley and Benz (1985) at same site showed 4% of broadwings were catching dragonflies in that year.

These data suggest that feeding by migrating raptors occurs even in long-distance migrants and soaring birds, although additional data collection is needed to verify the proportion, as less than 5% of migrants in total were assessed. The suggestion that raptors feed regularly is supported by studies using satellite-telemetry on Broad-winged and Swainson's Hawks that document regular stopover behavior by both long-distance migrants during migration, a time when birds could be resting or feeding (McCabe et al. in prep., Kochert et al. 2011).

In this study, we could have a bias towards observing a greater proportion of migrating birds with crops as birds that have fed recently may be more likely to fly lower and nearer the counters than birds that have not fed recently and/or we may see birds with crops more easily as they have just taken flight after foraging. Conversely, there can be a bias to miss birds with small distended crops as migrants often are flying past quickly and slight differences are less likely to be detected. Further on days of poor light or high flight, less numbers might be detected than are occurring. We hypothesize that these biases may outweigh each other in part.

However, the low percentage of birds assessed for all species, excluding the sharpshin, suggest some strong caution in interpretation of our preliminary results. Ideally, we were hoping to have assessed at least 10 to 15% of the migrants per species and to balance our data collection with a variety of wind and weather conditions. As a result, we consider these results preliminary yet intriguing and suggest other watchsites may want to also collect such data in hopes of broadening our understanding of foraging on migration.

Despite the preliminary nature of our results, the data suggest that migrating raptors using the Kittatinny Ridge migration corridor during autumn are feeding en route with possibly more than 30% of some species showing evidence of recent feeding. These data underscore the importance of protecting native habitat for raptors on and near the Kittatinny

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Ridge and other key migration corridors. If birds are feeding regularly during migration and perhaps rely on the opportunity to forage to sustain them during the migration journey, there needs to be quality habitat for them to find prey, whether it is songbirds or mammals or fish. Collecting more data on the frequency of foraging in a variety of landscapes and at different latitudes, may inform our understanding of the conservation needs of migrating raptors in North America.

Recommendations for Future Studies

Based on our preliminary results, we encourage other watchsites with multiple observers or interns present, to consider collecting similar data for at least a few hours a day. Such data collection from a number of sites would inform knowledge of patterns in foraging by migrants. We suggest such data collection should be done by an additional counter as to not distract the main counter from the count and scanning necessary to detect migrants. However, it could be done for only a few species, such as the accipiters or redtails, and it could be a great intern or counter in training project.

At Hawk Mountain, we conclude we need to spend more time assessing if a raptor has a crop during autumn migration within each year. We hope to recruit additional counters or trainees to assist with the task so as not to distract the main counter. Along with extra counter, it could work well for sites where tablet data entry is in use to add “crop or no crop” fields to the count form that allow effective recording of crop presence within the tablet as birds are migrating past.

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Table 1. Migrating raptors displaying full crops passing Hawk Mountain, PA 2011-2018.

Species	# Days	# Assessed	% Assessed ¹	% Full Crop
Sharp-shinned Hawk	208	2648	11.4	31.2
Cooper's Hawk	100	347	3.5	30.7
Northern Goshawk	16	40	2.5	22.5
Red-tailed Hawk	122	608	3.7	14.8
Red-shouldered Hawk	36	72	2	5.6
Broad-winged Hawk	70	215	3.1	11.6
Osprey	64	146	2.4	11.1
Northern Harrier	57	99	1.7	16.2
American Kestrel	57	199	3.5	1.5
Merlin	43	99	2.3	12.1
Peregrine Falcon	26	36	1.4	33.3
Total Raptors	799	4509	5.2	26.4
Mean per Year	78.7		3.4	17.3

¹compared to total observed on days assessed.

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Figure 2. Long Distance Migrant raptors displaying a full crop, preliminary study in autumn 2011 to 2017 at Hawk Mountain, PA.

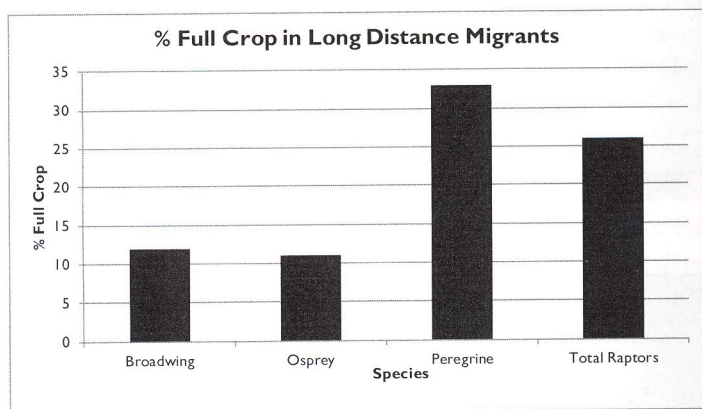
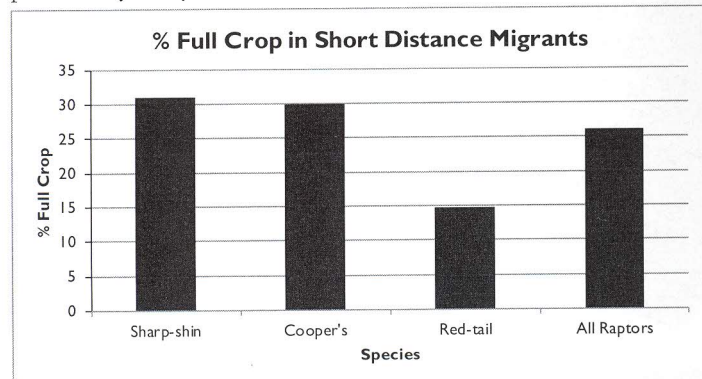


Figure 3. Short Distance Migrant raptors displaying a full crop, preliminary study in autumn 2011 to 2017 at Hawk Mountain, PA.

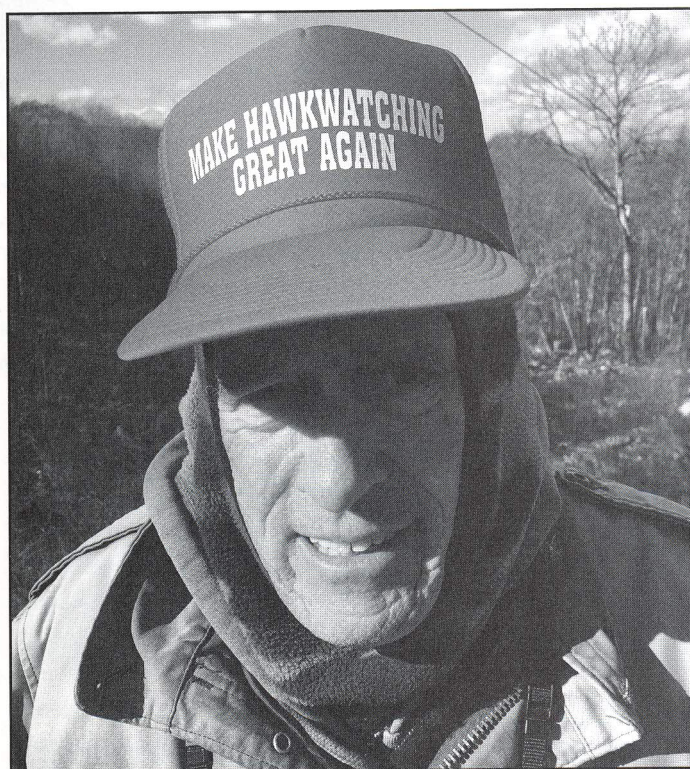


Hawkwatchers' Field Notes

By Paul Fritz, pfritz@mtaonline.net

There are many wonderful raptor photographs being taken now with digital cameras. As nice as these pictures are, I would like to publish only those that are unique. I'm looking for photos such as raptors chasing or carrying prey, unusual plumages, interactions between raptors, or raptors interacting with other species. The photos don't have to be recent pictures, just unusual. Please contact me if you have or know of photographs that I would be interested in. Thanks!

One last thing, I have heard a number of hawkwatchers express concern about drones causing problems with migrants. Have any of the watches had problems with drones yet? If so, I would be interested in hearing how you handled it. I believe this is only going to get worse.



Gene Wagner of Waggoner's Gap. Gene says, "I am Gene Wagner and I approve this message." Photo by Paul Fritz.

Peregrine Falcon Kills Bald Eagle

The observation below was witnessed by Bill Tonner at State Line, Alpine, New Jersey, at 3:30 p.m. on April 9, 2018.

In the week following the attack, State Line watchers determined the female Peregrine Falcon was protecting her three chicks. All three youngsters successfully fledged and hopefully they too will pass their powerful genes to the next generation. Photo of the Peregrine pair by David Dean.