

Raptor Population Index Project

Technical Report

**TRENDS IN AUTUMN COUNTS OF MIGRATORY RAPTORS IN
U.S. FISH AND WILDLIFE SERVICE REGION FIVE**

Christopher J. Farmer

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TRENDS IN AUTUMN COUNTS OF MIGRATORY RAPTORS IN U.S. FISH AND
WILDLIFE SERVICE REGION FIVE

CHRISTOPHER J. FARMER

*Acopian Center for Conservation Learning, Hawk Mountain Sanctuary, Orwigsburg,
Pennsylvania 17961, USA*

EXECUTIVE SUMMARY

Sixteen species of raptors migrate southward through U.S. Fish and Wildlife Service Region Five each autumn and are counted at hawkwatches throughout the region. For most of these species, migration monitoring offers the best means of detecting temporal trends in breeding populations. I analyzed trends in counts of nine visible migrating raptors at five long-term hawkwatches arranged in an approximate East-West transect across the region. Together, these hawkwatches count a sample of approximately 123,000 migratory raptors annually. I derived annual population indexes from the counts using ANCOVA and fitted trajectories to the time series of indexes with a polynomial regression. I estimated trends as the geometric rate of change in the fitted trajectory by re-parameterizing the regression so that the first regression term was equivalent to the slope of a log-linear regression.

From 1974 to 2004, population indexes of five species increased or remained relatively constant at all five hawkwatches. During this period, one species (American

Kestrel) decreased at all hawkwatches, and four showed varying trends at the different hawkwatches. In the most recent decade (1990-2000), two species increased at all five hawkwatches, though one species (Peregrine Falcon) showed a decelerating trajectory at most locations. The remaining seven species had variable trends across the region.

For each species, population trends estimated from migration monitoring in Region Five and their conservation implications are reviewed in detail in the discussion section of the report.

Each autumn, 16 raptor species migrate southward through northeastern and North America (Zalles and Bildstein 2000). Migrating raptors are visible from traditional watchsites, many of which count migrating raptors using standardized techniques (e.g. Barber et al. 2001, Anonymous 2002, Kunkle 2002). For most of the species counted in this way, migration monitoring offers the most feasible means of detecting temporal trends in breeding populations (Dunne and Hussell 1995, Farmer et al. 2007, in press).

Typically, trends are calculated for single hawk migration watchsites (e.g., Bednarz et al. 1990, Kjellen & Roos 2000, Mueller et al. 1988). Trends in the count at a single watchsite may not be representative of an entire migrating population within a geographic region, however, and this has led to efforts to simultaneously estimate trends at several watchsites (Titus & Fuller 1990, Hoffman & Smith 2003). Titus and Fuller (1990) used route regression to combine trends for six watchsites in eastern North America into regional trend estimates. Combining trend estimates in this fashion required a weighting mechanism, and Titus and Fuller (1990) therefore weighted each watchsite by its total volume of migration. While intuitively appealing, this means of estimation may provide regional trend estimates that are geographically biased (see Dunn and Hussell 1995).

In contrast to the approaches described above, Hoffman and Smith (2003), presented trends for seven watchsites in western North America, but did not attempt to generate quantitative regional estimates of trends. Instead, they compared trends from individual watchsites qualitatively, and combined this information with insights into the migration ecology of individual species to develop their characterization of regional population trends.

I estimated population trends in ten species of raptors for the periods 1974-2004 and 1990-2000 at five migration watchsites in U.S. Fish and Wildlife Region Five. Together, these watchsites count an average of approximately 123,000 migratory raptors annually. I characterized regional trends in much the same manner as Hoffman and Smith (2003), because no method of quantitatively combining trends at individual watchsites into regional estimates is currently available.

METHODS

Data Collection. – I analyzed counts of visible migrating raptors at Lighthouse Point Hawk Watch, Connecticut (41°15'N, 72°52'W), Cape May Point, New Jersey (39°54' N, 74° 49'W), Montclair Hawk Lookout, New Jersey (40°50' N, 74°13' W), Hawk Mountain Sanctuary, Pennsylvania (40° 38' N, 75° 59' W), and Waggoner's Gap, Pennsylvania (40°17' N, 77°17' W) (Fig. 1). These count sites are all near the southern terminus of Region Five. I used hourly counts of nine raptor species to develop annual population indexes and estimates of trends from 1974 to 2004 (1976-2004 at Cape May Point). At all watchsites, binoculars ($\leq 10x$ magnification) were used to detect and identify migrating raptors. Telescopes were used occasionally to identify but not to detect raptors. Depending on weather and the volume of migration, observations at the watchsites were often extended beyond or terminated before the end of the daily sampling periods listed in the paragraphs that follow.

Hourly counts of migrants have been made annually at Lighthouse Point, Connecticut since 1974. From 1974 to 1993, a volunteer primary observer conducted the count aided by a variable number of other volunteers. From 1994 to 2004, several volunteer observers participated in the count, each taking primary responsibility for one

day of the week. Counts were conducted from the first week of September to the last week of November each year. Raptors were considered migrants if they moved to the west across New Haven Harbor. Observations at Lighthouse Point typically were recorded from 0600 to 1400 hours EST. The mean number of hours of observation each day in 1974-2004 ranged from 4.9 ± 1.4 in 1993 ($n = 92$ days) to 6.5 ± 2.5 in 1981 ($n = 58$ days), with an overall average daily coverage of 6.0 ± 2.2 ($n = 78$ days).

Hourly counts of migrants have been made annually at Cape May Point, New Jersey since 1976. At Cape May, counts were conducted primarily by one or two trained staff. Raptors were counted as migrants if they moved in a southerly direction past an observation platform located at Cape May Point State Park. Observations at Cape May typically were recorded from 0600 to 1700 hours. The mean number of hours of observation each day in 1976-2004 ranged from 7.3 ± 1.78 in 1977 ($n = 70$ days) to 10.8 ± 2.48 in 1985 ($n = 85$ days), with an overall average daily coverage of 8.9 ± 2.20 ($n = 86$ days).

Hourly counts of migrants have been made annually at Montclair Hawk Lookout, New Jersey since 1957. From 1957-1993, counts were conducted by a primary volunteer observer assisted by a variable number of other volunteers. From 1994 to 2004 counts were conducted by professional staff and volunteers, with one person having primary responsibility for the count each day. Raptors were counted as migrants if they moved southwest past the lookout. Observations at Montclair typically were recorded from 0900 to 1700 hours. The mean number of hours of observation each day in 1974-2004 ranged from 6.2 ± 1.9 in 1995 ($n = 94$ days) to 7.4 ± 1.2 in 1998 ($n = 90$ days), with an overall average daily coverage of 7.0 ± 3.4 ($n = 80$ days).

Counts of migrants have been made annually at Hawk Mountain Sanctuary, Pennsylvania since 1934 (except 1943-45); data have been recorded hourly since 1966. Counts were conducted from 15 August to 15 December by trained volunteers and staff, with primary responsibility given to one or two people each day of the count (Barber et al. 2001). Raptors were considered migrants if they moved to the south or southwest across a southeast-northwest line at North Lookout. Observations at Hawk Mountain typically were recorded from 0800 to 1700 hours EST. The mean number of hours of observation each day in 1966-2003 ranged from 7.3 ± 2.51 in 1967 ($n = 76$ days) to 8.7 ± 2.57 in 2001 ($n = 139$ days), with an overall average daily coverage of 8.0 ± 2.67 ($n = 105$ days).

Hourly counts of migrants have been made annually at Waggoner's Gap, Pennsylvania since 1952 (excluding 1973-1979). Prior to 1973, a volunteer primary observer conducted the count aided by a variable number of other volunteers. Counts after 1979 were conducted by approximately 20 trained volunteers, with one serving as primary observer on each day. Raptors were counted as migrants if they moved south or southwest past the lookout. Observations at Waggoner's Gap typically were recorded from 0800 to 1700 hours. The mean number of hours of observation each day in 1974-2004 ranged from 3.6 ± 2.4 in 1984 ($n = 71$ days) to 8.1 ± 2.1 in 1998 ($n = 144$ days), with an overall average daily coverage of 6.0 ± 2.2 ($n = 104$ days).

Migration Count Index. – The length of a count day can vary across a season and across years, making it necessary to weight counts by effort. If annual coverage increases across years, addition of early and late count days increases the number of days with low counts, and can produce a spurious trend unless corrected for by the use of species-

specific seasonal passage windows (Titus et al. 1989). A 95% seasonal passage window was identified for each species to control for this effect, and to better fit the assumptions of parametric regression.

For each species of raptor, I also identified a daily passage window during which 95% of individuals were counted at each watchsite. Daily passage windows were compared and combined into a single daily passage window for each site if no differences were found among species. Raptors counted outside of the daily passage window were excluded from analysis, as were count days outside of the seasonal passage window. A monitoring “day” can vary widely within and between sites, making birds counted per day a meaningless index unless standardized. This standardization was accomplished by correcting all daily counts for a “standard” effort level (e.g., nine hours at Cape May) defined by the 95% daily passage window.

An annual index estimating the annual mean daily count for each watchsite was derived from regression estimates of the “geometric mean” daily count, adjusted for various covariates. The full regression model with all covariates was:

$$\ln(N_{ij} + 1) = a_0 + \sum_{j=1}^J a_j Y_j + \sum_{k=1}^4 b_k i^k + \sum_{j=0}^J \sum_{k=1}^4 c_{jk} (Y_j i^k) + e_{ij} \quad (1)$$

where N_{ij} was the number of one species of raptor counted (or estimated, see above) during the standard hours on day i in year j , Y_j was a series of dummy or indicator variables which were set equal to 1 when year = j and were zero in all other years, i^k were 1st through 4th order terms in date, $(Y_j i^k)$ were year-date interaction terms created by multiplying each Y_j by each i^k , a_0 was the intercept estimated by the regression, a_j , b_k , c_{jk} and d_l were coefficients estimated by the regression representing the effects of each independent variable on $\ln(N_{ij}+1)$, and e_{ij} was an error term representing unexplained

variation. This regression model was a one-way ANCOVA in which the year terms were factors and all of the other independent variables were covariates. Regression analyses were always weighted in proportion to the number of hours of observation on each day, h_{ij} .

The general approach to deriving these indexes was similar to those used previously (Hussell 1981, 1985, Hussell et al. 1992, Dunn et al. 1997, Francis and Hussell 1998), and a detailed description can be found in Farmer et al. (2007, in press).

Trend Analysis. - Trends in annual indexes were estimated for each site by fitting a polynomial regression model to the time series of index values. To reduce correlations among the polynomial terms, each regression was centered at the midpoint in the time series. A best-fitting polynomial trajectory model was identified for each species using the three-step process described in Farmer et al. (2007, in press).

Trend estimates (geometric mean rate of change over pre-determined time interval; Link and Sauer 1997) and their significance were derived by re-parameterizing the year terms as described by Francis and Hussell (1998) and Farmer et al. (2007, in press). I chose the proportional rates of change from 1974-2004 and 1990-2000 to examine patterns of population change. The re-parameterization transformed year terms so that the first-order year term estimated the rate of change between the two sets of years. To reduce the potential effect of extreme trajectories at the ends of the polynomial model, I compared the mean indexes for the three-year periods at either end of the time series (e.g. 1974-76 and 2002-04).

RESULTS

The five watchsites counted an average of nearly 123,000 total hawks of 16 species annually from 1974-2004 (Tables 1-5). Three species, Sharp-shinned (48,288), Broad-winged (31,710), and Red-tailed Hawks (10,257) comprised over 70% of these annual total counts.

Long-Term Trends 1974-2004 - Migration counts of Ospreys, Bald Eagles, Cooper's Hawks, and Peregrine Falcons increased or remained stable and those for American Kestrels decreased at the five migration watchsites (Tables 1-5). Trends for Northern Harriers, Sharp-shinned Hawks, Broad-winged Hawks, Red-tailed Hawks varied across the region during this period (Tables 1-5).

Decadal Trends 1990-2000 - Counts of Bald Eagles and Peregrine Falcons increased or remained stable at all five watchsites (Tables 1-5). Trends for Ospreys, Northern Harriers, Cooper's Hawks, Sharp-shinned Hawks, Broad-winged Hawks, Red-tailed Hawks, and American Kestrels varied across the region during this period.

DISCUSSION

In the sections that follow, population trends and conservation status are discussed for each species.

STATES IN REGION FIVE WITH HAWKWATCHES

The following states in Region Five contain hawkwatches that are actively contributing data to the Raptor Population Index (RPI) project (number of hawkwatches in parentheses): CT (17), MA (7), ME (1), NH (3), NJ (11), NY (8), PA (21), VT (1).

OSPREY

Population trends and conservation status

Rates of increase for Ospreys from 1974 to 2004 were significant and positive at hawkwatches from the Kittatinny Ridge east to the Atlantic Coast (Tables 1-5). Trends were positive, but non-significant for this species at Waggoner's Gap, which monitors some breeding populations to the west of the Kittatinny Ridge. From 1990 to 2000, all five hawkwatches recorded decreases in counts of Ospreys. At Hawk Mountain Sanctuary (-2.6 \%yr^{-1} , $P \leq 0.01$) and Lighthouse Point (-9.0 \%yr^{-1} , $P \leq 0.01$), these declines were significant, but the remaining three watchsites recorded non-significant decreases. The decreasing trends over the last decade at these eastern watchsites are cause for concern, as they may indicate the emergence of new threats to Osprey populations. Population trajectories for Ospreys at these sites (Figs. 2, 4, 6, 8, 10) suggest that the recent trends are part of a longer-term decline at the two coastal hawkwatches, but these shifts may represent cyclic population dynamics in populations sampled by the three inland sites. Continued population change at the 1990-2000 rates will lead to 50% reductions of Osprey source populations in approximately 8 years at Lighthouse Point, 99 years at cape May Point, 58 years at Montclair Hawk Lookout, 27 years at Hawk Mountain Sanctuary, and 77 years at Waggoner's Gap.

Possible threats and causes of recent population change

Possible threats include development of waterfront property (leading to loss of nesting and foraging habitat), misuse of pesticides and herbicides, reduced abundance of fish, and shooting on the wintering grounds.

BALD EAGLE

Population trends and conservation status

Rates of increase for Bald Eagles from 1974 to 2004 and from 1990 to 2000 were significant and positive at hawkwatches throughout the region (Tables 1-5). Population trajectories for Bald Eagles at these sites (Figs. 2, 4, 6, 8, 10) suggest that, with the exception of Cape May Point, the recent trends are part of a long-term pattern of exponential population increase. The fitted trajectory for Cape May Point suggests a decrease in counts since the late 1990s, but the overall trend for the decade is still one of significant increase at this hawkwatch. Continued population change at the 1990-2000 rates will lead to 50% increases of Bald Eagle source populations in approximately 8 years at Lighthouse Point, 6 years at Cape May Point, 8 years at Montclair Hawk Lookout, 12 years at Hawk Mountain Sanctuary, and 16 years at Waggoner's Gap.

Possible threats and causes of recent population change

Possible threats include development of waterfront property and removal of dominant trees from forest, misuse of pesticides and herbicides, reduced abundance of fish. Recent increases are due primarily to banning of some pesticides, reforestation of the eastern U.S., and recovery efforts under the Endangered Species Act.

NORTHERN HARRIER

Population trends and conservation status

Rates of increase for Northern Harriers from 1974 to 2004 were non-significant at most of the hawkwatches, with a general pattern of positive trends near the coast and negative trends inland, however, a negative trend was recorded at Cape May Point, which has counts an order of magnitude higher than the other sites. Hawk Mountain Sanctuary recorded a significant decrease (-2.0% per year, $P \leq 0.01$) during this period. From 1990 to 2000, trends were primarily negative, with a significant decrease (-3.0% per year, $P \leq$

0.01) recorded at Hawk Mountain Sanctuary (Tables 1-5). Population indexes and fitted trajectories for Northern Harriers at these sites (Figs. 2, 4, 6, 8, 10) suggest that populations in the region undergo cyclic fluctuations with a period of approximately 10 years. High inter-annual variability in counts of this species at hawkwatches reduces the power of migration monitoring to detect population trends. Continued population change at the 1990-2000 rates will lead to 50% decreases of Northern Harrier source populations in approximately 36 years at Lighthouse Point, 94 years at Cape May Point, 23 years at Hawk Mountain Sanctuary, and 94 years at Waggoner's Gap, and a 50% increase in approximately 105 years at Montclair Hawk Lookout.

Possible threats and causes of recent population change

Possible threats include development of wetlands and open fields, misuse of pesticides and herbicides, and reduced prey (small mammal) availability.

SHARP-SHINNED HAWK

Population trends and conservation status

Rates of increase for Sharp-shinned Hawks from 1974 to 2004 were significant at northern coastal sites, significantly negative at Cape May Point and Hawk Mountain Sanctuary, and non-significantly negative at Waggoner's Gap. From 1990 to 2000, trends were significantly negative at Lighthouse Point (-3.3% per year, $P \leq 0.05$) and Hawk Mountain Sanctuary (-3.3% per year, $P \leq 0.01$) and non-significant at the remaining hawkwatches (Tables 1-5). Population indexes and fitted trajectories for Sharp-shinned Hawks at these sites (Figs. 3, 5, 7, 9, 11) suggest populations of this species are cyclic, but the timing and period of cycles appears to vary between coastal and inland sites. Continued population change at the 1990-2000 rates will lead to 50%

decreases of Sharp-shinned Hawk source populations in approximately 21 years at Lighthouse Point, 21 years at Hawk Mountain Sanctuary, and 117 years at Waggoner's Gap, and 50% increases in approximately 23 years at Cape May Point, and 346 years at Montclair Hawk Lookout.

Possible threats and causes of recent population change

Possible threats include clearcut logging of boreal forests (leading to loss of habitat and reductions in prey species abundance), and misuse of pesticides and herbicides. Other possible causes of changes in migration counts include migratory short-stopping (wintering at more northerly latitudes than has historically been the case) and fluctuations in prey abundance due to population dynamics of spruce budworm in the boreal forest.

COOPER'S HAWK

Population trends and conservation status

Rates of increase for Cooper's Hawks from 1974 to 2004 were significant and positive throughout the region. From 1990 to 2000, trends were non-significantly negative at Lighthouse Point, non-significantly positive at Cape May Point, and significantly positive at sites from the coastal plain to the Kittatinny Ridge (Tables 1-5). Population indexes and fitted trajectories for Cooper's Hawks at these sites (Figs. 3, 5, 7, 9, 11) suggest that population increases have recently stabilized at coastal hawkwatches, and that proportional rates of increase have remained constant and positive at inland sites. Continued population change at the 1990-2000 rates will lead to a 50% decrease of Cooper's Hawk source populations in approximately 17 years at Lighthouse Point and 50% increases in approximately 21 years at Cape May Point, 7 years at Montclair Hawk Lookout, 17 years at Hawk Mountain Sanctuary, and 14 years at Waggoner's Gap.

Possible threats and causes of recent population change

Possible threats include shooting on wintering grounds in the southeastern U.S. and misuse of pesticides and herbicides. Possible causes of recent increases include increased abundance of vulnerable prey and reforestation of the eastern U.S.

BROAD-WINGED HAWK

Population trends and conservation status

Rates of increase for Broad-winged Hawks from 1974 to 2004 were negative throughout the region, but significant only at Hawk Mountain Sanctuary. From 1990 to 2000, significant decreases were recorded at Montclair Hawk Lookout (-6.4% per year, $P \leq 0.01$) and Hawk Mountain Sanctuary (-3.1% per year, $P \leq 0.01$), with non-significant decreases at coastal hawkwatches and a non-significant increase at Waggoner's Gap (Tables 1-5). Population indexes and fitted trajectories for Broad-winged Hawks at these sites (Figs. 3, 5, 7, 9, 11) show that although high variability makes it difficult to fit curves to the indexes, counts have decreased at all sites east of the Kittatinny Ridge in the last decade. Continued population change at the 1990-2000 rates will lead to a 50% decrease of Broad-winged Hawk source populations in approximately 30 years at Lighthouse Point, 49 years at Cape May Point, 11 years Montclair Hawk Lookout, and 22 years at Hawk Mountain Sanctuary, and a 50% increase in approximately 17 years at Waggoner's Gap.

Possible threats and causes of recent population change

Possible threats include clearcut logging of boreal forests, and misuse of pesticides and herbicides. Reduced migration counts in the eastern U.S. also may be due to changes in migration geography.

RED-TAILED HAWK

Population trends and conservation status

Rates of increase for Red-tailed Hawks from 1974 to 2004 were significantly positive at Lighthouse Point, significantly negative at Hawk Mountain Sanctuary, and non-significantly negative at the remaining hawkwatches. From 1990 to 2000, significant increases were recorded at Lighthouse Point (3.1% per year, $P \leq 0.01$) and Waggoner's Gap (4.3% per year, $P \leq 0.05$), significantly negative at Hawk Mountain Sanctuary (-1.9% per year, $P < 0.01$), non-significantly positive at Cape May Point and non-significantly negative at Montclair Hawk Lookout (Tables 1-5). Population indexes and fitted trajectories for Red-tailed Hawks at these sites (Figs. 3, 5, 7, 9, 11) suggest that counts have declined recently at all hawkwatches except Lighthouse Point, perhaps indicating that decreases at more southerly sites are due to migratory short-stopping by birds from northerly source populations. Continued population change at the 1990-2000 rates will lead to 50% increases of Red-tailed Hawk source populations in approximately 22 years at Lighthouse Point, 210 years at Cape May Point, and 16 years at Waggoner's Gap and 50% decreases in approximately 25 years Montclair Hawk Lookout and 53 years at Hawk Mountain Sanctuary.

Possible threats and causes of recent population change

Breeding-season and winter surveys indicate that eastern populations of the Red-tailed Hawk have increased over the last 30 years. Decreases in migration counts are therefore likely the result of migratory short-stopping by increased numbers of hawks or of decreases in the migratory component of populations of this partial migrant while the resident population increases. Red-tailed Hawks are leap-frog migrants, so it is possible

that decreases at migration monitoring stations reflect changes in source populations breeding to the north of stable or increasing resident populations near the hawkwatches.

AMERICAN KESTREL

Population trends and conservation status

Rates of increase for American Kestrels from 1974 to 2004 were negative throughout the region, and significantly so at all hawkwatches discussed in this report except Waggoner's Gap. From 1990 to 2000, significant decreases were recorded at Lighthouse Point (-7.1% per year, $P \leq 0.01$), Cape May Point (-4.5% per year, $P \leq 0.01$), and Montclair Hawk Lookout (-3.3% per year, $P \leq 0.01$). Hawk Mountain Sanctuary and Waggoner's Gap recorded non-significant increases in this species (Tables 1-5).

Population indexes and fitted trajectories for American Kestrels at these sites (Figs. 3, 5, 7, 9, 11) suggest that population decreases for this species have accelerated since 2000 at Lighthouse Point, Hawk Mountain Sanctuary, and Waggoner's Gap, and remained relatively constant for the past 30 years at Cape May Point and Montclair Hawk Lookout. Continued population change at the 1990-2000 rates will lead to a 50% decrease of American Kestrel source populations in approximately 10 years at Lighthouse Point, 15 years at Cape May Point, and 21 years at Montclair Hawk Lookout, and 50% increases in approximately 500 years (i.e. nearly static population) at Hawk Mountain Sanctuary, and 23 years at Waggoner's Gap. It is important to note, however, that indexes of kestrels at Hawk Mountain Sanctuary and Waggoner's Gap have declined recently, and a significant negative trend (-4.8% per year, $P < 0.01$) arises for Hawk Mountain if 2001-2004 are included in the analysis. At this rate, a 50% decrease will occur in approximately 15 years.

Possible threats and causes of recent population change

Possible threats include loss of foraging habitat due to reforestation of eastern U.S. (as opposed to deforestation in the boreal zone), increased predation on fledglings due to increases in populations of Cooper's Hawks, and low fledgling survival due to high rates of infection with West Nile Virus.

PEREGRINE FALCON

Population trends and conservation status

Rates of increase for Peregrine Falcons from 1974 to 2004 were significantly positive throughout the region. From 1990 to 2000, non-significant increases occurred at all hawkwatches except Lighthouse Point, which recorded a non-significant decrease (Tables 1-5). Population indexes and fitted trajectories for Peregrine Falcons at these sites (Figs. 3, 5, 7, 9, 11) suggest that population increases for this species have decelerated since 1990 and source populations are either stabilizing or entering a period of decline. Continued population change at the 1990-2000 rates will lead to a 50% increase of Peregrine Falcon source populations in approximately 21 years at Cape May Point, 21 years at Montclair Hawk Lookout, 44 years at Hawk Mountain Sanctuary, and 33 years at Waggoner's Gap and a 50% decrease in 154 years at Lighthouse Point. While the deceleration of increases at some hawkwatches in the last decade is of potential concern, data are currently insufficient to determine whether populations are stabilizing or decreasing due to a new threat.

Possible threats and causes of recent population change

Possible threats include consumption of prey infected with West Nile Virus, and continued threats from the misuse of pesticides and herbicides. After strong recovery

from the late 1970s through early 1990s, populations may be reaching carrying capacity in some areas, and this may be the cause of deceleration seen in migration monitoring trajectories.

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LITERATURE CITED

- Anonymous. 2002. 2002 Hawk migration field manual for Holiday Beach Migration Observatory. Holiday Beach Migration Observatory, Windsor, Ontario, Canada
- Barber, D. R., C. R. Fosdick, L. J. Goodrich, and S. Luke. 2001. Hawk Mountain Sanctuary count manual, 1st edition. Hawk Mountain Sanctuary Association, Kempton, Pennsylvania.
- Bednarz, J. C., D. Klem, Jr., L.J. Goodrich, and S.E. Senner. 1990. Migration counts of raptors at Hawk Mountain, Pennsylvania, as indicators of population trends 1934-1986. *Auk* 107:96-109.
- Dunn, E. H. and D. J. T. Hussell. 1995. Using migration counts to monitor landbird populations: review and evaluation of current status. *Current Ornithology* 12:43-88.
- Dunn, E. H., D. J. T. Hussell, and R. J. Adams. 1997. Monitoring songbird population change with autumn mist netting. *Journal of Wildlife Management* 61:389-396.
- Farmer, C.J., D.J.T. Hussell, and D. Mizrahi. 2007. Methods for detecting population trends in migratory birds of prey. *The Auk* 123. *In press*.
- Francis, C. M. and D. J. T. Hussell. 1998. Changes in numbers of land birds counted in migration at Long Point Bird Observatory, 1961-1997. *Bird Populations* 4:37-66.
- Hoffman, S. W. and J. P. Smith. 2003. Population trends of migratory raptors in western North America 1977-2001. *Condor* 105:397-419.
- Hussell, D. J. T. 1981. The use of migration counts for monitoring bird population levels. *Studies in Avian Biology* 6:92-102.

- Hussell, D.J.T. 1985. Analysis of hawk migration counts for monitoring population levels. Pages 243-254 in Proceedings of Hawk Migration Conference IV (M. Harwood, Ed.). Hawk Migration Association of North America.
- Hussell, D. J. T., M. H. Mather and P. H. Sinclair. 1992. Trends in numbers of tropical- and temperate-wintering migrant landbirds in migration at Long Point, Ontario, 1961-1988. Pages 101-114 in Ecology and Conservation of Neotropical Migrant Landbirds. (J. M. Hagan III, and D. W. Johnson, Eds.). Smithsonian Institution Press, Washington, D.C.
- Kjellén, N., and G. Roos. 2000. Population trends in Swedish raptors demonstrated by migration counts at Falsterbo, Sweden 1942-97. *Bird Study* 47:195-211.
- Kunkle, D.R. 2002. Bake Oven Knob autumn hawk count manual. Wildlife Information Center, Inc. Slatington, Pennsylvania, USA. 26pp.
- Link, W. A. and J. R. Sauer. 1997. Estimating population trajectories from count data. *Biometrics* 53:488-497.
- Mueller, H. C., D. D. Berger, and G. Allez. 1988. Population trends in migrating Peregrines at Cedar Grove, Wisconsin, 1936-1985. Pages 496-506 in *Peregrine Falcon Populations, Their Management and Recovery* (T. J. McCade, J. H. Enderson, C. G. Thelander, and C. M. White, Eds.). The Peregrine Fund, Inc., Boise, Idaho.
- Titus, K. and M. R. Fuller. 1990. Recent trends in counts of migrant hawks from northeastern North America. *Journal of Wildlife Management* 54:463-470.
- Titus, K., M. R. Fuller and J. L. Ruos. 1989. Considerations for monitoring raptor population trends based on counts of migrants. Pages 19-32 in Proceedings of the

Third World Conference on Birds of Prey. International Council for Bird
Preservation.

Zalles, J. L. and K. L. Bildstein. (Eds.). 2000. Raptor Watch: a Global Directory of
Raptor Migration Sites. Birdlife Conservation Series No.9. Birdlife International,
Cambridge, United Kingdom, and Hawk Mountain Sanctuary Association,
Kempton, Pennsylvania

Table 1. Average annual counts and population trends (annual percent change) for 9 raptors at Lighthouse Point, New Haven, Connecticut.

Species	Ave. annual count	1974-2004 trend	<i>P</i>	1990-2000 trend	<i>P</i>
Osprey	1250	5.1	≤0.01	-9.0	≤0.01
Bald Eagle	21	15.7	≤0.01	8.9	≤0.01
Northern Harrier	523	0.7	>0.10	-1.9	≤0.10
Cooper's Hawk	635	7.5	≤0.01	-4.0	≤0.10
Sharp-shinned Hawk	6790	1.8	≤0.05	-3.3	≤0.05
Broad-winged Hawk	2126	-0.4	>0.10	-2.3	≤0.10
Red-tailed Hawk	340	3.1	≤0.01	3.1	≤0.01
American Kestrel	2309	-3.1	≤0.01	-7.1	≤0.01
Peregrine Falcon	32	7.8	≤0.01	-0.5	>0.10

Table 2. Average annual counts and population trends (annual percent change) for 9 raptors at Cape May Bird Observatory, Cape May Point, New Jersey.

Species	Ave. annual count	1976-2004 trend	<i>P</i>	1990-2000 trend	<i>P</i>
Osprey	2346	2.4	≤0.01	-0.7	>0.10
Bald Eagle	87	8.4	≤0.01	10.8	≤0.01
Northern Harrier	1657	-0.7	> 0.10	-0.7	>0.10
Cooper's Hawk	2497	4.6	≤0.01	3.3	>0.10
Sharp-shinned Hawk	27224	-4.5	≤0.01	3.0	>0.10
Broad-winged Hawk	2344	-1.4	>0.10	-1.4	>0.10
Red-tailed Hawk	1943	-1.8	>0.10	0.3	>0.10
American Kestrel	9106	-4.5	≤0.01	-4.5	≤0.01
Peregrine Falcon	632	6.0	≤0.01	3.4	≤0.10

Table 3. Average annual counts and population trends (annual percent change) for 9 raptors at Montclair Hawk Lookout, Montclair, New Jersey.

Species	Ave. annual count	1974-2004 trend	<i>P</i>	1990-2000 trend	<i>P</i>
Osprey	500	1.5	≤0.01	-2.6	≤0.01
Bald Eagle	77	4.7	≤0.01	5.9	≤0.01
Northern Harrier	144	0.6	>0.10	0.7	>0.10
Cooper's Hawk	520	4.1	≤0.01	4.1	≤0.01
Sharp-shinned Hawk	6079	-1.1	≤0.01	-3.3	≤0.01
Broad-winged Hawk	8653	-3.1	≤0.01	-3.1	≤0.01
Red-tailed Hawk	3730	-1.9	≤0.01	-1.9	≤0.01
American Kestrel	533	-1.6	≤0.01	0.1	>0.10
Peregrine Falcon	28	4.3	≤0.01	1.6	>0.10

Table 4. Average annual counts and population trends (annual percent change) for 9 raptors at Hawk Mountain Sanctuary, Kempton, Pennsylvania.

Species	Ave. annual count	1974-2004 trend	<i>P</i>	1990-2000 trend	<i>P</i>
Osprey	520	2.4	≤0.01	-1.2	>0.10
Bald Eagle	35	7.7	≤0.01	9.2	≤0.01
Northern Harrier	248	-2.0	≤0.01	-3.0	≤0.01
Cooper's Hawk	120	10.2	≤0.01	10.2	≤0.01
Sharp-shinned Hawk	3345	-0.3	≤0.10	0.2	>0.10
Broad-winged Hawk	14330	1.4	>0.10	-6.4	≤0.01
Red-tailed Hawk	994	1.3	>0.10	1.3	>0.10
American Kestrel	775	-3.3	≤0.01	-3.3	≤0.01
Peregrine Falcon	19	12.3	≤0.01	3.3	≤0.10

Table 5. Average annual counts and population trends (annual percent change) for 9 raptors at Waggoner's Gap, Carlisle, Pennsylvania.

Species	Ave. annual count	1974-2004 trend	<i>P</i>	1990-2000 trend	<i>P</i>
Osprey	289	2.0	>0.10	-0.9	>0.10
Bald Eagle	65	6.7	≤0.01	4.4	≤0.01
Northern Harrier	230	-0.4	≥0.10	-0.8	≥0.10
Cooper's Hawk	425	5.1	≤0.01	5.1	≤0.01
Sharp-shinned Hawk	4850	-0.6	>0.10	-0.6	>0.10
Broad-winged Hawk	4257	-1.1	>0.10	4.1	≤0.10
Red-tailed Hawk	3250	-0.2	>0.10	4.3	≤0.05
American Kestrel	212	-0.3	>0.10	3.1	≤0.10
Peregrine Falcon	29	2.3	≤0.05	2.1	>0.10

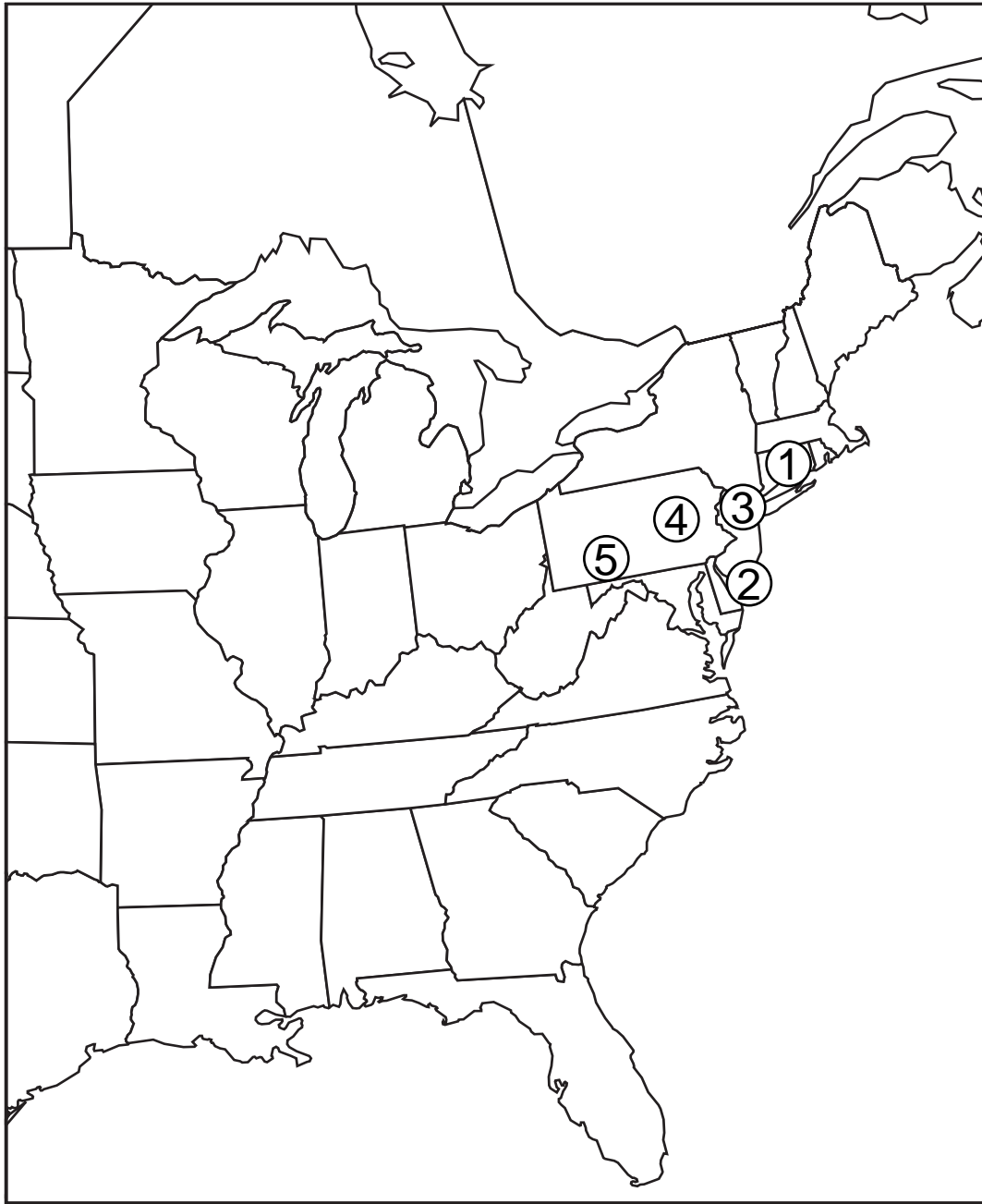


Figure 1. Locations of five hawkwatches in US Fish and Wildlife Service Region Five. Numbers identify (1) Lighthouse Point Hawk Watch, Connecticut (2) Cape May Point, New Jersey (3) Montclair Hawk Lookout, New Jersey (4) Hawk Mountain Sanctuary, Pennsylvania and (5) Waggoner's Gap, Pennsylvania.

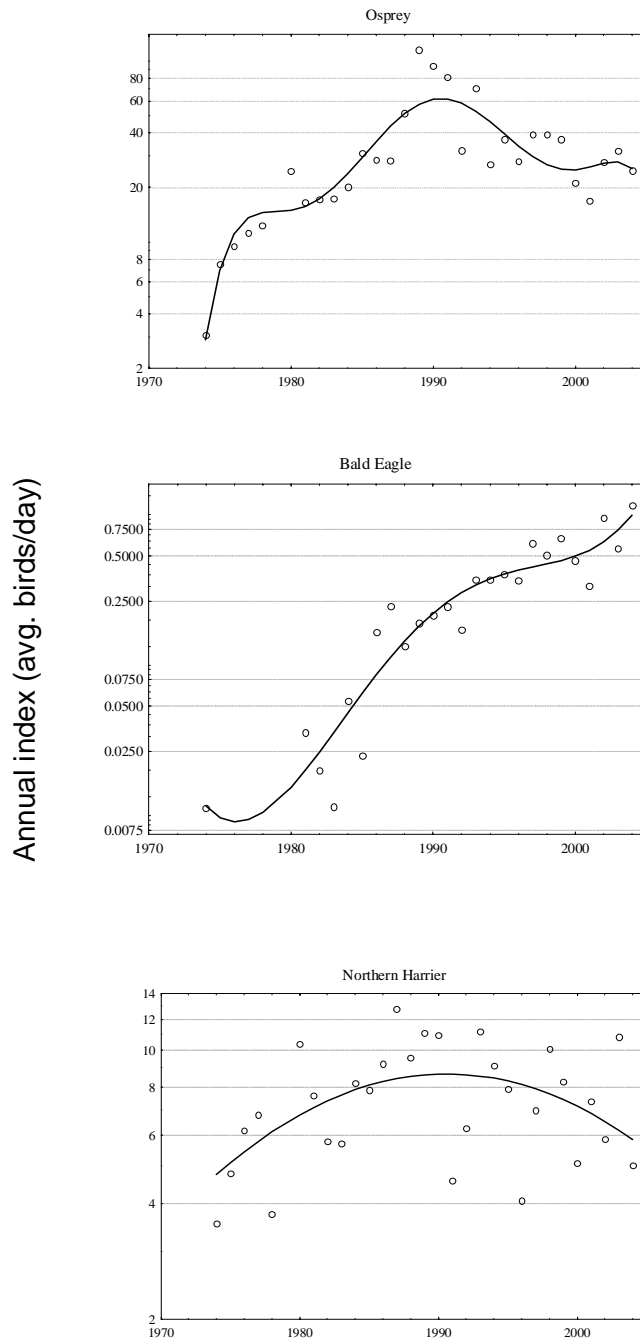


Figure 2. Population indexes and trajectories for Ospreys, Bald Eagles, and Northern Harriers at Lighthouse Point, Connecticut, 1974-2004.

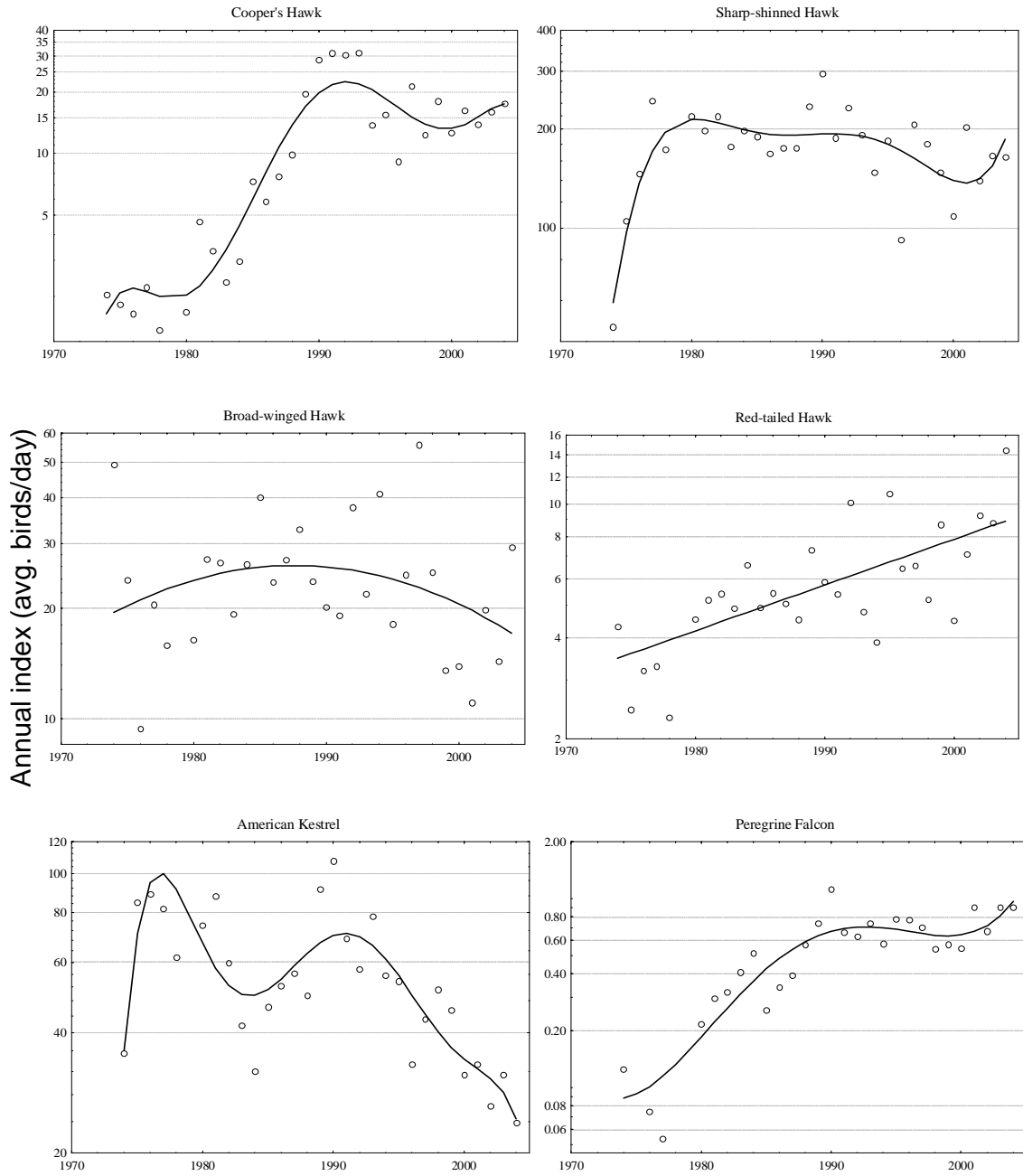


Figure 3. Population indexes and trajectories for two accipiters, two buteos, and two falcons at Lighthouse Point, Connecticut, 1974-2004.

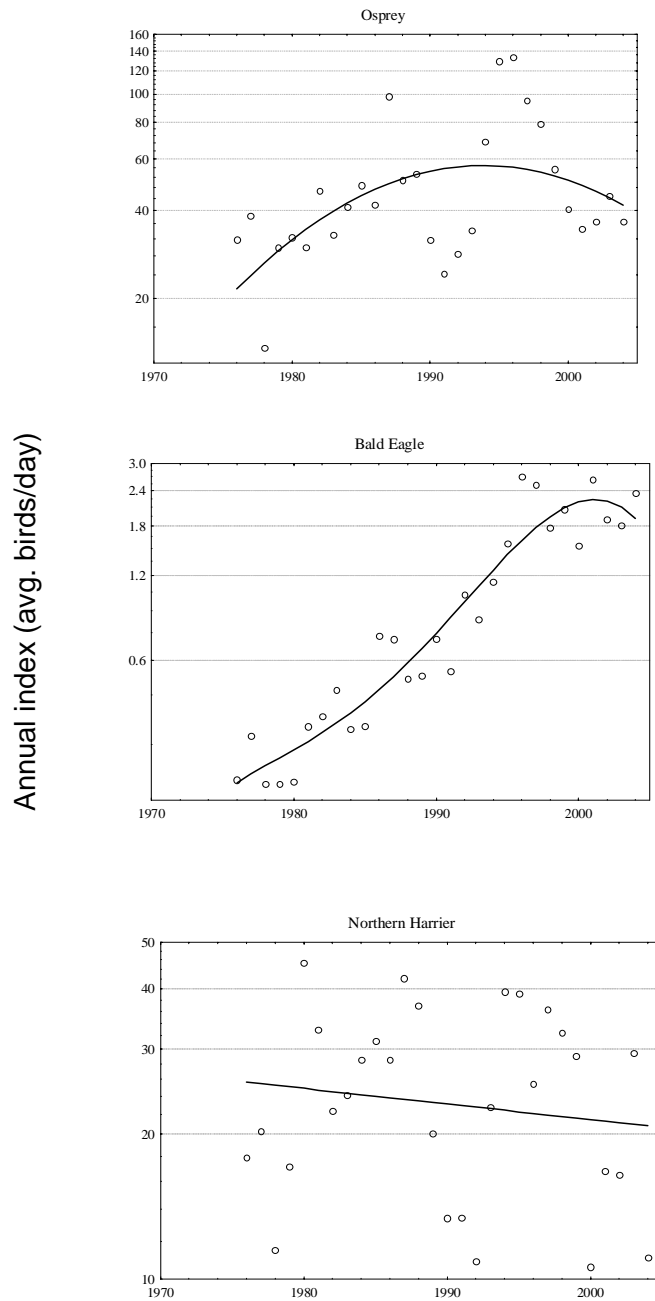


Figure 4. Population indexes and trajectories for Ospreys, Bald Eagles, and Northern Harriers at Cape May Point, New Jersey, 1976-2004.

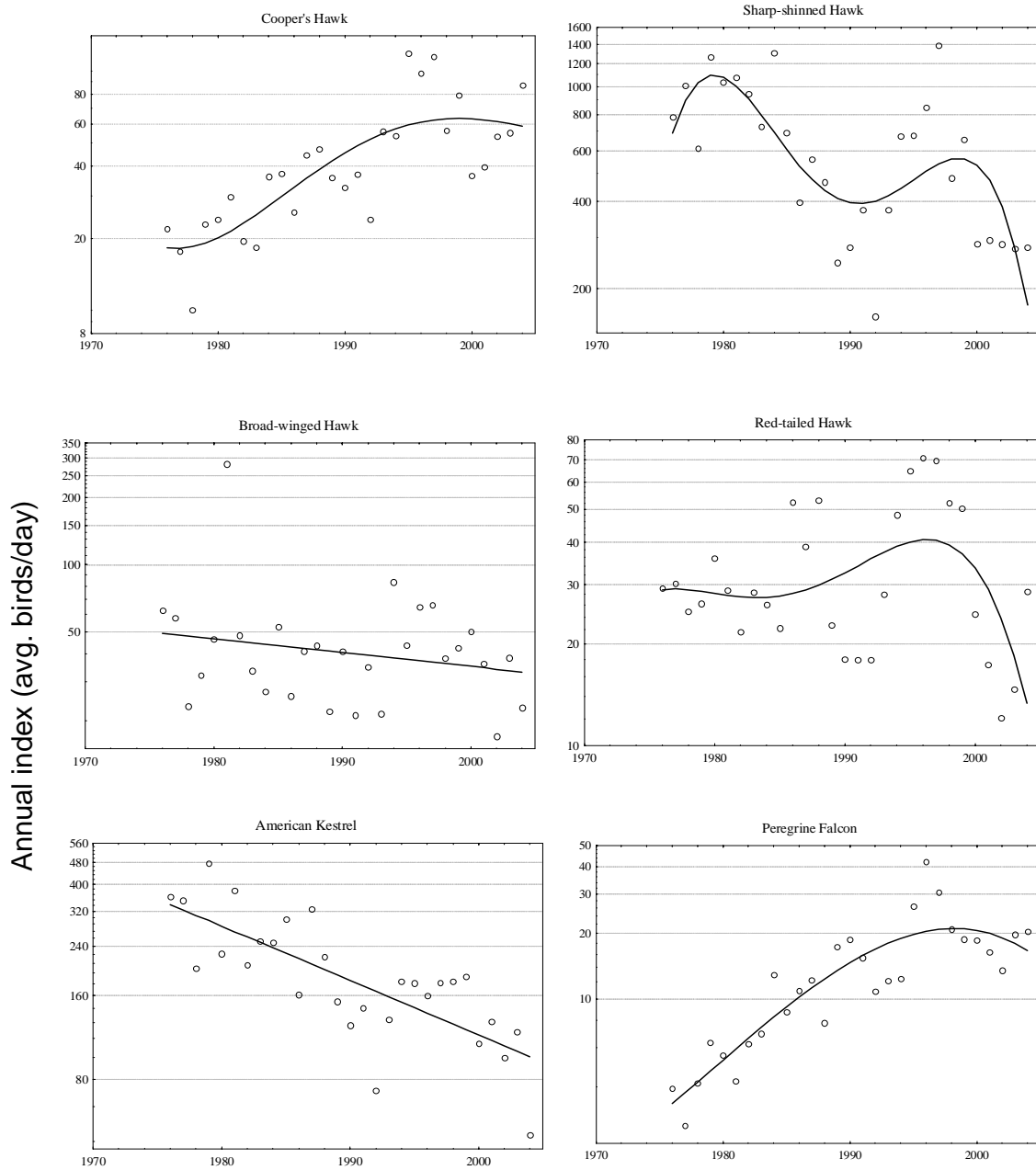


Figure 5. Population indexes and trajectories for two accipiters, two buteos, and two falcons at Cape May Point, New Jersey, 1976-2004.

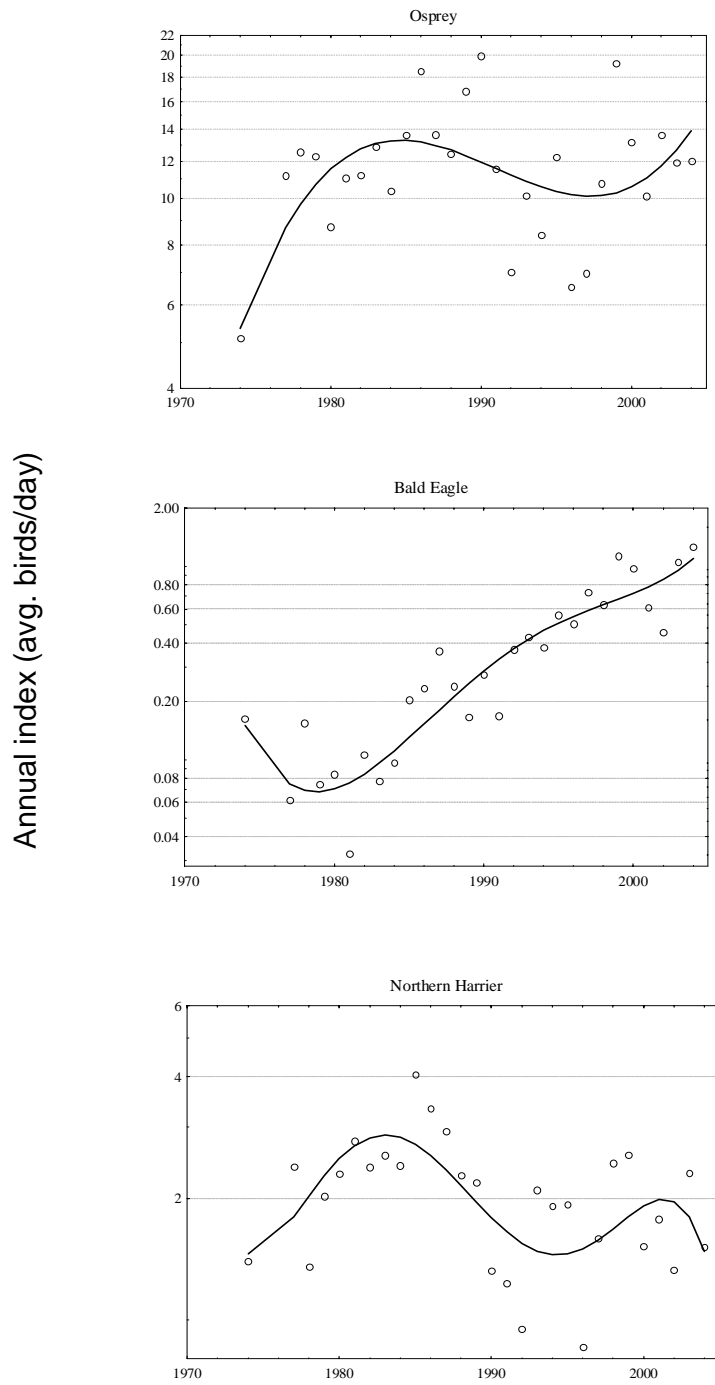


Figure 6. Population indexes and trajectories for Ospreys, Bald Eagles, and Northern Harriers at Montclair Hawk Lookout, New Jersey, 1974-2004.

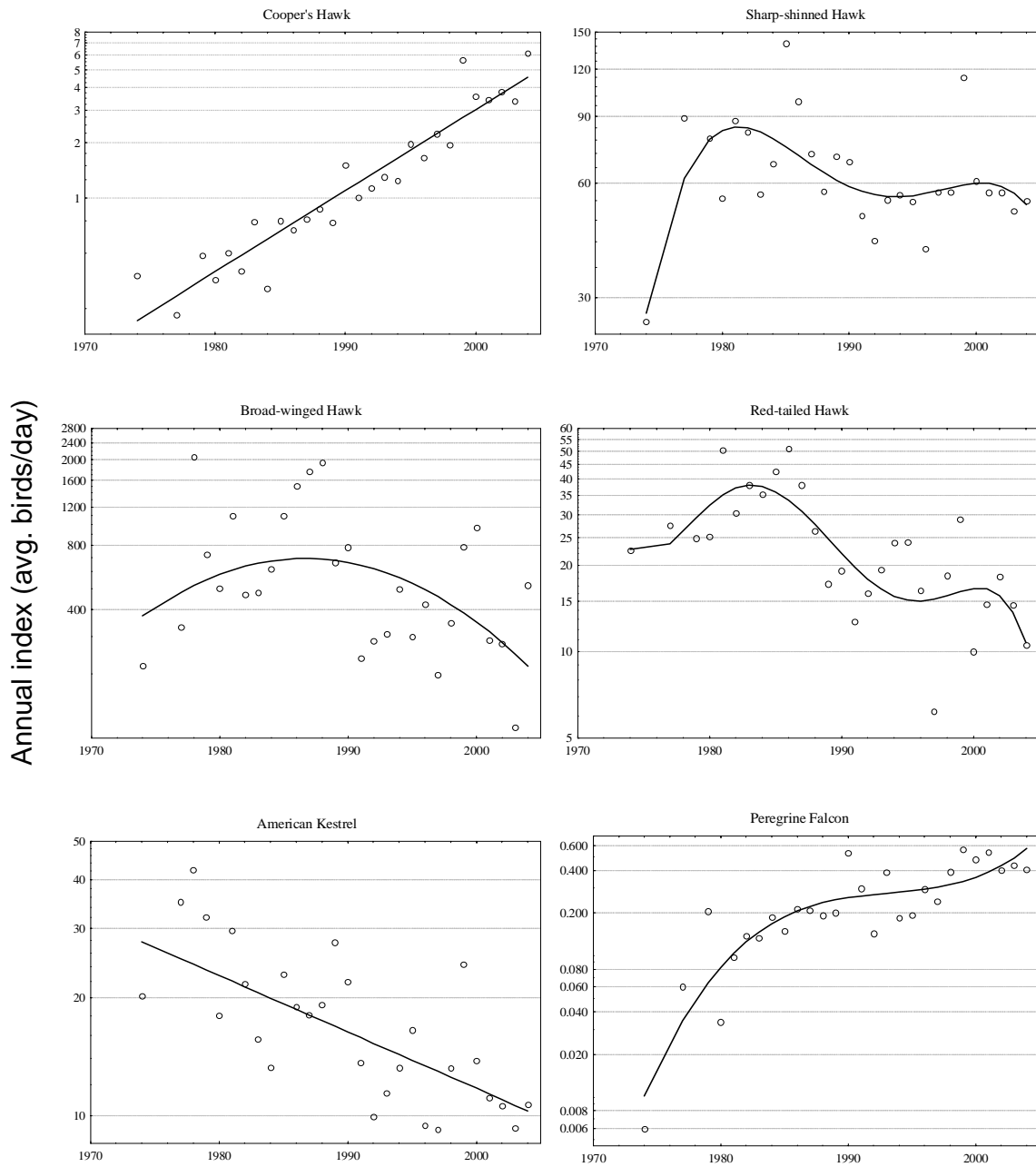


Figure 7. Population indexes and trajectories for two accipiters, two buteos, and two falcons at Montclair Hawk Lookout, New Jersey, 1974-2004.

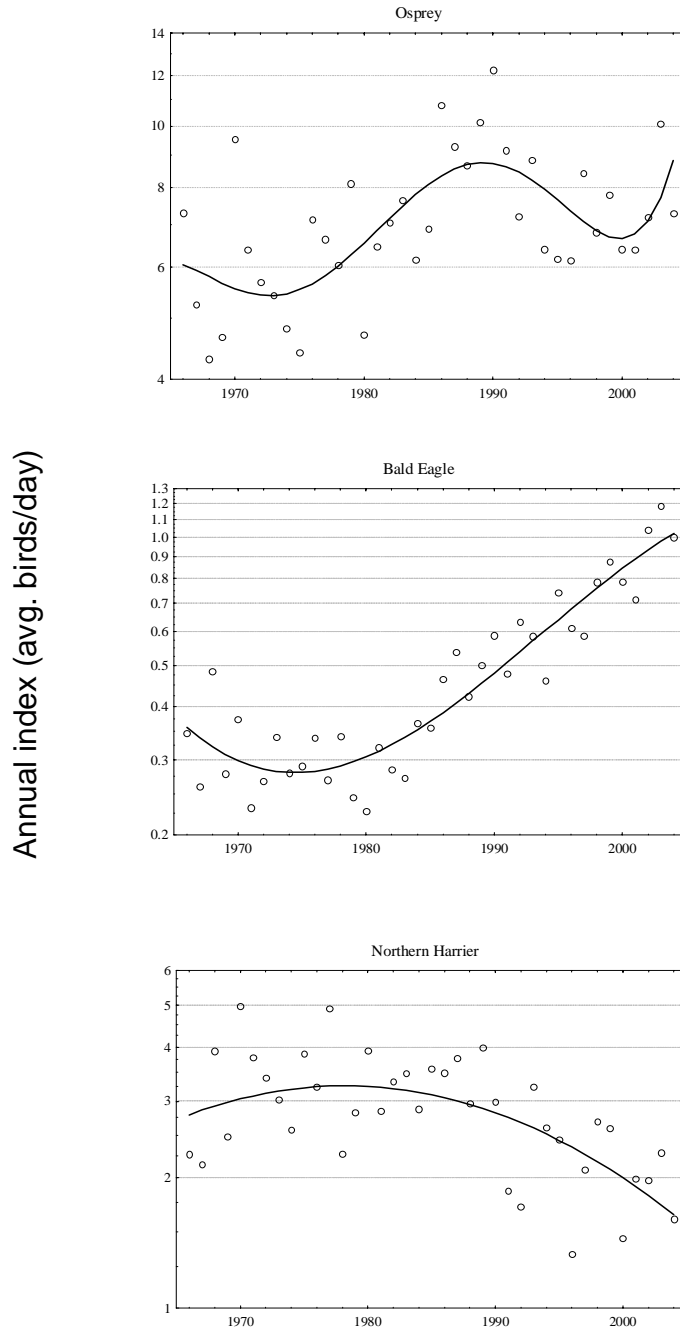


Figure 8. Population indexes and trajectories for Ospreys, Bald Eagles, and Northern Harriers at Hawk Mountain Sanctuary, Pennsylvania, 1966-2004.

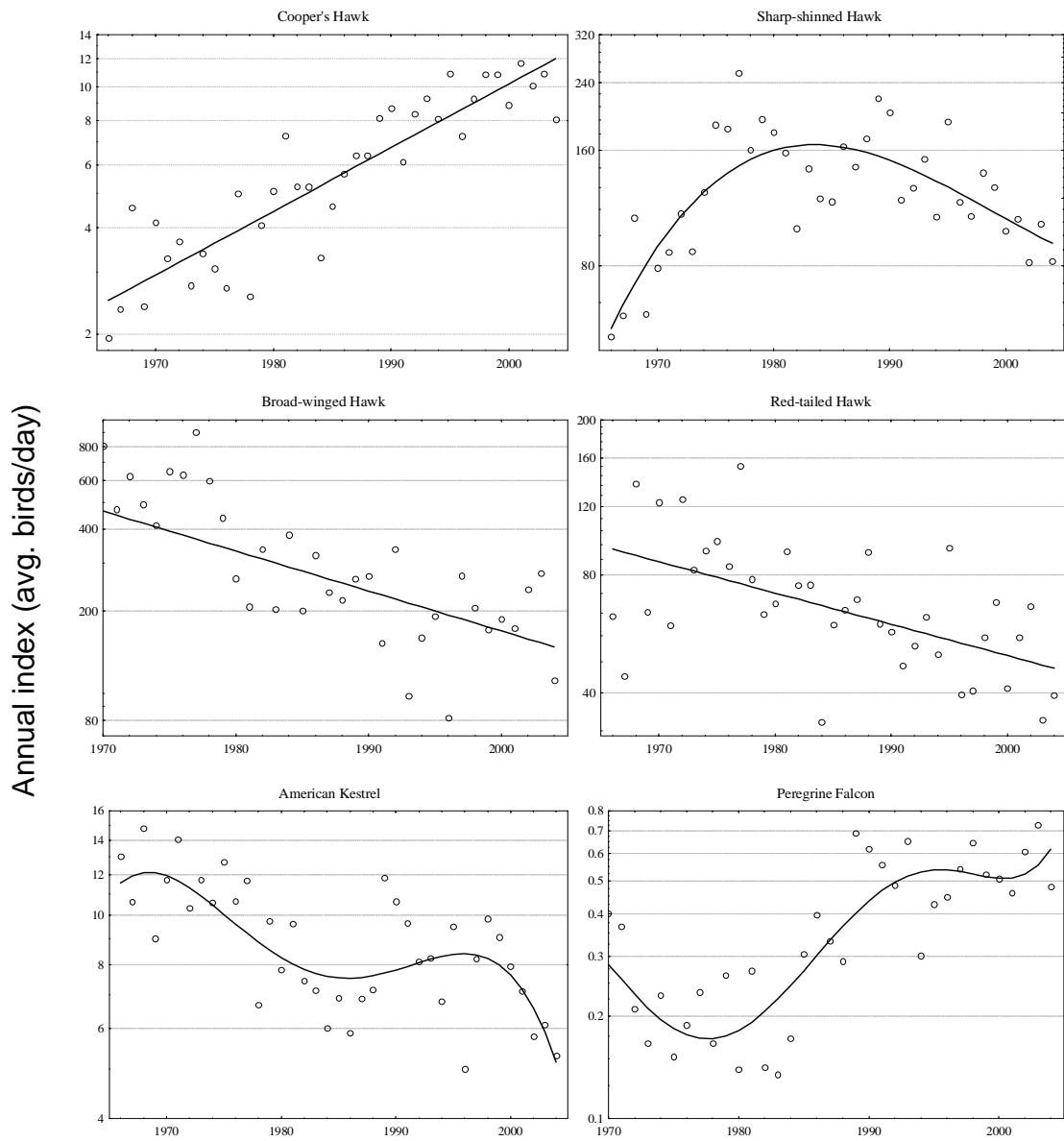


Figure 9. Population indexes and trajectories for two accipiters, two buteos, and two falcons at Hawk Mountain Sanctuary, Pennsylvania, 1966-2004.

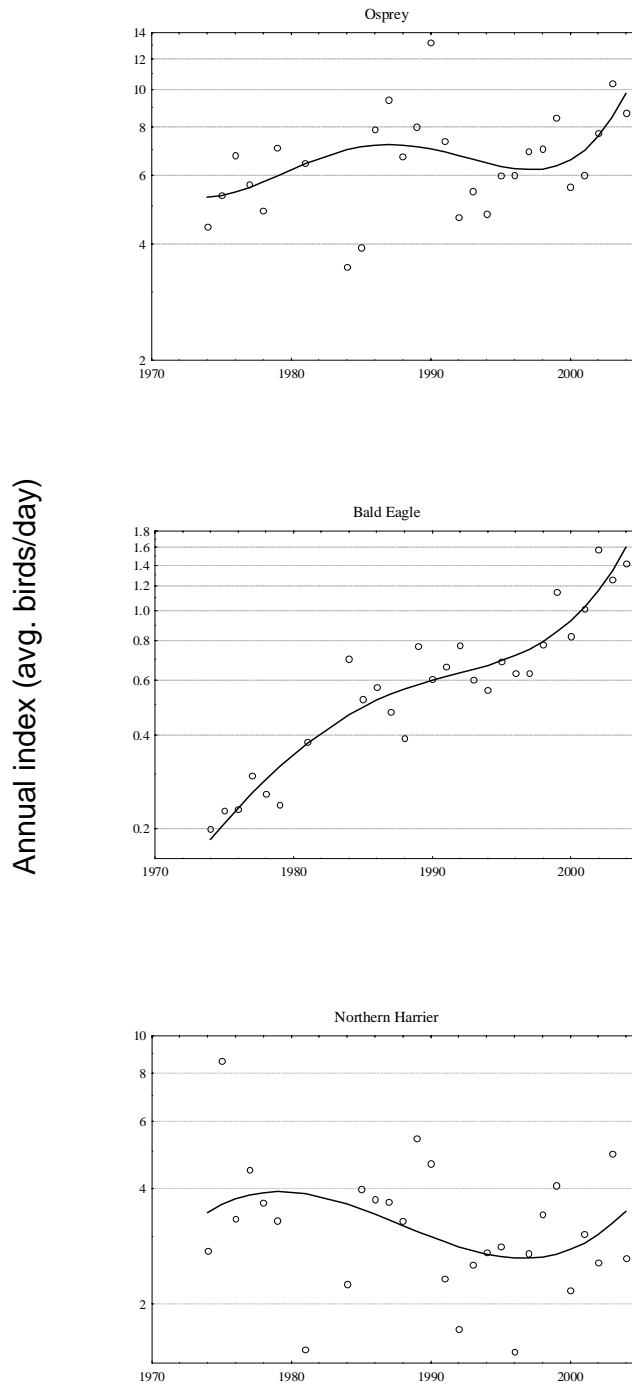


Figure 10. Population indexes and trajectories for Ospreys, Bald Eagles, and Northern Harriers at Waggoner's Gap, Pennsylvania, 1974-2004.

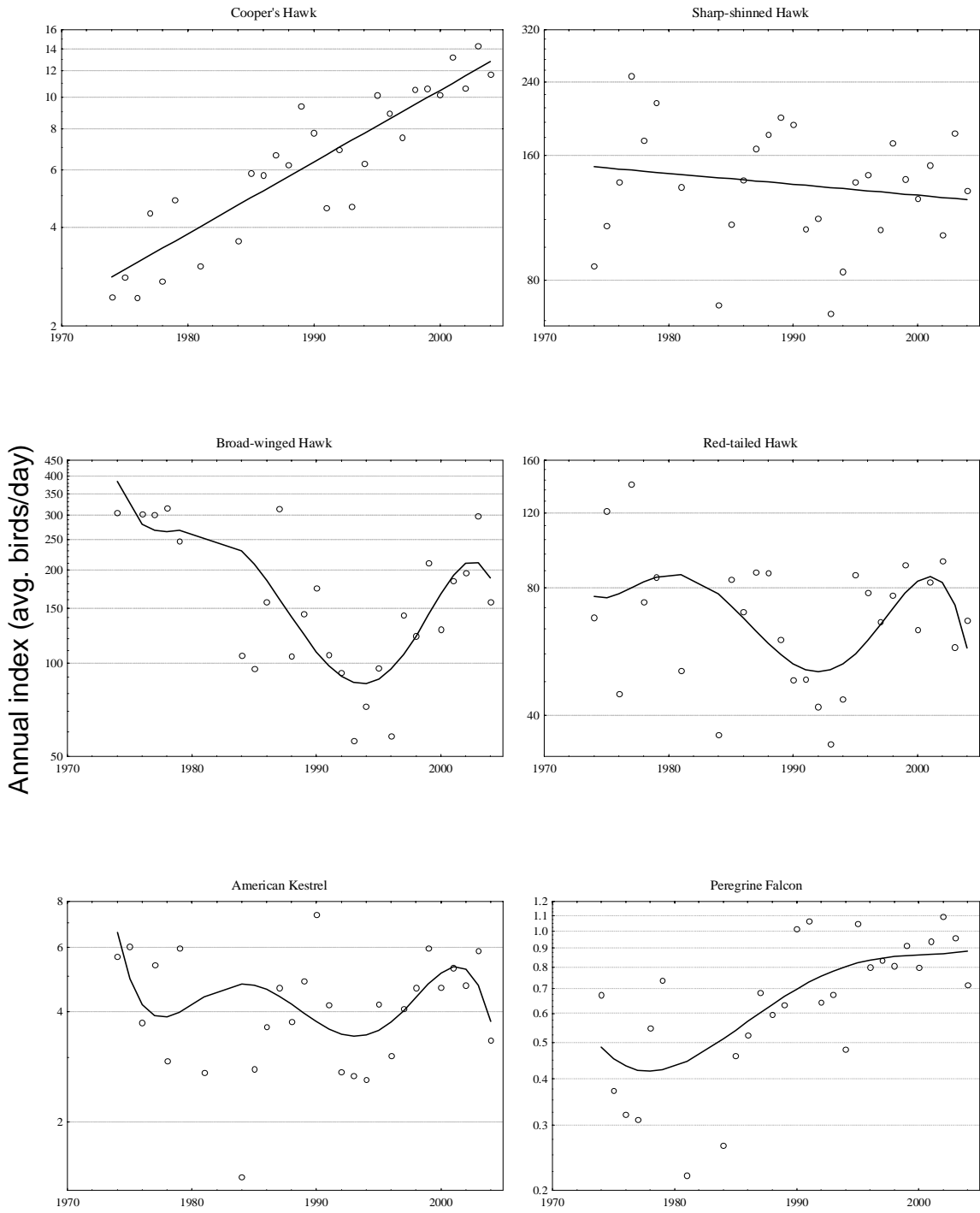


Figure 11. Population indexes and trajectories for two accipiters, two buteos, and two falcons at Waggoner's Gap, Pennsylvania, 1974-2004.

THE RAPTOR POPULATION INDEX PROJECT

(<http://www.rpi-project.org>)

RPI is a partnership between the Hawk Migration Association of North America, Hawk Mountain Sanctuary, and HawkWatch International housed at the Cornell Lab of Ornithology.

RPI Vision and Objectives

The RPI partner organizations believe that raptor migration counts can contribute effectively to long-term population monitoring by producing scientifically sound assessments of population status that are shared widely through public outreach and education.

Specifically, the Raptor Population Index Project is:

- (1) Producing statistically defensible indexes of annual abundance and trends for each species of migratory raptor from as many count sites as possible
- (2) Providing frequently updated assessments of the status of each species and
- (3) Making those results widely available to participating count sites, the scientific community, conservation agencies, and the public.

RPI Purpose, Need, and History

Because diurnal raptors are at the top of many food chains, they are sensitive indicators of ecosystem health. Hawkwatchers, attracted to mountaintops and shorelines to enjoy the spectacle of raptor migrations, have been able to combine their recreational pursuits with collection of valuable long-term data on the status of raptor populations.

Over the past several decades, hundreds of independent watchsites have contributed meticulously collected data, stored on paper forms, to a central repository. Although one of their goals was to monitor the health of migratory raptor populations, these count results rarely reached the analysis stage and were left for many years as an unused but precious information resource.

RPI, the Raptor Population Index Project, was formally started in the summer of 2004 in response to this need. The existing network of independent watchsites, operated by hundreds of volunteer citizen scientists and professional biologists, was brought together to fill this gap by submitting count data collected at their sites to the HawkCount.org web site, RPI's central data bank.

RPI in Flight: Progress Review 2005-2006

During the last year, RPI: The Raptor Population Index Project:

- Expanded and developed the hardware and database capabilities of HawkCount.org, its on-line information system
- Developed a scientifically-defensible method to assess population trends using migration count data
- Expanded the network of hawkwatches contributing data to HawkCount.org and transferred historical data to electronic format from nine fall and spring sites
- Produced initial population trend estimates for the Eastern and Great Lakes regions
- Established a model protocol to standardize data collection
- Reached multiple audiences through its new website (www.rpi-project.org) as well as other reports, general audience papers, and slide programs to promote the RPI Project
- Developed regional conservation assessments for several species

Plans for 2006-2007

During the next year, RPI will:

- Strengthen collaboration with count sites and assist them in data collection and data transfer into the HawkCount.org website
- Expand and improve HawkCount.org's reporting capabilities and graphic design, develop watchsite database
- Complete a second series of regional analyses from Western sites, including

Chelan Ridge, WA
Bonney Butte, OR
Goshute Mountains, NV
Bridger Mountains, MN
Wellsville Mountains, UT
Lipan Point, AZ
Yaki Point, AZ
Manzano Mountains, NM

-- Complete a third series of regional analyses for Gulf sites, including

Corpus Christi, TX

Smith Point, TX

Veracruz, Mexico

-- Produce conservation assessments for 10 species

-- Continue to disseminate information on RPI to target audiences

The delivery of many of these results will be made in a single product, a book entitled “The State of North American Birds of Prey”, to be released in September 2007.

Collaborate with RPI!

Why should your hawkwatch be part of RPI?

-- HawkCount.org provides safe storage of data

-- RPI site makes data visible, and available for use, upon permission from data owner, to researchers, conservation managers, and the general public

-- HawkCount.org provides results to many data queries in real time (and continues to improve and further develop its reporting capabilities)

-- RPI will provide you with statistically valid assessments of trends of raptors at your site and comparisons with other sites

Through RPI, counting hawks at your site counts for raptor conservation. As RPI develops, we expect to improve and increase our direct interaction with participating sites.

How can you contribute to RPI?

-- Collect data systematically at your watchsite and enter it in hourly format in the HawkCount.org web site

-- Encourage adoption of the new HMANA standard data collection protocol (available at www.rpi-project.org)

-- Enter historical data from your site into the HawkCount.org database

-- Help promote awareness of the RPI Project and its values among your local Hawkwatching community

-- Make a donation to RPI (as individual or watchsite)

Become a Sponsor of the RPI Project and support raptor conservation

Generous support of individuals and hawk watches has been critically important to the successful launching of RPI. Once again, we cordially invite individuals and hawk watches to help bring the RPI vision to reality by becoming Annual Sponsors.

Please choose one of the following six levels of sponsorship:

Golden Eagle \$5,000+

Osprey \$2,500 - \$4,999

Northern Goshawk \$1,000 - \$2,499

Peregrine Falcon \$500 - \$999

Broad-winged Hawk \$100 - \$499

American Kestrel <\$100

Please make checks payable to: HMANA (RPI project) and send them to Ernesto Ruelas Inzunza, Raptor Population Index Project Manager, Cornell Laboratory of Ornithology , 159 Sapsucker Woods Road, Ithaca, NY 14850. Alternatively, you may contribute on line at <http://hmana.org/rpi>

All contributions are tax deductible to the extent allowed by law.

The RPI Team

Management Committee:

Keith L. Bildstein, Stephen W. Hoffman, David J.T. Hussell, Kirk Moulton, Jeff P. Smith, Will Weber.

Science Advisory Committee:

Jonathan Bart (United States Geological Survey), Keith L. Bildstein (Hawk Mountain Sanctuary), Charles M. Francis (Canadian Wildlife Service), Mark R. Fuller (United States Geological Survey), Laurie J. Goodrich (Hawk Mountain Sanctuary), Stephen W. Hoffman (Bozeman, Montana), David J.T. Hussell (Ontario Ministry of Natural Resources), Steven T. Kelling (Cornell Lab of Ornithology), David Mizrahi (New Jersey Audubon Society), Bruce Peterjohn (United States Geological Survey), Jeff P. Smith (HawkWatch International).

RPI Staff:

Ernesto Ruelas Inzunza, RPI Project Manager, HMANA, ruelas@hmana.org
Christopher A. Farmer, North American Monitoring Coordinator, HMS, farmer@hawkmtn.org.
Jason Sodergren, HawkCount Database Specialist, HMANA jason@taiga.com

Organization Support:

Laurie J. Goodrich (HMS), Iain MacLeod (HMANA), Casey Lott (HMANA)

RPI Project Contacts

Ernesto Ruelas Inzunza
Hawk Migration Association of North America
Cornell Lab of Ornithology
159 Sapsucker Woods Rd.
Ithaca, NY 14850
ruelas@hmana.org
Tel. (607) 254-2464
Organizational background at: www.hmana.org

Keith L. Bildstein
Acopian Center for Conservation Learning
Hawk Mountain Sanctuary
410 Summer Valley Rd.
Orwisburg, PA 17961
bildstein@hawkmtn.org
Tel. (570) 943-3411, ext. 108
Organizational background at: www.hawkmountain.org

Jeff P. Smith
HawkWatch International
1800 S. West Temple
Suite 226
Salt Lake City, UT 84115
Tel. (801) 484-6808, ext. 109
Organizational background at: www.hawkwatch.org

Lighthouse Point, Connecticut

60 km SW of Hartford, Connecticut, USA

N 41° 14' 59.5", W 72° 54' 5.1"
(N 41.24986, W 72.90142)

<http://www.battaly.com/nehw/>

General Site Information

Lighthouse Point is a coastal plain watchsite with a 360 degree view at Lighthouse Point Park, E New Haven Harbor, Long Island Sound. Salt marsh, tidal flats, and upland oak forest dominate the site. Park facilities include parking lots, picnic areas, and beaches. Counts are made at the southernmost parking lot at the park.

Site Contacts

Name	E-mail	Phone
Ronald G. Bell	ronald.g.bell@snet.net	(203) 387-3815
Neil W. Currie	nwcurrie@snet.net	(203) 426-9861

Raptors Observed at Lighthouse Point

Species	Ave. count / season	Max. Year	Min. Year	No. on peak day(s)
Turkey Vulture (<i>Cathartes aura</i>)	318	559 (2004)	7 (2002)	87 (Oct 20, 2005) 80 (Oct 20, 2004) 61 (Nov 09, 2004)
Osprey (<i>Pandion haliaetus</i>)	479	1130 (2005)	249 (2006)	107 (Sep 27, 2005) 87 (Sep 24, 2005) 85 (Aug 31, 2006)
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	55	137 (2005)	11 (2006)	15 (Sep 24, 2005) 13 (Sep 27, 2005) 12 (Oct 15, 2005)
Northern Harrier (<i>Circus cyaneus</i>)	179	414 (2005)	32 (2006)	37 (Oct 17, 2005) 27 (Sep 12, 2002) 19 (Oct 16, 2005)
Sharp-shinned Hawk (<i>Accipiter striatus</i>)	2878	6208 (2005)	14 (2006)	806 (Oct 20, 2005) 795 (Oct 17, 2005) 637 (Oct 11, 2004)
Cooper's Hawk (<i>Accipiter cooperii</i>)	478	1292 (2005)	10 (2006)	150 (Oct 17, 2005) 136 (Oct 16, 2005)

				110 (Oct 20, 2005)
Northern Goshawk (<i>Accipiter gentilis</i>)	5	11 (2005)	1 (2002)	2 (Nov 02, 2005) 1 (Nov 15, 2004) 1 (Nov 11, 2005)
Red-shouldered Hawk (<i>Buteo lineatus</i>)	72	148 (2004)	1 (2006)	25 (Oct 24, 2005) 25 (Nov 09, 2004) 16 (Nov 14, 2004)
Broad-winged Hawk (<i>Buteo platypterus</i>)	218	735 (2005)	3 (2006)	647 (Sep 27, 2005) 32 (Oct 01, 2004) 25 (Sep 13, 2004)
Swainson's Hawk (<i>Buteo swainsoni</i>)	1	1 (2005)	1 (2005)	1 (Oct 17, 2005)
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	289	834 (2004)	6 (2006)	75 (Nov 14, 2004) 58 (Nov 13, 2004) 57 (Oct 28, 2004)
Rough-legged Hawk (<i>Buteo lagopus</i>)	3	5 (2004)	0 (2005)	1 (Oct 26, 2004) 1 (Oct 28, 2004) 1 (Nov 15, 2004)
Golden Eagle (<i>Aquila chrysaetos</i>)	4	10 (2005)	1 (2006)	3 (Nov 07, 2005) 2 (Nov 11, 2005) 1 (Nov 18, 2005)
American Kestrel (<i>Falco sparverius</i>)	752	2010 (2005)	26 (2006)	389 (Oct 16, 2005) 301 (Oct 17, 2005) 232 (Oct 12, 2004)
Merlin (<i>Falco columbarius</i>)	219	595 (2005)	12 (2006)	221 (Oct 16, 2005) 32 (Oct 17, 2005) 22 (Oct 12, 2004)
Peregrine Falcon (<i>Falco peregrinus</i>)	66	140 (2005)	8 (2006)	15 (Oct 20, 2005) 12 (Sep 23, 2005) 9 (Sep 27, 2005)

Count Season
Fall: Aug 25 to Nov 30

Data Inventory (at hawkcount.org, as of Sep 05, 2006)

Data Summary	Data Years
4 years (178 days) of data saved: 0 years of hourly totals, 3 years of daily totals, and 1 years of mixed hourly/daily totals.	2002, 2004-2006

Site History**Site Topography**

Coastal site

Directions to Site

To reach the park, if heading north on Route 95, take Exit 50 (Woodward Avenue, Lighthouse Point). Turn right onto Townsend Avenue and proceed about 2.1 miles to Lighthouse Road. Turn right onto Lighthouse Road, which leads into the park, and keep to your left, going towards the bathhouse. Hawkwatching is generally done from the parking lot just east of the large field before the bathhouse. If heading south on Route 95, take Exit 51 (U.S. 1, Frontage Road, Lighthouse Point), which merges with Frontage Road, and runs parallel to Route 95 for about a mile. Turn left at the light onto Townsend Avenue, and continue as described above.

Cape May, New Jersey

Cape May Point, New Jersey, USA

N 38° 55' 57.3", W 74° 57' 28.8"
(N 38.93258, W 74.958)

<http://www.njaudubon.org/Centers/CMBO/>

General Site Information

Cape May, New Jersey, is one of the most renowned birding areas, not only in the U.S., but in the world. The peninsular geography and prevailing westerly winds create a migrant trap unmatched in the eastern North America. Each fall, 16 regularly occurring species of hawks migrate through Cape May. Late September through mid October is the time of peak raptor diversity and marks the period when impressive numbers of Peregrine Falcons pass through. The Cape May Point Hawk Count platform has been staffed each fall since 1976 by the Cape May Bird Observatory's official hawk counter, from September 1 to the end of November. A daily and annual raptor count is tallied throughout the fall, and exceptional totals are recorded each year. If you are a novice, there are education interns on hand from early September through early November to help you hone your hawk I. D. skills.

Site Contacts

Name	Role	E-mail	Phone
David Mizrahi	Vice President for Research, Cape May Bird Observatory	david.mizrahi@njaudubon.org	(609) 861-0700
Vince Elia	Research Associate, Cape May Bird Observatory	vince.elia@njaudubon.org	(609) 861-0700

Raptors Observed at Cape May

Species	Avg. count / season	Max. Year	Min. Year	Peak Days
Black Vulture (<i>Coragyps atratus</i>)	200	345 (2005)	106 (2004)	55 (Nov 11, 2005) 44 (Nov 17, 2005) 41 (Oct 02, 2003)
Turkey Vulture (<i>Cathartes aura</i>)	1691	3131 (2005)	1159 (2004)	607 (Nov 18, 2005) 344 (Nov 17, 2005) 257 (Nov 19, 2005)

Osprey (<i>Pandion haliaetus</i>)	2066	2447 (2005)	1863 (2003)	192 (Oct 16, 2005) 177 (Sep 29, 2002) 176 (Sep 25, 2005) 20 (Sep 03, 2005)
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	204	262 (2005)	165 (2003)	16 (Oct 13, 2003) 14 (Oct 17, 2005)
Northern Harrier (<i>Circus cyaneus</i>)	1396	2273 (2003)	832 (2004)	137 (Oct 06, 2003) 135 (Oct 13, 2003) 118 (Nov 08, 2003)
Sharp-shinned Hawk (<i>Accipiter striatus</i>)	16362	19007 (2003)	13973 (2004)	2662 (Oct 13, 2003) 1502 (Sep 22, 2004) 1383 (Oct 24, 2003)
Cooper's Hawk (<i>Accipiter cooperii</i>)	4556	5829 (2005)	3511 (2002)	601 (Oct 20, 2005) 570 (Oct 13, 2003) 552 (Oct 19, 2005)
Northern Goshawk (<i>Accipiter gentilis</i>)	26	49 (2004)	5 (2003)	10 (Nov 09, 2004) 7 (Nov 28, 2002) 6 (Nov 11, 2005)
Red-shouldered Hawk (<i>Buteo lineatus</i>)	577	699 (2005)	483 (2002)	185 (Nov 18, 2005) 153 (Nov 09, 2004) 121 (Nov 08, 2003)
Broad-winged Hawk (<i>Buteo platypterus</i>)	859	1838 (2003)	452 (2002)	619 (Oct 13, 2003) 318 (Oct 06, 2003) 176 (Sep 29, 2003)
Swainson's Hawk (<i>Buteo swainsoni</i>)	2	3 (2005)	1 (2002)	1 (Sep 23, 2005) 1 (Oct 23, 2005) 1 (Oct 26, 2005)
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	1587	2327 (2005)	921 (2002)	363 (Nov 11, 2005) 340 (Nov 18, 2005) 254 (Nov 09, 2004)
Rough-legged Hawk (<i>Buteo lagopus</i>)	3	7 (2003)	1 (2005)	2 (Nov 08, 2003) 2 (Sep 16, 2003) 1 (Oct 18, 2005)
Golden Eagle (<i>Aquila chrysaetos</i>)	11	12 (2005)	9 (2003)	7 (Nov 02, 2005) 3 (Oct 31, 2002) 3 (Nov 08, 2003)
American Kestrel (<i>Falco sparverius</i>)	5388	7312 (2003)	2672 (2004)	1418 (Oct 15, 2005) 1189 (Sep 16, 2003)

				1101 (Sep 29, 2003)
Merlin (<i>Falco columbarius</i>)	1629	1890 (2003)	1308 (2002)	342 (Oct 15, 2005) 276 (Sep 16, 2003) 188 (Oct 14, 2004)
Peregrine Falcon (<i>Falco peregrinus</i>)	1044	1164 (2005)	942 (2003)	298 (Oct 05, 2002) 241 (Oct 05, 2005) 223 (Oct 04, 2005)

Count Season**Fall:**

Sep 01 to Nov 30

Procedures/Protocols

Cape May Data Collection Protocol

Data Inventory (at hawkcount.org, as of Sep 04, 2006)

Data Summary	Data Years
4 years (354 days) of data saved: 3 years of hourly totals, 0 years of daily totals, and 1 years of mixed hourly/daily totals	2002-2005

Site History

Founded in 1975 by the New Jersey Audubon Society*, the Cape May Bird Observatory (CMBO) is a leader in research, environmental education, bird conservation, and recreational birding activities. Our mission: to understand and instill appreciation of the needs of resident and migrating birds so that human ambitions do not undermine them. Funded almost entirely by the support of an international membership, two facilities serve our members' interests and needs. The Center for Research and Education in Goshen was opened in 1997. This 8,600 square-foot center, surrounded by 26 acres of marsh and upland, is strategically located to access the natural wealth of New Jersey's Delaware Bayshore. Open 9am to 4:30 pm, seven days a week, the facility focuses on backyard habitat and backyard bird watching, with displays, a bookstore featuring natural history books, optics, bird feeders and supplies, a 170-seat lecture room, outside observation deck, natural landscaping demonstrating model backyard habitat, wildlife art gallery, and offices for staff.

*New Jersey Audubon Society, founded in 1897, is senior to (and has no affiliation with) the National Audubon Society.

Site Topography

Cape May is situated at the southeastern-most tip of New Jersey. During periods of northwest and west winds in fall large numbers of southbound hawks, as well as other migrants, are steered toward the coast and subsequently funneled down the peninsula to Cape May. When migrating raptors arrive at the southern tip of the state, the 13 mile expanse of Delaware Bay causes most species to hesitate before choosing a strategy for continuing their migration.

Directions to Site

To reach the Cape May Hawk Watch, take the Garden State Parkway south to the end. Continue straight on Route 109 at the end of the Parkway. This road becomes Lafayette Street after you cross the bridge over the canal. Go about 2 miles and bear right onto Perry Street. In about 0.4 miles you will come to the traffic light at Broadway and Sunset. Continue straight ahead on Sunset for 1.7 miles to Lighthouse Avenue. Turn left onto Lighthouse Avenue and go 0.7 miles to entrance for the Lighthouse and the State Park on your left. The hawk watch platform is at the far end of the parking lot.

DIRECTIONS TO THE NORTHWOOD CENTER

From the Garden State Parkway --

Follow Parkway to the end; proceed through traffic light over large canal bridge and stay straight. You will then be on Lafayette Street all the way into Cape May. At the end of Lafayette, you'll come to a T-Head at Collier's Liquor Store. Bear right and follow the road but bear slightly left (go past Swain's Hardware store) through 2 traffic lights. The 2nd traffic light will put you on Sunset Blvd. Go straight to Lighthouse Avenue; take a left on Lighthouse; take 2nd right onto East Lake Drive. Park along the roadside.

From Route 55 --

Take Rt. 55 South to the end, which merges onto Rt. 47. Continue south onto Rt. 347 (which rejoins Rt. 47 just north of Dennisville). Continue south on Rt. 47 for about 35 minutes until you reach the traffic light at the intersection of Rt 626 (Railroad Avenue). Take a right onto Rt 626 and continue on this road for about 15 minutes. Rt 626 becomes Seashore Road. Continue straight and will come to a large intersection at Rt 9; cross the intersection and continue over the small canal bridge. Rt 626 now becomes Broadway. At the next traffic light, take a right onto Sunset Blvd. Go straight to Lighthouse Avenue; take a left on Lighthouse; take 2nd right onto East Lake Drive. Park along the roadside.

Montclair Hawk Lookout, New Jersey

Montclair, New Jersey, USA

N 40° 50' 47.9", W 74° 12' 46.6"
(N 40.84664, W 74.21294)

<http://www.njaudubon.org/sites/hwmont.html>

General Site Information

The Montclair Hawk Lookout is nestled atop a 500-foot basalt ledge on a ridge known as the First Watchung Mountain in Montclair, New Jersey. It is a well constructed, stone-filled platform that is the site of the Montclair Hawk Lookout, a sanctuary of the New Jersey Audubon Society. This is the first ridge west of the lower Hudson River Valley, and runs from northeast to southwest. What makes this site interesting during migration is the mixture of both coastal and ridge flights. In some years, exceptional Broad-winged Hawk flights have been observed in the Fall. The view from the platform is spectacular, considering its location amidst one of the most densely populated areas in the country. While participating in the "hide and seek" search for hawks in the ever spinning billowing clouds above, one can be treated to the south and east with a view of the Verrazano Narrows Bridge, the entire New York City skyline including the Statue of Liberty, all the way northeast to the Palisades. To the north and west, peaks from the Ramapo Mountains can be discerned, and the beginning of the Second Watchung Mountain. Directly across from the Lookout facing north is the Essex County Park of Mills Reservation from where the Spring Hawk Count is conducted, as the visibility to the south is better from there.

Site Contacts

Name	Role	E-mail	Phone
Else Greenstone	Hawkwatch Coordinator	wglaw2@cs.com	(908) 276-4605
Wayne Greenstone		wglaw2@cs.com	(908) 276-4605

Raptors Observed at Montclair Hawk Lookout

Species	Avg. count / season	Max. Year	Min. Year	Peak Days
Black Vulture (<i>Coragyps atratus</i>)	41	96 (2005)	13 (2002)	38 (Oct 19, 2005) 8 (Apr 06, 2005) 7 (Mar 15, 2003)
Turkey Vulture (<i>Cathartes aura</i>)	1004	2033 (2005)	17 (1976)	210 (Oct 28, 2005) 184 (Oct 22, 2003) 164 (Oct 25, 2003)
Osprey	370	748 (2003)	2 (1976)	74 (Sep 18, 2002)

<i>(Pandion haliaetus)</i>				39 (Oct 05, 2002) 38 (Oct 06, 2002)
Mississippi Kite <i>(Ictinia mississippiensis)</i>	1	1 (2005)	1 (2005)	1 (May 03, 2005)
Bald Eagle <i>(Haliaeetus leucocephalus)</i>	292	1363 (1993)	6 (2006)	169 (Nov 19, 1993) 104 (Oct 21, 1993) 96 (Nov 17, 1993)
Northern Harrier <i>(Circus cyaneus)</i>	89	194 (2003)	0 (1989)	22 (Oct 03, 1993) 22 (Apr 17, 2004) 20 (Sep 29, 1976)
Sharp-shinned Hawk <i>(Accipiter striatus)</i>	1979	4213 (1993)	0 (1989)	873 (Oct 06, 1993) 840 (Oct 05, 1993) 774 (Sep 29, 1976)
Cooper's Hawk <i>(Accipiter cooperii)</i>	299	547 (2004)	47 (2006)	56 (Oct 20, 2005) 35 (Oct 19, 2005) 32 (Oct 11, 2004)
Northern Goshawk <i>(Accipiter gentilis)</i>	207	1218 (1993)	2 (1976)	107 (Oct 29, 1993) 105 (Nov 19, 1993) 93 (Oct 26, 1993)
Red-shouldered Hawk <i>(Buteo lineatus)</i>	163	292 (2003)	5 (1993)	35 (Nov 07, 2003) 32 (Nov 10, 2004) 30 (Nov 22, 2003)
Broad-winged Hawk <i>(Buteo platypterus)</i>	2721	6270 (2004)	0 (1989)	1884 (Sep 19, 2004) 1669 (Sep 17, 2002) 1648 (Sep 20, 2004)
Red-tailed Hawk <i>(Buteo jamaicensis)</i>	1405	7511 (1993)	0 (1989)	1203 (Oct 27, 1993) 755 (Oct 21, 1993) 664 (Oct 26, 1993)
Rough-legged Hawk <i>(Buteo lagopus)</i>	61	297 (1993)	1 (2003)	51 (Oct 30, 1993) 34 (Oct 31, 1993) 31 (Oct 29, 1993)
Golden Eagle <i>(Aquila chrysaetos)</i>	13	55 (1993)	1 (2004)	6 (Oct 29, 1993) 5 (Nov 19, 1993) 4 (Oct 30, 1993)
American Kestrel <i>(Falco sparverius)</i>	348	688 (2004)	0 (1989)	118 (Oct 03, 1993) 70 (Oct 02, 1993) 50 (Oct 09, 2003)
Merlin	66	116 (2004)	0 (1989)	14 (Oct 01, 1993)

<i>(Falco columbarius)</i>				13 (Oct 03, 1993) 11 (Apr 26, 2005)
Peregrine Falcon <i>(Falco peregrinus)</i>	27	45 (2005)	1 (2006)	12 (Oct 05, 2002) 5 (Oct 06, 2002) 4 (Oct 03, 2002)
Prairie Falcon <i>(Falco mexicanus)</i>	1	1 (1993)	1 (1993)	1 (Nov 06, 1993)
Gyr Falcon <i>(Falco rusticolus)</i>	1	1 (1993)	1 (1993)	1 (Nov 19, 1993)

Count Season

Spring: Mar 15 to Apr 30

Fall: Sep 01 to Nov 30

Data Inventory (at hawkcount.org, as of Sep 05, 2006)

Data Summary	Data Years
9 years (668 days) of data saved: 2 years of hourly totals, 6 years of daily totals, and 1 years of mixed hourly/daily totals	1976-1977, 1989, 1993, 2002-2006

Site History

The Montclair Hawk Watch has been conducted since 1957. It is the second oldest continuous hawk watch in the nation. Only Hawk Mountain boasts a longer record. With this long history, a glance over the shoulder is appropriate. In 1957, the Montclair Hawk Watch was formally organized by three members of the Montclair Bird Club--Ruth Edwards, Sue Haupt and Ruth Beck--and ran from September 10 through September 29. Today, the Lookout is covered for three months in the Fall and two months in the Spring.

These many years later, hawkwatchers still climb to the top of the ridge to observe the migration of the magnificent birds of prey. There have been extraordinary changes during that period of time. We have witnessed the near-demise of the Peregrine Falcon, and the threat to the Bald Eagle and Osprey, due to the flagrant misuse of pesticides during the 1960's, and the ongoing recovery of these birds.

We have seen the development of lands surrounding the Lookout, and the encroachment upon access to the site. We have witnessed unparalleled flights of Broad-winged Hawks, and marveled at every single bird passing along our little ridge during these many seasons. We have enjoyed the camaraderie amongst hawkwatchers, and the wealth of knowledge shared by those who stood on this ridge long before we ever climbed to its summit.

Despite development all around, the Lookout is now a protected sanctuary of the New Jersey Audubon Society, due largely to the extraordinary efforts of former NJAS President Milt Levy, Trustee Jean Clark and President Tom Gilmore. In 1959, George Breck, a former president of the Montclair Bird Club, advanced the funds to purchase the property for the Club, which in turn donated it to NJAS in September of that year. At the dedication, George Breck explained that the Lookout was being preserved as a sanctuary in perpetuity "so our children's children can enjoy such spectacles as we see here today."

Many such spectacles were enjoyed and treasured during the following years. There were the good seasons, the slow seasons, young people with keen eyes spotting distant specks and wise veterans recognizing the unique characteristics of form and movement that placed a fleeting talon-print across the sky. 1986 marked the passing of our dear friend and leader Andrew Bihun, Jr., who had started his hawkwatching in the early days at Hawk Mountain, and brought those fine skills and dedication to Montclair, where he kept meticulous records for more than 20 years and taught a new generation of hawkwatchers the joy and wonder of nature's annual pageant. In a fitting tribute to his devotion, the Lookout was dedicated to Andy's memory on September 16, 1988. On that day, some 17,420 hawks were observed, the biggest single day count ever made from the Lookout.

Site Topography

A mountaintop watchsite with a 240 degree view to the NE, on First Watchung Mountain, the first mountain W of the lowermost Hudson River. The site is an exposed cliff-top adjacent to Mills Reservation, a forested county park, and Cedar Grove Reservoir, and is surrounded by a large metropolitan area. Access requires a 200 m staircase walk.

Directions to Site

To reach the Montclair Hawk Watch from the Garden State Parkway in Bloomfield, take exit 151 for Watchung Avenue and head west on Watchung to its end at Upper Mountain Avenue in Montclair, about 2.1 miles. Make a right turn and go north on Upper Mountain 0.7 miles to Bradford Avenue. Make a left turn and go up Bradford 0.1 miles to Edgecliff Road and make a right turn. Go up Edgecliff 0.2 miles and park on the shoulder (to avoid parking problems, please park well off the side of the road). The lookout path is on the south side of the road.

The Montclair Hawk Watch is easily reached via mass transit, as it is located in the heart of northern New Jersey's urban complex, an important factor in these days of high traffic congestion. Walking time from the railroad and bus station on Bellevue Avenue in Upper Montclair is about 15 minutes. Take Bellevue west (up the mountain) to Upper Mountain Avenue, turn right and follow the directions above.

Hawk Mountain Sanctuary, Pennsylvania

Kempton, Pennsylvania, USA

N 40° 38' 29.7", W 75° 59' 29.5"
(N 40.64158, W 75.99153)

<http://www.hawkmountain.org/>

General Site Information

Located in the Kittatinny Ridge, eastern Pennsylvania, Hawk Mountain Sanctuary's landscape is second-growth mixed deciduous forest, including oak-maple (*Quercus-Acer*) associations and Eastern Hemlock (*Tsuga canadensis*) on the mountains and rolling, partly wooded, farmland and Christmas-tree plantations in the valleys. The Appalachian Trail abuts Hawk Mountain Sanctuary on the east. Visitor facilities include a welcome center with a raptor museum and bookstore, and a biological field station with residences for visiting scientists. The Sanctuary, which is open year-round, attracts more than 80,000 visitors annually, with as many as 3,000 visitors on some weekend days in October. The watchsite has 10 lookouts and 15 km of trails. An admission fee is charged for access to the lookouts. The Sanctuary's long-term count site, the North Lookout, is a 465-m rocky outcrop with a 240° view to the east, 1.5 km from the Visitor Center parking lot. Raptors slope-soar along the Kittatinny Ridge and thermal-soar over adjacent valleys at the site. Migration is most pronounced on northwest winds, especially on the several days following the passage of a cold front.

Site Contacts

Name	Role	E-mail	Phone
Laurie Goodrich	Senior Monitoring Biologist	goodrich@hawkmtn.org	(570) 943-3411 x 106
Dr. Keith Bildstein	Acopian Director of Conservation	bildstein@hawkmtn.org	(570) 943-3411 x108
Dr. Chris Farmer	North American Monitoring Coordinator	farmer@hawkmtn.org	(570) 943-3411 x102

Raptors Observed at Hawk Mountain Sanctuary

Species	Avg. count / season	Max. Year	Min. Year	Peak Days
Black Vulture (<i>Coragyps atratus</i>)	43	133 (2005)	1 (1979)	42 (Nov 09, 2004) 21 (Nov 15, 1998) 21 (Oct 19, 2005)
Turkey Vulture (<i>Cathartes aura</i>)	161	472 (2005)	1 (1968)	80 (Oct 24, 1994) 67 (Oct 31, 2005) 66 (Oct 06, 1996)

Mississippi Kite (<i>Ictinia mississippiensis</i>)	2	2 (2004)	1 (2005)	1 (Apr 17, 2004) 1 (Apr 23, 2004) 1 (Apr 21, 2005)
Osprey (<i>Pandion haliaetus</i>)	497	872 (1990)	155 (2006)	187 (Sep 18, 2004) 175 (Sep 23, 1989) 158 (Sep 18, 1996)
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	58	206 (2005)	10 (2002)	11 (Sep 04, 2006) 11 (Oct 16, 2005) 10 (Sep 03, 2005)
Northern Harrier (<i>Circus cyaneus</i>)	249	475 (1980)	26 (2006)	35 (Oct 16, 1980) 31 (Sep 16, 1980) 26 (Nov 03, 1980)
Sharp-shinned Hawk (<i>Accipiter striatus</i>)	5170	10612 (1977)	123 (2006)	2475 (Oct 08, 1979) 1747 (Oct 13, 1979) 1688 (Oct 01, 1986)
Cooper's Hawk (<i>Accipiter cooperii</i>)	447	1154 (2005)	36 (2006)	204 (Oct 08, 1981) 163 (Oct 17, 2005) 130 (Oct 23, 2005)
Northern Goshawk (<i>Accipiter gentilis</i>)	89	347 (1972)	22 (1966)	64 (Nov 10, 1973) 48 (Nov 23, 1972) 43 (Nov 17, 1973)
Red-shouldered Hawk (<i>Buteo lineatus</i>)	242	451 (1983)	10 (2006)	105 (Oct 19, 1983) 83 (Oct 23, 1977) 52 (Oct 28, 2002)
Broad-winged Hawk (<i>Buteo platypterus</i>)	8374	29519 (1978)	355 (2006)	10066 (Sep 14, 1978) 7722 (Sep 18, 1978) 4863 (Sep 17, 1968)
Swainson's Hawk (<i>Buteo swainsoni</i>)	2	10 (2004)	1 (1984)	9 (Sep 02, 2004) 1 (Sep 23, 1987) 1 (Oct 22, 1969)
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	3476	5715 (1980)	99 (2006)	861 (Nov 10, 1994) 797 (Nov 13, 1982) 742 (Nov 02, 1980)
Rough-legged Hawk (<i>Buteo lagopus</i>)	10	23 (1980)	0 (2006)	6 (Dec 06, 1987) 6 (Dec 03, 1985) 6 (Nov 13, 1977)
Golden Eagle (<i>Aquila chrysaetos</i>)	42	123 (2005)	1 (2002)	15 (Nov 11, 2005) 10 (Oct 30, 2005) 10 (Nov 02, 2005)

American Kestrel (<i>Falco sparverius</i>)	525	839 (1989)	51 (2006)	168 (Sep 03, 1977) 141 (Sep 30, 1994) 134 (Sep 18, 1994)
Merlin (<i>Falco columbarius</i>)	69	204 (2005)	7 (1972)	49 (Oct 15, 2005) 36 (Oct 10, 1997) 34 (Oct 22, 1989)
Peregrine Falcon (<i>Falco peregrinus</i>)	27	62 (2002)	3 (2006)	31 (Oct 05, 2002) 10 (Oct 06, 2000) 9 (Oct 02, 1999)
Gyr Falcon (<i>Falco rusticolus</i>)	1	1 (1988)	1 (1975)	1 (Nov 10, 1988) 1 (Nov 02, 1975)

Count Season

Spring: Feb 01 to Jun 01

Fall: Jul 01 to Feb 01

Procedures/Protocols

HMS Migration Count Manual (2001)

Data Inventory (at hawkcount.org, as of Sep 05, 2006)

Data Summary	Data Years
41 years (4424 days) of data saved: 35 years of hourly totals, 1 years of daily totals, and 5 years of mixed hourly/daily totals.	1966-2006

Site History

In the late 1920s and early 1930s the Sanctuary was a traditional gathering point for hawk shooters, who killed thousands of migrating raptors, annually. Establishment of the Sanctuary by the Emergency Conservation Committee in 1934 ended the practice at the site (Broun 1949). Sanctuary efforts led to the legal protection of diurnal raptors throughout the Commonwealth of Pennsylvania in 1970. Current conservation efforts include ecological research, environmental monitoring, science education, and the preservation of natural habitats.

Site Topography

A mountaintop watchsite on the Kittatinny Ridge, a 300-km long, northeast-to-southwest ridge in the central Appalachian Mountains of eastern Pennsylvania. The site includes more than a dozen ridgetop outcrops overlooking the Kempton Valley to the south and ridges and valleys of the central Appalachian Mountains to the north.

Directions to Site

Hawk Mountain is located north of Hamburg, Pennsylvania, approximately 7 miles northeast of I-78.

From New York City, New York: 3 hours

- Take I-78 WEST thru New Jersey to Pennsylvania
- Continue on I-78 thru Pennsylvania, passing Lehigh Valley exits
- To Exit 35 (Lenhartsville)
- On Rt. 143 NORTH, go 4 miles to Sunoco gas station
- Turn LEFT at blue Hawk Mountain sign onto Hawk Mt. Road
- Go 7 miles to top of mountain, turn LEFT into parking lot

From Scranton, Pennsylvania: 1.5 hours

- Take I-81 to the Frackville exit for Route 61 South
- Take Rt. 61 SOUTH
- To Rt. 895 EAST (take Jughandle, exit to right)
- Go 2 miles to RIGHT at blue Hawk Mountain sign (Drehersville)
- Cross railroad tracks and Little Schuylkill River
- Go 2 miles to top of mountain, turn RIGHT into parking lot

From Pottsville, Pennsylvania and I-81: 1/2 hour

- Take Rt. 61 SOUTH (Frackville Exit for I-81)
- To Rt. 895 EAST (take Jughandle, exit to right)
- Go 2 miles to RIGHT at blue Hawk Mountain sign (Drehersville)
- Cross railroad tracks and Little Schuylkill River
- Go 2 miles to top of mountain, turn RIGHT into parking lot

From Allentown, Pennsylvania: 35 minutes

- Take I-78 WEST
- To Exit 35 (Lenhartsville).
- On Rt. 143 NORTH, go 4 miles to Sunoco gas station on right
- Turn LEFT at blue Hawk Mountain sign onto Hawk Mt. Road
- Go 7 miles to top of mountain; turn LEFT into parking lot

From Philadelphia, Pennsylvania: 1.5 to 2 hours

- Take Northeast Turnpike Extension (I-476)
- NORTH to Exit 56 (Lehigh Valley)
- To Rt. 22 WEST toward Harrisburg (becomes I-78 West)
- To Exit 35 (Lenhartsville)
- On Rt. 143 NORTH, go 4 miles to Sunoco gas station on right
- Turn LEFT at blue Hawk Mountain sign onto Hawk Mt. Road
- Go to top of mountain; turn LEFT into parking lot

From Reading, Pennsylvania: 40 minutes

- Take Rt. 61 NORTH
- To Rt. 895 EAST
- Go 2 miles to RIGHT at blue Hawk Mountain sign (Drehersville)
- Cross railroad tracks and Little Schuylkill River
- Go 2 miles to top of mountain; turn RIGHT into parking lot

From Pittsburgh, Pennsylvania: 5-6 hours

- Take Pennsylvania Turnpike (I-276 EAST)
- To Carlisle Interchange
- To I-78 EAST
- To Exit 29B Exit (Rt. 61 NORTH)
- Go 4 miles and turn right at Rt. 895 EAST.
- Go 2 miles to RIGHT at blue Hawk Mountain sign (Drehersville)
- Go 2 miles to top of mountain; turn RIGHT into parking lot

From Harrisburg, Pennsylvania: 1 hour

- Take I-78 EAST
- To Exit 29B (Rt. 61 NORTH)
- Go 4 miles and turn RIGHT onto Rt. 895 EAST
- Go 2 miles; RIGHT at blue Hawk Mountain sign (Drehersville)
- Cross railroad tracks and Little Schuylkill River
- GO 2 miles to top of mountain; turn RIGHT into parking lot

Waggoner's Gap, Pennsylvania

40 km W of Harrisburg, Pennsylvania, USA

N 40° 16' 37.9", W 77° 16' 33.7"
(N 40.27719, W 77.27603)

<http://user.pa.net/~waggap/>

General Site Information

Waggoner's Gap is small gap in the Kittatinny Ridge (also called Blue and North Mountain) where PA Route 74 crosses between Cumberland and Perry Counties. It was named for a family with extensive landholdings at the base of the mountain in Cumberland County, not for its use by wagons. Hawk watching and counting have been done from two sites over the years. The first, at the concrete tower along Route 74, was used as an alternate during inclement weather. The main site sits on the spine of the mountain 75 yards east of the highway. This site is essentially a rock pile with steep descents on both sides. This enables watchers to see both sides of the ridge from one spot. This gives the advantage of being able to see off wind birds easily and increases the wind directions that are productive without requiring a physical move. The ridge runs from the ENE to WSW. The nearest major ridge to the south is South Mountain, roughly 12 miles distant. The nearest major ridge to the north is Tuscarora Mountain, roughly 14 miles away. This expanse on both sides helps limit diffusion of the flight. Trees on both sides of the ridge limit visibility of low flying birds. They also prevent detection of low flying birds coming down the ridge until they are close to the lookout. It also prevents low flying raptors from seeing the hawkwatchers until they are close. Best winds are NW and S, with higher numbers seen with NW winds, but closer views on the S winds.

Site Contacts

Name	Role	E-mail	Phone
Dave Grove	Compiler	waggap@pa.net	(717) 258-5253
Kim Van Fleet		kvanfleet@audubon.org	(717) 213-6880

Raptors Observed at Waggoner's Gap

Species	Avg. count / season	Max. Year	Min. Year	Peak Days
Black Vulture (<i>Coragyps atratus</i>)	54	127 (2003)	0 (1978)	34 (Nov 13, 2002) 34 (Oct 31, 1999) 21 (Oct 17, 1992)
Turkey Vulture (<i>Cathartes aura</i>)	702	1814 (2005)	1 (1976)	341 (Oct 16, 2005) 264 (Oct 23, 2004) 262 (Nov 03, 1997)

Osprey (<i>Pandion haliaetus</i>)	190	585 (1990)	2 (1953)	92 (Sep 18, 1993) 80 (Sep 18, 1996) 78 (Sep 30, 1986)
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	47	303 (2005)	1 (1970)	16 (Sep 14, 2001) 15 (Oct 15, 2005) 15 (Sep 03, 2006)
Northern Harrier (<i>Circus cyaneus</i>)	142	458 (2003)	5 (1956)	42 (Oct 27, 1975) 40 (Oct 28, 1974) 39 (Oct 14, 1989)
Sharp-shinned Hawk (<i>Accipiter striatus</i>)	2861	8958 (1987)	19 (1963)	1981 (Oct 02, 1986) 1628 (Sep 30, 1986) 1560 (Oct 04, 1977)
Cooper's Hawk (<i>Accipiter cooperii</i>)	254	1055 (2005)	3 (1955)	207 (Oct 10, 1998) 137 (Oct 16, 2005) 121 (Oct 04, 1992)
Northern Goshawk (<i>Accipiter gentilis</i>)	60	218 (1999)	1 (1960)	35 (Oct 11, 1986) 29 (Nov 07, 1999) 22 (Nov 05, 2001)
Red-shouldered Hawk (<i>Buteo lineatus</i>)	144	441 (1996)	2 (1954)	105 (Oct 29, 2001) 77 (Oct 27, 1975) 74 (Oct 29, 1991)
Broad-winged Hawk (<i>Buteo platypterus</i>)	2851	14254 (1987)	17 (1954)	5305 (Sep 20, 2002) 4827 (Sep 21, 1987) 3959 (Sep 19, 1993)
Swainson's Hawk (<i>Buteo swainsoni</i>)	2	2 (1995)	1 (1988)	1 (Aug 21, 1988) 1 (Oct 10, 1987) 1 (Oct 11, 1987)
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	1896	5731 (1999)	2 (1954)	748 (Nov 01, 1987) 571 (Nov 10, 1994) 503 (Oct 28, 2002)
Ferruginous Hawk (<i>Buteo regalis</i>)	1	1 (1996)	1 (1996)	1 (Nov 23, 1996)
Rough-legged Hawk (<i>Buteo lagopus</i>)	9	30 (1995)	0 (1973)	7 (Dec 21, 1995) 5 (Nov 06, 1987) 5 (Apr 10, 1987)
Golden Eagle (<i>Aquila chrysaetos</i>)	73	245 (2003)	1 (1965)	28 (Nov 08, 2003) 27 (Oct 27, 2002) 26 (Nov 07, 1999)

Eurasian Kestrel (<i>Falco tinnunculus</i>)	1	1 (1995)	1 (1995)	1 (Oct 07, 1995)
American Kestrel (<i>Falco sparverius</i>)	137	474 (1999)	2 (1956)	65 (Aug 29, 1999) 56 (Oct 16, 2005) 45 (Sep 16, 1998)
Merlin (<i>Falco columbarius</i>)	29	147 (2005)	1 (1952)	27 (Oct 15, 2005) 21 (Oct 10, 1997) 17 (Oct 05, 2002)
Peregrine Falcon (<i>Falco peregrinus</i>)	21	70 (1991)	1 (1967)	18 (Oct 04, 2000) 14 (Oct 03, 2003) 14 (Oct 06, 1998)
Gyr Falcon (<i>Falco rusticolus</i>)	1	1 (1986)	1 (1986)	1 (Nov 17, 1986)

Count Season

Fall: Aug 01 to Dec 31

Procedures/Protocols

Waggoner's Gap Data Collection Protocol

Data Inventory (at hawkcount.org, as of Sep 05, 2006)

Data Summary

Data Years

54 years (3648 days) of data saved:	1952-1982, 1984-2006
25 years of hourly totals,	
22 years of daily totals, and	
7 years of mixed hourly/daily totals	

Site History

During the 1930s a change began to emerge in perceptions about birds of prey. Instead of being only regarded as vermin to be exterminated, people began to study raptors with admiration. This trend first found noted voice at Hawk Mountain, with the efforts of Rosalie Edge beginning to shape new attitudes focused on stopping the ongoing slaughter of hawks.

Places that had only seen shooting soon began to see quiet, peaceful observations of the autumn migration replace the carnage. Lesser known ridge lookouts were scouted and became known in the birding community. Most sites were in eastern Pennsylvania, with Bake Oven Knob being the most notable. By the late 30s two locations west of the Susquehanna River began to attract regular visitors. They were Sterrett's Gap and Waggoner's Gap. Reverend E. S. Frey compiled a book of counts made at Sterrett's Gap.

Ted Hake from York County was one of the pioneers at Waggoner's Gap. He visited from the late 30s into the 90s, but left no recorded counts. The first known counts were made starting in 1948 by Lou Knohr, a high school science teacher at Carlisle High School. Unfortunately, the counts from 48-51 were lost. The first counts extant from 1952 to 1953 were in a summary format by species and obtained from Dr. Bertram Henry.

The first daily counts from Waggoner's Gap were made by Lou Knohr and presented to Dr. C. J. Ralph of Dickinson College. These counts spanned the years 1954-1973 and only listed those raptors seen by Mr. Knohr and his wife Elsie on their frequent visits. A few other counts were recorded during this time and preserved by Dr. Ralph in the archives of the College. By the early 1970s interest in monitoring raptor migration resulted in a count in 1973 sponsored by the Appalachian Audubon Chapter of the National Audubon Society and led by Michael Kotz, a high school student from Harrisburg.

This effort of 795 hours has been lost. The year 1974 saw the founding of the Hawk Migration Association of North America. Waggoner's Gap was represented by Dr. Ralph and Malcolm Simons Jr. Plans were made to submit the Waggoner's Gap counts to HMANA using the HMANA forms. Rich Peiffer, a Cumberland Valley High School teacher, was chosen to be compiler. Peiffer, with help from Jake Baum and others, held the job until 1981 when he died from a cancer. Greg Smith, from York, PA then took on the job until 1988, when the job was passed to Kim Van Fleet. She and her husband Glen served until 1994, when Dave Grove became compiler.

Hours of observation increased throughout the period and it is now routine for over 1,000 hours of counting to be recorded in a season. The count protocol was oral history until 1998 when a written protocol was adopted by the counters. The land at the site was privately owned until 1953, when the site was purchased by the Reineman Wildlife Sanctuary Trust. In 2001, 20 acres of land encompassing the hawk watch was deeded to Pennsylvania Audubon for the purpose of preserving the site as a hawk watch. That fall a parking lot was built on the north side of the ridge and trails were built from the lot to the hawk watch.

Site Topography

A mountaintop watchsite with a 270 degree view of the SE on Kittatinny Ridge, the SE-most ridge in the C Appalachian Mountains. Counts are made from an exposed boulder field.

Directions to Site

From the east: On I-81 S take the Middlesex exit (exit 52) and turn right on Rt. 11S toward Carlisle. Go through the truck stops to the Carlisle turnpike exchange where we pick up all Pa Turnpike travelers. Continue south on Rt. 11 for 1.5 miles to a traffic light at Wolf Bridge Rd. Turn right. Follow Wolf Bridge Rd 2.5 miles to a stop sign at PA Rt. 34. Turn right and go .4 miles to a left turn on PA Rt. 944 W. Go 5 miles to a stop sign at the intersection with Pa Rt. 74. Turn right and go 2 miles up the mountain, being careful

on the 90 degree turns. The parking lot is 200 yards beyond the crest on the right. Sign - Waggoner's Gap 1,476 feet

From Baltimore: Travel north on I83. Either take the Pa Turnpike west from Exit 18 or turn off I-83 onto I 581 W to I 81 S a mile beyond the Turnpike. Then follow the above.

From D.C.: Take Rt. 15N past Gettysburg to Pa Rt. 74N at Dillsburg. Follow Rt. 74 N through Carlisle to the mountain.

From Winchester, VA: Take I 81N to exit 47A in Carlisle. Turn left on Pa Rt. 34N. Go to the square in Carlisle and turn left onto Pa Rt. 74 N. Follow 74 N to the parking lot (Be careful following signs, there are two turns that can be tricky)

The Waggoner's Gap Hawk Watch can be reached by walking up a rock trail from the parking lot on the north side of the Kittatinny Ridge. The parking lot is off PA Route 74, about 6 miles NW of Carlisle, Pa.

(Site Profile data compiled by Jason Sodergren and Ernesto Ruelas Inzunza with the collaboration of Ronald G. Bell, Keith L. Bildstein, Neil W. Currie, Vice Elia, Christopher J. Farmer, Laurie J. Goodrich, Else Greenstone, Wayne Greenstone, Dave Grove, David Mizrahi, and Kim Van Fleet.)