GOLDEN GATE
RAPTOR
OBSERVATORY

Golden Gate Raptor Observatory

Hawkwatch Trends and Graphs

Data from Fall Hawk Counts at the Marin Headlands, California

Compiled by Nathan K. Elliott and edited by Allen M. Fish

Data collected through the efforts of hundreds of dedicated GGRO staff, interns, and volunteers—thank you!

July 2016

Citation:
Elliott, N.K., and A.M. Fish. 2016. Golden Gate Raptor Observatory Hawkwatch Trends and Graphs—Data from fall hawk counts at the Marin Headlands, California. GGRO Report. 24 pp.

For additional copies, write ggro@parksconservancy.org

Table of Contents

Timing Profiles by Species

WHEN DO DIFFERENT RAPTORS PASS BY HAWK HILL?

These graphs show how often a specific raptor has been sighted on any day of the season (normalized as raptors per hour of effort, or RPH). Historically, the peak of "Peak" is Sep. 24th, with an average RPH of a whopping 95!

Each species (and often age/sex categories within a species) has a unique migration profile which generally lines up with what we expect. *Note that abundant species have smoother curves than rare species due to the number of data points available.*

INTERPRETING THE GRAPHS

The following graphs show how our raptor sightings per hour (y-axis) break down throughout the year (x-axis), presenting a “migration” (or more appropriately, “raptor activity”) timing profile for each species.

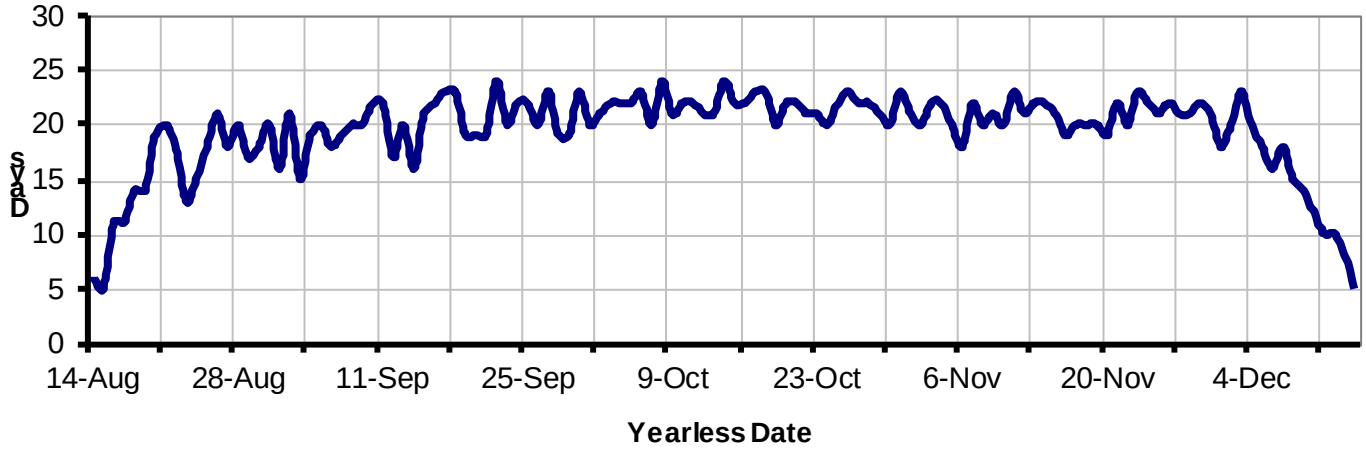
Days/hours counted are shown opposite. Raptor species charts are displayed left to right by taxonomy, starting with total raptor sightings on the upper left of the next page. *Note that y-scales are relative and not the same between species!*

SPECIFIC TRENDS

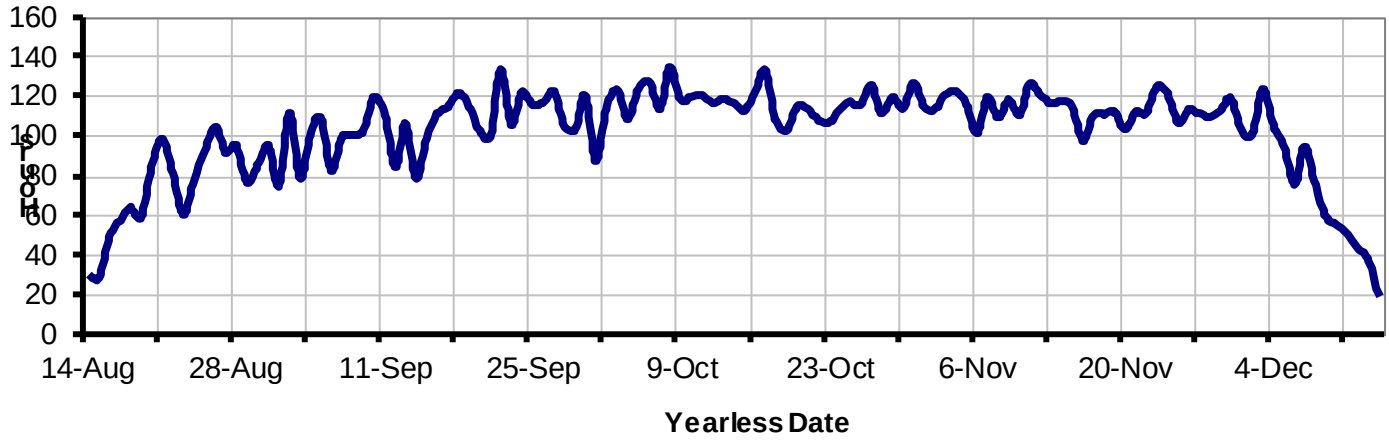
Each species has a unique migration profile. Some species start strong and finish weak, like the Prairie Falcon. Others follow the exact opposite trend, most notably the Rough-legged Hawk. Many species peak mid-season, displaying both broad peaks (e.g. the Red-shouldered Hawk) and narrow peaks (e.g. the Broad-winged Hawk). The Red-tailed Hawk and Merlin are unique in displaying double peaks, one in mid to late September and the other in late October.

Within species, the trends become even more complicated. Though the American Kestrel is fairly constant throughout the year, more females are sighted early while more males are seen late. And many species, most notably the accipiters and Redtails, have a higher proportion of adults late-season. For some species (e.g., SSHA and COHA), juveniles peak before adults, while the opposite is true for others (e.g., BWHA).

Number of Days Included in Analysis



Total Hours Spent on Hawk Hill

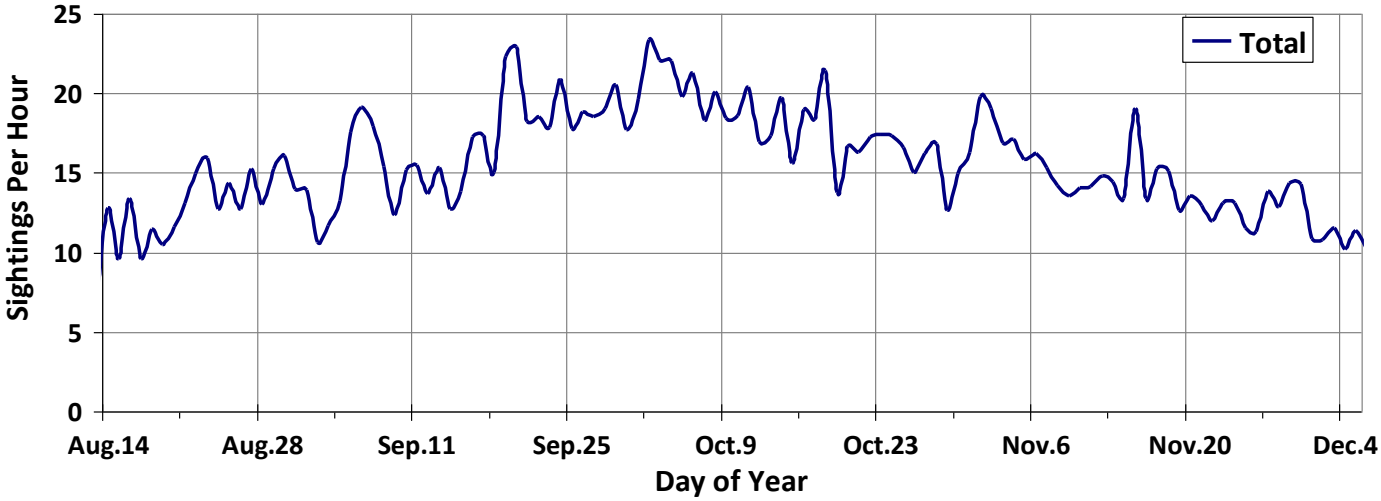


Note: Many species are now counted by age/sex categories that were previously recorded as undocumented (e.g., BAEA and FEHA). The raptor per hour values shown for these new age/sex categories have been normalized for the amount of effort spend counting during years in which they were a valid choice. This allows direct comparison with those age/sec categories that have been counted for the entire study period though the sample size is lower.

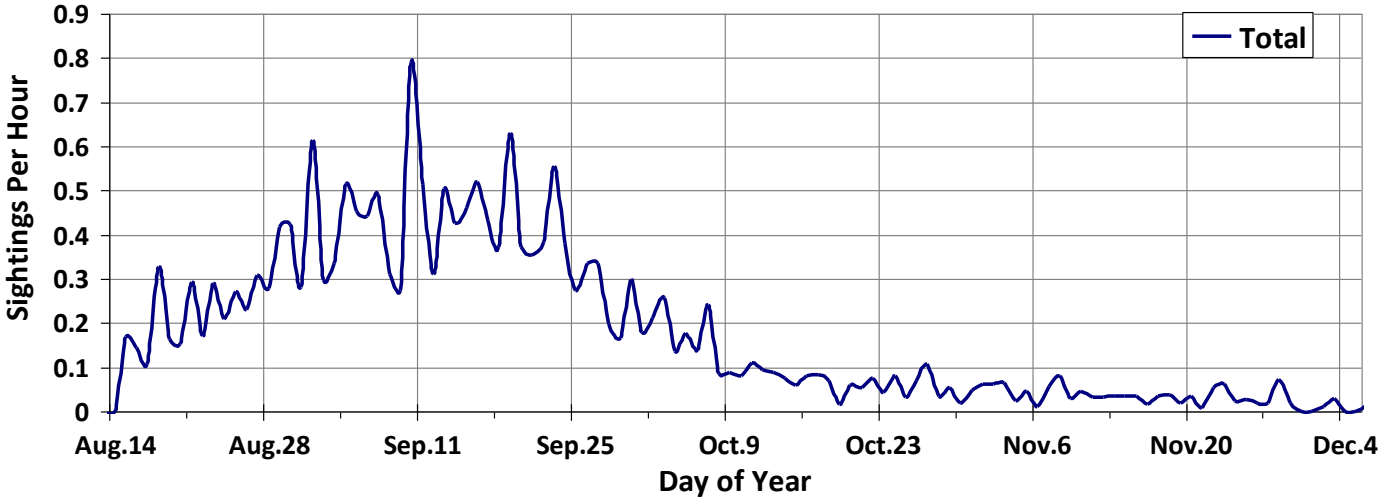
Migration Profiles by Species

All Raptors

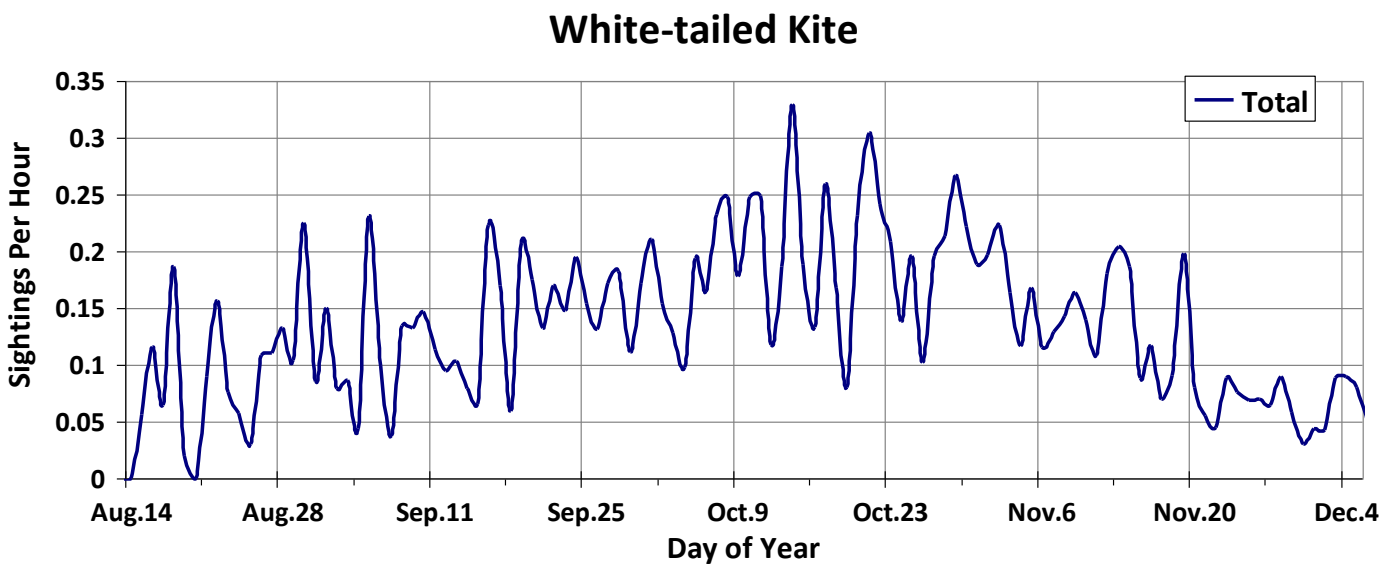
Turkey Vulture

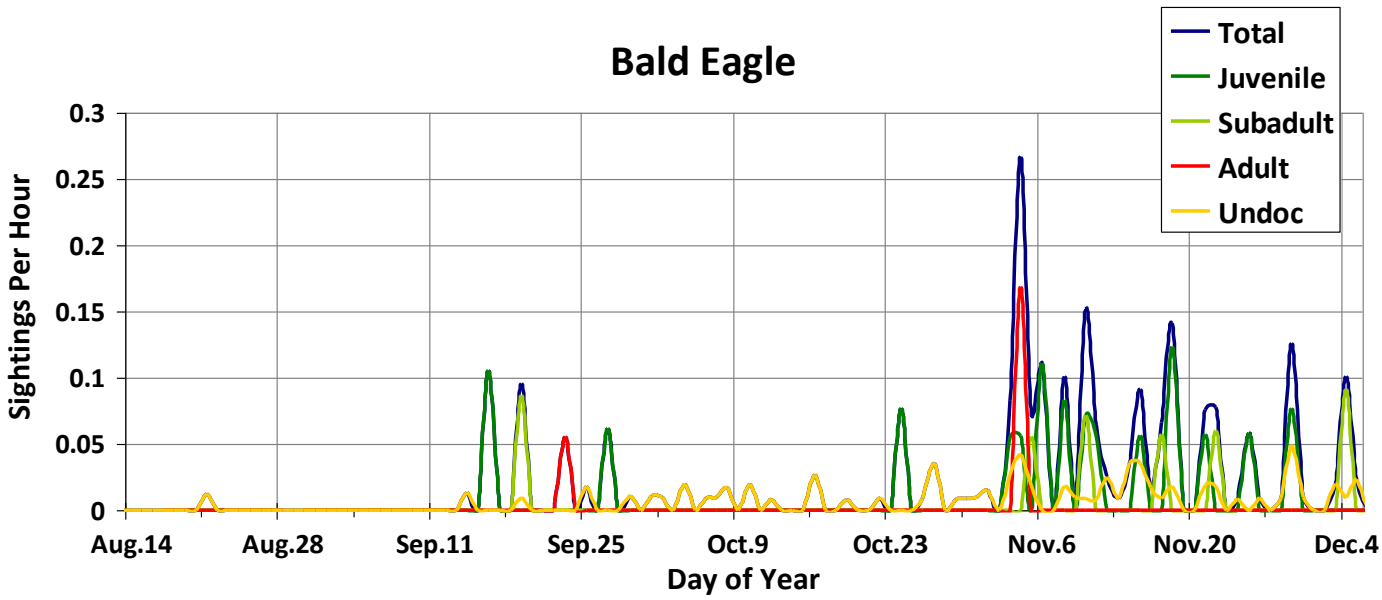


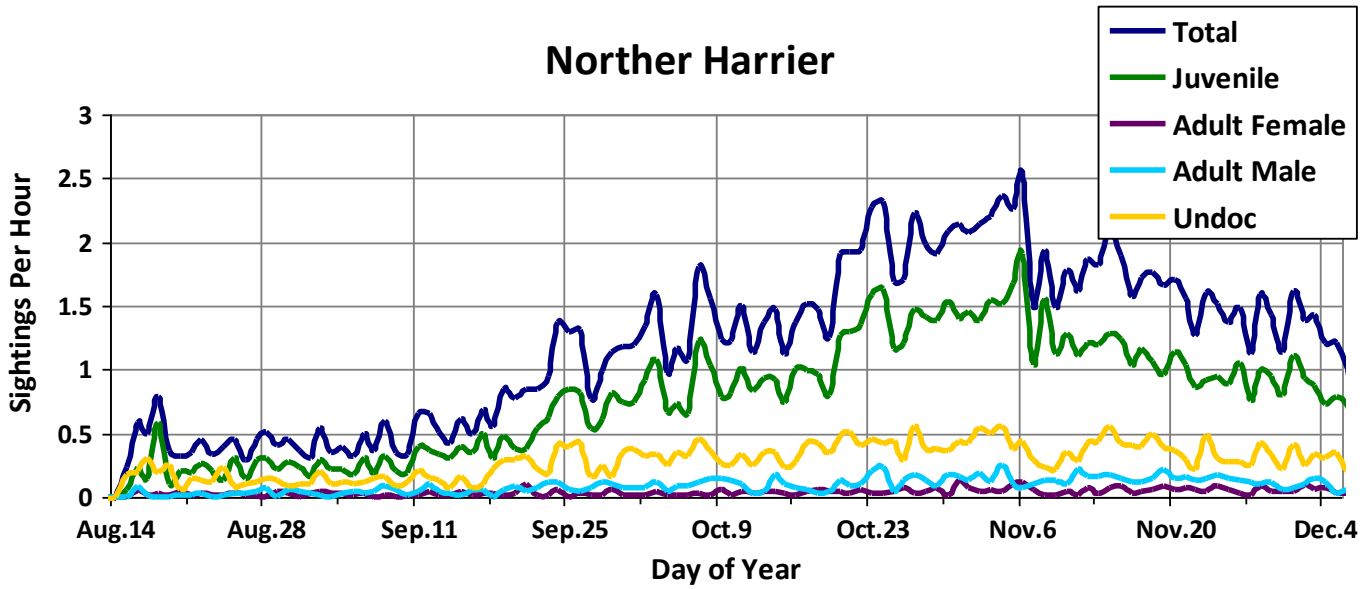
Osprey



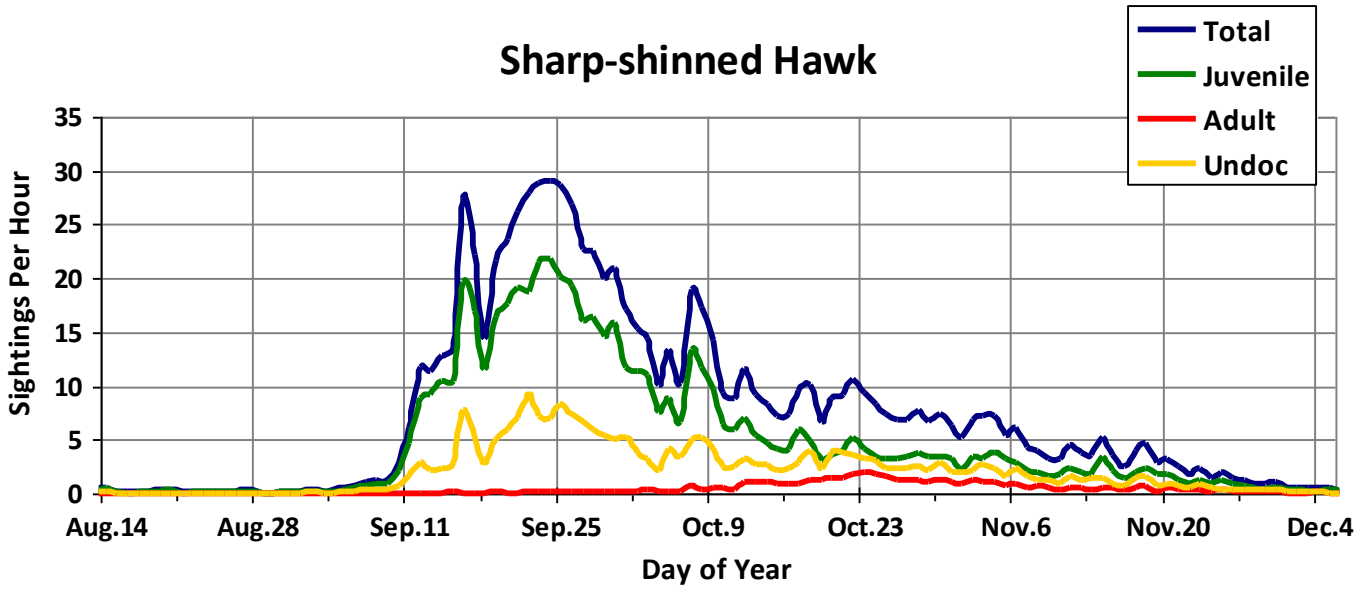
Migration Profiles by Species

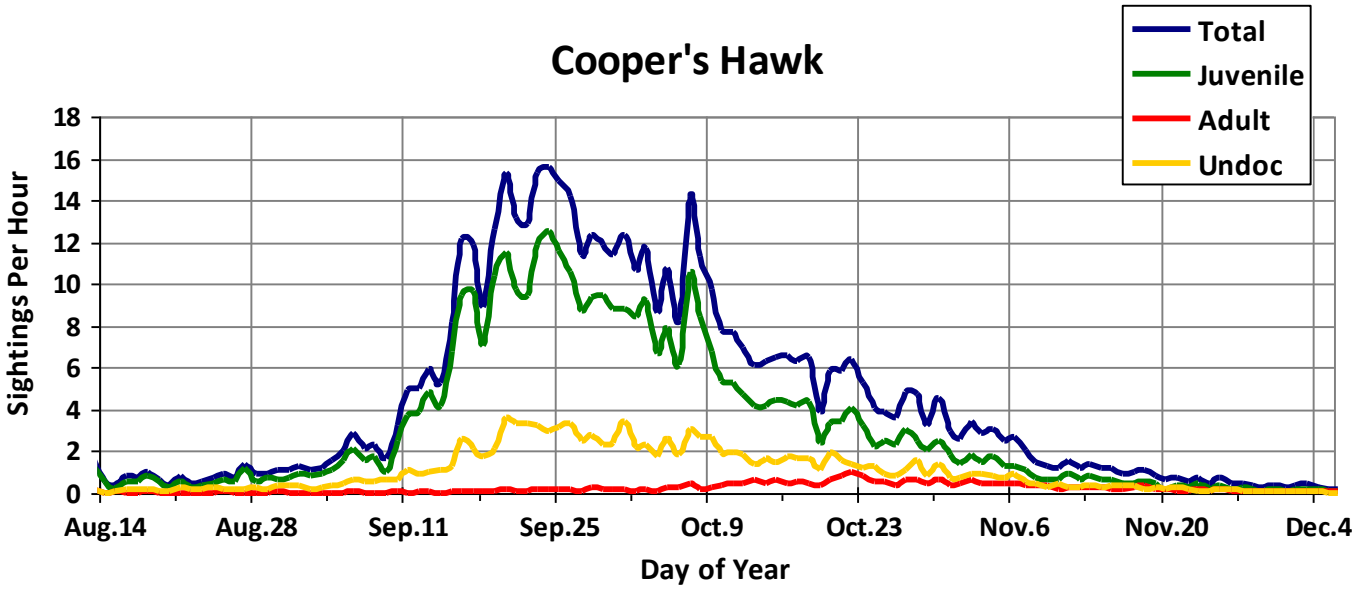


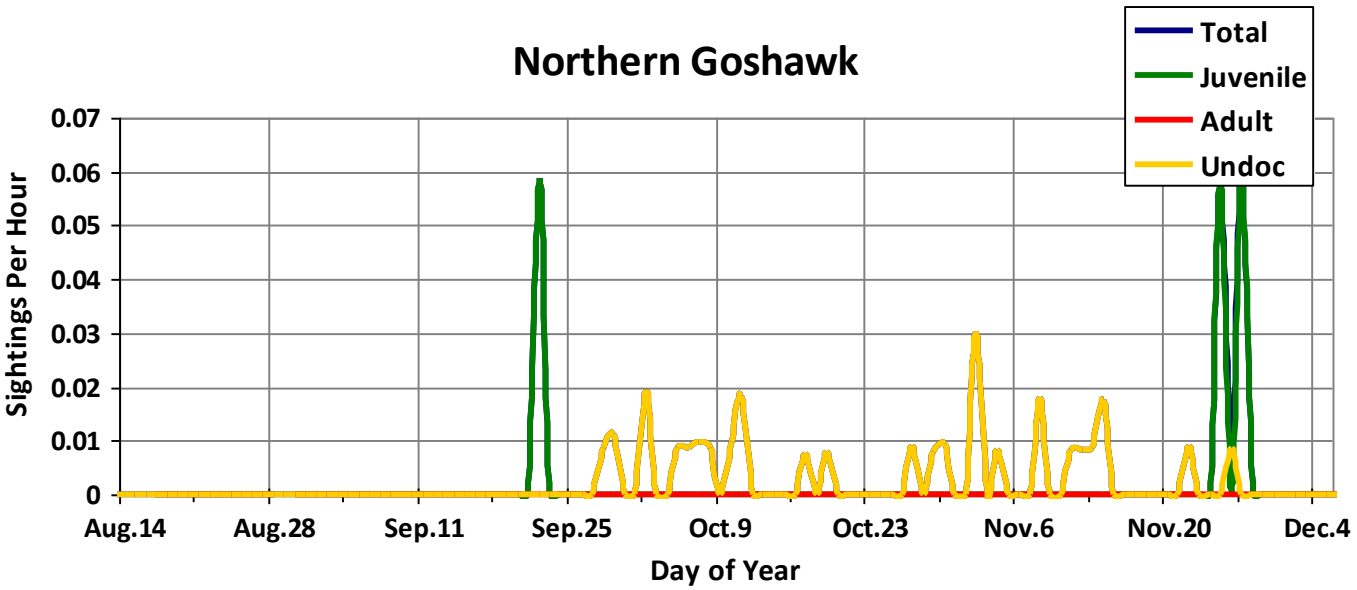




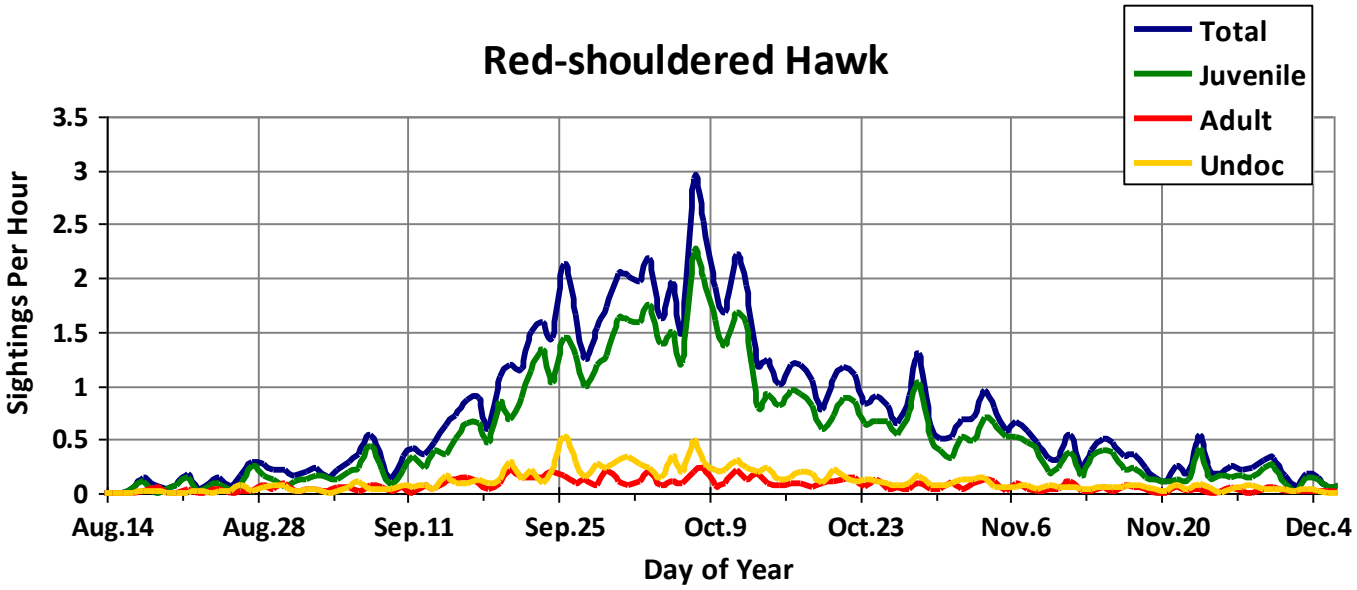
Migration Profiles by Species

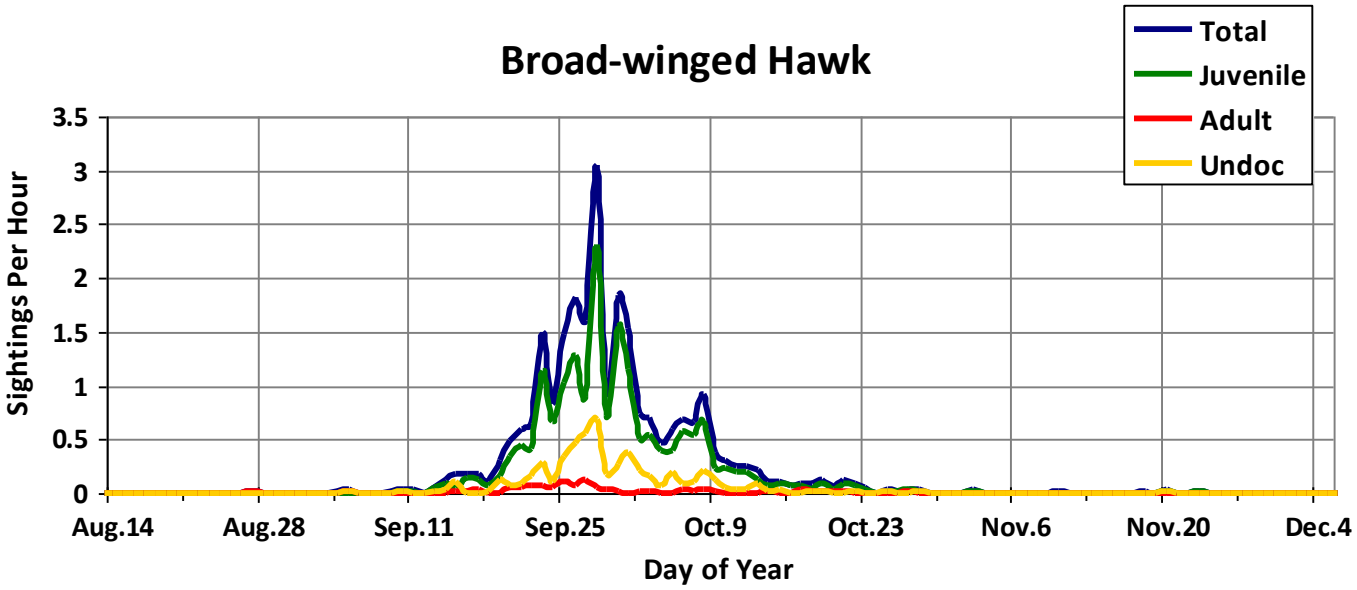


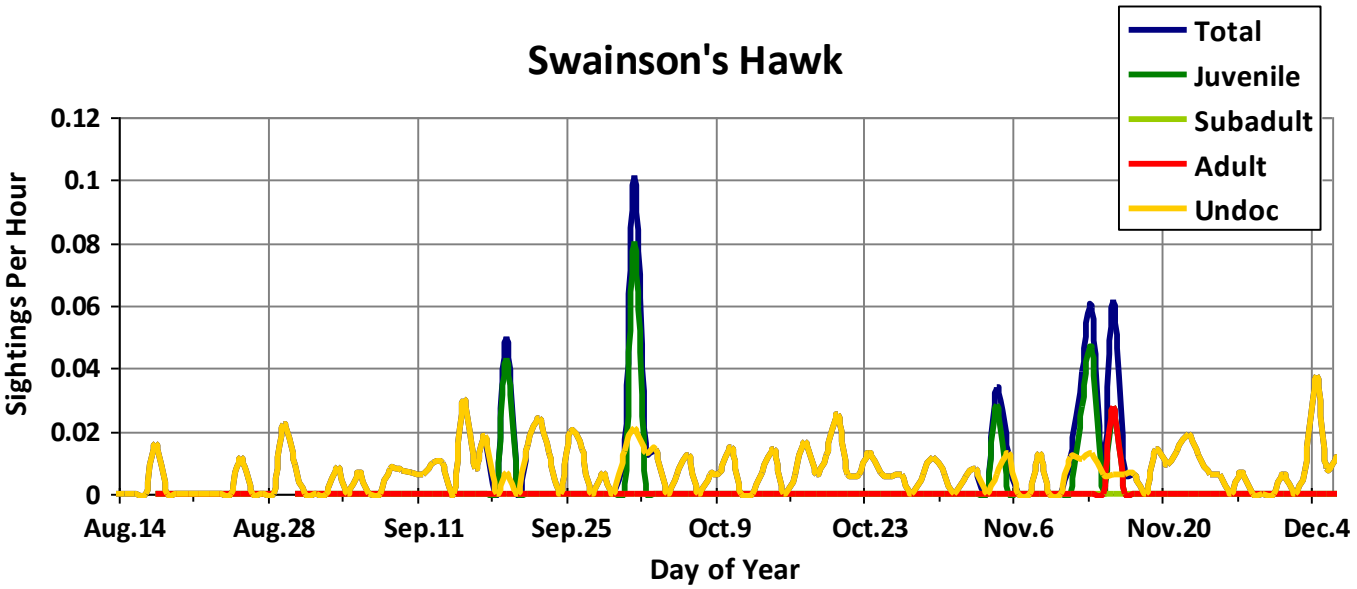




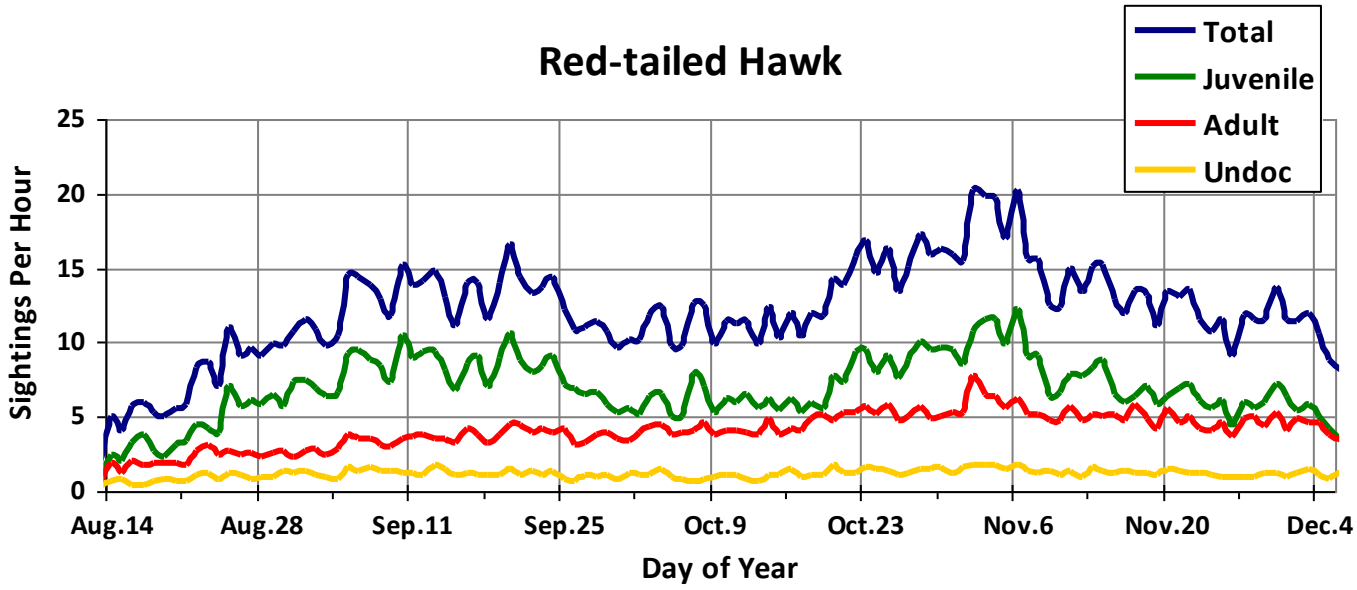
Migration Profiles by Species

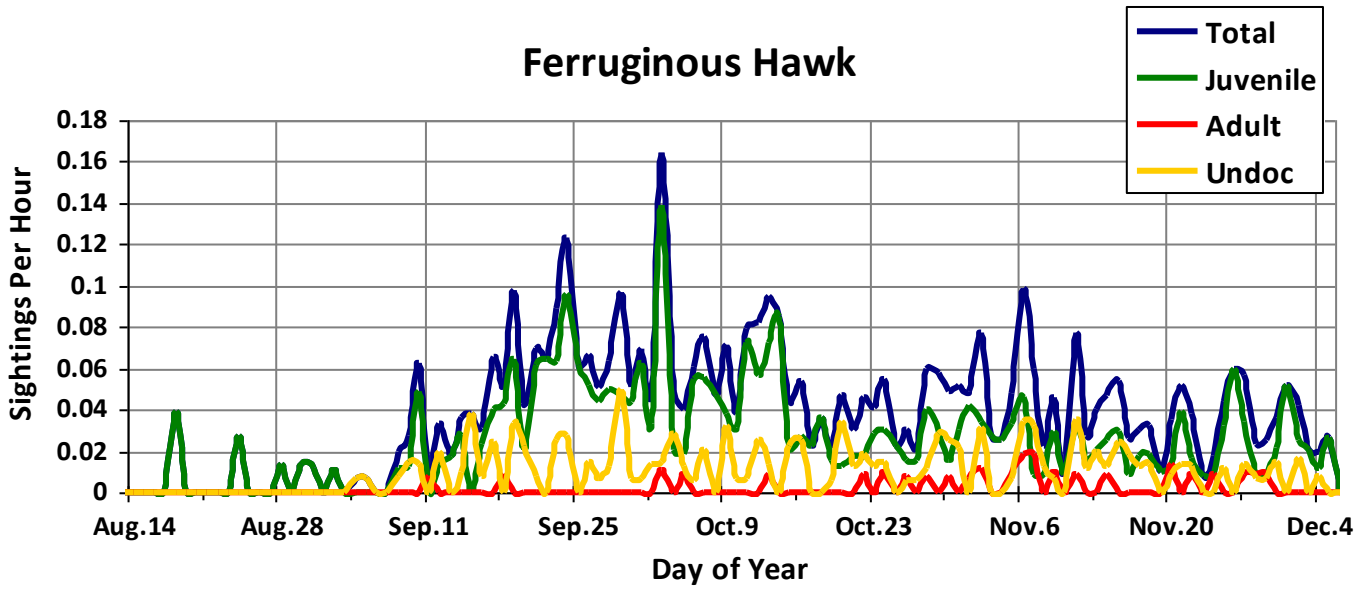


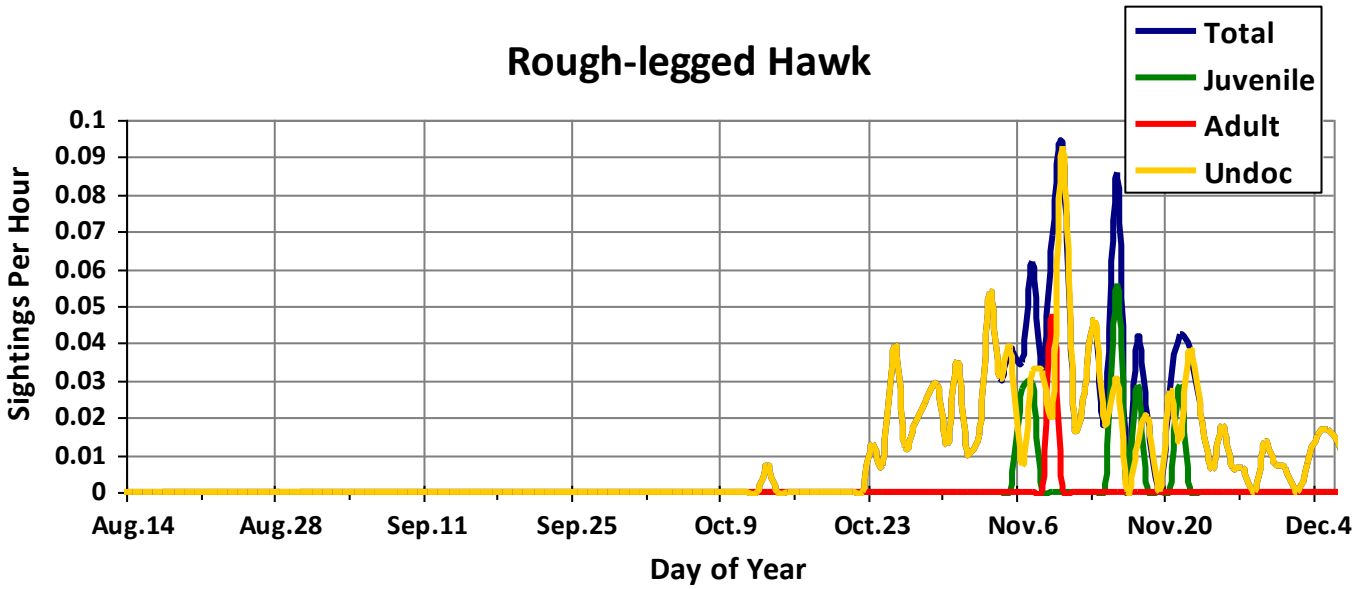




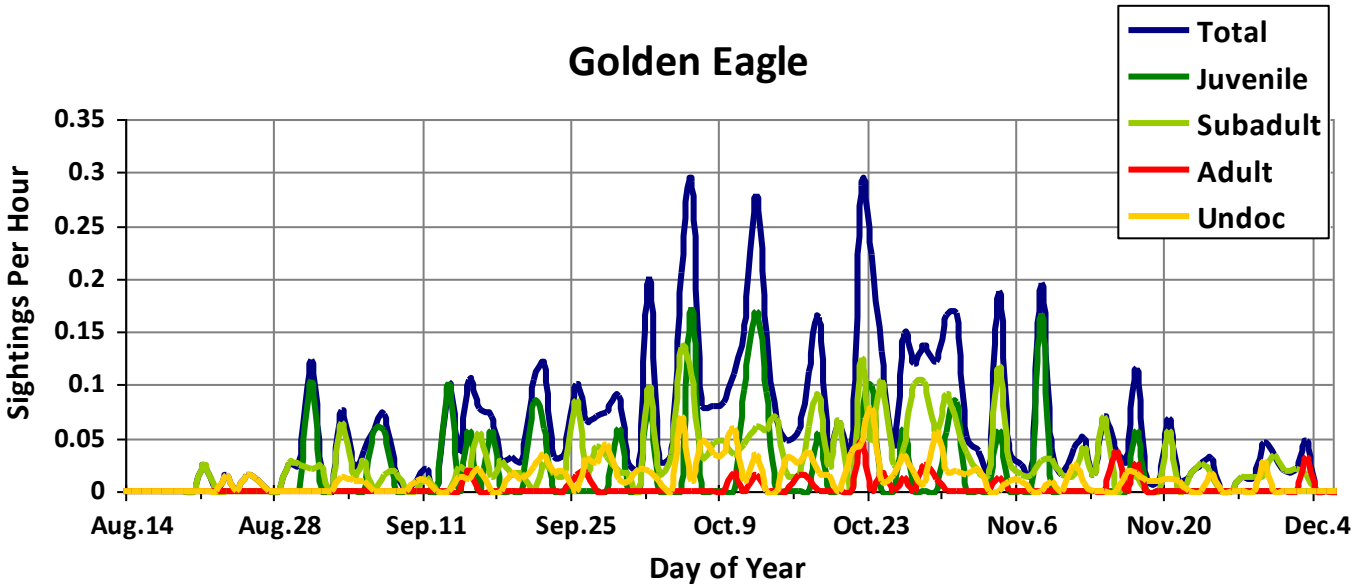
Migration Profiles by Species

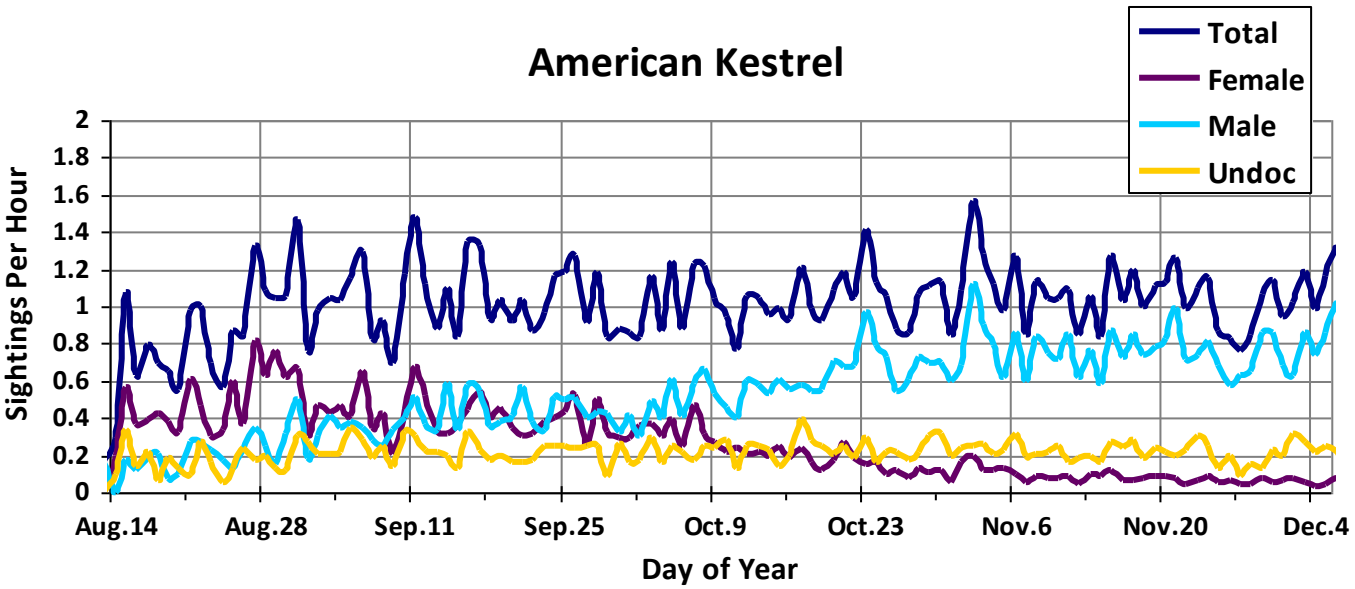


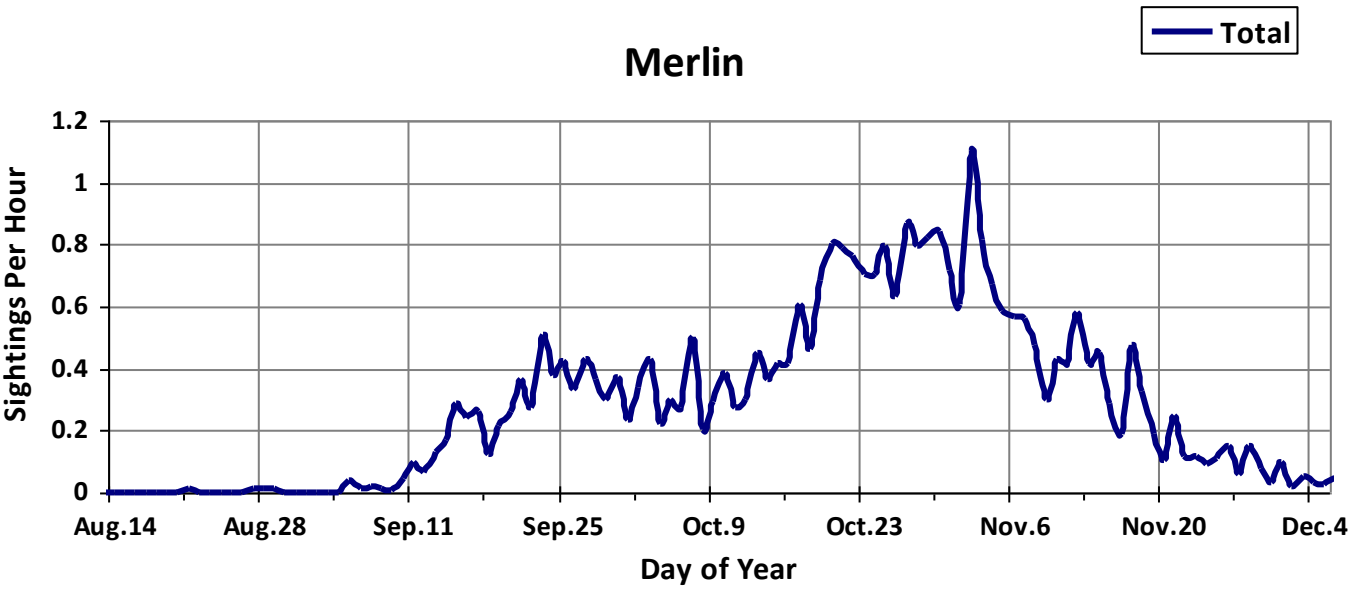




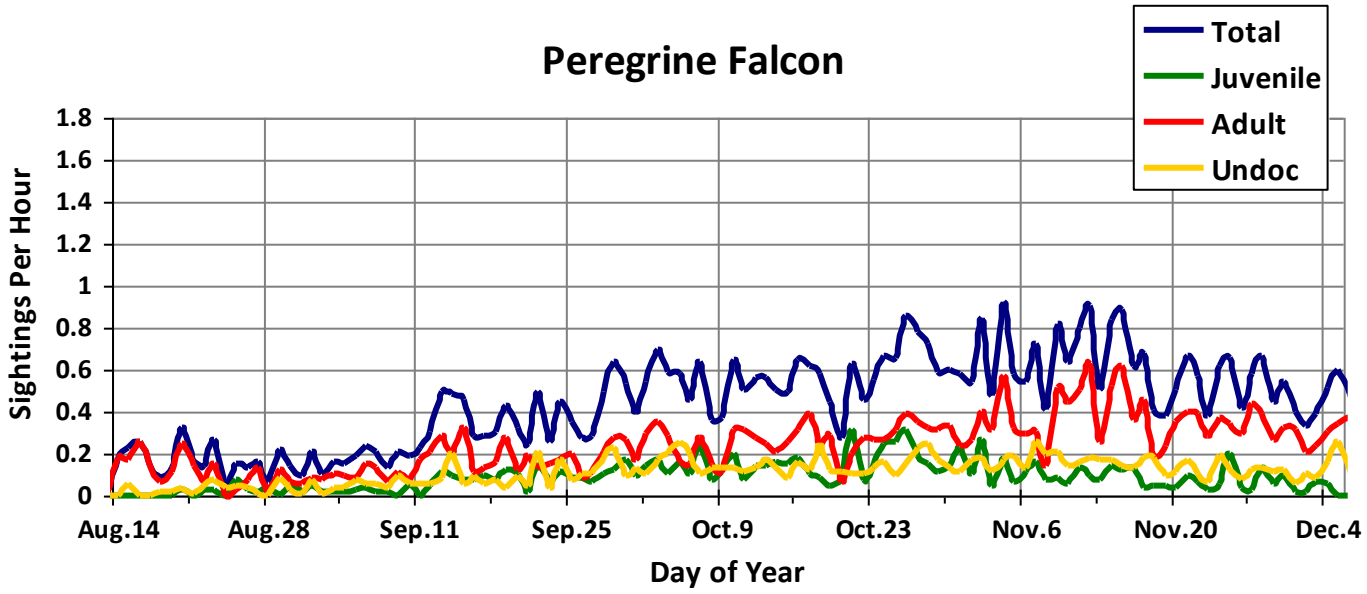
Migration Profiles by Species

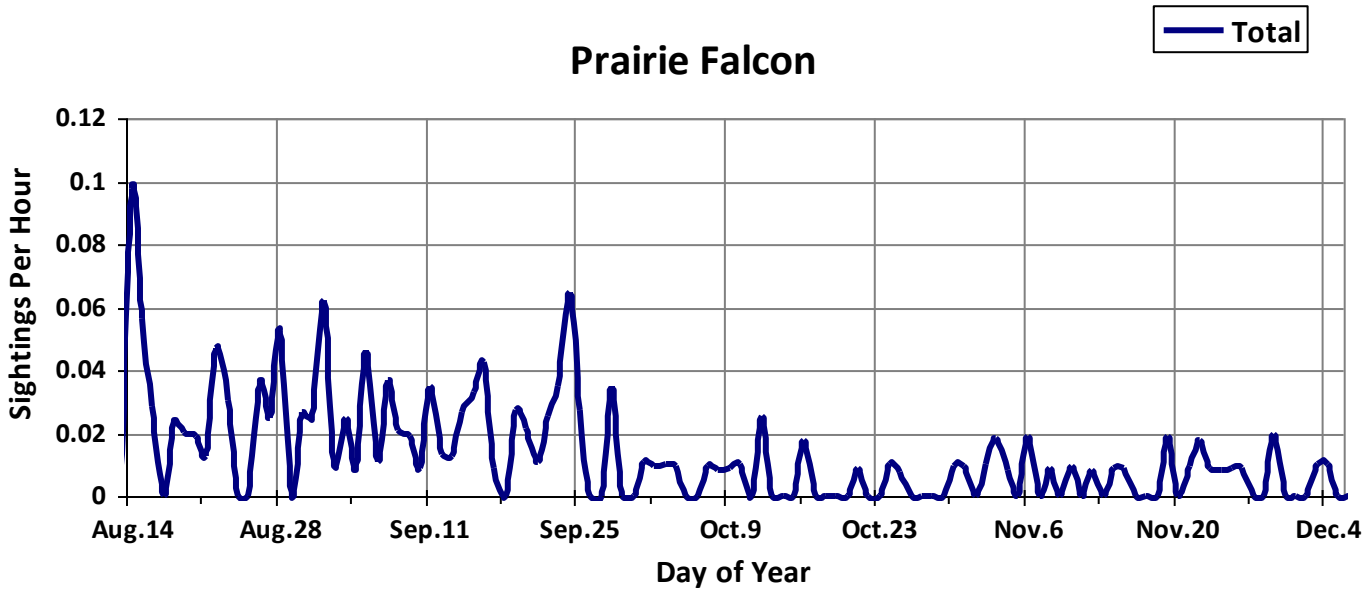


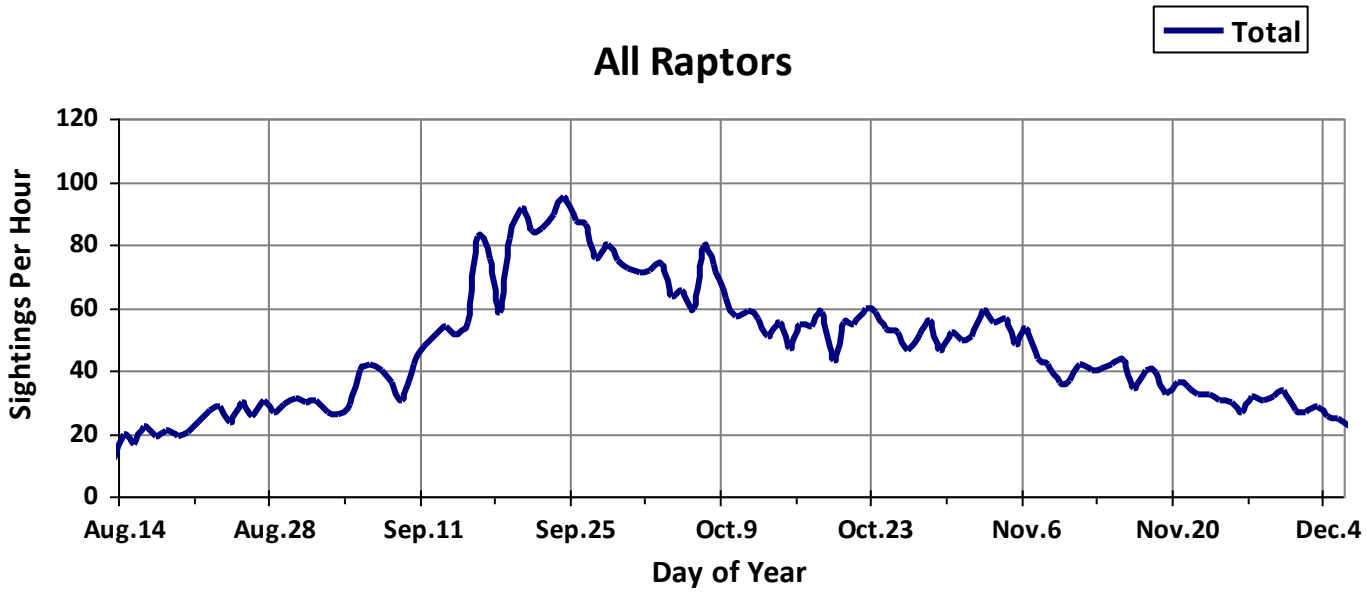




Migration Profiles by Species







Migration Profiles by Species

MAKING THE GRAPHS

These graphs were generated using all 24 years of GGRO hawkwatch data collected using a regularized quadrant system. Sightings of a given species/age/sex combination were totaled by the month and day on which they were observed and then averaged by the total number of hours spent counting a given species/age/sex categoryon that day. The resultant data are per hour, allowing comparisons between disparate seasons and days.

Do note that many species are now counted by age/sex categories that were previously recorded as undocumented (e.g., BAEA and FEHA). The raptor per hour values shown for these new age/sex categories have been normalized for the amount of effort spend counting during years in which they were a valid choice. This allows direct comparison with those age/sec categories that have been counted for the entire study period though the sample size is lower.

These graphs use a running average to present smoother curves that are easier to interpret and less influenced by abnormally high or low counts. The date range of August14th through December 5th was chosen to ensure that each day had at least 5 years of data behind it (the very early and very late season are less consistently covered, as can be seen in the "Days Counted" graph). Check out the dips mid-season in both days and hours counted--that's due to fog and other bad weather!

Yearly Trends in Sightings

INTERPRETING THE GRAPHS

These graphs show how the number of raptor sightings (y-axis) have changed across 30 years of GGRO hawkwatch data (x-axis). Yearly sightings are on the left y-axis, and raptors per hour on the right y-axis with year across the bottom. Actual number of sightings are plotted as dark blue diamonds for each year with a trendline (5th degree polynomial) shown as a lighter blue dashed line to capture the overall changes in sightings over tie. Note that the trendline is for illustrative purposes only and is not a marker of statistically significant trends.

GGRO's data collection has changed over time and important dates are marked on the plots. In particular, 1989 saw the institution of the quadrant system which was then regularized in 1992. The mid-1990s had further refinement of counting methods, particularly the presence of expert observers in North Quadrant and a better standardization of how to count (and recount) the more common species. For illustration, see how the "Total Raptors" and "Turkey Vulture" counts (top of opposing page) increase fairly steadily until the mid-1990s, when they begin to oscillate like one would expect. 2010 saw the lowest counts in recent years due to construction and counting from Slacker Hill rather than Hawk Hill.

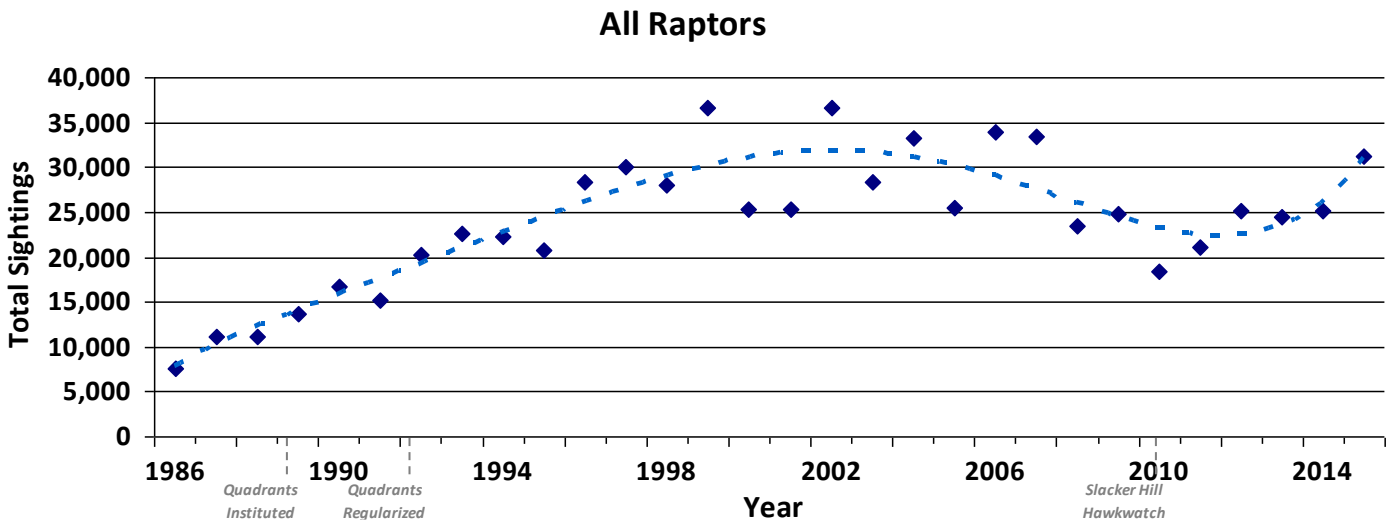
CHANGES ACROSS 30 YEARS OF GGRO HAWKWATCH

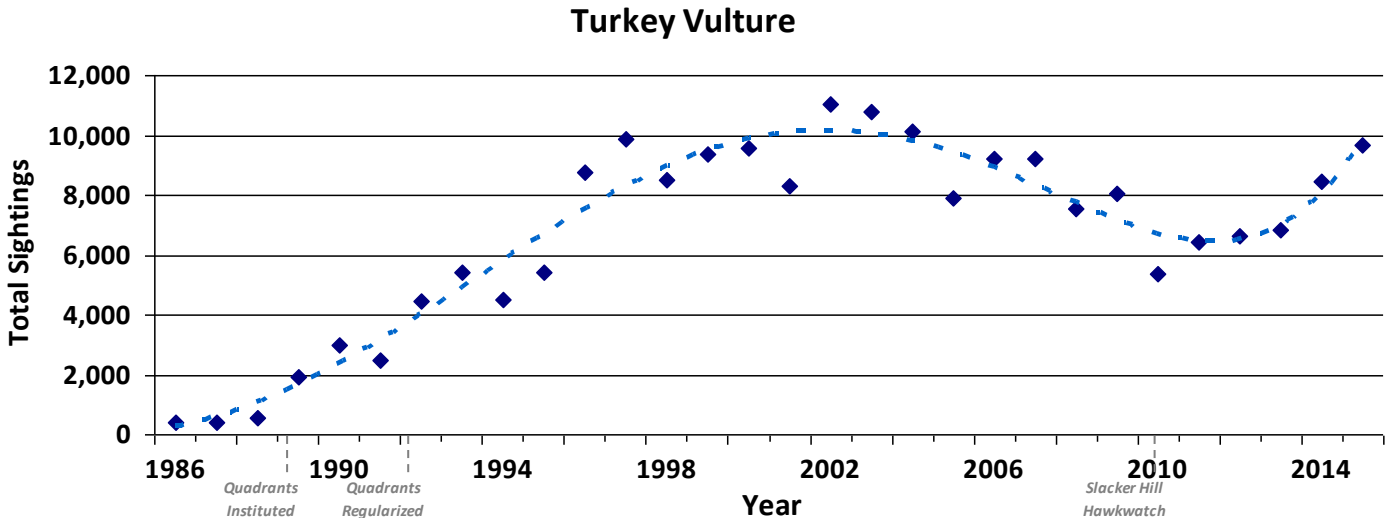
As you know, long-term monitoring sites like the GGRO Hawkwatch on Hawk Hill are very important for picking up changes in species populations. They are important early-warning mechanisms that can pick up on signs of environmental trouble, as in the case of DDT in the 1970s.

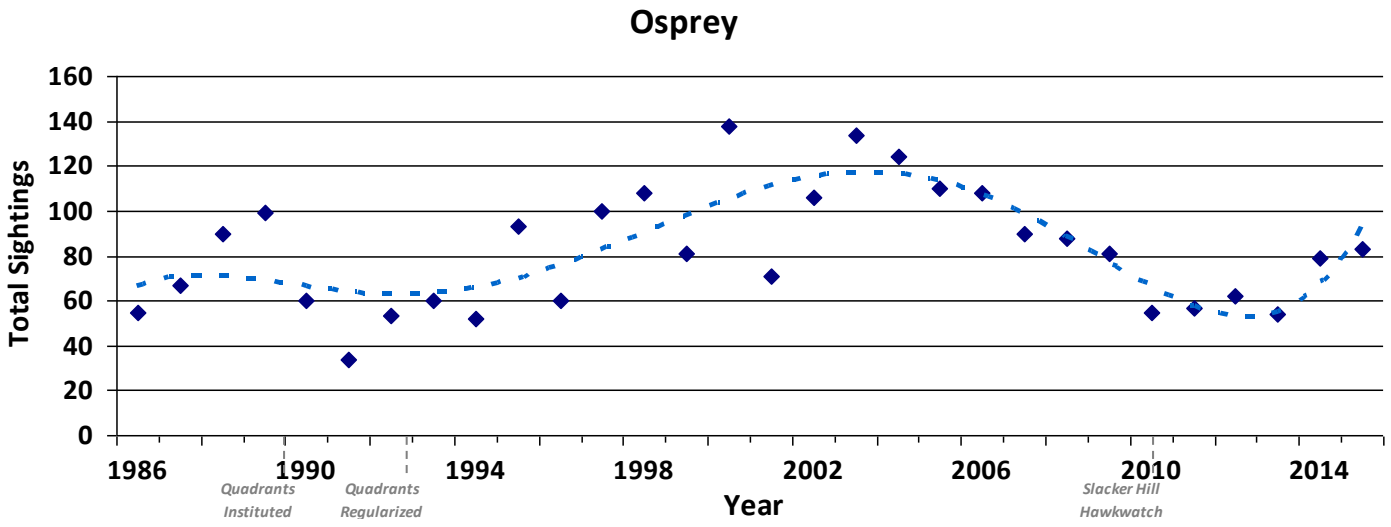
At the GGRO, our data set now goes back 30 years, letting us draw some conclusions about the overall health of raptor populations on the Pacific Coast. The majority of species seen from Hawk Hill have either shown slight to moderate increases or remained constant (no significant and/or substantial trend).

The Peregrine Falcon is one of the positive exceptions. Irrespective of normal inter-annual variations, Peregrine Falcon sightings have been increasing at the average rate of 4% (of our maximum sightings) per year (linear regression, ANOVA $P<0.001$) though have recently levelled off. As a result, the 2015 Hawkwatch saw about five times as many Peregrines and four times as many Redshoulders as the 1986 Hawkwatch!

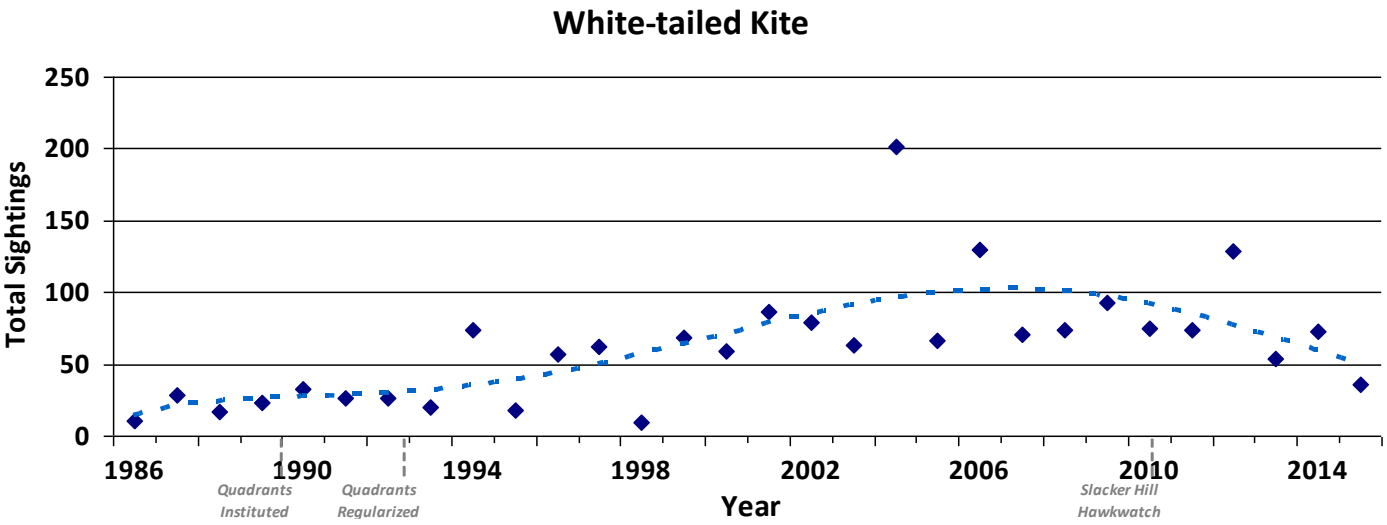
Yearly Trends in Sightings

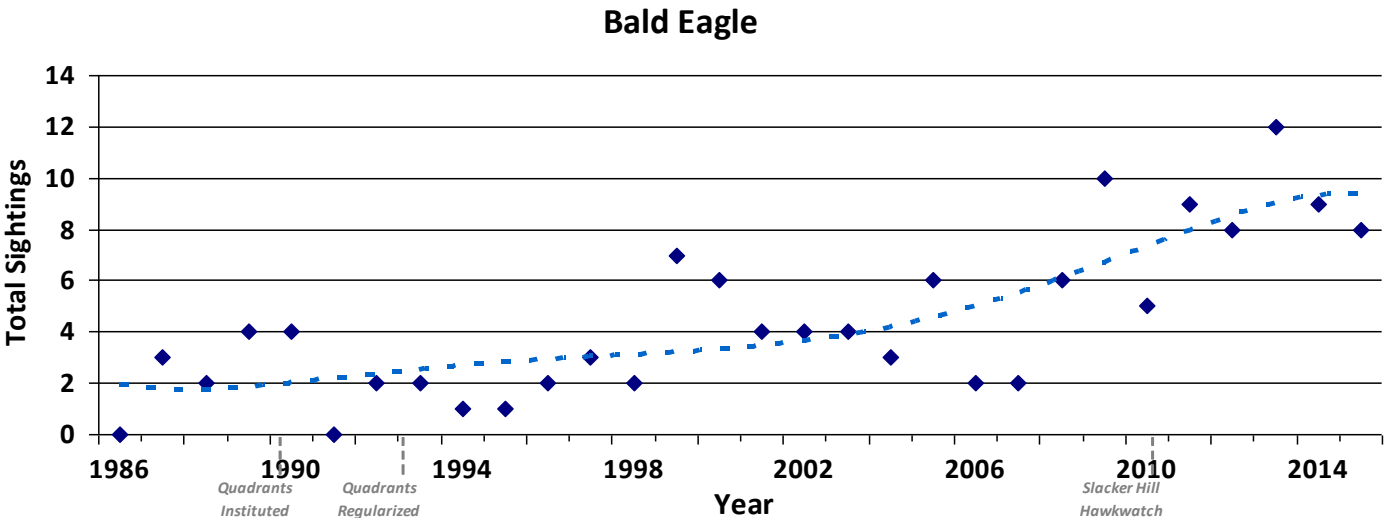


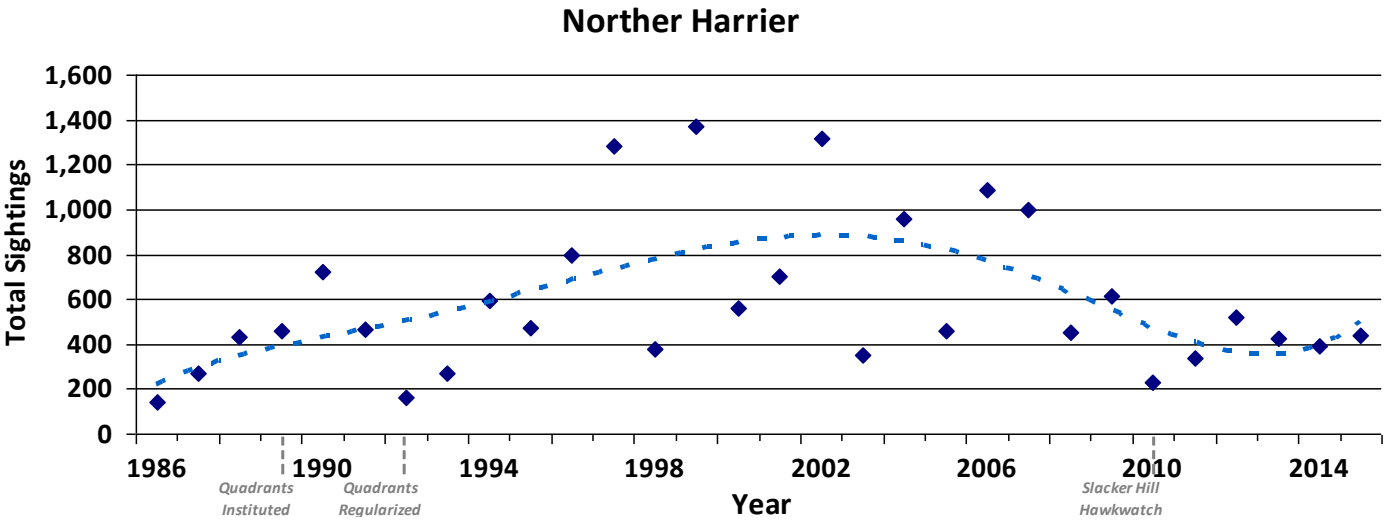




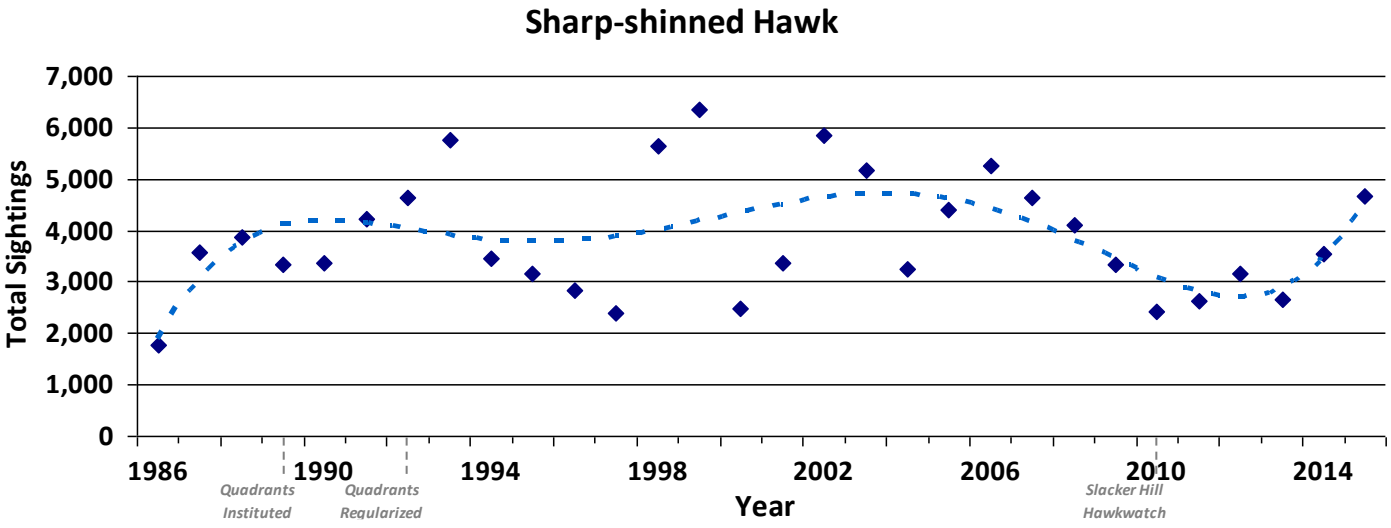
Yearly Trends in Sightings

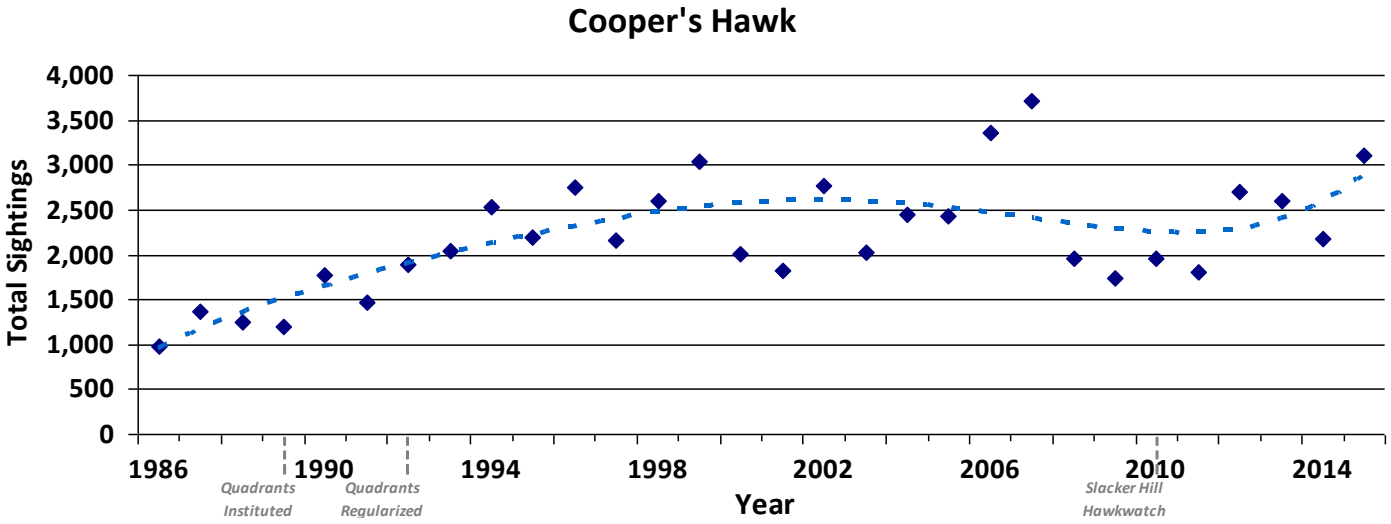


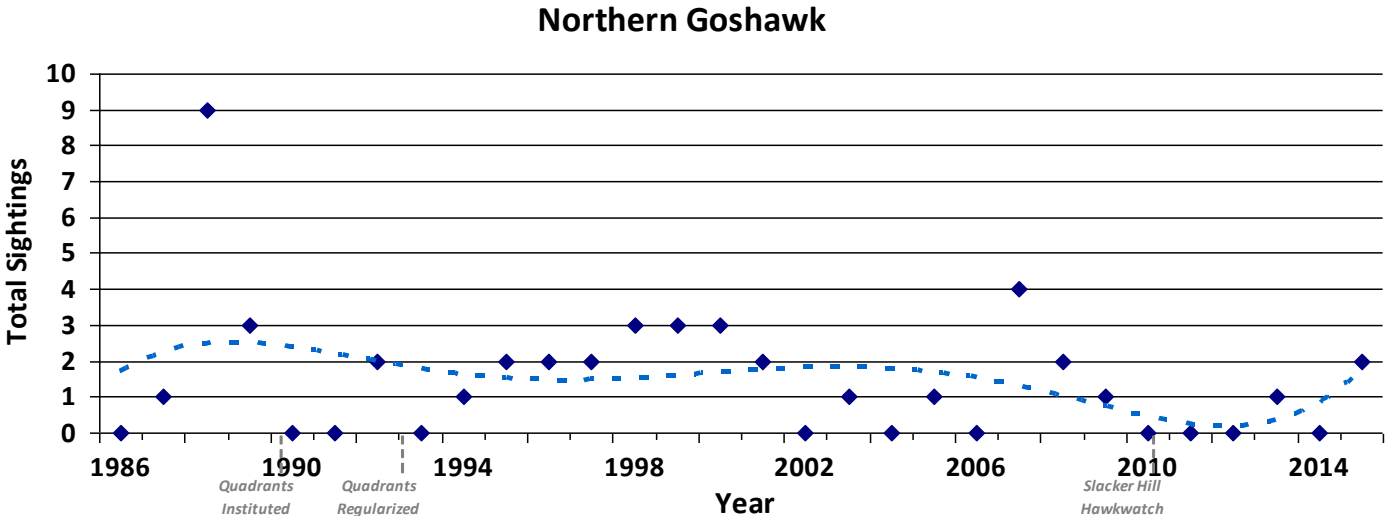




Yearly Trends in Sightings

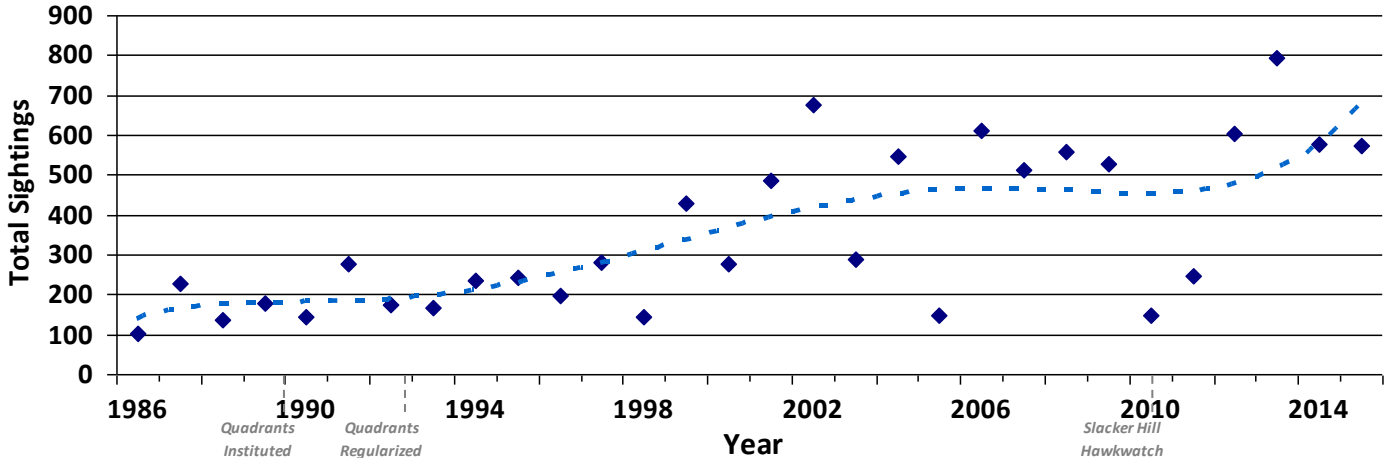




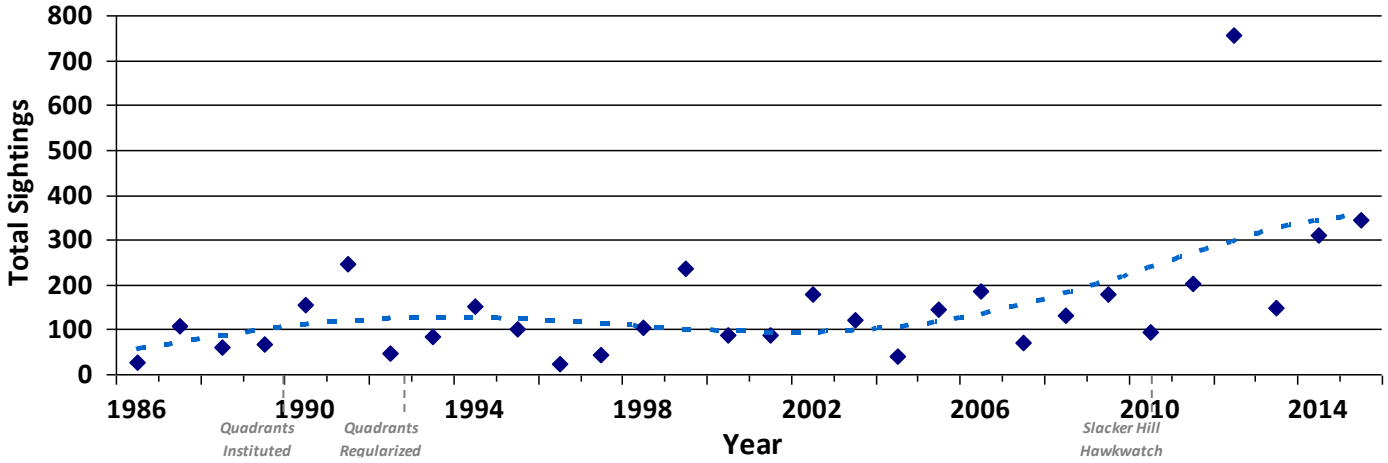


Yearly Trends in Sightings

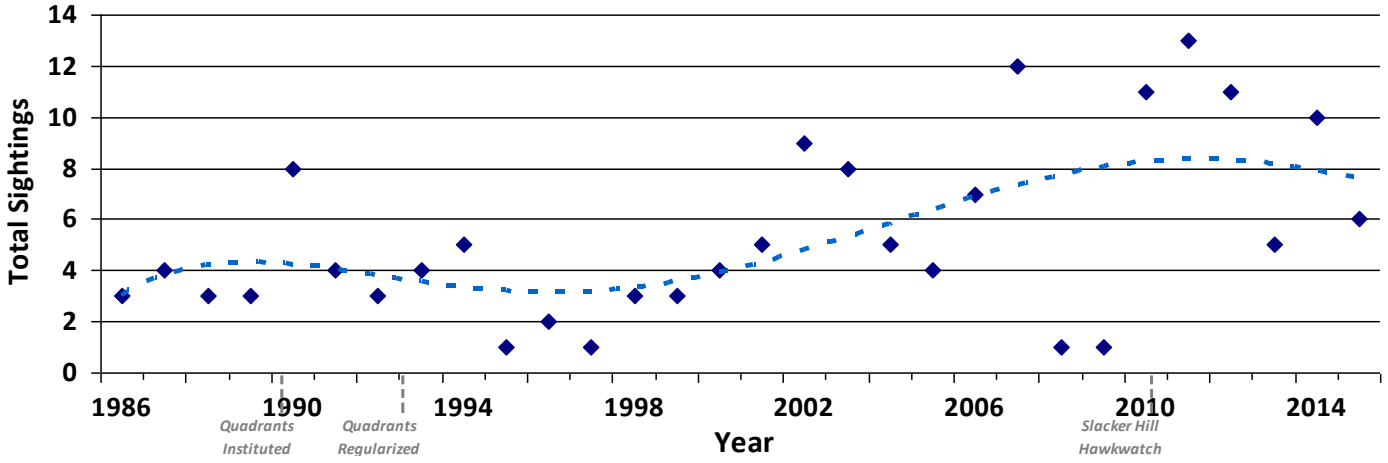
Red-shouldered Hawk



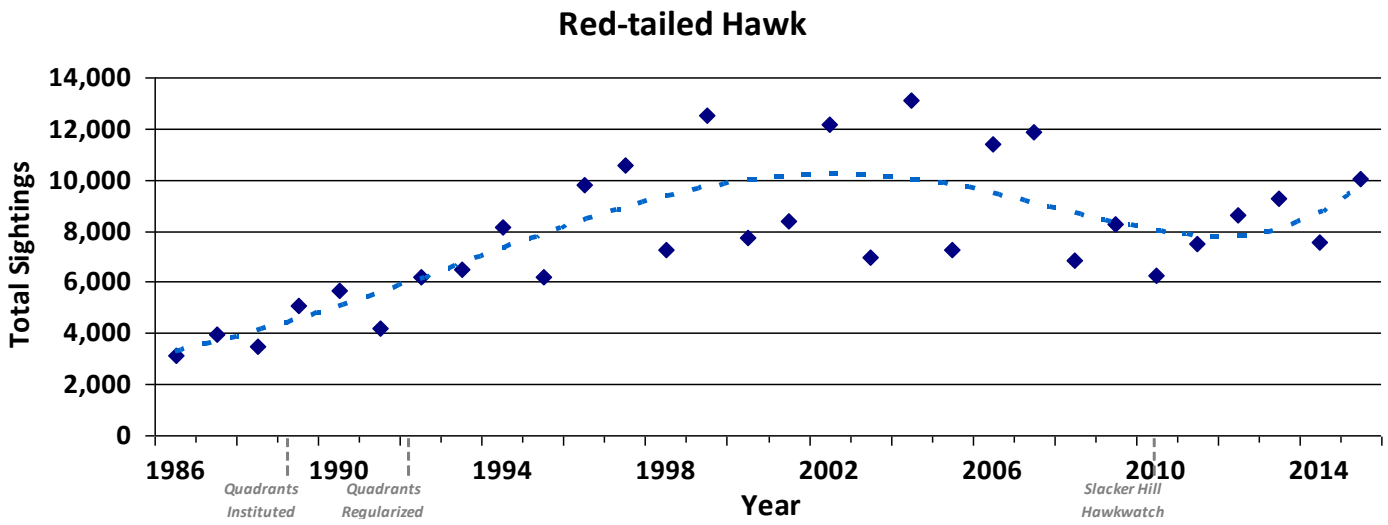
Broad-winged Hawk

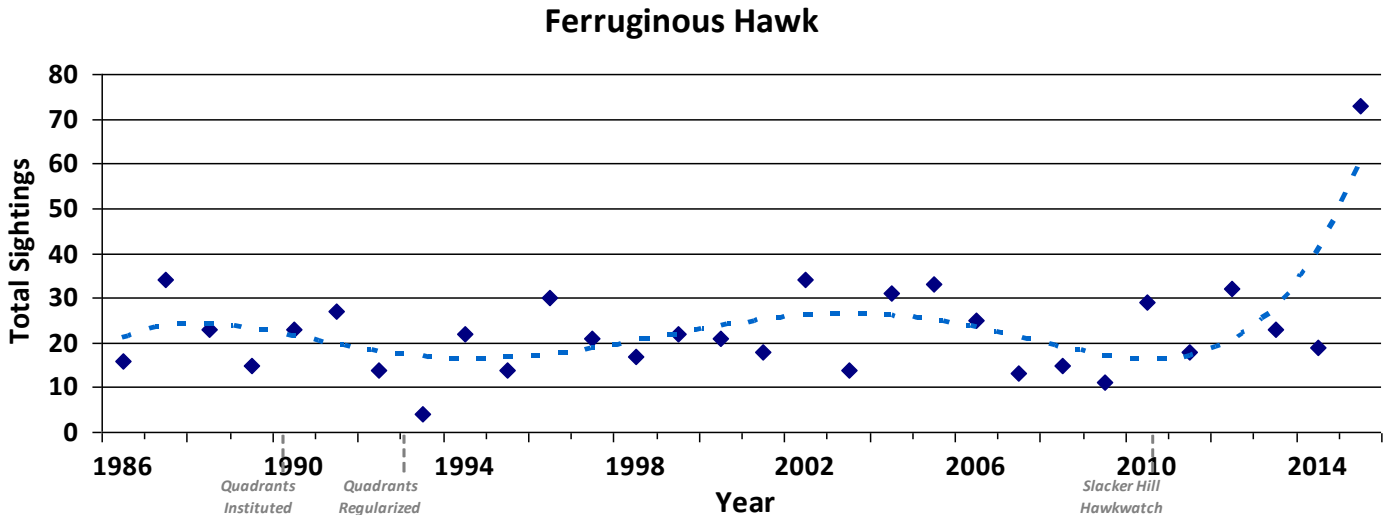


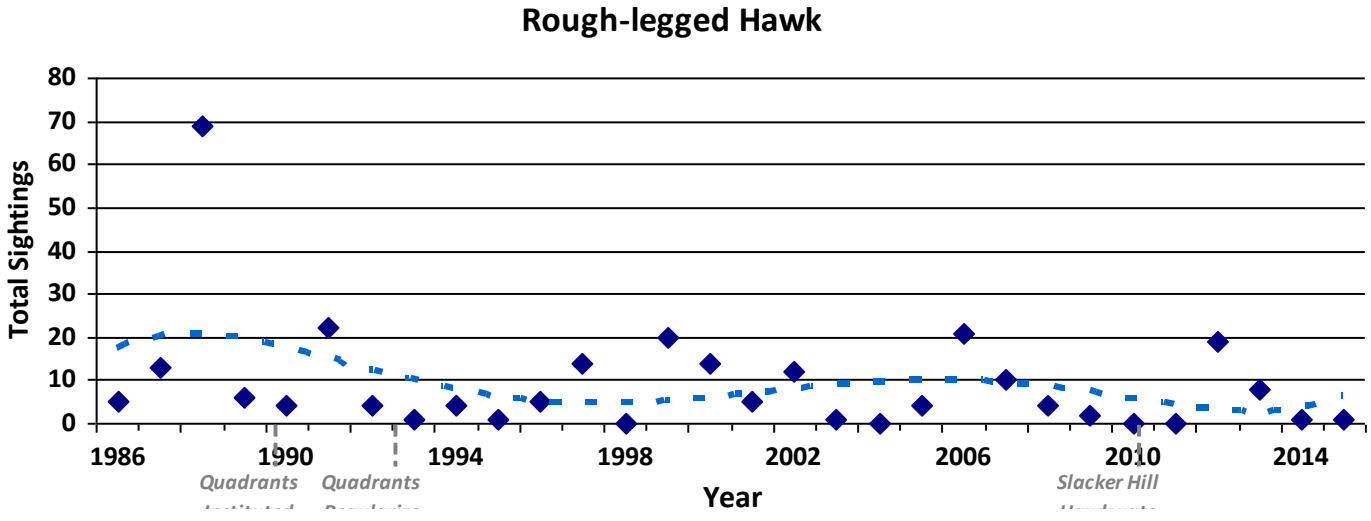
Swainson's Hawk



Yearly Trends in Sightings

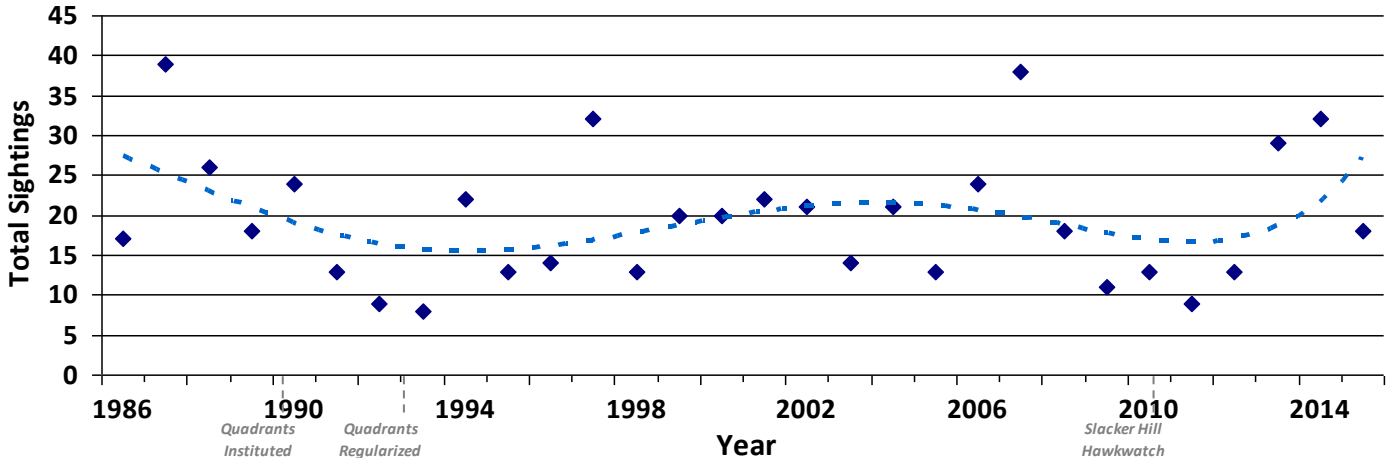




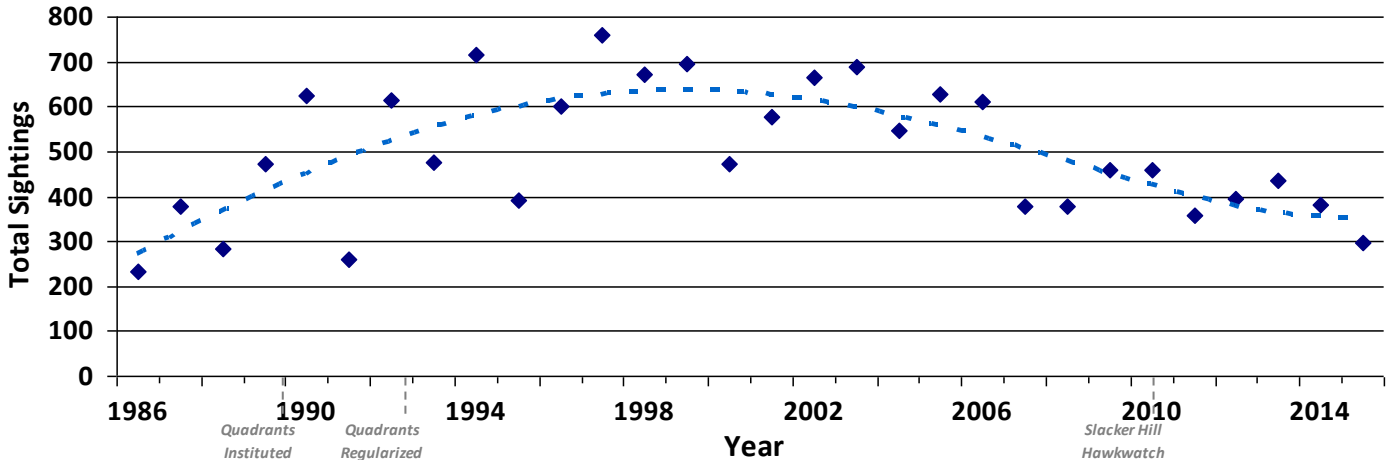


Yearly Trends in Sightings

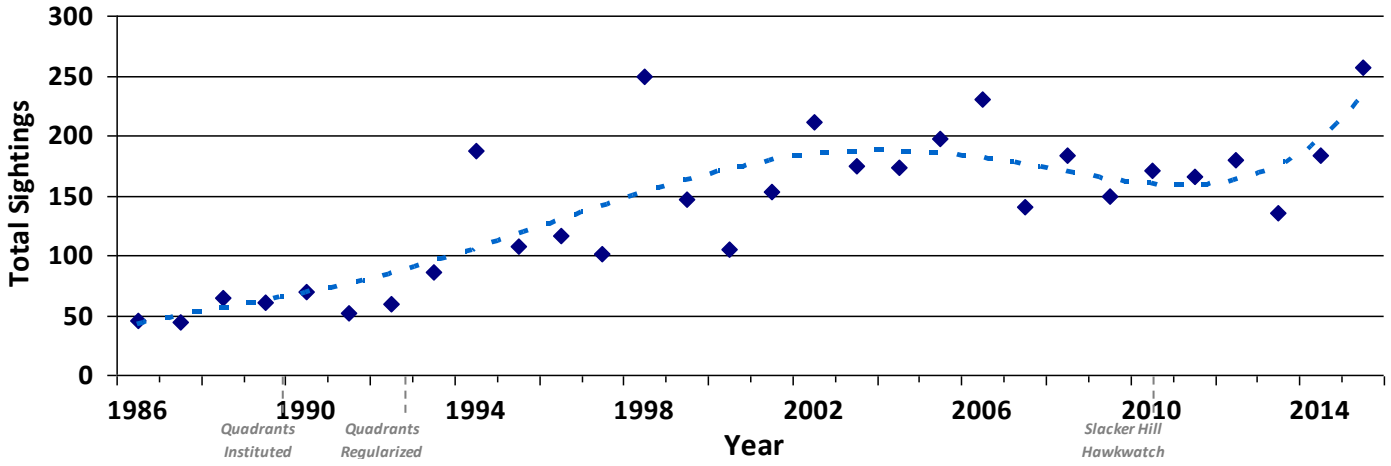
Golden Eagle



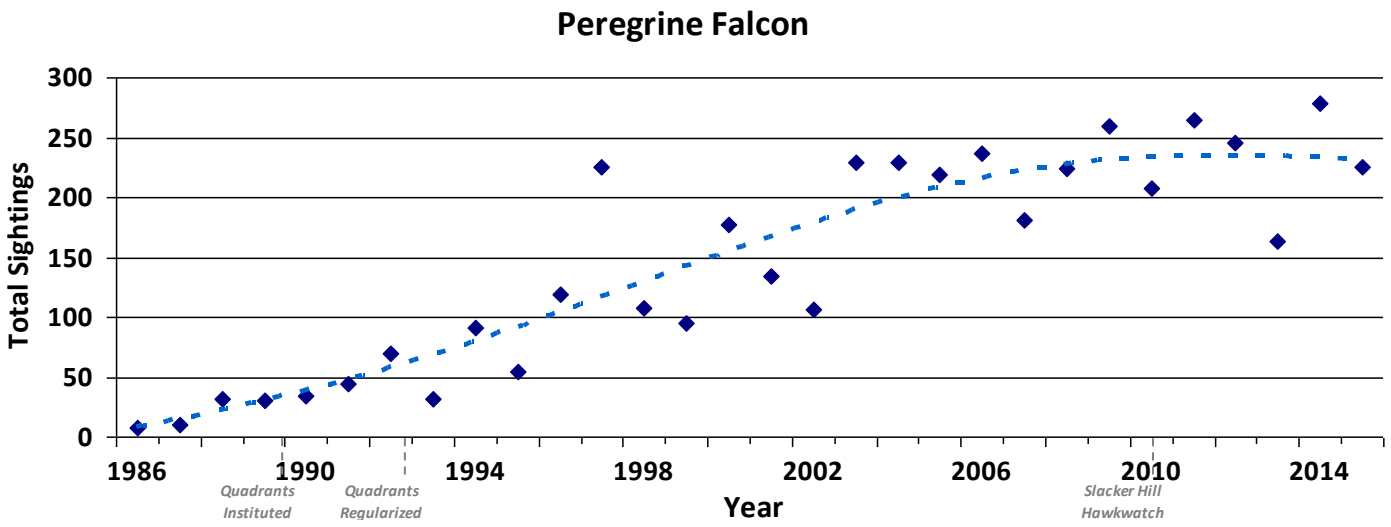
American Kestrel

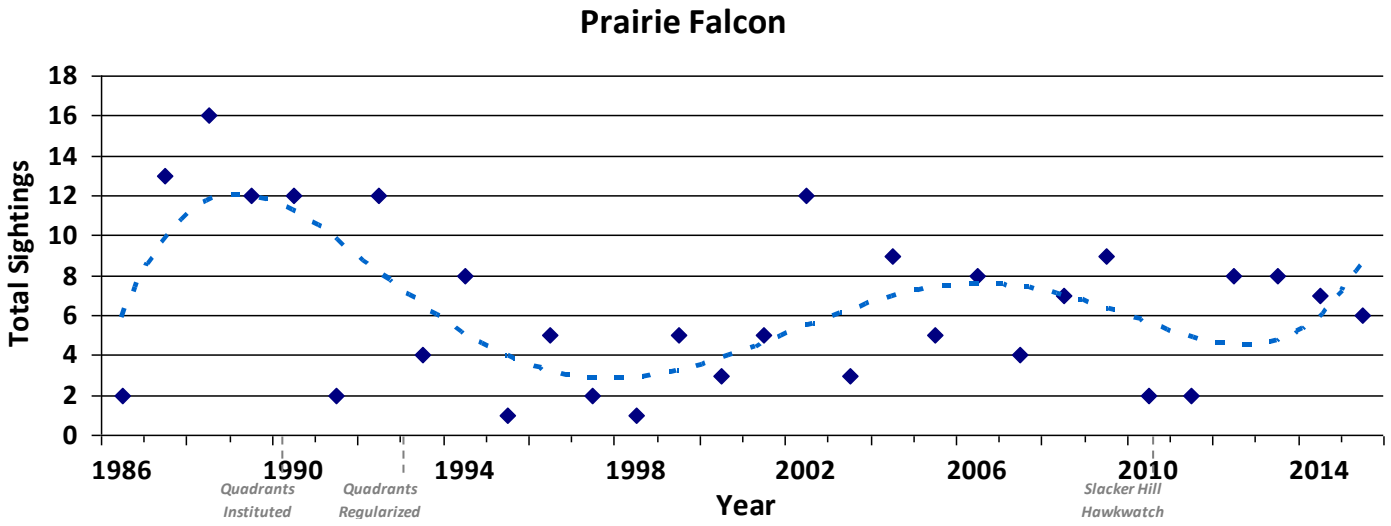


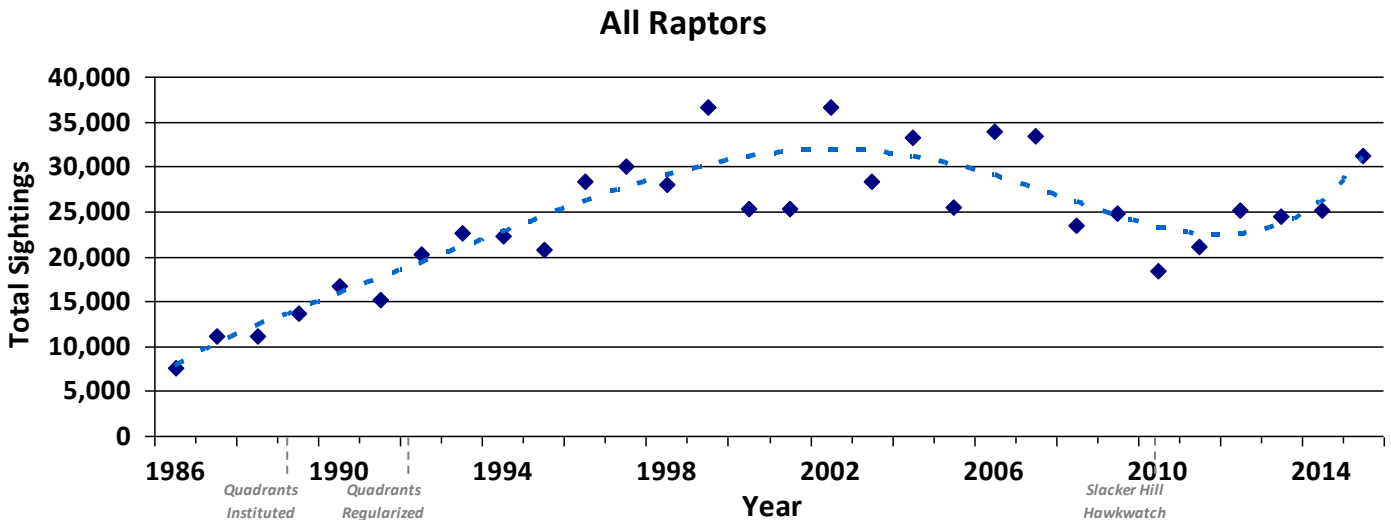
Merlin



Yearly Trends in Sightings







Yearly Trends in Sightings

THE CYCLICAL NATURE OF OUR SIGHTINGS

As you have likely noticed, the almost all of these graphs seem to alternate pretty steadily between high and low counts. Such inter-annual cycles are to be expected when monitoring any population, but unfortunately make analysis much more difficult—it's often hard to sort out an actual trend when the year-to-year variation between sightings is so extreme. It's also interesting to note that the cycles of different species often don't line up, which begs some interesting questions.

MAKING THE GRAPHS

Data were first truncated by date, using August 14-December 14 to weed out especially early or late counts. Seasonal rph was included in addition to season totals to account for any variation in hours counted by year. For the most part, this difference was negligible, but there are usually a few years in which the difference is visible for each species.

Notes

Golden Gate Raptor Observatory
1064 Fort Cronkhite
Sausalito, CA 94965

(415) 331-0730
www.ggro.org

July 2016