



Millersville University Hawkwatch Site

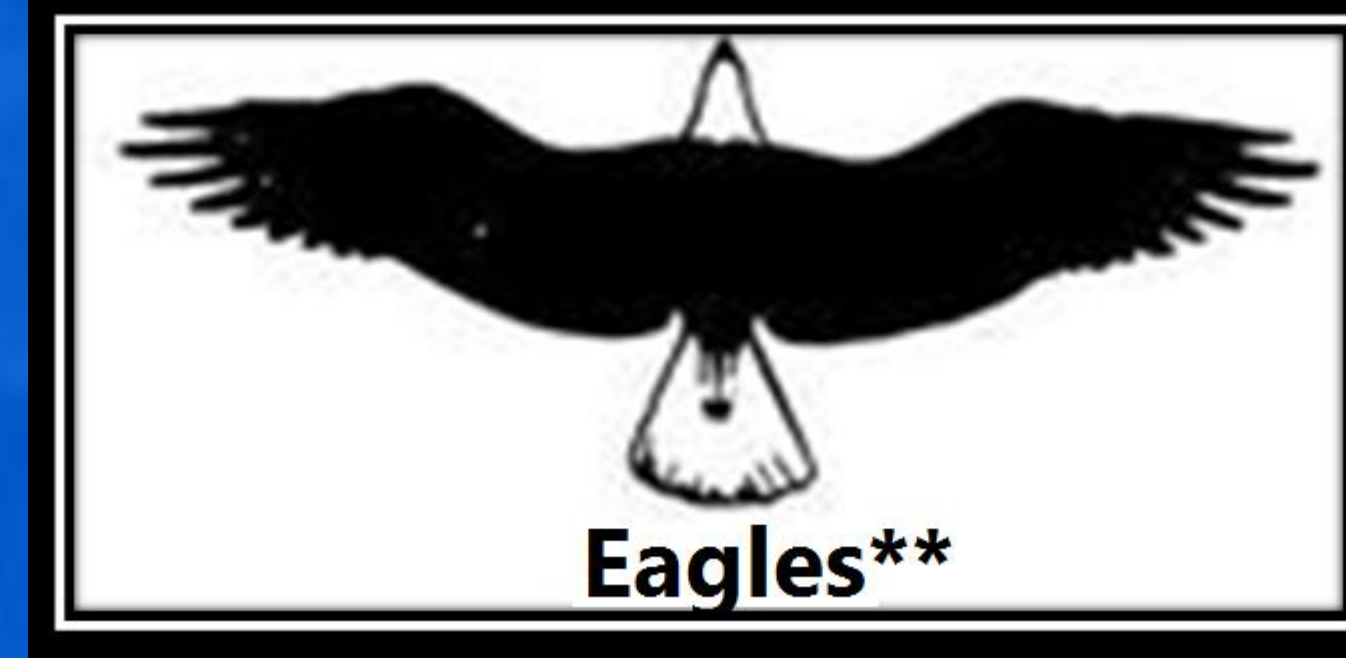
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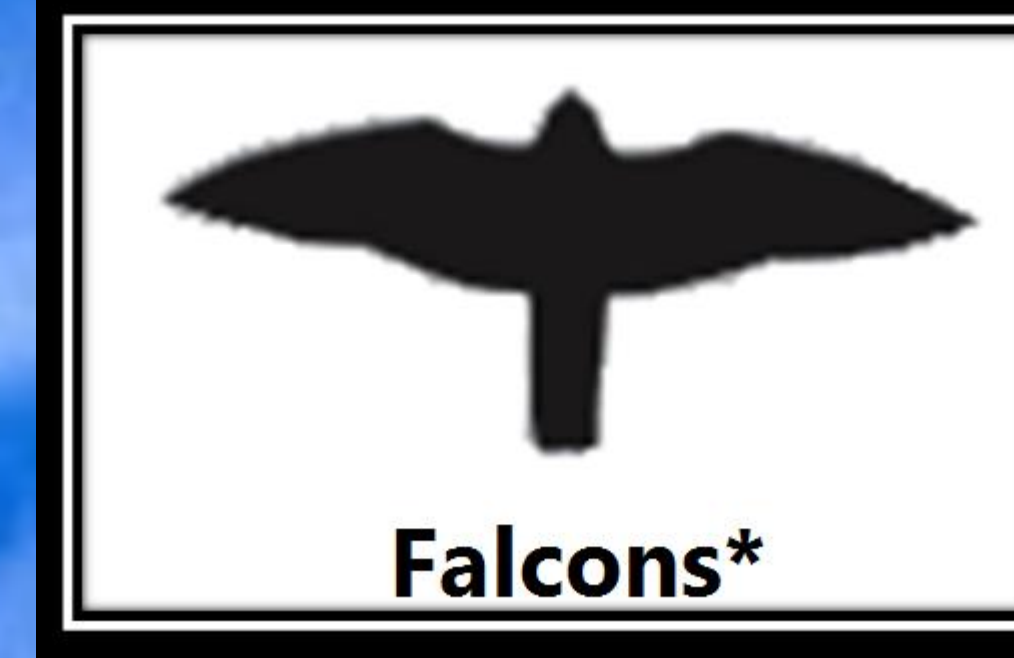
Accipiters*



Buteos*



Eagles**



Falcons*



Osprey**



Vultures*

Introduction

Since the 1930s, hawkwatch sites have quantified population trends for birds of prey (i.e., raptors) by counting their numbers during migration. Because raptors serve as effective bioindicators, the information gathered on raptor population trends has reflected the overall health of environmental communities. For example, Rachel Carson used Hawk Mountain Sanctuary's annual migration counts to show that organochlorine pesticides (DDT) were responsible for declining bald eagle (*Haliaeetus leucocephalus*) populations (Bednarz et al. 1990; Carson 1962).

Today, hawkwatch sites have partnered to form the Raptor Population Index (RPI) project to promote accurate and long-term raptor counts, a vital component of bird conservation, across North America (RPI-Project.org). Modern technology has provided new platforms for migration data collection via the use of various apps on portable tablets and phones that allow for live updates and interactive statistical profiles.

Hawkwatch sites are commonly located in topographic regions known to concentrate migrants (Bednarz et al. 1990). The improvement of the geographic coverage of hawkwatch sites is a long term goal towards the further comprehension of raptor population trends (Bildstein et al. 2014). In collaboration with Hawk Mountain Sanctuary, our objective was to establish a student-run hawkwatch site at Millersville University to gain experience with electronic data collection and the geographic viability of monitoring raptor migration at Millersville, PA, (a southern Pennsylvania site), in comparison to more established hawkwatch sites in the region (Figure 1).

Methods

In Spring and Fall 2017, Hawk Mountain Sanctuary provided student training in raptor identification. Students also received supervised training on two electronic data collection methods (i.e., TrekTellen and Dunkadoo). In Fall 2017, trained students counted migrating raptors on top of Caputo Hall on the Millersville University campus.

Raptor migration data was gathered at Millersville University from September 18th – October 20th, 2017 (peak raptor migration period; n=24 days) and compared to numbers recorded at Hawk Mountain Sanctuary (PA) and Cape May Bird Observatory (NJ) (Figure 1). Species included in the analysis were narrowed down and grouped taxonomically: "Vultures" were black (*Coragyps atratus*) and turkey vultures (*Cathartes aura*); "Eagles" were golden (*Aquila chrysaetos*) and bald eagles (*Haliaeetus leucocephalus*); "Accipiters" were sharp-shinned (*Accipiter striatus*) and Cooper's hawks (*Accipiter cooperii*); "Buteos" were red-shouldered (*Buteo lineatus*), red-tailed (*Buteo jamaicensis*), and broad-winged hawks (*Buteo platypterus*); "Falcons" were American kestrels (*Falco sparverius*), merlin (*Falco columbarius*) and peregrine falcons (*Falco peregrinus*); and "Osprey" (*Pandion haliaetus*) as their own group.

Migration data for all 3 sites were recorded onto TrekTellen, Dunkadoo, and paper data sheets according to the Hawk Migration Association of North America protocol (hmana.org). Due to uneven raptor count effort at the 3 sites, we averaged the number of hawks counted per hour for each day at each site by raptor group. Raptor count data was not normally distributed between days, therefore we compared the median number of raptors counted per hour using a Mood's median test with statistical significance based on p-value ≤ 0.05 .

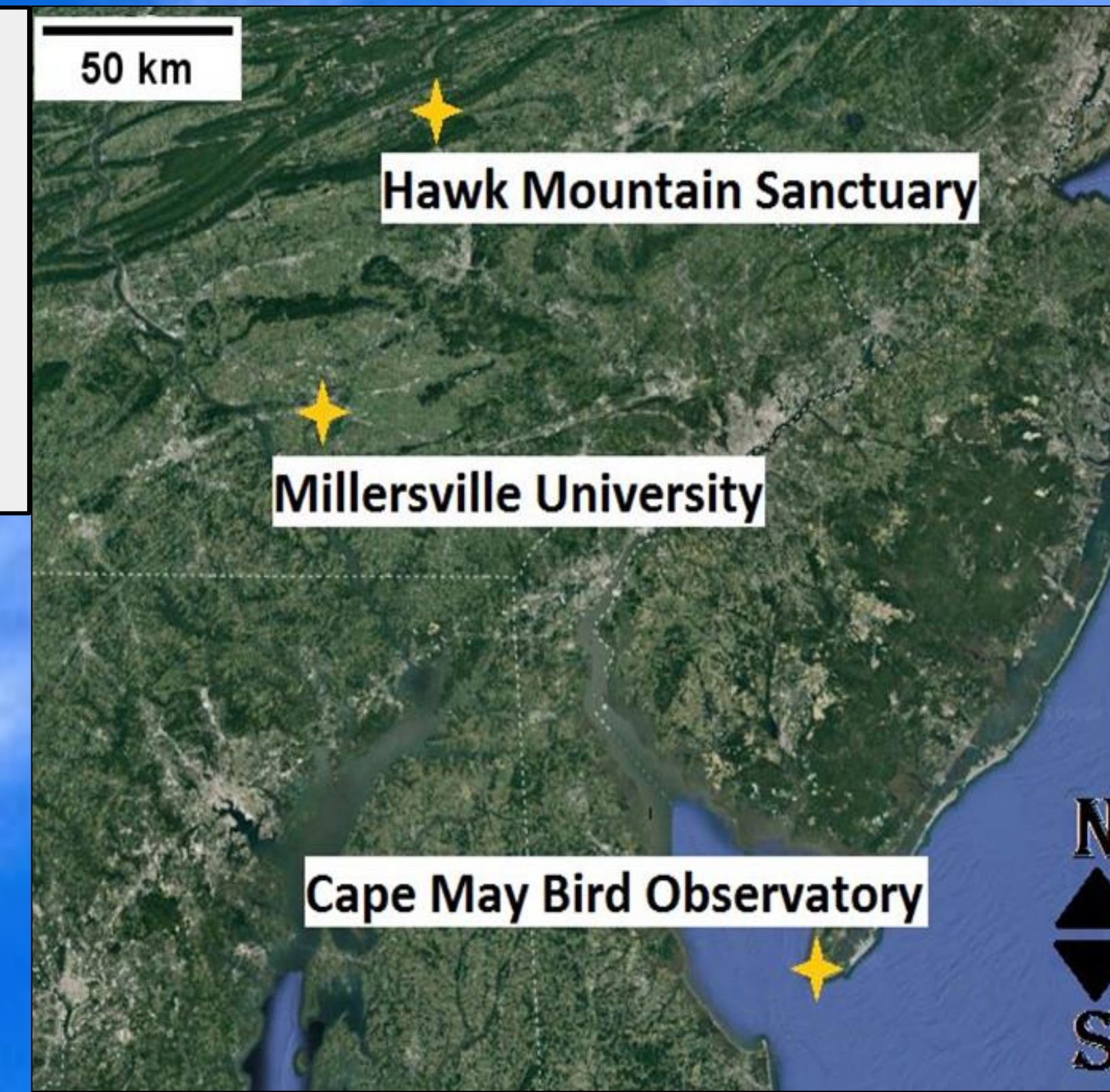
Notes

Equipment was funded by the Millersville University Biological Student Investigator Grant.

*Images of Buteos, Accipiters, Falcons and Vultures taken from the North East Hawk Watch guide by Paul Carrier "A Guide for Hawks Seen in the Northeast"

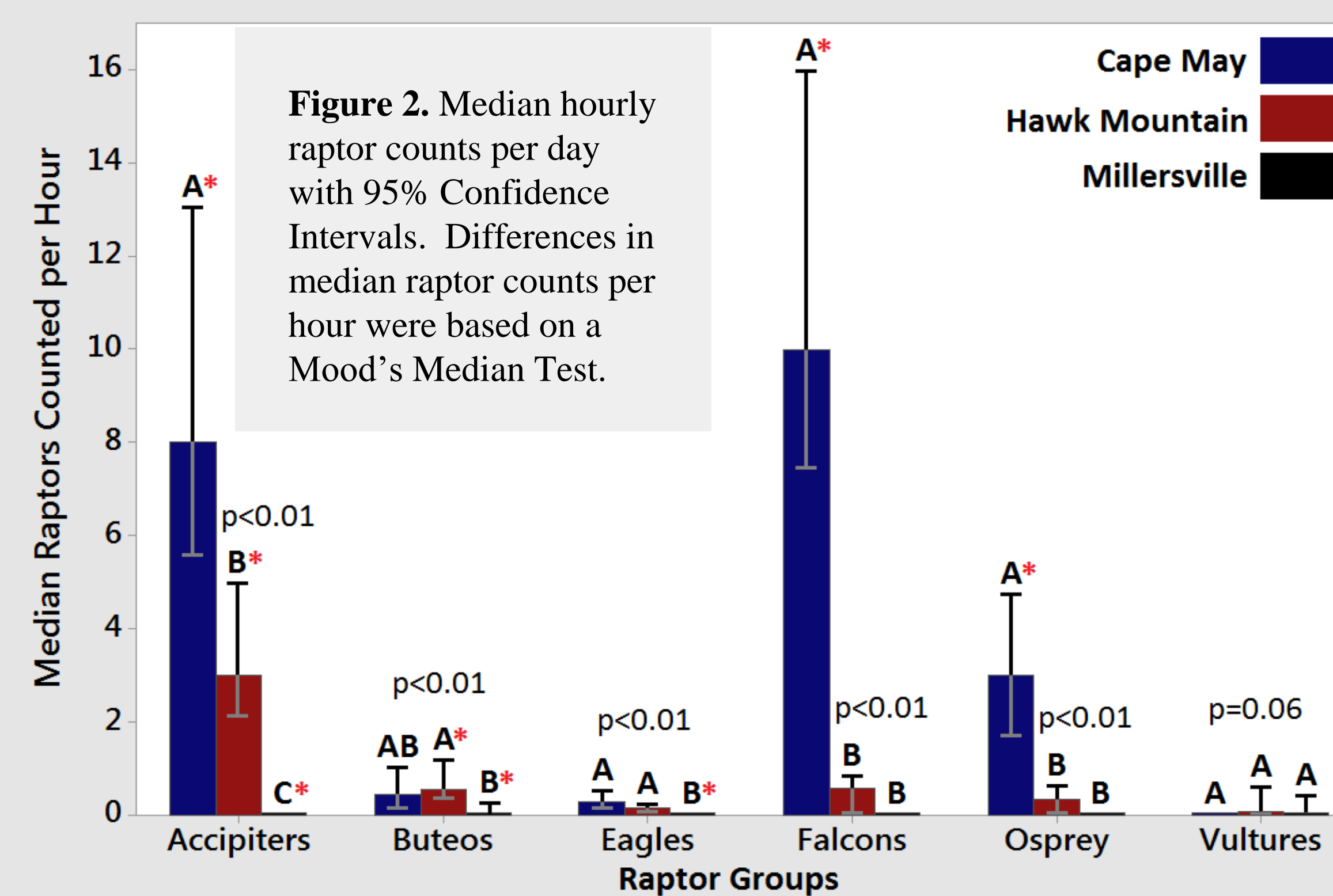
**Images of Eagles and Osprey taken from the National Audubon Society guide by Chuck Ripper "Overhead Flight Silhouettes"

Figure 1. Location of Hawk Mountain Sanctuary and Cape May Bird Observatory in relation to Millersville University. Base satellite image retrieved from Google Earth (2018).



Results

Cape May Bird Observatory recorded the highest raptor counts (16,960 total birds) over the 24 day period while Millersville University recorded the lowest (254 birds). Cape May saw significantly more Accipiters, Falcons, and Osprey per hour than the other two sites (Figure 2). Hawk Mountain Sanctuary (5,432 birds) counted more Accipiters and more Buteos per hour than Millersville. Millersville University recorded significantly less Accipiters and Eagles per hour compared to the other two sites while there was no significant difference between site counts of Vultures (Figure 2).



Acknowledgments

A special thanks to Dunkadoo administrator Carol Goodman, TrekTellen administrator Gerard Troost, Millersville University Meteorology Department, Millersville University custodial staff, Cape May Bird Observatory, Hawk Mountain Sanctuary, Elizabeth Erickson and HawkWatch International.

Student Hawk Watch Leaders: Halie Parker, Jennifer Houtz, Kevin Faccenda, Amanda Goldsmith and Jordan Williams. **Student Hawk Watch Volunteers:** Scott Reynolds, Madeline Giardina, Alexis Leigh Shollenberger, Emily Ritter, Adam Hummel, Jessica Holloway, Emily Dinkel, Rochelle Jones, Christina Clawson, Victoria Coutts, Rachel Malampy, Austin Harrison, Veronica Luce, Darren Hugues.

Discussion

Large numbers of raptors counted at the Cape May Bird Observatory during the 24 day study can be attributed to the geography of the area; the North Atlantic coast is a major migration route for raptors traveling the Nearctic-Neotropical corridor (Heintzelman 1986). As New Jersey funnels into the Cape May peninsula, migrating birds are concentrated and large numbers are observed (Lott 2006) (Figure 1). Raptors often follow topographic features or "leading lines" during migration, i.e. ridges and coastlines (Bildstein 2006). They concentrate along these features using wind currents to save energy on their migration. Regional subpopulations of individual species, such as Broad-winged Hawk, also may diverge between coastal and mountain migration routes (Miller et al. 2002). Such a divergence or the lack of a leading topographic line could explain the significantly low numbers of migrating raptors observed at Millersville, which is situated between the two major geographic migration routes (Figure 1).

Despite low numbers, a hawkwatch site at Millersville University could still be useful in monitoring phenological shifts in North American raptor migration cycles based on climate change (Therrien et al. 2017), information collected would be still valuable to the RPI project (RPI-Project.org) and provide information on migration patterns through mid-Atlantic region. Bildstein et al (2014) expressed that improvements are needed in the statistical procedures watchsites use to analyze raptor counts and the need to establish uniform digital records. At Millersville University, students showed that tablet data entry could be implemented effectively and the use of digital records and apps such as TrekTellen and Dunkadoo allowed instant digital recording of data and provided interactive live-update tables and figures that provided a dynamic public profile (Figure 3).

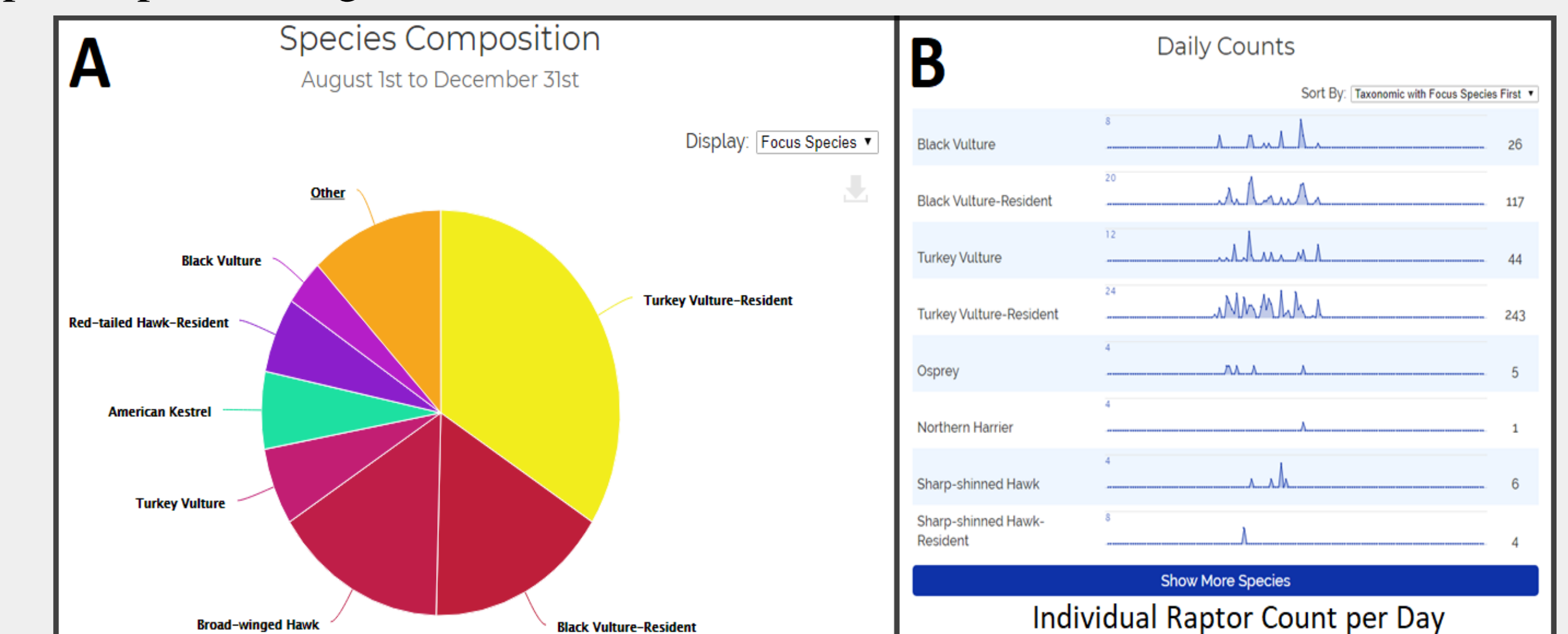


Figure 3. Screen captures of Dunkadoo's live-update statistics for Millersville. A) Pie chart showing the Fall 2017 composition of raptors counted. B) Histogram showing count totals of focal raptor species.

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