GOLDEN GATE NATIONAL PARKS CONSERVANCY

# PACIFIC RAPTOR

GOLDEN GATE RAPTOR OBSERVATORY

ISSUE
41

FALL
MIGRATION
2019

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Red-tailed Hawk. Photo: Veronica Pedraza

Front Cover Artwork: Sharp-shinned Hawk (*Accipiter striatus*) migrating past Hawk Hill. 12x16 Gouache painting on paper by Bryce W. Robinson. Bryce is an ornithologist and illustrator who works to integrate visual media and research to better communicate topics in ornithology. You can see more of Bryce's work at www.ornithologi.com.

# PACIFIC RAPTOR 41

## FEATURE CONTENTS

GGRO bander and docent Lynn Schofield releases a Cooper's Hawk at a weekend Hawk Talk program. Photo: Paula Eberle

# INTRODUCTION

Dear Friend of the GGRO,

We write this in September 2020, when many uncertainties about the COVID-19 pandemic remain. For more than three decades, the Parks Conservancy has invited people to the Golden Gate National Parks to support deep and meaningful ecological work through community science. And when the time is right, when we can assure physical distancing and other safety measures, we look forward to continuing to do exactly that once again.

Together, we will cultivate and restore native landscapes, we will monitor at-risk and endangered species, and we will keep a pulse on the bird of prey populations of California at the largest raptor migration site in the Pacific states.

Thank you for supporting our important work, as a volunteer, donor or an impassioned bird lover. As you read through this year's Pacific Raptor, reporting on the 2019 season of the Golden Gate Raptor Observatory, we hope you take great pride in your role in preserving and protecting our wild landscapes. GGRO is one of the Golden Gate National Parks Conservancy's flagship community science programs, and you are what makes it possible!

Thank you for your ongoing support for the Parks Conservancy's mission and future, and for all that you do to preserve these precious national parklands.

Allen Fish
GGRO Director, Golden Gate National Parks Conservancy

Christine Lehnertz
President & CEO, Golden Gate National Parks Conservancy

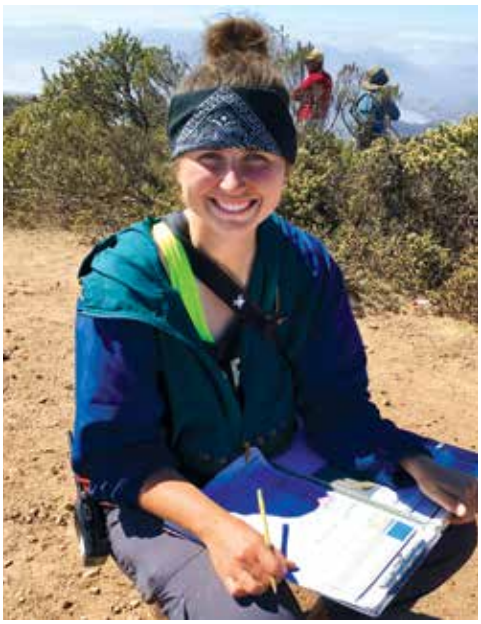
## 2019

# PRESENTATIONS AND PUBLICATIONS

Along with generating an enormous amount of original information on California raptor movements and ecology, the GGRO relies on excellent relationships with more than a dozen academic labs, government agencies, and NGO's to leverage the greatest amount of science from our work. Many research projects take years to develop, analyze, and produce results; more years are required to publish. In 2019, our collaborations resulted in three journal publications, two from Dr. Joshua Hull's lab at the University of California, Davis, and one from Dr. Chris Briggs' lab at Hamilton College in New York.

Doctoral candidate and GGRO bander Ryan Bourbour. Photo: Ryan Bourbour

The two UC Davis articles were headed up by doctoral candidate and GGRO bander, Ryan Bourbour. One was a collaborative paper with US Fish and Wildlife Service biologists examining mercury loads in feathers at migration stations like GGRO across the United States. The other was a methodological review of a technique pioneered in the Hull lab using DNA to determine the prey species of hawks by swabbing the bills and feet of the raptors.



2018 GGRO Intern Laura Kwasnoski. Photo: Nelia White

Prey DNA samples collected from talons and beaks of raptors banded at GGRO. Photo: Ryan Bourbour

*Bourbour, RP, BL Martinico, MM Crane, AC Hull, and JM Hull. 2019. Messy eaters: Swabbing prey DNA from the exterior of inconspicuous predators when foraging cannot be observed. Ecology and Evolution. doi: 10.1002/ece3.4866*

*Bourbour, RP, BL Martinico, JT Ackerman, MP Herzog, AC Hull, AM Fish, and JM Hull. 2019. Interspecies, temporal, and geographic comparisons of feather mercury concentrations in North American raptors sampled at migration monitoring stations. Ecotoxicology. doi: 10.1007/s10646-019-0216-2*

Hamilton College undergrad and GGRO intern Laura Kwasnoski led an analysis looking for health impacts of rat poisons on Red-tailed Hawks banded at GGRO. Laura included the work and talents of two other former GGRO interns, Kristina Dudus and Emily Abernathy, in her research.

*Kwasnoski, LA, KA Dudus, AM Fish, EV Abernathy, and CW Briggs. 2019. Examining sublethal effects of anticoagulant rodenticides on haemosporidian parasitemia and body condition in migratory Red-tailed Hawks. Journal of Raptor Research 53 (4): 402-409.*

Many other GGRO research projects are in the works—seeds and saplings moving toward tree status in the coming years. Three manuscripts have been submitted for publication in 2020. If there is a common theme in the more than eighty scientific articles produced through the GGRO, it would have to be collaboration—between academics and volunteers, between agency biologists and grad students—a commitment to getting the science done and out to the world. Great gratitude to all of our past and present collaborators for investing your time and energy with GGRO.

# RAPTORS IN LIGHT OF CLIMATE CHANGE

*Allen Fish*

GGRO Director Allen Fish takes a selfie break on a foggy afternoon at Hawk Hill. Photo: Allen Fish

Last fall, I got word of a new scientific article on climate change and birds. Three biologists at the University of Haifa and Tel-Hai College in Israel—Yosef Kiat, Yoni Vortman, and Nir Sapir—had just published an article titled "Feather moult and bird appearance are correlated with global warming over the last 200 years." What? A 200-year dataset? How is that possible? And even more amazing: climate change can impact the look of a bird, its very plumage? I found a PDF of the original article from *Nature Communications* and started reading.

## CLIMATE CHANGE CORRELATES WITH PLUMAGE CHANGES

To obtain a two-century dataset, Kian and team visited ten major natural history museums across Europe, scoring the extent of molt on 4012 bird specimens from the years 1805 to 2016. They focused on nineteen species of songbirds, only juvenile birds, so they could track dates for the start and end of the first autumn molt. Some of these species molt before autumn migration, some after. What did Kian and his team find?

After plotting their molt data against a measure of climate change called Global Mean Temperature Anomalies (GMTA), they found three results over the 200+ years of data: (1) the amount of molt increased for 16 of the 19 songbird species; (2) for ten species that showed different adult plumages in males and females, female birds progressed toward adult plumage faster in four species since 1990; and (3) this pattern of increasing molt extent over time appeared in all three categories—year-round resident species, short-distance, and long-distance migrating species.

To grab a mental picture of why this might be happening, think of a generic calendar year, January through December, stretched out on a horizontal

**ALLEN FISH,** hired as GGRO Director in 1985, was the Golden Gate National Parks Conservancy's first bird biologist. With a background in evolutionary ecology from UC Davis, Allen has an interest in bird population responses to urbanness, climate change, and other human impacts. He is equally fascinated by human responses to wild birds.

axis, left to right. One of the general findings of climate change research in the last decade is that many birds nest earlier as spring temps start earlier (breeding season shifts left). Another finding is that autumn migration is delayed, as winter temps are delayed (migration season shifts right). These two patterns have the net effect of "opening up" the post-breeding juvenile molt "season" that resides between fledging and the onset of migration. Presumably, the bird does not show much overlap in breeding, molt, and migration because each is a very energetically expensive activity.

There is a lot more to think about in Kian's paper and I encourage you to read the original article which, in my mind, deserves a place in history. Why? For one, how many bird studies have 200-year datasets? Also, this is great proof of the value of museum collections, perhaps the most important validation since Dan Anderson crossed the continent to measure 1400 Peregrine Falcon eggshells in the mid-sixties to document the impact of DDT.

So, what do we know about raptors and climate change from the scientific literature? There are many general patterns and models about how birds in general might respond to climate change, but do birds of prey present a different situation? Maybe a better way to ask this is: do predatory birds respond differently to climate change than bird species at other places on the trophic (food) landscape? Of course, they might.

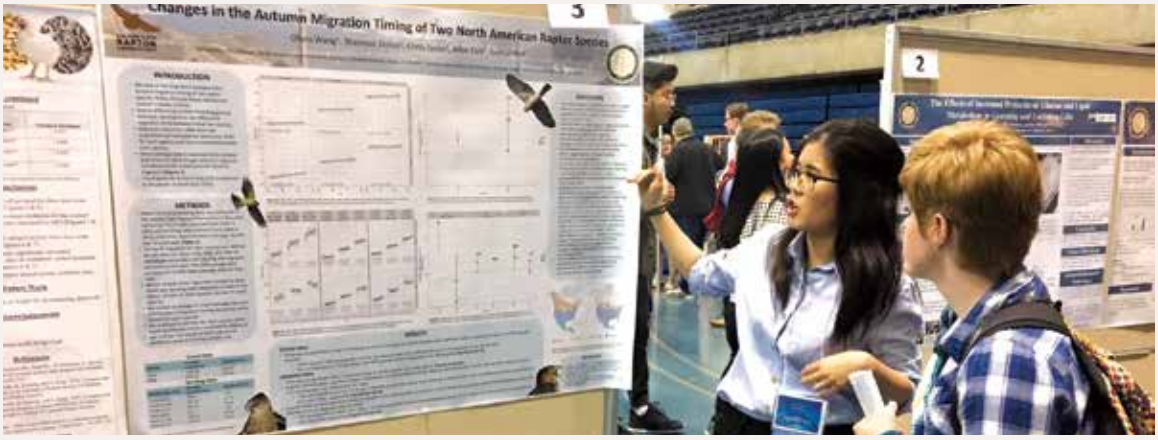
One of the primary effects of climate change has been the shifting of phenologies (dates) of events, as Kian et al. (2019) showed in their molt study. Imagine for a minute the climate impact on a raptor species that is highly dependent on insect prey, such as the European Honey Buzzard, eater of hornets and wasps. Whatever impact the climate has on wasps will likely befall Honey Buzzards. Contrast this with a generalist predator like the Red-shouldered

This young Red-tailed Hawk resists a light February snow in the mountains of California. Photo: Pamela Rose Hawken

Hawk in North America. Redshoulders take a great range of prey, largely what is found in a riparian forest, from snail to stickleback, shrew to squirrel, and songbird to pheasant. So not only is the Redshoulder positioned a bit higher up the trophic ladder than the Honey Buzzard, but as a generalist predator it has greater nimbleness in its ability to switch prey types in the face of low prey numbers.

## ARE RAPTOR MIGRATIONS SHIFTING?

Another area of climate and raptor study focuses on the phenology of migration. With many raptor migration databases available around the world, climate ecologists are beginning to compile regional counts to see if climate-related shifts show up. Jean-Francois Therrien of Hawk Mountain Sanctuary, PA, and colleagues (2017) used 25-year autumn raptor counts from sites stretched from Duluth eastward across the Great Lakes to the




Olivia Wang presents "Changes in the Autumn Migration Timing of Two North American Raptor Species" at the UC Davis Undergraduate Research Conference in 2018. Olivia Wang later joined GGRO as an intern for the 2018 season. Photo: Olivia Wang

East Coast. They found that autumn migration had delayed on average by one day per ten years, but this wasn't all. The most pronounced delays were seen in short-term migrants, like Sharp-shinned Hawks and Merlins, while long-distance, trans-equatorial migrants like Peregrine Falcons and Osprey showed no delay at all. Why should that be?

***...whatever anomalous hawk behavior we can observe, they all carry the potential to illuminate a clearer picture of what is happening more broadly in natural landscapes during this era of profound climate impact.***

Therrien et al. (2017) hypothesize that "raptor species with a greater potential for adjustment—that is, short-distance migrants, small species, and diet generalists—would exhibit a greater phenological response than would long-distance migrants, larger species, and diet specialists." In other words, an Osprey on course for wintering in the South American tropics has a 30-million-year-old, hard-wired genetic program to migrate quickly to reach those warm fishable coastlines. A Sharp-shinned Hawk, dependent on small bird prey, can adjust its migration based on winter prey supply, on competition for prey, or—presumably—climate-related cues, such as temperature, wind-speed, and direction.

## GOLDEN GATE PHENOLOGICAL SHIFTS

In 2018, Olivia Wang and Joshua Hull of UC Davis analyzed GGRO data for Sharp-shinned and Cooper's Hawks, to sleuth out any phenological shifts for the Hawk Hill counts from 1992 through 2016. Here's what they learned: no shifts for Cooper's Hawks, however Sharp-shinned Hawks delayed their start of migration by 7.5 days over 25 years, and their half-way migration point by 5.5 days.

We so often think of Cooper's and Sharpshins as sister species, one just slightly bigger than the other, so why should their migration phenologies be so different? Why should climate change affect Sharpshins more profoundly than Cooper's Hawks? A few reasons I can think of:

First, Cooper's are a pretty common year-round raptor species in the San Francisco Bay Area, whereas Sharpshins arrive for fall migration, stay for the winter (or migrate south), and mostly leave in the breeding season. There are a few Sharpshin nests in the SF Bay Area region, but they are rare and mostly in thick conifer forests. Why should local nesting have an impact on phenological shifts? There are so many local young Cooper's Hawks in the Bay Area each summer and fall, I think they swamp the chance to measure a change in migratory phenology in that species at the Golden Gate.

The Red-shouldered Hawk is a prey generalist, making it more capable of tolerating climate and ecological change. Photo: George Eade.

Second, as mentioned above, Sharp-shinned Hawks are small bird predators. Cooper's Hawks are more flexible in their diets, sometimes taking as many herptiles and mammals as birds. Some songbird species (warblers, tanagers, vireos, sparrows) are highly migratory, requiring the Sharpshin to be more migratory as well. Cooper's, of course, also eat migratory birds, but they have more options as far as shifting their hunts to more slow-moving, terrestrial prey as well.

Third, Sharpshins are small—one quarter to one-half the mass of a Cooper's Hawk. Given surface-to-volume ratios, this means that Sharp-shinned Hawks must eat more and hunt more. They must stay on top of their prey supplies more constantly and vigorously than a Cooper's Hawk, on average. This requires that they stay physically close to their prey, even tracking the migratory movements of songbirds.

## THE COLOSSAL CLIMATE

The great biologist Theodosius Dobzhansky once wrote: "Nothing makes sense in biology except in the light of evolution." I missed Dr. Dobzhansky at UC Davis by just four years, having arrived there in 1979, a fresh-scrubbed, dorky but passionate student of birds. Although Dobzhansky died in 1975, I wonder if today he might have revised his famous quote to add "...in the light of evolution and climate change."

Long-term, consistently-collected data about the natural world have never been more important than they are today. And although it is difficult to make sense of raptor population changes in light of climate change or evolution, it is critical for us to try to do so. Why? Because whatever patterns we can detect and dissect, whatever anomalous hawk behavior we can observe, they all carry the potential to illuminate a clearer picture of what is happening more broadly in natural landscapes during this era of profound climate impact. ●

Kiat, Y, et al. 2019. Feather moult and bird appearance are correlated with global warming over the last 200 years. Nature Communications 10: 2450. doi: 10.1038/s41467-019-10452-1.

Terraube, J, et al. 2015. Coping with fast climate change in northern ecosystems: mechanisms underlying the population-level response of a specialist avian predator. Ecography 38: 690-699. doi: 10.1111/ecog.01024.

Therrien, JF, et al. 2017. Long-term phenological shifts in migration and breeding–area residency in eastern North American raptors. Auk (Ornithological Advances) 134: 871-881. doi: 10.1642/AUK-17-5.1.

# THE COMPLEX ART OF "SEEING" HAWKS

*Catherine Elliot*

Catherine Elliot and her husband Tom Luster both volunteer on the Wednesday 1 Hawkwatch Team. Photo: Gretchen Zantzinger

The Broad-winged Hawk suddenly appeared above me—closer than I had ever seen one, maybe just thirty feet above. I was startled and delighted, because I had only seen "Broadies" as far off specks in the sky. This one had soared up above me for a moment, and then it was gone.

I was still reeling with amazement when Christine Cariño, our excellent Wednesday hawkwatch dayleader, asked me whether the Broad-winged was an adult or juvenile. I remembered seeing the hawk's classic silhouette—like a Red-tailed Hawk but with shorter, broader wings—and its light white underwings. I couldn't remember anything else. Christine reminded me to look next time for rufous barring on the chest (the plumage of an adult Broad-winged hawk) or dark streaking (a sign that the Broad-winged hawk is a first-year bird).

That day reminded me again that "seeing" hawks is a complex art. In that moment, I saw only a couple key features of the hawk and no more. How could I miss the color of the hawk's body when I was looking straight up at it?

Sometimes I think watching hawks is like watching a fast play in a Warriors basketball game—I don't see all the details of a complex play the first time around, especially if I think about something else for even a moment. But with a basketball game on TV, I can rewind the play, watch again while listening to the commentators, and learn. We can't rewind a bird's flight, but I work to improve my

CATHERINE ELLIOT has been a hawkwatcher for over four years. In her professional life, Catherine protects redwood forests to conserve their important bird and wildlife habitat and to provide lovely places for people to enjoy.

skills by looking at each new bird and learning from what Christine and my other hawkwatch team members point out. They're gracious and fun, and we enjoy helping each other learn and collect the most accurate data we can.

During each season, our team witnesses up to nineteen raptor species migrating through the Golden Gate. I'm glad to see each bird. I'm proud to volunteer at GGRO and contribute to its long legacy of data collection for scientific study, but what keeps me coming back is to share the joy and sense of awe with others who delight in these hawks' migrations, and yes, to "see" the hawks better.

2019 Interns Emma Regnier and Maggie Brown scan for raptors in the east quadrant. Photo: Allen Fish

A juvenile Broad-winged Hawk, age indicated by the dark streaking on its chest, photographed from Hawk Hill during the 2019 season. Photo: Willie Hall

# MEASURING THE RATE OF RAPTORS

*Step Wilson*

Rough-legged Hawk photographed at Lynch Canyon December 2019. Photo: John Davis

Hawk counting at the Golden Gate Raptor Observatory has its own idiosyncrasies, protocols, and set of assumptions, as do other count sites across the country and the world. The rugged topography of the Marin Headlands creates challenges for counting—the many hills and valleys make it difficult to maintain continuous sight of a raptor before it crosses the Golden Gate or meanders its way through this prey-heavy area.One of our main protocols is to use the quadrant system where a team of two or more counters face each of the cardinal directions to identify, record, and pass counted birds. This system of "passing" recorded birds from one quadrant to the next lowers the possibility of duplication. Additionally, if a raptor has not been tracked in that quadrant or passed from another and appears after ten minutes of not being seen, it goes on the count as a new sighting. This protocol relies on the assumption that one cannot be sure if the newly seen female American Kestrel is the same one that was spotted ten minutes ago in the same area or whether it's a new one that should be added to our count.

In conjunction with this protocol is a key assumption that raptors will pass and re-pass through our count site at the same rate from year to year. It is one of the reasons we refer to our total count as sightings and why we reference the raptors per hour data more than the total count.

Are these factors a cause for alarm? Do they negate our data? Are we doing good science? I don't think so, no, and I believe we are. Let me explain.

I don't believe it is a cause for alarm because many hawk count stations have protocols and assumptions that they use as well. For example, many stations use an imaginary line that raptors must pass in order to be added to the count. Do these lines always determine true migrants? What's to stop the raptors

STEP WILSON came to GGRO as a bander in 1995 and caught the raptor bug, committing the next twenty years to raptor studies in Mexico, Israel, and across the American West. Step returned to GGRO in 2016 to be GGRO's first Hawkwatch/Outreach Manager.

from turning around out of sight and passing the magic line again? Some stations use a maximum (simultaneously) daily sighted method for counting Turkey Vultures or Red-tailed Hawks. Might some of these raptors roost locally and meander again in front of the counters the next day or even later?

Most sites do not count "local" or resident birds. Some behaviors and movements lend themselves to easily determine local status, but what happens when the locals are not acting local? I admit that all migration stations encounter inherent difficulties in counting hawks at their respective locations. All counts have implemented approaches to deal with their specific situations, and consistent dedication and adherence to these protocols is what makes them reliable from year to year. I believe our count site meets the requirements stated in the first criteria of the Hawk Migration Association of North America (HMANA 2006), which states: "A monitoring program should provide three types of information: (1) An estimate/sample of population size, (2) An estimate of demographic parameters (e.g. information on population structure provided by data on species' sex and age classes), and (3) A measure of the environmental variables believed to affect the first two estimates. It is expected that this protocol and its revised contents continue to be clear, simple, and practical for citizen scientists and field biologists collecting data in the field, but also useful and informative for the needs of managers, conservationists, and scientists in later data analysis. This protocol can be easily customized for the particularities of a specific site."

The hawk migration conducted in the autumn of 2019 was not typical, consistent, or certain. It was full of changing protocols. Not the protocols we use to count migrating raptors, but the protocols we need to allow volunteers to go out and count the raptors. Considerations for volunteer safety during high wind days, smoke days, and power shutdowns demanded reevaluation of our safety preparedness and park policies around volunteer work during these events. The landscape of our work environment is changing as is the climate.

Hawkwatchers gather in the north quadrant for a raptor ID study. During these ID studies, banders release a bird that has been ID'd, aged, and sexed, into the north quadrant for hawkwacthers to test their identification skills. Photo: Nelia White

GGRO misses count days due to dense fog or heavy rain. More recently count days have been missed because of excessive heat, wildfires, poor air quality, and power outages. While noise and activity during last year's new trail construction likely influenced GGRO's count, this season's count was conducted while helicopters flew within the vicinity of the count site. Take-offs and landings were all done within a quarter mile of Hawk Hill, potentially diverting raptor flights from the area. Although the work being performed around the count and banding sites didn't stop our efforts, it surely impacted both programs in some manner as the helicopter flights continued into September.

Most of the distortion in this year's count data came from low numbers counted and banded for Sharp-shinned Hawks. Sharpshins are the third highest counted and second most banded raptor by our volunteers. Having their numbers drop for the season impacts counters and banders alike, but is it concern for the future of Sharpshins themselves?

Harlan's Hawk seen from Hawk Hill during the 2019 season. Photo: Step Wilson

It appears that Sharp-shinned Hawk migration through the Marin Headlands could be on a four or five-year cycle. Looking at the count data from 1991 onwards, there is a significant dip every four or five years which continues usually into the next year before the numbers rise again (Page 20, Figure 2). The first one is in 1996 and 1997 dropping to 5.48 and 3.86 raptors per hour (rph) respectively, then again in 2000 at 4.51, 2004 at 6.15, and 2009 at 6.7 rph. There was another dip in 2013 but that count was also affected by reduced October count days due to the government shutdown that year. Those lost count days coincide with the peak of Sharp-shinned Hawk migration. The five years after that lacked a low point even though the count has been generally lower than in seasons past. Will we have a rebound next year? Will we have high counts of Sharpies as in years past? Is there really a cycle with which this little accipiter is in rhythm? Next season and future year counts will shed more light on some of these questions.

Some high points and phenomenal fun for the hawkwatchers and banders are Rough-legged and Harlan's Hawks, the latter a subspecies of Red-tailed Hawk. Both northern visitors are always a delight to encounter. Maybe it's because they are traveling great distances before they arrive here or because they vary significantly in their field marks within the same species. Or maybe it's due to their low numbers and late arrival that we anticipate and await them. Or perhaps it is the pizza prize, started so long ago at GGRO, for the first Rough-legged Hawk sighting that invigorates volunteer excitement.

A juvenile Sharp-shinned Hawk flies past Hawk Hill after a successful hunt, indicated by this individual's full crop, a part of the bird's digestive track used to store food. Photo: George Eade

Even though Ferruginous, Red-tailed, and Swainson's Hawk also have different color morphs, something about Rough-legged and Harlan's Hawks piques our interest. In any case, our interest is piqued and usually satisfied once a season. But this year, both species were seen at least twice in one day. The first was two Rough-legged Hawks sighted on October 14—seen in a span of mere minutes adding to the excitement. Next was a day of double Harlan's sightings on November 3. Harlan's Hawks are usually distinguishable with a close enough view and these two were close. One was identified as an adult and the other a juvenile, which are harder to identify to subspecies.

Amid all these challenges and experiences, the GGRO Hawkwatch continues and every year we are thrilled by the magic the fall season brings.

HMANA. 2006. Standard data collection protocol for raptor migration monitoring. http://rpi-project.org/docs/HMANA_Data_Collection_Protocol_20060611.pdf

# RAPTOR SIGHTINGS - MARIN HEADLANDS

| | Autumn 2019* (443 hours) | | 10-Yr Average ('07-'18)** (478 hours) | |
|---|---|---|---|---|
| | **Sightings** | **Raptors/hr** | **Sightings** | **Raptors/hr** |
| Turkey Vulture | 7340 | 16.57 | 7577 | 15.81 |
| Osprey | 58 | 0.13 | 74 | 0.15 |
| White-tailed Kite | 31 | 0.07 | 68 | 0.14 |
| Bald Eagle | 19 | 0.04 | 9 | 0.02 |
| Northern Harrier | 807 | 1.82 | 562 | 1.18 |
| Sharp-shinned Hawk | 2021 | 4.56 | 3666 | 7.67 |
| Cooper's Hawk | 2629 | 5.93 | 2330 | 4.87 |
| Northern Goshawk | 0 | 0 | 1 | <0.01 |
| Red-shouldered Hawk | 280 | 0.63 | 445 | 0.93 |
| Broad-winged Hawk | 110 | 0.25 | 286 | 0.60 |
| Swainson's Hawk | 4 | 0.01 | 8 | 0.02 |
| Red-tailed Hawk | 8248 | 18.62 | 8477 | 17.73 |
| Ferruginous Hawk | 17 | 0.04 | 28 | 0.06 |
| Rough-legged Hawk | 8 | 0.02 | 5 | 0.01 |
| Golden Eagle | 13 | 0.03 | 18 | 0.04 |
| American Kestrel | 286 | 0.65 | 349 | 0.73 |
| Merlin | 156 | 0.35 | 187 | 0.39 |
| Peregrine Falcon | 196 | 0.44 | 233 | 0.49 |
| Prairie Falcon | 0 | 0 | 5 | 0.01 |
| Unidentified | 784 | 1.77 | 1059 | 2.22 |
| Total | 23,007 | 51.93 | 25,387 | 53.11 |

**2019 hawk count lost six days due to power shutdowns and park closures*
***2010 and 2013 data not included due to partial season*

# Sketches & Stories

## From the 2019 Migration

Written and Illustrated by Emma Regnier

**August 12**

Deep blue skies and steady winds greeted us on the very first day of the 2019 field season! I was assigned to Hill 88 Blind along with Taylor and Monday I's Day Leader, Buzz Hull.

A female American Kestrel appeared out of thin air and danced around the blind! Buzz worked his raptor magic until suddenly – she was caught!

This kestrel was the first raptor I had the privilege of banding under Buzz's watchful eye...


**August 14**

An adult Ferruginous Hawk spiraled up from Kirby Cove, cruising the thermals on its enormous wings. Everyone was mesmerized!




**September 3**

I quickly learned that a big part of hawkwatching in the Marin Headlands is "fogwatching." While waiting for the hill to clear, we'll go birding around the lagoon to get our avifauna fix.



**September 23**

After a long day of banding – a whopping 66 birds between all four blinds – the last thing I expected to see as I left the office was a pair of Gray Foxes wrestling and playing together!


**October 9 & 10**

Blackout across Marin! What do stir-crazy interns do without electricity? Carve some pumpkins, of course!

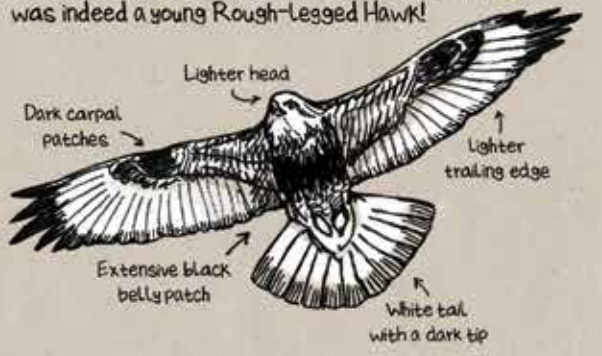


**October 20**

I'll never foget the joy of holding my first wild Merlin. Her brown eyes burned with ferocity, and I found myself marveling over this incredibly adorable yet lethal huntress.

**October 14**

Exhuberant cheering from East Quadrant confirmed that the beautiful Buteo soaring over South Slacker Hill was indeed a young Rough-legged Hawk!




**November 4**

Just as we were about to close up for the day, we got a glimpse of a strangely white-headed hawk heading our way! With a little bit of luck, we actually managed to catch him and I found myself staring into the eyes of the palest juvenile Red-tailed Hawk I'd ever seen – He took my breath away!


**November 13**

With Hawk Hill capped in fog, the Wednesday II hawkwatchers searched for the vagrant Tri-colored Heron in Rodeo Lagoon. Thankfully, their patience paid off when the little heron emerged from the reeds!

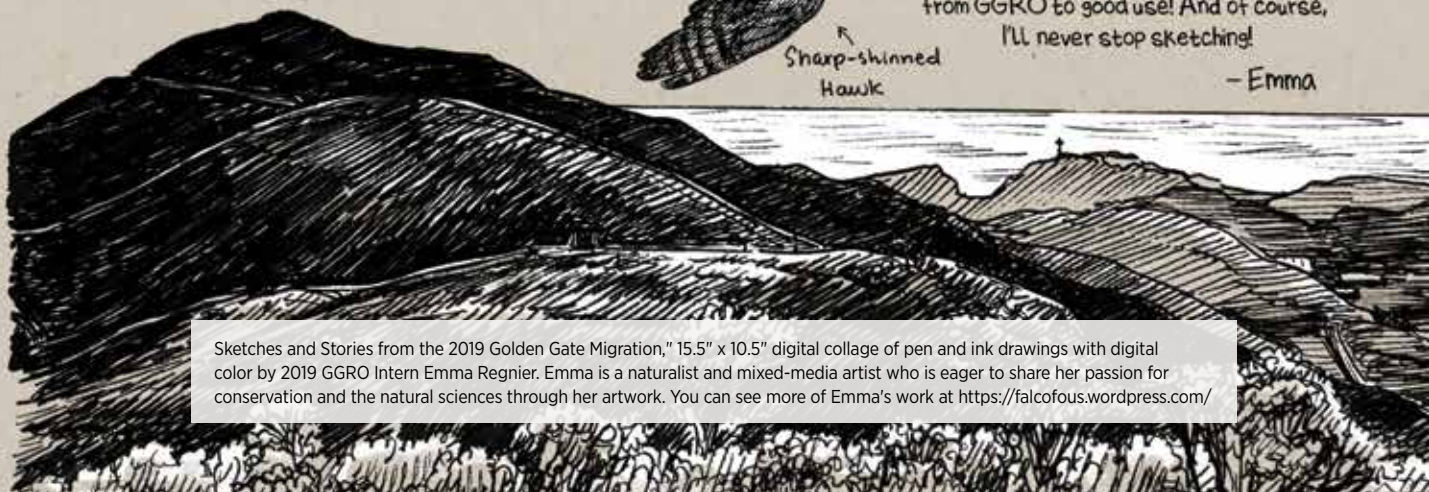


**December 1**

Today was the last day of the field season, and in typical Bay Area winter fashion, it was pouring rain. While the hawks and humans were bummed, the salamanders were quite happy!


It's true what they say – time really does fly when you're having fun! It's bittersweet to leave the place I've called home for the last 8 months, but I know that I'll put the lessons I've learned from GGRO to good use! And of course, I'll never stop sketching!

– Emma



Sketches and Stories from the 2019 Golden Gate Migration," 15.5" x 10.5" digital collage of pen and ink drawings with digital color by 2019 GGRO Intern Emma Regnier. Emma is a naturalist and mixed-media artist who is eager to share her passion for conservation and the natural sciences through her artwork. You can see more of Emma's work at https://falcofous.wordpress.com/

# TRAINING THE NEXT GENERATION OF RAPTOR BIOLOGISTS

*Ben Dudek*

Banding Manager Teresa Ely and volunteer bander Ben Dudek prepare to release a juvenile Sharp-shinned Hawk. Photo: Ben Dudek

On a hot afternoon in late August, I drove my grandmother's Volvo sedan packed with all my possessions up a washed-out dirt road southeast of Albuquerque, New Mexico and wondered what the next two months had in store. After traveling the country for two years working as a seasonal field biologist, I had signed on to work with HawkWatch International's fall migration project in the Manzano Mountains. I had experience banding a variety of different birds, including seabirds, waterfowl, and passerines from my previous jobs, but this would be my introduction to trapping and banding raptors.

I had a lot of questions leading up to the start of the season, as any first-year raptor bander might. First and foremost: how do you catch raptors? Would we set up double-high mist nets, as some passerine banding stations do, and hope raptors would fly into them? And once caught, how do you safely hold and process raptors? I had previously only held one raptor, a juvenile Merlin that was caught in a mist net while banding songbirds in Maine, and I'm embarrassed to say I held the Merlin the same way I was trained to safely secure small birds, in the passerine banding grip. It was not the best way to secure a feisty Merlin, as evidenced by my bloody cuticles. And finally, and perhaps most desperately, would I be able to tell the difference between a Sharp-shinned Hawk and a Cooper's Hawk in hand? The notoriously tricky identification of the two accipiters was something I struggled with in the field and I was worried I would embarrass myself in front of the experienced lead bander.

**BENJAMIN DUDEK** joined GGRO as a bander in 2017 after spending the previous six fall migration seasons banding hawks as a seasonal biologist for HawkWatch International and as a volunteer with Intermountain Bird Observatory. Ben currently works as a wildlife biologist in the Bay Area.

2019 Intern Paula Eberle releases a juvenile Red-tailed Hawk. Photo: Teresa Ely

As my luck would have it, the lead bander that season in the Manzanos was former Golden Gate Raptor Observatory (GGRO) intern and future Banding Manager Teresa Ely. In addition to her deft skills as a raptor biologist and her amiable personality, Teresa brought GGRO's rigorous approach to training with her.

I quickly learned that hawks are attracted into a trapping area and then caught with a series of nets, including mist nets, dho-gazas, and bow nets. Raptors are easily secured by firmly grasping the legs, and large coffee cans create a dark, quiet, and safe space for raptors to be held while being measured. And the squared-off head of Cooper's Hawks could be easily distinguished from the round-headed and bug-eyed Sharp-shinned Hawks in hand. The opportunity to observe these birds up close greatly improved my identification in the field.

Over the next two months, I was trained how to set up the trapping site, how to operate the lines and traps, and how to safely capture, extract, handle and measure and weigh raptors. During that season, Teresa and I trapped together six days a week. Teresa spent many long days instructing me how to lure for different raptors, when it was safe to trigger a bow net, which handholds were necessary to take accurate morphological measurements, and how to age and sex each species until she felt confident that I was capable of running a trapping blind by myself.

It was not until I joined GGRO in 2017 that I realized I had been put through the GGRO Apprentice Program that first season in New Mexico. When Teresa asked me how I knew a particular bird was "settled" before triggering a bow net, when she

2019 Intern Emma Regnier processes a Red-shouldered Hawk. Photo: Veronica Pedraza

checked my measurements on each species until she felt I was a proficient processor, or when she asked me to diagnose and fix problems with each trap, she was really evaluating my abilities as a siteleader.

Despite having been taught this way, I continue to be impressed with GGRO volunteers' level of effort and commitment to training interns and new apprentices. Every year, GGRO accepts five or six interns without much raptor handling experience. And every two years, around 25 apprentices, who sometimes have no experience with birds at all, join the banding program. And yet, at the end of each season, several interns have become siteleaders and apprentices are able to look back on a season in which their skills and confidence working with wild raptors have grown tremendously.

When I started at GGRO, I was impressed by the amount of training that happened before the season even began. Interns spend their first month studying raptors in the office and during local field trips, and apprentice banders start their time at GGRO by attending raptor ID classes and banding skills workshops. In their first couple days in the field, new interns and apprentices are shown everything that goes into a day at GGRO from setting up the trapping blind, luring for and capturing raptors, safely handling and processing different species, and collecting invaluable data from each bird. Protocols have been developed for almost every situation throughout the day and it can be overwhelming to take everything in as a new bander.

Even after three seasons at GGRO and six years of banding raptors before that, I find I do not always have all the answers out in the field. Questions from new banders force me to reevaluate my approach to each situation and always teach me something new. When faced with a daunting question or task, volunteers often respond with, "I'm sure there are instructions written for this," and of course, there usually are. Over 35 years, GGRO has created and innovated many techniques used for trapping migratory raptors, but the commitment to training new interns and volunteers and fostering a sense of responsibility among 100+ banding volunteers is perhaps the organization's most impressive accomplishment. The banding program has been honed over three decades and, while there is always more to learn and improve upon, through the help of its volunteers, GGRO has created a supportive learning environment to train the next generation of raptor enthusiasts.

Banding raptors kick-started my passion for raptor ecology. That first year in New Mexico was slow numbers-wise by historical standards, but life-changing for me as a young biologist. The season brought waves of accipiters, buteos, falcons, and eagles. An adult Northern Goshawk at the end of that season capped off an incredible fall and I was hooked. For the next three falls, I returned to New Mexico to trap and band raptors. I followed that passion for raptors to graduate school at Boise State

University, and eventually to a wildlife biology job in the Bay Area. For the Bay Area community, GGRO offers a unique experience and the challenges of time commitments to off-season tasks and trainings is buoyed by the opportunity to work closely with these amazing birds of prey, to observe the seasonal and annual variability of fall migration, and to continue to learn something new every day.

The opportunity to volunteer with GGRO as a community scientist is important to me in so many ways. First, it is important to continue our long-term monitoring program by collecting data that helps inform our knowledge of North American raptor populations. By assessing population trends, we gain invaluable information on each species that migrates along the Pacific Flyway each year.

Second, as a wildlife biologist, GGRO gives me the opportunity to continue to learn and build skills out in the field with a group of other volunteers from diverse backgrounds. But perhaps most importantly, it provides an opportunity for me to work with and help train the next generation of biologists and community scientists. Many first-year apprentices will learn the skills they need to become fully-fledged raptor banders in a few short years and will continue to contribute to GGRO's community science program in myriad ways. Many interns will complete their internship at GGRO and head out across the country to continue their passion for raptors by working on seasonal field projects or at other raptor migration sites.

As I watch GGRO interns develop a passion for working with raptors and continue into the world of field biology, I am reminded of my own journey and how important that first season was in developing my skills as a bander and raptor biologist. The commitment to training and fostering a supportive learning environment are essential for our newest banders because they will soon become the next generation of teachers for young aspiring biologists.

Bander Allison Gee releases a juvenile Red-tailed Hawk against the backdrop of the Golden Gate and San Francisco Bay. Photo: Calvin Hom

# CHANGES IN MIGRATING ACCIPITERS

*Teresa Ely*

The most common question I heard in 2019 was, "Where are all the Sharpies?" The low Sharp-shinned Hawk numbers coupled with GGRO program cancellations left people feeling a little disappointed by the end of the autumn migration season. We only banded about 40% of the average number of Sharp-shinned Hawks: 181 compared to the previous 10-year average of 445 per year.

2019 Intern Emma Regnier releases a juvenile Cooper's Hawk. Photo: Teresa Ely

There were of course early years at GGRO where the Sharpie numbers were lower, when the program was experimenting with blind locations, so I examined our data starting from 1991, when the Hill 88 blind came into the scene (Figure 1). 2019 is the second-lowest year on record for Sharp-shinned Hawks banded in a season at GGRO. In fact, in 1991, with the brand new Hill 88 blind, volunteers banded 186 Sharpies, five birds more than in 2019.

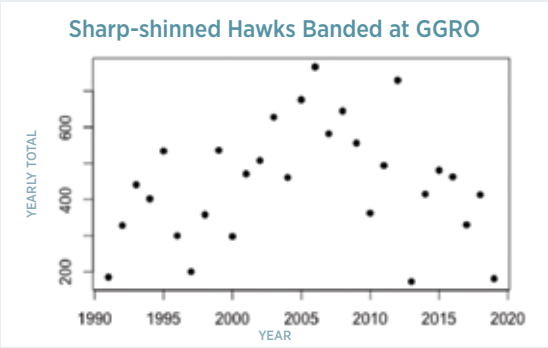



Figure 1. Sharp-shinned Hawk banding totals at GGRO 1991-2019.

As many volunteers remember, 2013 was the season when the government shut down in early October during the peak two-week period for Sharpies, and that year, we banded just 173 Sharpshins. So, while 2013 was a low year, we know there were Sharpies migrating that could have been banded, which would make 2019 the lowest Sharpie year to date at GGRO.

## A DEEP DIVE INTO SHARP-SHINNED HAWK COUNTS

Though we ended the 2019 season with a lower-than average number of newly banded raptors, we still banded over 1000 raptors! We continue to collect data points for an incredible and impressive dataset that spans 35 years. Researchers dream of datasets this big. My colleagues during grad school were always jealous that I had over 18,000 kestrel

**TERESA ELY** was a GGRO Intern in 2008, then continued to work at raptor migration stations throughout the west and Mexico. She completed her master's degree in Ecology, Evolution, and Behavior at the University of Nebraska, Lincoln before returning to GGRO as Banding Manager in 2016.

data points, with about 1400 from GGRO, and the rest from other migration sites throughout the US. Like so many others, I wished we had a more successful 2019 season, but I also see the value in another year of data, so I decided to dust-off my RStudio skills and look more closely at our data.

We know that the metrics for banding and counting raptors are different, and that both datasets are important for different reasons. There are many factors for banding that can cause us to trap fewer and different birds than are counted. I decided to look at the GGRO hawk count data to see if there were any trends for Sharpies. There are some high years and low years, however when analyzing all the data points, the counts have remained steady over time (Figure 2).

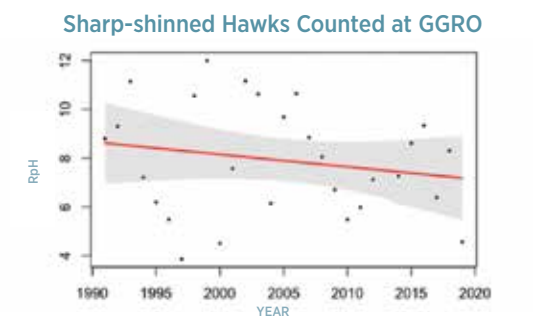



Figure 2. Sharp-shinned Hawk Raptors per Hour (RpH) at GGRO 1991-2019. 2013 data not included due to incomplete season.

Even though our 2019 Sharpshin count numbers were below average, I feel confident that this year was just a "low" year. We had weather patterns in the Pacific Northwest (e.g., late rainfall and cold springtime temperatures) that might have had a negative effect on raptor nestling and fledgling survival in spring-summer 2019. It would be interesting to compare our numbers from this season to other Intermountain Western raptor migration sites that count more adult hawks, to see if there was a comparative lull. It is easy to get depressed about the 2019 Sharpie numbers, but a friend once told me, "We only see 'normal' on a graph. Mother Nature usually plots those dots above or below the mean."

## SEEKING CLUES IN ACCIPITER MEASUREMENTS

If there is not an informative trend in the GGRO count data for Sharpies, what else can the data tell us? There have been recent papers published about the body size of birds changing in response to climate change (Van Buskirk et al. 2010, Weeks et al. 2020). I have been thinking about the changes in body size of raptors for a few years now. Since this was the subject of my master's research (Ely et al. 2018), I started investigating the GGRO morphometric data to see if we captured any changes in accipiter body size over the years.

In GGRO's 35 years we have banded over 13,000 Sharp-shinned Hawks and 16,000 Cooper's Hawks. If you multiply those by the number of measurements taken on each bird (8), that is more than 230,000 data points. I kept my statistics simple. We can let another grad student take it to the next level with principal component analyses, generalized additive models, or Bayesian models. I used a linear regression to determine whether there was any change in culmen (bill length), hallux (the big talon on the back of the foot), tail, wing chord, and weight. I accounted for size differences in sexes, ages, and seasonal changes, and I removed birds with full crops (undigested prey) when analyzing weight. I did not analyze trends in adult measurements because our sample size for adults is small.

Sure enough, when we look at the data, accipiter body size is changing over time (Table 1)! For juvenile Sharp-shinned Hawk males and females, I saw a decrease in culmen and hallux. Wing chord decreased in juvenile females but remained steady in males. Two interesting notes: (1) The tail lengths of Sharpshins increased over time, although weight

did not change over time. (2) For Cooper's Hawks, the hallux and the wing chord decreased, whereas tail length increased. Culmen only decreased significantly in males. Cooper's Hawk weight did not change in either sex.

What does all this mean? The change in accipiter body size was not uniform for all measurements, sexes, and species, so background causes will not be easy to figure out. More in-depth analysis and research will be needed. But this is the reason we collect long-term morphometric data on each species that we band. The first GGRO raptor banders decided to take these measurements in hopes these data would be used in the future to analyze long-term trends.

## WHY LOOK AT BODY CHANGE?

There has been a lot of interest recently in the body-size change of birds. More and more papers are being published that examine changes in body size using long-term banding datasets or series of museum specimens. There is a pattern that species of larger sizes are often found in colder environments and species of smaller sizes are found in warmer climates. Ecologists call this

| | SEX | CHANGE METRIC | % CHANGE | SLOPE | P-VALUE |
|---|---|---|---|---|---|
| **SHARP-SHINNED HAWK JUVENILE** | | | | | |
| Culmen (mm) | F | -0.15 | -1.24 | -0.01 | **<0.01** |
| | M | -0.18 | -1.88 | -0.01 | **<0.01** |
| Tail (mm) | F | 0.48 | 0.30 | 0.02 | **0.02** |
| | M | 0.51 | 0.38 | 0.02 | **0.04** |
| Hallux (mm) | F | -0.14 | -0.97 | -0.01 | **<0.01** |
| | M | -0.22 | -1.92 | -0.01 | **<0.01** |
| Wing Chord (mm) | F | -0.85 | -0.43 | -0.03 | **<0.01** |
| | M | -0.26 | -0.16 | -0.01 | 0.28 |
| Weight (g) | F | 0.09 | -0.05 | <0.01 | 0.85 |
| | M | -0.01 | -0.01 | <0.01 | 0.98 |
| **COOPER'S HAWK JUVENILE** | | | | | |
| Culmen (mm) | F | -0.06 | -0.34 | <0.01 | 0.05 |
| | M | -0.11 | -0.74 | <0.01 | **<0.01** |
| Tail (mm) | F | 0.58 | 0.27 | 0.02 | **<0.01** |
| | M | 1.33 | 0.70 | 0.05 | **<0.01** |
| Hallux (mm) | F | -0.19 | -0.83 | -0.01 | **<0.01** |
| | M | -0.16 | -0.83 | -0.01 | **<0.01** |
| Wing Chord (mm) | F | -1.20 | -0.49 | -0.04 | **<0.01** |
| | M | -1.43 | -0.66 | -0.05 | **<0.01** |
| Weight (g) | F | 0.91 | 0.22 | 0.03 | 0.40 |
| | M | 1.51 | 0.55 | 0.05 | 0.11 |

Table 1: Morphometric changes in female and male juvenile Sharp-shinned and Cooper's Hawks from 1991 to 2019 in the Marin Headlands, CA. The p-values that are bold are < 0.05, which means there is a significant change.

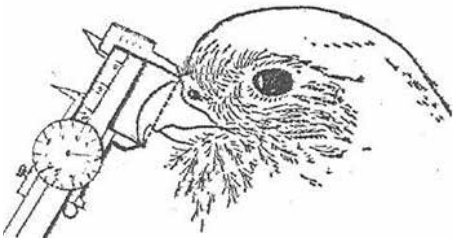


Illustration of culmen length measurement from GGRO Bander's Manual.

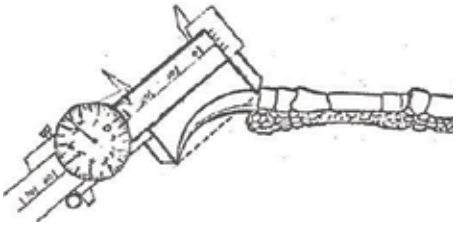


Illustration of hallux claw length measurement from GGRO Bander's Manual.

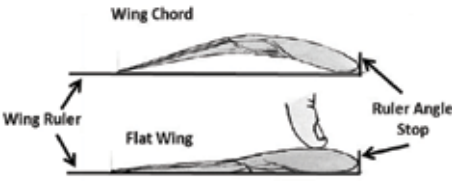



Illustration of wing chord versus flat wing measurement from GGRO Bander's Manual.

Bergmann's Rule. It would make sense to associate a decrease in body size to warming trends in climate. However, other factors like food availability and shifts in diet can affect body-size change as well.

For example, Cattau et al. 2017 found evidence of rapid body size change in Snail Kites at the same time that their diet shifted from a native snail to the larger and invasive Island Apple Snail. In less than a decade, kite bill-size increased, which makes the kites more efficient at extracting meat from the bigger snail shell. Another study, this one on Goshawks in Denmark, suggested that a diet shift to smaller prey—due to a decline in grouse—selected for a decrease in wing length. In addition, juvenile Goshawks' bill length decreased, and juvenile females had shorter tarsi (legs) (Yom-Tov et al. 2006).

More thorough analysis is needed, but there does appear to be a small change in body size in the accipiters migrating through the Marin Headlands over 30 years. Since weight is not changing, and measurements like tail length are increasing over time, we cannot say for certain that climate change is causing the body size changes we have measured. However, if passerines are getting smaller over time, decreasing prey size could influence the changes we are seeing in accipiter's beak and claw lengths. The next step would be to look at what the Sharp-shinned and Cooper's hawks are eating, and to investigate if those prey species are getting smaller over time. ●

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Ely, TE, CW Briggs, SE Hawks, GS Kaltenecker, DL Evans, FJ Nicoletti, J-F Therrien, O Allen, and JP DeLong. 2018. Morphological changes in American Kestrels (Falco sparverius) at continental migration sites. Global Ecology and Conservation 15. doi: 10.1016/j.gecco.2018.e00400

Van Buskirk, J, RS Mulvihill, and RC Leberman. 2010. Declining body sizes in North American birds associated with climate change. Oikos 119: 1047-1055. doi: 10.1111/j.1600-0706.2009.18349.x

Weeks, BC, DE Willard, AA Ellis, ML Witynski, M Hennen, and BM Winger. 2020. Shared morphological consequences of global warming in North American migratory birds. Ecology Letters 23.2: 316-325. doi: 10.1111/ele.13434

Yom-Tov, Y, and S Yom-Tov. 2006. Decrease in body size of Danish goshawks during the twentieth century. Journal of Ornithology 147: 644-647. doi: 10.1007/s10336-006-0090-4

# RAPTORS BANDED - MARIN HEADLANDS

| | Autumn 2019* (8/12/2019 - 1/2/2020) | Annual Average 1993-2018** | Totals 1983-2019 |
|---|---|---|---|
| Northern Harrier | 10 | 10.31 | 333 |
| Sharp-shinned Hawk | 181 | 470.12 | 13,254 |
| Cooper's Hawk | 596 | 556.62 | 16,786 |
| Northern Goshawk | 0 | 0.23 | 7 |
| Red-shouldered Hawk | 15 | 16.15 | 480 |
| Broad-winged Hawk | o | 1.58 | 46 |
| Swainson's Hawk | 0 | 0.38 | 11 |
| Red-tailed Hawk | 227 | 306.92 | 10,551 |
| Ferruginous Hawk | 0 | 0.04 | 3 |
| Rough-legged Hawk | 0 | 0.15 | 6 |
| Golden Eagle | 0 | 0.04 | 2 |
| American Kestrel | 10 | 52.19 | 1492 |
| Merlin | 23 | 31.00 | 840 |
| Peregrine Falcon | 7 | 4.27 | 124 |
| Prairie Falcon | 0 | 1.77 | 50 |
| Eurasian Kestrel | 0 | 0.04 | 1 |
| Total | 1069 | 1452 | 43,996 |

**Data compiled by Teresa Ely; 2019 data are through January 2, 2020; 2019 banding lost six days due to power shutdowns and park closures*

***1993-2018 are used for this comparison due to similarity of methods and effort between those years and 2019*

Male American Kestrel. Kestrels are the smallest species banded at GGRO each autumn. Photo: Veronica Pedraza

# GGRO RECOVERY DATA SUPPORTS AIRPORT SAFETY

*Nancy Brink*

On October 19, 2011, former GGRO research director Buzz Hull banded a juvenile male Red-tailed Hawk and sent him on his way. We never know where a banded hawk's journey might lead us. We band hawks in hopes that someone will once again encounter them, and that knowledge gained will be of practical or scientific value in conserving raptor populations.

A few months after banding, GGRO received a report on this young Redtail from the Bird Banding Lab (BBL), a United States Geological Survey (USGS) program established in 1920 to support distribution of bands and management of banding and encounter data for all bird species in North America. GGRO reports its data for hawks banded each fall to BBL, which has accumulated more than 64 million records of banded birds. This includes nearly 2.5 million diurnal raptors and owls, 239,791 of which are Red-tailed Hawks. When someone encounters a banded raptor, they will hopefully report it to BBL. The BBL database now contains more than 4 million band encounter reports, including 89,424 encounters of diurnal raptors and owls, 14,002 of which are Red-tailed Hawks.

The young Redtail (now GGRO recovery #1129) was recovered at San Francisco International Airport on December 19, 2011, exactly two months after its banding. Sadly, the hawk struck a plane's right jet engine as it sped down the runway to take off. The plane returned to the gate and fortunately, no one was injured. But it was a costly collision, destroying 22 of the engine's 28 fan blades.

Airport officials reported the strike to the Federal Aviation Administration (FAA), which entered it in a National Wildlife Strike Database. A feather and DNA material were sent to the Smithsonian Feather Identification Lab to confirm species. The band number was reported to BBL.

When GGRO receives a BBL encounter report, volunteers swing into action to confirm data and expand the hawk's story. Marion Weeks, who has led GGRO's band recovery efforts for more than 25 years, notes that GGRO regularly receives reports of hawks, primarily Red-tailed Hawks, who have been struck by aircraft or removed from airports.

Airports are enticing locations for Redtails, which seem to adapt readily to human

**NANCY BRINK** is a filmmaker and writer, who assists with band recovery follow up, and has enjoyed fall migrations as a GGRO bander for nearly twenty years.

All of the large airports of the Pacific States provide occasional seasonal habitat for birds of prey. A Red-tailed Hawk is seen here perch-hunting at Portland International Airport. Photo: Carole Hallett

presence. Runways straddle open fields. Strips of grass provide abundant habitat for ground squirrels and other rodent prey. Pigeons and other birds abound. Fences, light poles, and antennae make excellent hunting perches.

Collisions between birds and airplanes have been of concern since Orville Wright reported the first strike in 1905. Hawks have inspired and informed the development of human flight, but the development of faster, quieter, and more powerful jet engines, and shrinking wildlife habitat put raptors at greater risk from aircraft strikes.

2009 was a turning point in attention to bird strikes, when US Air pilot Chesley "Sully" Sullenberger landed an Airbus A320 on the Hudson River shortly after take-off, both engines crippled by bird strikes. The event accelerated collaboration by federal agencies, airport safety personnel, and wildlife biologists to improve strike-reporting. Mitigation is also critical on or adjacent to airports, where most strikes occur, including modifying habitat to remove perches and making airports less attractive to raptors. "Bird wailers" and falconry birds are employed to scare off raptors and other wildlife. Raptors and owls are sometimes relocated to safer locations. Some are shot.

But questions arise about what mitigation methods are most effective. What will best discourage raptors from settling down at the airport? How far away must a raptor be relocated to ensure it doesn't return? And how do banded birds help in this effort?

Dr. Richard Dolbeer, an ornithologist and international leader in bird strike issues, has proposed cross-referencing the BBL banded bird database with the National Wildlife Strike Database to expand data available to

***According to the Banded Bird Strike Database, three species of raptors top the list of banded birds struck by aircraft between 1990 and 2018: Peregrine Falcons (131), Red-tailed Hawks (83), and American Kestrels (58).***

biologists and airport personnel. The goal of this Banded Bird Strike Database, notes Dolbeer, is to "provide a scientific foundation for policies and management actions to mitigate risk" and to create "safer skies for all who fly...birds and people!"

GGRO's banding data and recoveries are part of this larger resource. GGRO's Recovery #1129, Buzz Hull's banded Red-tailed Hawk, is found in both the National Wildlife Strike Database and the BBL database and so becomes part of this new cross-referenced database. So is another Redtail banded by GGRO in September 2010, which struck a plane at San Jose International Airport in June 2016 (Recovery #1407). While one banded hawk might not seem significant, the accumulated information provided by band encounters can help to refine questions and improve mitigation methods.

According to the Banded Bird Strike Database, three species of raptors top the list of banded birds struck by aircraft between 1990 and 2018: Peregrine Falcons (131), Red-tailed Hawks (83), and American Kestrels (58). Of the three species, Redtail strikes cause the greatest damage; and overall, buteos pose the fifth greatest strike threat to both military and civilian aircraft (Dolbeer, et al. 2000; Zakrajsek & Bissonette 2005). Here are some of the trends revealed by the Banded Bird Strike Database:

Peregrine Falcons topped the Banded Bird Strike Database list of banded birds struck by aircraft between 1990 and 2018. Photo: George Eade

A juvenile female Red-tailed Hawk (recovery #1575-B) sitting on a pole at the Point Mugu Naval Air Station in Ventura County. Red-tailed Hawks came in second on the Banded Bird Strike Database's list of banded bird species struck by aircraft between 1990 and 2018. Photo: Jeremiah Psiropoulos

American Kestrels came in third, behind Peregrine Falcons and Red-tailed Hawks, on the Banded Bird Strike Database's list of banded bird species struck by aircraft between 1990 and 2018. Photo: George Eade

## BANDED BIRD STRIKE DATABASE:

- Red-tailed Hawk populations have increased slightly between 1990 and 2018 and Redtail-aircraft strikes have increased substantially. The average age of Redtails struck by aircraft is just under 3 years; adults are struck more frequently than juveniles and are more likely than juveniles to return to an airport when relocated. Of 59 relocated banded Redtails, 52 returned and were struck at the same airport; 7 were struck at a different airport.
- As post-DDT Peregrine Falcon populations increase, so do Peregrine-aircraft strikes.

  The majority of Peregrine strikes between 1990 and 2018 were juvenile birds in their first summer or fall.
- American Kestrel populations declined between 1990 and 2018, yet aircraft strikes increased substantially. Kestrels are also struck most often as juvenile birds.

This year, GGRO received 73 new band recovery and encounter reports from BBL: 47 Redtails, 16 Cooper's Hawks, 4 Sharp-shinned Hawks, 3 Peregrine Falcons, and one each of Osprey, Northern Harrier, and American Kestrel. Five were reports of Redtails encountered at airports (Recoveries #1542, #1553, #1546, #1556, and #1575-B) and represent a range of outcomes for the hawks.

On January 25, 2019, a juvenile female Red-tailed Hawk (recovery #1542) was trapped at the Joint Forces Training Base at Los Alamitos in Orange County, CA. Banded by GGRO in October 2018, the Redtail was relocated from Los Alamitos about 100 miles to Alpine County by biologist Derek Collins. Derek noted that there is currently a 15% return rate for Redtails at the airbase. If a bird does not already have a band, he and other airport biologists band hawks with color bands (orange with white letters) before relocation, making it easier to identify those that return. They are also experimenting to see if increasing distance by increments of 50 miles decreases return rates of relocated hawks.

While airport officials were unable to trap and remove two of the hawks, and one died in rehab of a probable airport strike, a final report provides more cheerful news. Biologist Jeremiah Psiropoulos photographed a juvenile female Red-tailed Hawk (recovery #1575-B) sitting on a pole at the Point Mugu Naval Air Station in Ventura County on October 31, 2018. The Redtail had been banded by GGRO just eight days earlier, on October 23. Fortunately, she posed no menace to aircraft. Two and a half weeks later, the same Redtail was photographed again, in San Ysidro, just a few miles from the US-Mexico border. ●

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Dolbeer, RA. 2018. Integration of Bird Banding Laboratory and National Wildlife Strike databases to enhance data quality and aviation safety. Presentation to Bird Strike Committee.

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# RECENT RECORDS

*Marion Weeks*

**1389** Juvenile female Cooper's Hawk banded on 9/26/15 by Ray Arpon and found on 2/25/16 at Mill Valley, Marin County, CA; thought to have hit something as it had a detached retina, and was euthanized on admission. Reported by Kate Lynch of WildCare of San Rafael. On 6/5/19 a former GGRO intern, Elizabeth Wommack, now Curator and Collections Manager of Vertebrates for the University of Wyoming, spent a couple days at the Museum of Vertebrate Zoology at University of California, Berkeley. While Beth prepared this banded Cooper's Hawk for their skin collection, she discovered the bird had been shot.

**1418-B** Juvenile Red-tailed Hawk banded on 8/25/15 by Anna Fryjoff-Hung; found on 2/15/19 injured at an intersection at San Jose, Santa Clara County, CA; transported by San Jose Animal Control to Wildlife Center of Silicon Valley (WCSV). Diagnosed and treated for a wing injury, the hawk was released 5/2/19. Reported by Jenny Liu and Ashley Kinney of WCSV. This bird was earlier sighted at Milpitas, Santa Clara County, CA on 10/8/16.

**1491-C** Juvenile male Red tailed Hawk banded on 11/12/17 by Kaela Schnitzler; sighted and reported by Robert Hinz for the third time in the same Mill Valley, Marin County, CA neighborhood on 10/28/18.

Encounter 1526. Photo: Victor Brouk

**1526-B** Juvenile male Red-tailed Hawk banded on 8/14/18 by Teresa Ely; sighted on 11/22/18 by Step Wilson at Hawk Hill, Marin Headlands, Golden Gate National Recreation Area (GGNRA), Marin County, CA. This Redtail was earlier sighted at San Francisco's Presidio, San Francisco County, CA on 8/16/18.

**1533** Correction of this record is as follows: An error was made in the reading of the number on the color band originally reported to the Bird Banding Lab (BBL). This resulted in the species of the bird being inaccurate.

**MARION WEEKS** has been banding with GGRO since 1992 and has taken the initiative to dig deeper into band recoveries by reaching out to band reporters and rehabilitation facilities for encounter details and rehabilitation updates.

Encounter 1533. Photo: Edward Kimball

Based on the misinformation, BBL identified it as a Cooper's Hawk, but when Ed Kimball sent the photo to us, we could read the correct number and also identify the species as a juvenile Red-tailed hawk banded on 8/31/18 by Anne Ardillo. The bird was photographed on 10/19/18 about two miles south of Jenner, Sonoma County, CA.

**1536** Juvenile female Red-tailed Hawk banded on 9/20/18 by Claire O'Neil; found freshly dead on road on 12/8/18 by Rebecca and William Bouch. They believe the bird had been hit by a car just northeast of Henry, San Luis Obispo County, CA.

**1537** Juvenile female Peregrine Falcon banded on 11/1/18 by Teresa Ely; found grounded 1/19/19 near the Oakland International Airport, Oakland, Alameda County, CA and taken to Sulphur Creek Nature Center (SCNC). SCNC staff examined the bird and found nothing amiss but noted she did not eat during her captivity and was released 1/22/19; reported by Samantha Conner who exclaimed, "She was huge!"

Encounter 1538. Photo: Lam-Son Vinh

**1538-A** Juvenile male Red-tailed Hawk banded on 11/5/18 by Ryan Byrnes; photographed at Huntington Central Park, Huntington Beach, Orange County, CA by Lam-son Vinh on 1/3/19.

**1538-B** Juvenile male Red-tailed Hawk banded on 11/5/18 by Ryan Byrnes; photographed on 12/29/19 while sitting on a light pole near the maintenance area of the same park at Huntington Beach, Orange County, CA; reported by Roger Schoedl.

**1539** Juvenile female Red-tailed Hawk banded on 8/23/16 by Natalie Torres; was brought to Peninsula Humane Society (PHS) on 7/16/18 after being found at an intersection at San Francisco, San Francisco County, CA. Caught due to injuries that usually result from being hit

by a car or flying into a window, it was bleeding from the mouth but also had a puncture of wound of unknown origin extending from the abdomen towards the base of the tale. Minimally responsive, the hawk was euthanized that same day; reported by Nicole Weger of PHS.

**1540** Juvenile female Cooper's Hawk banded on 10/14/18 by Jean Perata; "a pile of feathers with back and leg bones and the band on one leg" were found on 11/11/18 at Grey Lodge Wildlife Area, Butte County, CA by Gary Zang.

Encounter 1541-A. Photo: Peter Beeler

**1541-A** Juvenile male Red-tailed Hawk banded on 9/20/18 by Marc Blumberg; photographed by Peter Beeler on 11/14/18 as it was perched atop a light pole by the San Francisco Bay, San Francisco County, CA.

**1541-B** Juvenile male Red-tailed Hawk banded on 9/20/18 by Marc Blumberg; photographed when perched on a tree branch by Robert Martin and two other GGRO banders on 1/13/19 at Buena Vista Park, San Francisco, San Francisco County, CA.

**1541-C** Juvenile male Red-tailed Hawk banded on 9/20/18 by Marc Blumberg; found injured on 4/25/19 on a seventh-floor balcony at San Francisco, San Francisco County, CA and taken to PHS; due to its badly fractured wing, the bird was euthanized; reported by Nicole Weger.

**1542** Juvenile female Red-tailed Hawk banded on 10/1/18 by Lora Roame; trapped at the Joint Forces Training Base at Los Alamitos, Orange County, CA by Derek Collins, Animal and Plant Health Inspection Service (APHIS) biologist on 1/25/19. This bird was relocated about 100 miles away to Alpine County, CA.

**1543** Juvenile male Red-tailed Hawk banded on 9/11/18 by Teresa Ely; hit by a car on 12/15/18 near Ortonville, Ventura County, CA; taken to Ojai Raptor Center where it was found to be severely emaciated (672 grams), infected with roundworms, and had coccidiosis: he was treated and released on 1/23/19 weighing 1121 grams; reported by Elizabeth Chouinard.

**1544** Juvenile female Cooper's Hawk banded on 10/5/18 by Taryn Orlemann; "the very decomposed body" of this Cooper's Hawk was found by a residential garage on 12/29/18 at Santa Ynez, Santa Barbara County, CA; reported by 12-year old Kylie LaPointe and her father.

**1545** Juvenile female Sharp-shinned Hawk banded on 10/3/18 by Brian Tsuru; sighted at Garden Grove, Orange County, CA on 11/15/18; reported by Marisela Rivera who stated, "it got locked up in the cage where it entered to try and eat my [parakeets]."

**1546** Juvenile male Red-tailed Hawk banded on 8/16/17 by Laura Echavez; killed by Matthew Stevens, APHIS biologist, at Travis Air Force Base, Solano County, CA on 9/25/18 as the bird presented a danger to aircraft.

**1547** Juvenile male Red-tailed Hawk banded on 11/5/18 by Buzz Hull; found as roadkill on 1/21/19 four miles east southeast from Stevinson, Merced County, CA; reported by Hector Valtierra, adjunct professor at Cuyamaca College.

**1548** Juvenile male Red-tailed Hawk banded on 8/29/18 by Vanessa Cabrera; remains found on 11/3/18 near off-ramp of Highway 85 at Saratoga, Santa Clara County, CA; reported by Earl Magnone.

**1549** Juvenile male American Kestrel banded on 9/7/18 by Will Rose; found dead on 9/19/18 "freshly run over" on road northwest of Watsonville, Santa Cruz County, CA; reported by Freddy Menge who had watched a kestrel hunting from a wire above the overpass for several days prior.

**1550** Juvenile female Red-tailed Hawk banded on 11/3/18 by Catherine Fisher; found dead and headless on 11/14/18 in a pasture with native oaks at Sonoma, Sonoma County, CA; reported by Barbara Roy.

Recovery 1550. Photo: Barbara Roy

**1551** Juvenile male Peregrine Falcon banded on 10/25/07 by Terry Mead; found weakened on the side of Hydaburg Highway, at Prince of Wales Island, Alaska on 5/5/18 by Susan Culliney and Melanie Smith while scouting sites for

Encounter 1551. Photo: Susan Culliney

the upcoming Southeast Alaska Birding Trail. They carried him from Hydaburg Highway to Craig, a ferry trip from Hollis to Ketchikan, and then a commercial flight to Sitka to the Sitka Raptor Center. It is speculated that he was worn out from the northward migration; he refused to eat and died; no injuries or head trauma were found. Of note, Susan Culliney, a GGRO intern in 2004, now works as Policy Director for Audubon Alaska.

**1552** Juvenile male Red-tailed Hawk banded on 12/6/18 by Candace Davenport; found on 3/8/19 freshly dead of unknown cause in a field at Bird's Landing, Solano

County, CA; reported by Eric Shelton.

**1553** Juvenile male Red-tailed Hawk banded on 9/3/18 by Kirsti Carr; caught and killed on 3/28/19 during animal control operations as it and two other Redtails spent a couple of days on a runway at Moffett Federal Airfield, Mountain View, Santa Clara County, CA; reported by Eric Chow, APHIS biologist.

**1554** Juvenile male Red-tailed Hawk banded on 9/4/17 by Ed Sotello; found grounded on 11/4/18, perhaps hit by a car at Belmont, San Mateo County, CA; taken to PHS where it was treated for injuries, but died the next day; reported by Greg Hassett of PHS.

**1555** Juvenile female Red-tailed Hawk banded on 11/2/17 by Marion Weeks; found dead on 4/22/19 along Highway 5 near Kalama, Cowlitz County, WA; Department of Transportation workers reported the bird to Glen Kalisz, Conservation Agency personnel for Washington state who reported it to BBL.

**1556** Juvenile female Red-tailed Hawk banded on 9/1/18 by Lynn Schofield; found on 11/26/18 at Travis Air Force Base, Fairfield, Solano County, CA with wounds on dorsal side of both wings, "elbows" scraped and cut up, and a scrape wound near tail plus internal injuries, but without any broken bones. Brought to Suisun Wildlife by military personnel where the bird died two days later; reported by Kris Reiger.

**1557** Juvenile male Cooper's Hawk banded on 10/4/17 by Laura Booth; found on 12/13/18 freshly dead in backyard at Half Moon Bay, San Mateo County, CA; reported by Krista Alexander who believes it flew into something and broke its neck.

**1558** Juvenile female Cooper's Hawk banded on 10/5/18 by Brian Smucker; banded leg found on 11/11/18 near a koi pond on large wooded "very bird-friendly property" at Los Osos, San Luis Obispo County, CA; reported by Gloria Zamora.

**1559** Juvenile female Cooper's Hawk banded on 9/19/18 by Kathleen Grady; found on 12/8/18 at Los Osos, San Luis Obispo County, CA; reported by Kathy Duncan of Pacific Wildlife and unable to locate the record of this bird though she recalled the dead bird was very skinny.

**1560** Juvenile male Red-tailed Hawk banded on 12/3/17 by Emily Weil; leg with the metal band on it and part of the rib cage found on 5/10/19 on a trail at the Kohl Mansion, Burlingame, San Mateo County, CA; reported by Jim Taschetta.

**1561** Juvenile female Red-shouldered Hawk banded on 8/29/16 by Teresa Ely; died on 5/23/19 after it "slammed into [a second floor] window and broke its neck" at San Jose, Santa Clara County, CA reported by Jesus Plancarte.

**1562** Juvenile male Red-tailed Hawk banded on 9/10/18 by Kirsti Carr; found dead on 12/11/18 near a chicken coop at Bishop, Inyo County, CA; reported by Hari Nam Elliot.

Encounter 1563. Photo: Eric Figura

**1563** Juvenile female Cooper's Hawk banded on 9/30/16 by Rosa Albanese; banded leg bone and three feathers only found on 12/24/18 in a backyard just 10-15 feet from Umpqua River behind a house at Glide, Douglas County, OR; reported by Eric Figura.

**1564** Juvenile male Red-tailed Hawk banded on 9/8/18 by Catherine Fisher; sighted 12/2/18 at Buena Vista Park, San Francisco, San Francisco County, CA; reported by Robert Martin, a GGRO bander, who added that it stayed around the area for much of the winter.

**1565** Juvenile male Red-tailed Hawk banded on 9/18/08 by Jerry Hadfield; found dead, wet, and in rigor at a lake on 6/12/19 at Calabasis, Los Angeles County, CA; brought to the California Wildlife Center; reported by Samantha Orzech.

**1566** Juvenile female Cooper's Hawk banded on 9/20/18 by Marc Blumberg; reported by Jeremy Tonkin who found the bird dried out inside an old camper with broken windows on 6/6/19 on his property at Gilroy, Santa Clara County, CA.

**1567** Juvenile male Cooper's Hawk banded on 10/19/18 by John Ungar; banded bone and another bone found on 6/23/19 by Rochelle Bening's four-year-old son partially covered by leaves in their backyard at San Bruno, San Mateo County, CA. Rochelle noted that at the age of two, her son became interested in bones on Halloween and now wants to be an archeologist. That very morning, he had asked his mom if they could "go on an adventure to find bones."

**1568** Juvenile Red-tailed Hawk banded on 9/27/2004 by Claire O'Neil; hit by a car at Sebastopol, Sonoma County, CA on 7/4/2019 and picked up by Brad Marsh of the Santa Rosa Bird Rescue Center (BRC); he observed its mate flying above them and calling out then sitting in a tree directly above him. With no broken bones but unable to stand or self-feed, and suffering from spinal shock trauma with central nervous system issues, the bird was rehabilitated and then released at the same place on 8/16/19. Note: This is one of GGRO's 2004 telemetry birds named Quentin.

**1569** Juvenile female Red-tailed Hawk banded on 10/11/18 by Bill Prochnow; observed on 12/23/18 as it flew into a power line and was electrocuted and fell to the ground; a rescuer took the bird to Napa Wildlife Rescue (NWR) where it was treated, but eventually euthanized on 1/2/19; reported by Linnaea Furlong and Juliana Viera of NWR.

**1570** Juvenile female Cooper's Hawk banded on 9/23/17 by Steve

O'Neill; found 12/22/18 on ground with blood in its mouth at a Lucky's parking lot at Santa Rosa, Sonoma County, CA; it was dead on arrival at BRC; reported by Taylour Stephens.

**1571** Juvenile male Cooper's Hawk banded on 10/14/18 by Anne Ardillo; caught due to injury on 2/17/19 at Planada, Merced County, CA; taken to Stanislaus Wildlife Care Center where it was euthanized shortly after arrival as the injuries were severe and believed due to being hit by a car; reported by Veronica Sandow.

**1572** Juvenile female Cooper's Hawk banded on 10/6/12 by Dick Horn; found injured in a backyard on 2/24/19 at Bakersfield, Kern County, CA by the resident who called Animal Control; they failed to show so she kept the bird in a box and took it to California Living Museum (CALM) on 2/26/19. Due to the severity of the wing injury the bird was euthanized that same day; reported by Chris Palmer of CALM.

**1573** Juvenile female Cooper's Hawk banded on 10/31/18 by Jeff Wilcox; found dead on 2/18/19 on a path to the river and under trees at Soquel, Santa Cruz County, CA; reported by Melinda McComb who noted there was a puncture wound to the chest of unknown origin.

**1574** Juvenile female Cooper's Hawk banded on 9/19/18 by Steve O'Neill; found freshly dead on 10/2/18 on road traveled by Ranger Mark Sensenbach and others on the way to their office at Arroyo Grande, San Luis Obispo County, CA.

Encounter 1575-A. Photo: Gerald Friesen

**1575-A** Juvenile female Red-tailed Hawk banded on 10/23/18 by Rachel Miller; reported by bird photographer Gerald Friesen who saw this bird on 11/17/18 while at a sod farm at San Ysidro, San Diego County, CA along with several other birds that were heading south into Mexico. He noted the border wall was about 200 yards away.

**1575-B** Juvenile female Red-tailed Hawk banded on 10/23/18 by Rachel Miller; photographed while sitting on a pole on 10/31/18 by Jeremiah Psiropoulos, APHIS personnel at Point Magu Naval Airbase. He noted that this bird was not a menace to aircraft.

**1576** Juvenile male Red-tailed Hawk banded on 8/26/18 by Steve Rock;

caught due to injury on 2/3/19 at South San Francisco, San Mateo County, CA; taken to PHS and euthanized due to injuries; reported by Sedef Tekin of PHS.

**1577** Juvenile male Red-tailed Hawk banded on 9/8/18 by Michael Armer; sighted on 1/29/19 near UCSF Hospital at San Francisco, San Francisco County, CA; reported by Rudy Warren.


Encounter 1578. Photo: Georgia Kinninger

**1578** Juvenile male Red-tailed Hawk banded on 12/3/2017 by Emily Weil; few feathers and color banded leg bone found on 8/16/19 in open space at a retreat center at Burlingame, San Mateo County, CA; reported by Georgia Kinninger.

**1579** Juvenile male Red-tailed Hawk banded on 8/26/18 by Michele Garcia; flew into a window of a home at Bodega Bay, Sonoma County, CA on 12/21/18 and the resident transported it to BRC for care but it died on 12/23/18; reported by Taylour Stephens of BRC.

**1580** Juvenile male Red-tailed Hawk banded on 8/23/18 by Claire O'Neil; found on 12/11/18 at Ventura, Ventura County, CA close to the Ojai Raptor Center (ORC); bird was lethargic and had injury under the tongue; treated then released 1/18/19; reported by Elizabeth Chouinard of ORC.

**1581** Juvenile female Red-tailed Hawk banded on 11/5/18 by Kirsti Carr; a homeless man brought the deceased bird to Newport Mesa Animal Hospital on 1/4/19 and reported that it was found in the middle of Newport Boulevard, Costa Mesa, Orange County, CA; reported by staff member Lily Cole.

**1582** Juvenile male Red-tailed Hawk banded on 10/17/18 by Brian Tsuru; while driving patrol duty on 8/21/19, Shane Zook observed the Redtail swoop down in front of a pickup and get hit; he stopped and picked up the dead bird about 7.5 miles from the Deschutes River Woods, Deschutes County, OR.

**1583** Juvenile male Cooper's Hawk banded on 10/13/12 by Toby Rohmer; lower leg with band on it found on 4/5/19 and the other leg found the next day at Guerneville, Sonoma County, CA; reported by Michael Hasley.

**1584** Juvenile female Red-tailed Hawk banded on 8/19/17 by Dian Langlois; found in a pool on 8/21/19 near the Cliff House at San Francisco, San Francisco County, CA; the bird was described as "alert, feisty, [and] stable though initially sort of listing to one side" when rescued; released the next day; reported by Kendra Jabin of PHS.

**1585** Juvenile male Northern Harrier banded on 10/16/12 by Marion Weeks; both legs, one banded, and few feathers along with "scraps of hide of some small animal" were found on 5/26/19 at Santa Venetia area of San Rafael, Marin County, CA; reported by Laura Moore-McClelland.

**1586** Juvenile female Sharp-shinned Hawk banded on 9/14/18 by Olivia Wang; found dead on a street corner at La Paz, Baja California Sur, Mexico on 2/4/19 and noted by BBL as having been shot; reported by Andrew Stoltzfus.

**1587** Juvenile female Red-tailed Hawk banded on 8/14/19 by Paula Eberle; found 8/22/19 dead on sidewalk at South San Francisco, San Mateo County, CA and believed to have been electrocuted by power lines above; reported by Falendra Ram.

**1588** Juvenile female Red-tailed Hawk banded on 9/24/16 by Steve Rock; died in route to the municipal shelter on 9/22/19 after striking a window at San Francisco, San Francisco County, CA; reported by Mara Lamboy of San Francisco Animal Control.

**1590** Juvenile male Peregrine Falcon banded on 10/12/18 by Serena Hubert; caught due to injury at Zamora, Yolo County, CA and brought to the California Raptor Center on 6/4/19; the falcon was euthanized the next day as its injuries were not amenable to repair and the falcon was in poor condition; reported by Bret Stedman who noted it also had an old healed fracture of its keel.

**1591** Juvenile female Red-tailed Hawk banded on 8/31/18 by Olivia Wang; photographed on top of telephone pole at Colusa National Wildlife Refuge, Colusa County, CA on 1/10/19; reported by Ellie Kidd.

**1592** Juvenile male Red-tailed Hawk banded on 9/24/18 by Buzz Hull; found dead in ditch along roadside on 10/13/19 south of Valley Falls, Lake County, OR; reported by biologist Steve Reidsma, who found the bird while doing a wetland survey.

**1593** Juvenile female Cooper's Hawk banded on 9/22/19 by Teresa Ely; a few feathers and body with banded tarsus found on 10/18/19 in remote canyon by Luke Carlson while hunting in foothills north of New Cuyuma, San Luis Obispo County, CA.

**1636** Juvenile male Sharp-shinned Hawk banded on 9/22/18 by Erin Berry; caught after flying through an open garage door toward windows at the back of the garage on 1/29/19 at Pacifica, San Mateo County, CA; finders used a towel to gently secure the "very agitated" bird. The band number was read and then the bird was released outside; reported by Gary Gibbs and David Peterson.

**1637** Juvenile female Sharp-shinned Hawk banded on 9/17/16 by Steve Rock; found dead on 2/12/19 in front yard two days after a snowstorm at Chino Hills, San Bernardino County, CA; reported by Mark Wagner.

Encounter 1636. Photo: David Peterson

**1638** Juvenile female Red-tailed Hawk banded on 12/1/17 by Traci Tsukida; found dead on 2/17/19 at Novato, Marin County, CA; reported by Hans Eide who described the bird as "very thin and dried out."

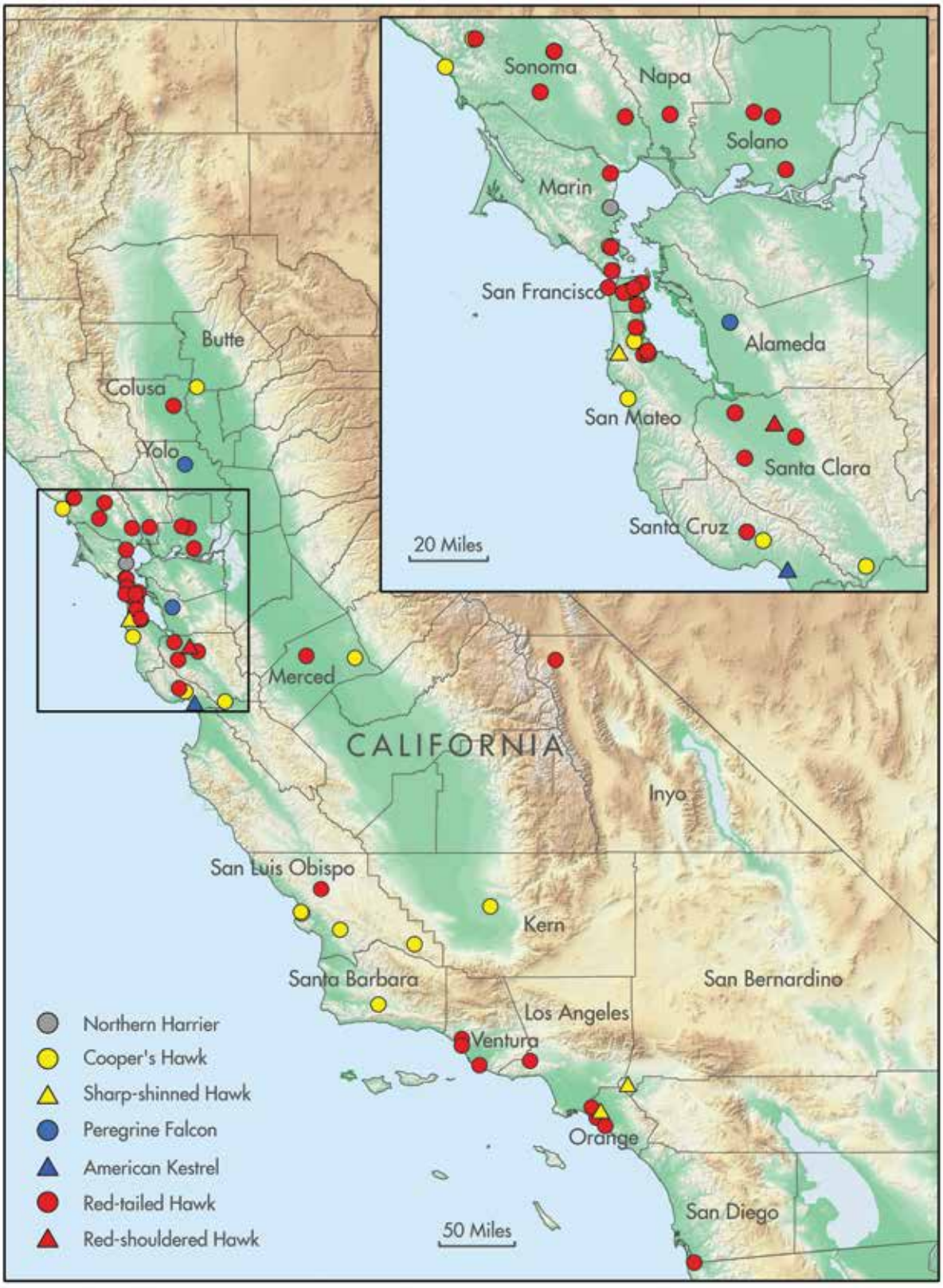
**1639** Juvenile male Red-tailed Hawk banded on 10/11/18 by Brian Tsuru; found dead on 3/10/19 at a home near Forestville, Sonoma County, CA in an enclosed area by chicken wire six feet tall; reported by Janet Beazlie.

**1640** Juvenile male Red-tailed Hawk banded on 9/13/18 by Michaela Figari; photographed on 4/14/19 while perched in a tree at Scotts Valley, Santa Cruz County, CA; reported by Bethany Kilzer.

Encounter 1640. Photo: Paul Kilzer

**1641** Juvenile female Red-tailed Hawk banded on 8/17/17 by Bill Prochnow; found at an intersection at San Francisco, San Francisco County, CA on 1/4/19 and reported as having hit something; Greg Hassett of PHS felt its injuries were of unknown origin and due to the fractured femur, it was euthanized on intake. ●


Kelsie McInnis; 2020




Kelsie McInnis; 2020

# THE STORY OF 368

*Teresa Ely*

Turkey Vulture 368 seen from Hawk Hill. Photo: Olivia Wang

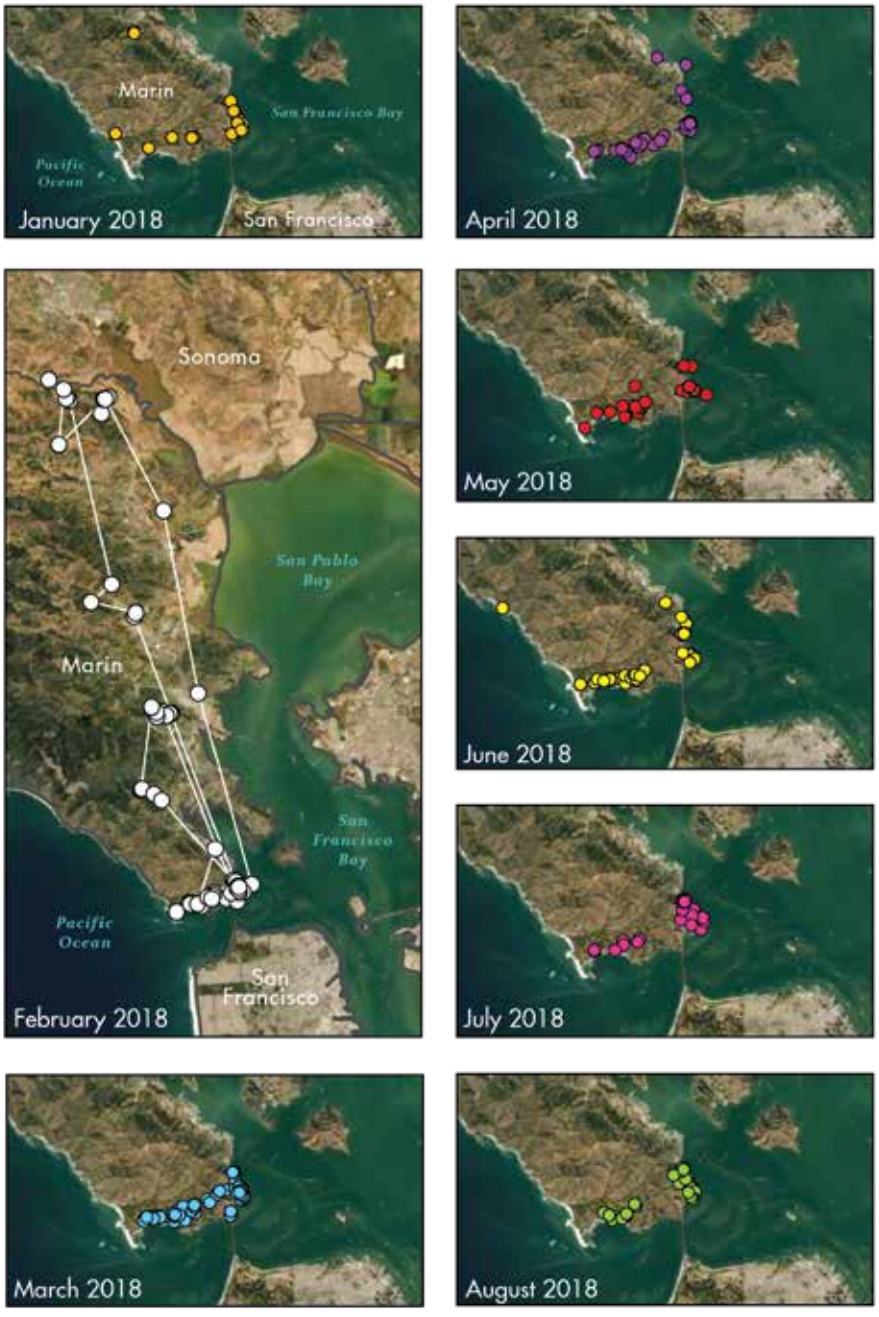
Turkey Vulture 368 is a household name for most GGRO volunteers. This bird, along with four others, was one of the first vultures tagged as part of GGRO's Vulture Research Project using a walk-in trap in December 2017. The walk-in trap is a large modified dog run, with perches and shade, and a rotting carcass positioned nicely to entice hungry birds. The vultures see the meat, walk in a one-way door, and cannot walk back out. During this first trapping attempt, two of the trapped vultures showed signs of poisoning and were promptly taken to WildCare of San Rafael, CA. One of the birds died from severe visceral gout, but the other bird recovered and was later tagged with a blue patagial tag, number 368. We were able to place a GSM transmitter on this bird and release it in January of 2018.

Turkey Vulture 368 is a "local" in the Marin Headlands and regularly flies by Hawk Hill, but its transmitter also gave us a glimpse into its annual movements. The transmitter collected data from January 2018 until August 2018, then went silent just before the migration season started. Vulture 368 moved as far north as Novato and spent a lot of its time in the Marin Headlands. We were able to determine two roosting locations, one in Kirby Cove and another at Fort Baker. During the migration season, it was seen on 41 different days (sometimes multiple sightings per day) from Hawk Hill and a handful of times from the banding blinds. During 2019, it was the most frequently sighted tagged Turkey Vulture by a considerable margin, with 69 confirmed records from Hawk Hill and 7 from the banding blinds.

If you see Turkey Vulture 368, you can report the sighting to the Bird Banding Laboratory at reportband.gov. For those hawkwatcher's and bander's that see 368 in the field, please continue recording this bird! Counting it daily might seem repetitious, but the frequency data of this vulture in the Marin Headlands is just as important as any other movement ecology data.

The GGRO Vulture Research Project has been made possible by generous donations made in memory of Paul Armer. Our great thanks to the Armer family for their long-time support of GGRO.

## Satellite Transmitter Locations For Turkey Vulture 368




Kelsie McInnis; 2020

# FIVE YEARS OF MIGRATORY STORY

*Audrey Yee*

By 2020, over a thousand San Francisco and Marin County fourth and fifth graders have participated in five wondrous autumns of raptor education presented by staff and interns of GGRO and the Crissy Field Center (CFC) of the Golden Gate National

Migratory Story students learn to spread their wings with 2019 GGRO Intern Emma Regnier. Photo: Paul Myers

Parks Conservancy. San Francisco and Marin County public elementary school students who participate in this innovative program will forever be captivated by their classroom learning and experiences in the field, hopefully to make lasting connections with raptors and our national parks and perhaps even to be inspired to work on behalf of these amazing avian predators.

During teacher and CFC staff-led classroom activities, students learn how to identify raptors, why they migrate, and how they adapt to changing conditions, which the young students relate to their own families' journeys, whether moving houses, schools or countries. Their field trip to Hawk Hill brings the curriculum alive: they share sightings and identifications and witness a raptor release, all while enjoying and exploring their Bay Area national parklands. For many, this is their first time seeing or crossing the Golden Gate Bridge, and all of these impressions stay with them. It is our hope that these young people will continue to be amazed by and curious about our natural world and become the volunteers, scientists, and park rangers of tomorrow.

Honoring his wife Judge Jennie Rhine's lifelong devotion to raptors and commitment to community science as a GGRO bander, Tom Meyer underwrites Migratory Story in her name. With his unwavering generous support, we continue to soar higher.

AUDREY YEE is in her sixteenth year at the Golden Gate National Parks Conservancy where she singly manages the planned and commemorative gifts programs. Audrey has worked very closely with Tom Meyer, GGRO Director Allen Fish, and Crissy Field Center staff to bring the Migratory Story program to fruition.

PaHoua Lee, Community Services and Program Manager for the Crissy Field Center (CFC), helps students spot raptors at Hawk Hill. PaHoua manages all CFC aspects of the Migratory Story program and plays a critical role in the successful delivery of the program each year. Photo: Paul Myers

| Migratory Story 2015-2019 | 2015 | 2016 | 2017 | 2018 | 2019 | 5-year Aggregate |
|---|---|---|---|---|---|---|
| Students Served | 193 | 290 | 196 | 166 | 235 | 1080 |
| Participating San Francisco Unified School District schools | 4 | 5 | 6 | 7 | 7* | 13 |
| Economically disadvantaged (free/ reduced-cost lunch) | 86% | 72% | 92% | 80% | 75% | 82.5% |
| Nonwhite | N/A | 92% | 98% | 92% | 85% | 91.75% |
| English language learners | 72% | 36% | 42% | 64% | 54% | 53.6% |
| Newcomers | N/A | N/A | N/A | 33% | 26% | 29.5% |
| Languages: English, Spanish, Cantonese; some years included Mandarin and Tagalog | 3 | 4 | 4 | 4 | 3 | 5 |

**Including one school from the Sausalito Marin City School District*

# UNEXPECTED NEST-MATES

*Gavin Emmons*

Although raptors tend to follow regular and well-studied behavior patterns, they can also be unpredictable, making unexpected choices that continue to reframe our understanding of their actions and complexity. These unexpected moments make raptors endlessly fascinating subjects that challenge and broaden our assumptions. As a raptor biologist at Pinnacles National Park for the past 17 years, I have come to appreciate the many nuances of breeding raptor behavior at the park. Perhaps the most exciting—and unexpected—moments I have observed at Pinnacles National Park were during the breeding season of 2018.

On April 24, 2018, I hiked upslope through open chaparral and oak woodland habitat to check the status of a breeding pair of Great Horned Owls. I set up a tripod and focused my scope on the nest site, a stick nest high in a Gray Pine, where I had confirmed one of the adult owls incubating eggs on a previous visit. Sure enough, I saw an adult Great Horned sitting high at the nest site, then rising and flying to a nearby perch. Two Red-shouldered Hawks—an adult and a juvenile—proceeded to scold and dive briefly at the adult owl. Scanning the nest site with my scope, I could see one nestling owl, mostly downy, about 2.5 weeks old by its size and feather development.

What came next was unexpected. I saw another nestling lift its head to scan the surrounding area. But it was a hawk nestling, not an owl! I blinked and checked again, and sure enough, the second nestling was a buteo, either a Red-shouldered or Red-tailed Hawk nestling, maybe a week old. Both nestlings settled down as the adult and juvenile Red-shouldered Hawks finished scolding the adult owl and left the area. The adult owl returned to the nest, carefully settling to incubate and shade the young. Stunned, I quietly packed and left the area.

What the heck was going on here? I had heard of raptors adopting nestlings from other species

**GAVIN EMMONS** is a raptor biologist for the National Park Service stationed at Pinnacles National Park in central California. Pinnacles is home to a rich diversity of wildlife including 13 breeding raptor species and one of the five core populations of California Condors.

before. This is a rare event but has been noted among different diurnal raptor species—Bald Eagles raising an Osprey or Red-tailed Hawk nestling, even hawks raising a kestrel. But I have not heard of a case where an owl has adopted a hawk nestling. I was curious to see if the Great Horned Owls would continue to consider the hawk nestling one of their own, or if they would realize it was different, and an easy prey source.

I visited the owl nest site three more times in the next three weeks, and each time I saw the Great Horned Owl and buteo hawk nestlings, they were healthy, alert, and developing normally. The adult owls continued to feed prey to both nestlings and behaved toward the hawk young as if it were their own.

I posted photos of both nestlings at the nest site on social media and developed quite a following of raptor researchers and enthusiasts. No one else had observed this behavior between owls and hawks prior, and collectively we were all excited to see what would happen. It seemed likely that an adult owl had taken a hawk nestling from a Red-shouldered or Red-tailed Hawk nest, to be delivered to the owl nestling as prey. For whatever reason, the adult owls changed their minds. Perhaps one of the adults delivered the uninjured hawk nestling, and then quickly flew off to find more food. Perhaps the owl nestling was not hungry, and when an adult returned to incubate, accepted both young as its own.

On May 10, 2018, I made my third visit. The owl nestling was 5 weeks old and the hawk nestling was approximately 22 to 25 days old. I was eager to see the hawk develop further so that I could identify it to species. Would it survive to fledging? Was it being fed by the adult owls at night? Would it be able to adjust to diurnal hunting after developing with nocturnal foster parents?

Imagine lifting your binoculars for a routine nest survey, expecting to find a Great Horned Owl (GHOW) nestling or two, only to see this, a GHOW and buteo nestling side-by-side in a single nest. Clockwise from previous page: GHOW nestling (~2.5 weeks old) and buteo hawk nestling (~12-15 days old) at Pinnacles National Park on April 30, 2018. GHOW nestling (~4 weeks old) and buteo hawk nestling (~16-19 days old) on May 4, 2018. Buteo hawk nestling (~22-25 days old) stretching and showing feather development on May 10, 2018. Photos: Gavin Emmons

Sadly, this unexpected nest effort ended with another unpredictable twist: the nest tree fell over prior to either nestling being old enough to fledge, and both likely perished in the tree fall. It was hard not to be disappointed, but it was nevertheless a fascinating view into a previously undocumented series of nesting behaviors that helped broaden our understanding of raptor behaviors. What unexpected observations will we document next? ●

# INTER-INTERN INTERVIEW: DR. LINNEA HALL '88

*Taylor Barnes '19*

Each season, we invite a current GGRO Intern to interview a previous GGRO Intern who has gone on to make important contributions to conservation science. This year, 2019 Intern Taylor Barnes spoke with Dr. Linnea Hall, interned with GGRO in 1988, just four years after the program's founding, and now manages one of the largest collections of bird nests and eggs in the world. Thank you, both to Taylor, for conducting and writing up this season's Inter-Intern Interview, and to Linnea for allowing us to print her story.

2019 Intern Taylor Barnes holds a fledgling Barn Owl during pre-season banding training. Photo: Taylor Barnes

**Where did your nature interest start? Were you an outdoorsy kid?**

I was always active outdoors, but at age eight I started riding horses, and when I was eleven my family bought twenty acres in Moorpark, California that we transformed into horse stables. I trained and showed horses from the age of nine until my mid-thirties, and my last horse (for now) just passed away in 2014. I learned to absolutely love animals from my work with horses, and at ten years old declared that I would be some kind of animal biologist. At the age of twelve, I knew I would be a research veterinarian, and I interned with horse vets from then until my twenties and attended Cal Poly SLO (where I took lots of anatomy and physiology courses) from 1984 to 1988. In the last semester of my senior year I took Ornithology from Dr. Eric Johnson, and everything changed!

**TAYLOR BARNES** became a 2019 GGRO Intern after graduating from the University of Nevada, Reno, with a BS in Wildlife Ecology and Conservation. Before joining GGRO, Taylor spent five years volunteering with her local wildlife rehabilitation facility where she developed a passion for conserving and protecting wildlife.

Dr. Linnea Hall, Executive Director of the Western Foundation of Vertebrate Zoology (WFVZ), with WFVZ Collections Manager René Corado. WFVZ hosts one of the largest collections of bird nests and eggs in the world. Photo: David Moskowitz

In an instant I changed my mind about my career, because I learned that I could be a researcher who studied wild animals, and I fell in love with birds.

**What attracted you to GGRO?**

While at Cal Poly I did a little hawk rehabilitation stint, and with my new passion as a budding ornithologist when I graduated, I looked for an internship with birds of prey that I could slip into with little knowledge and a fair bit of gumption, and one that also had a good mentor. Allen Fish was recommended to me, and once I met him, I knew I had found a good place to learn more about birds, nature, and science.

**Did any part of the GGRO experience help set you on your career path?**

Absolutely! Not only did I learn to ID hawks in flight for the rest of my life (thank you, thank you!), I learned to collect and analyze field data. In addition to tallying hawks in flight, I was able to analyze GGRO hawk counts and compare them with storm front information, and this became my first-ever scientific publication. After grad school, I went on to teach ornithology as a professor at CSU Sacramento, and later as the lead ornithologist at the Western Foundation of Vertebrate Zoology (WFVZ), and all the courses always include hawk IDs, of course. The internship also connected me with John Keane, who encouraged me to apply to UC Berkeley for my master's work, which set me on my formal career path in the sciences. My time with GGRO was thus a wonderful foundational experience, and I would strongly encourage any person interested in the natural sciences to apply.

**What was your master's research?**

Well, my actual project was on three species of mice in the White Mountains of California, conducting an experiment with them to see if I could induce

them to have a population explosion during a drought by giving them supplemental food. But the larger project we worked on in the White Mountains was much bigger than our individual master's projects. Over a three-year period (1989-1991) I also checked hundreds of bird nest boxes every couple of weeks in pinyon-juniper and bristlecone pine woodlands; counted passerines on point count transects throughout the woodlands; and even helped John Keane with his project on beautiful little Black-throated Gray Warblers. I learned to identify nearly a hundred bird species by sight and sound, which set me on a life-long path of counting all birds I come across and extolling the importance of learning their vocalizations!

**How about your PhD?**

After finishing my master's in 1992, I moved to southeastern Arizona to conduct point counts in eight "sky island" mountain ranges for a bird monitoring project. It was a tremendous introduction to the avifauna of that region, and I learned in 1992 that there was very little information about many of the Neotropical breeding species of the area, especially the Elegant Trogon. As a result, in 1993 I raised funds to study the species, and convinced Dr. R William Mannan, at the University of Arizona, to take me on as a student. From 1993-1996, I looked for trogons all over southeastern Arizona, captured some and put on radio transmitters, determined what type of habitat they selected, and watched their breeding efforts for thousands of hours at nest cavities. It was a privilege to work with this species; it truly is one of the most beautiful birds in North America.

**There seem to be two schools of thought regarding graduate school in wildlife ecology: (1) go right into a PhD program after your Bachelor's degree; or (2) do a master's first. What would you recommend to a recently-graduated undergrad?**

I think that students benefit a lot by doing both a master's and a PhD, as long as they are at different schools and on different projects. With two degrees you get broader experience as a scientist by conducting more projects. In addition, you meet more colleagues and establish more connections, which is very helpful after graduate school is over. And lastly, you get to learn from more people, which is the most important part, since graduate work is all about learning as much as you can so you come out with a good sense of what you want to do for your career, how you want to do it, and what you definitely want to avoid.

**You have worked on an amazing range of research projects according to your publishing record. Do you have a core research interest that links many of these projects?**

I have two "core research areas." (1) I love issues of habitat selection and habitat quality—why do species use what they do, and what do they need for optimum living, breeding, and behaving? (2) I also love to work on population estimation projects and nest monitoring projects—nowadays especially for rare, endangered, or declining bird species—and use that information to inform the US Fish and Wildlife Service, California Department of Fish and Wildlife, and land management organizations about how their bird populations are doing and how best to augment their populations. However, what lights me up more than anything is doing projects that make a difference for the animals I love. I have loved nature since I was a child, hate to see it destroyed, and

1988 GGRO Intern Linnea Hall prepares to release a juvenile Cooper's Hawk. Photo: Linnea Hall

have always wanted to be a voice for the voiceless. I think scientists owe a debt to the nature they study, to make sure that it flourishes. It is the cost of our degrees; we must help that which we come to know.

**You've been with the Western Foundation of Vertebrate Zoology (WFVZ) for a long stretch. Tell us a bit about the museum. What makes it compelling and interesting? What is a typical day at WFVZ for you?**

There really is no typical day at a museum, I've found! The WFVZ, which is a non-profit public charity, holds the largest collections of birds' eggs and nests in the United States. The museum has contributed to about 4,000 studies, on bird subjects including breeding, toxicology, ecology, and conservation. I am the Executive Director, so I have to do some administration, of course, but I also am the lead scientist and for a long while was the lead educator, so I've had a beautiful mixture of field time and classroom time over the past 17 years. My spring and summer are filled with avian conservation projects I conduct, and the fall and winter are filled with reporting and grant writing, Open Houses, and lots of kiddos visiting to learn about science and nature, which I LOVE. I am very fortunate to have the position I do.

**How do you feel about the rise of Community Science in field ecology and conservation biology? Any concerns?**

I think Community Science is fantastic and will be the way that science becomes accessible to everyone, rather than the lucky few. I oversee a community science project to monitor birds in the Santa Monica Mountains, and it is definitely one of the best projects the WFVZ has going. Of course, training is always the key in any project, and it is definitely necessary in a Community Science project, but that is how we teach and include more people in the sciences, by opening what we do to the public and letting them share in the wonder of the natural world.

For more information on Dr. Hall and the inspiring work of the WFVZ, please visit www.wfvz.org or peruse:

Purcell, R, LS Hall, and R Corado. 2008. Egg and Nest. Harvard Univ Press.

Kiff, LF. 2001. A history of the WFVZ 1956-1994. Contributions to the history of North American Ornithology Vol. 2: 183. Nuttall Ornithology Club.

Our great thanks also to author/photographer/naturalist David Moskowitz for the photo of Linnea and René. David's forthcoming book, *Bird Nests of North America*, will be out in spring of 2021. More info at www.davidmoskowitz.net and www.petersonbirdnests.com.

# WINTER RAPTORS AT LYNCH CANYON

*Jeremy Pallant*

The morning of our trip, we were greeted by a thick fog that we soon discovered was blanketing much of the Bay Area. Despite subpar weather conditions, we were still optimistic, and opted to make the trek to the East Bay. We arrived at Lynch Canyon mid-morning, the fog showing no signs of letting up. We paused upon our arrival to discuss our options: wait out the fog in hopes of clearer skies, drive home and wait for a day with more favorable weather, or throw caution to the wind and go ahead with our trip. As we were deliberating, the silhouette of a large raptor emerged from the fog at the edge of the parking lot.

The interns search for hawks on a dreary morning under the protection of a picnic table awning. Photo: Emma Regnier

We all turned to watch the bird passing overhead, showing the proportions of a large buteo. It was tough to make out field marks against the backlit sky, but then the bird stopped and began hover-hunting over a nearby field. As it stilled, the bird's legs bobbed like the needle on a sewing machine. A Rough-legged Hawk! We decided to stick it out for at least a few hours to see what the hiking trails had to offer in terms of bird activity.

Birding Lynch Road was tough. The fog was still thick and visibility was poor. At first, we saw little more than California Towhees and Golden-crowned Sparrows. As we approached the split between the Tower Trail and the Valley Trail, sheets of rain began coming down. Matters were made worse when we were confronted by a large steer in the middle of the trail, staring us down and kicking at the mud in an effort to dissuade us from advancing. We didn't need to be asked twice. We bundled up in our rain gear and hoofed back to the parking lot.

With our hopes waning, we had an early lunch at one of the barely protected picnic tables. Just as we were about to throw in the towel, the weather conditions

JEREMY PALLANT joined GGRO as a 2019 Intern after graduating from Allegheny College with a BS in Environmental Science. Jeremy spent time trapping and banding songbirds at the Wing Island Birding Station in Cape Cod and Cusuco National Park in Honduras before moving out to the West Coast for the 2019 season.

began to change. The rain diminished to a drizzle and then ceased and the fog ceiling began to lift. In a matter of minutes, it was a completely new day.

As conditions cleared, raptors took to the skies. A pair of Rough-legged Hawks rose up in front of a nearby hill, surveying the grasslands. They were soon joined by several Red-tailed Hawks of various ages, including some dark morphs. Farther off, two massive birds appeared above a ridge, rising on a thermal and soaring together in broad circles. Upon further inspection with a scope, their

Juvenile Red-tailed Hawk seen at Lynch Canyon. Photo: John Davis

identities became clear-two adult Golden Eagles! We watched as the eagles effortlessly ascended before disappearing into the cloud cover overhead. While a few of us continued to scan the hills, others turned their gazes lower, picking up a male American Kestrel, a White-tailed Kite in a snag, and a juvenile Northern Harrier skimming the grass. We were so busy birding from the parking lot that we nearly forgot about the rest of the park.

Before we had a chance to get back on the trails, we spotted a large buteo, slowly approaching from the north, its wings in a moderate dihedral. As it passed overhead, we got a terrific look at the ivory band at the base of its tail and the clean white undersides of its primaries and secondaries. Otherwise, the rest of the bird showed tones of dark chocolate brown and black. The dark-morph Rough-legged Hawk passed overhead, passively eyeing the terrain below. We all trained our binoculars and scopes on the bird until it disappeared to the south.

Returning to the trail, we were taken aback by the sheer number of passerines that had emerged as a result of the much-improved weather conditions. The previously silent hills were now buzzing with birdsong and rustling branches as songbirds came out to forage. Black and Say's Phoebes, Yellow-rumped Warblers, and Ruby-crowned Kinglets flitted between shrubs and the ground, searching for insects. A male Western Bluebird struggled to wolf down a centipede longer than its body. The metallic cries of California Scrub Jays and Red-shafted Flickers bounced off the canyon walls, and the cooing of Mourning Doves provided a peaceful backdrop.

As we re-approached the split in the trails, we were relieved to find that the steer was gone. With the path now clear, we hiked to Lynch Reservoir. After a short slog through ankle-deep mud, we emerged at the reservoir's edge. At the edge of the reservoir, two White-tailed Kites roosted atop a bare tree. Maggie pointed out several Northern Harriers patrolling the far ridges, including a stunning adult. The valley echoed with flute-like whistles, which Veronica identified as Western Meadowlarks.

The path from to the reservoir wound up to the summit of a nearby ridge. Midway to the peak, we stopped to look at an adult Golden Eagle perched

Adult Golden Eagle. Photo: John Davis

atop a radio tower, wings drooping, drying out after the rain. Across the valley, a juvenile Golden soared effortlessly over the crest of the opposite ridge, showing bright patches of white in its tail and wings.

While we'd been birding the reservoir, many Red-tailed Hawks had taken to the sky. On our walk back to the parking lot, there were times when we could see ten or more Redtails in a single field of view. Among these Red-tailed Hawks were a handful of dark morphs. One of the juvenile dark morphs flew directly over us. The bird had distinct "spikes" on the trailing edge of its wings, a trait unique to Harlan's Red-tailed Hawks. We didn't see the bird for long enough to confidently narrow it down to a subspecies, but we all had a suspicion that it was a juvenile Harlan's Hawk.

By the time we reached the car, it was closing in on 4 pm and the sun was well on its way to setting. We were tired, damp, and covered in mud, but still

Juvenile Rough-legged Hawk. Photo: John Davis

The skies cleared at Lynch Canyon to reveal a juvenile Golden Eagle overhead. Photo: Susana de Trapaga

happy for the day's birds. After a dreary morning of battling the elements, we had a terrific afternoon of birding. A huge thank you to Step Wilson, Susana de Trapaga, and John Davis for helping us plan the trip to Lynch Canyon—a fitting culmination to a wonderful 2019 intern season at GGRO.


The 2019 GGRO Intern Cohort brought great knowledge, skill, and passion to the 2019 season! Clockwise from top left: Jeremy Pallant, Paula Eberle, Taylor Barnes, Veronica Pedraza, Maggie Brown, Emma Regnier. Photo: GGRO

A female American Kestrel photographed at Lynch Canyon Open Space Park in Solano County. Photo: John Davis

The success of the Golden Gate Raptor Observatory rests on the shoulders of many people: the staff of the Golden Gate National Parks Conservancy and the National Park Service; the donors who provide a critical budgetary boost for our research and operation; and an exceptional, creative and dedicated volunteer staff. GGRO volunteers give a minimum of 70 hours a year to the National Park Service, often closer to 100 hours. Double that is not unusual. But whether you give sweat, donations, or moral support, we deeply appreciate your sponsorship, your stepping up for raptor conservation. Great thanks to all of you, our volunteers, and donors, and colleagues.

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Erin Fisher shows a juvenile Red-tailed Hawk with an unusual Harlan-influenced wing and tail pattern. Photo: Erin Fisher

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Back Cover: Adult female Rough-legged Hawk framed perfectly against Fort Cronkhite in the Marin Headlands. Captured from Hawk Hill. Photo by George Eade, a wildlife photographer with fifteen years' experience as a GGRO Hawkwatcher. In addition, George also volunteers his time monitoring raptor nests throughout the north Bay Area. View more of George's wildlife photography at https://geade.zenfolio.com/f351998031.


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