

PACIFIC RAPTOR

GOLDEN GATE RAPTOR OBSERVATORY



FALL MIGRATION 2022 | **ISSUE 44** | PUBLISHED SEPTEMBER 2023



The Marin
Headlands are
Coast Miwok
land.

PACIFIC RAPTOR 44

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Front cover: *Redtail on Fish Rock*. ©Lora Roame.

Artist's note: *Redtail on Fish Rock* was inspired by a hawkwatching day in 2022 when our GGRO count team spotted this banded Red-tailed Hawk perched atop Fish Rock—a prominent outcropping just north of the Hawk Hill summit. The image of this beautiful raptor nestled amongst the striking geology and colorful backdrop of the Marin Headlands will always remind me of my time spent counting raptors on Hawk Hill.

To see more of my scientific illustrations and artwork, follow me @LoraRoameArt.



A broad-backed adult female Peregrine tracks the iconic lines of the Golden Gate Bridge.
Photo: John Davis

INTRODUCTION

Hawk Hill: A Place to Celebrate Migration

In 2024, we'll celebrate the Golden Gate Raptor Observatory's (GGRO) 40th anniversary. Your support over the years has allowed us to monitor the Pacific Flyway, and to produce science to support the preservation of birds of prey.

Our work is made possible thanks to the collaboration among Golden Gate National Parks Conservancy and National Park Service (NPS) staff and scientists, and our community of dedicated volunteers and supporters. Thank you for doing your part for raptors over the years, and for witnessing the migrations that converge here.

Hawk Hill. The home of the GGRO is a spectacular vista point perched above the Golden Gate Bridge. It stands 920 feet high and a quarter mile from the tides of the Golden Gate, midway between the western and eastern edges of the Marin Headlands. Carpeted in coastal chaparral and capped with remnants of U.S. military history, Hawk Hill is home to the largest visible migration of birds of prey known on the West Coast of North America—a window on the Pacific Flyway like no other. Some of the raptors spotted over Hawk Hill may travel as far as Alaska and Argentina on their annual migration cycle.

But Hawk Hill isn't just for hawks. You can see the migration of many species here, from Vaux's Swifts to Band-tailed Pigeons, from humpback whales to monarch butterflies. Humans, too. All are part of the Hawk Hill migration story.

One afternoon last November, while talking to Hawk Hill visitors about raptors, we started jotting down some of their stories. We met a family from Georgia elated to see their first (Atlanta) falcon, a six-year-old and his mom from Texas who practiced addition with the GGRO count board, two brothers from Florida (one stationed at Travis Air Force Base) coming together for Thanksgiving, and an East Bay executive who was partway through her goal to hike all the trails in the Golden Gate National Recreation Area (GGNRA) in one year.

Over the following week, we chatted with visitors not just from the United States, but also from Taiwan, India, Ireland, Mexico, France, and Canada. One family from southern England could even see a Peregrine nest site from their backyard. Each conversation was fascinating, often enriched by cool bird stories.

The GGNRA is a magnet for both local and international tourism, and isn't tourism also a form of migration? Migration takes many forms, but some locations seem to be crossroads for an extraordinary amount of migration. Hawk Hill is one of these, a *stopover site* in ecology terms, whether bird or butterfly or human.

We hope you'll join us in celebrating our achievements over 40 years and looking ahead to the future. Because of you, we can dream of our next 40 years and the good work ahead!

With gratitude,



Christine Lehnertz
President & CEO
Golden Gate National Parks Conservancy



Allen Fish
Director, Golden Gate Raptor Observatory
Golden Gate National Parks Conservancy

INTRODUCTION

GGRO Announcements



Laura Echávez, Krista Fanucchi, and Teresa Ely. Photo: Allen Fish

PEOPLE

We were fortunate in the summer of 2022 to bring aboard two Biotechnicians to support the field season: Laura Echávez and Krista Fanucchi. Laura's name may be familiar as she was one of our excellent GGRO interns back in 2017, after which she dove deeply into raptor fieldwork: Golden Eagle, American Kestrel, and migration studies in Boise, and then California Condor, Bald Eagle and Peregrine Falcon studies in southern California. Most recently, Laura worked on Barn Owls in vineyards for her master's research at Cal Poly Humboldt.

Krista Fanucchi has had a rich career both in field ornithology and education, working most recently in the Portland public schools as a paraeducator. A North American Banding Council-certified songbird bander, Krista has done passerine mist-netting for Point Blue Conservation Science, and for the Institute for Bird Populations, as well as public interpretation for Yosemite Conservancy and the National Park Service.

We are delighted that we will have Laura and Krista's leadership through 2023. Our great thanks to a few exceptional donors for making this possible.

Another high point of 2022 was bringing Carmen DeLeon back to the Parks Conservancy. Part of the legendary 2008 GGRO intern team, Carmen has had a strong career in science education, working for NatureBridge, CuriOdyssey, and the Lindsay Wildlife



Carmen DeLeon. Photo: Laura Echávez

Experience. She is an integral member of our GGRO and One Tam teams as the Conservation and Community Science Department's Program Coordinator.

SCIENCE

As a nearly 40-year-old community science program, all the GGRO's scientific publications and presentations are steeped in collaboration. The research in 2022 alone includes collaborators from Colgate University; State University of New York, Syracuse; Hamilton College; Cornell University; University of Florida; University of Georgia; University of California, Davis; National Audubon Society; and the National Park Service. Thanks to all our research partners past and present, and particularly to Dr. Elisha Hull of UC Davis and Dr. Chris Briggs of SUNY Syracuse for their leadership in collaborating.

GGRO Senior Biologist Teresa Ely has dedicated much attention to supporting the careers of young biologists. At the annual meeting of the Raptor Research Foundation (RRF) in October 2022, Teresa co-taught the workshop on raptor banding and marking. After five years guiding the RRF's Early Career Raptor Researcher Committee, she handed off co-leadership of the team. Not coincidentally, her successor is GGRO Biotechnician Laura Echávez. Teresa also continues to guide the Women in Raptor Research and Conservation group—a community she founded in 2017, now with 650 members worldwide.

2022 Publications

Bourbour, R. P. (2022). The foraging ecology of raptors migrating along the coast of California revealed with eDNA metabarcoding. [Doctoral dissertation, University of California, Davis]. <https://escholarship.org/content/qt1rq9196s/qt1rq9196s.pdf>

Briggs, C. W., Dudus, K. A., Ely, T. E., Kwasnoski, L. A., & Downs, C. J. (2021). Hemolytic parasites affect survival in migrating Red-tailed Hawks. *Conservation Physiology*, 10(1). <https://doi.org/10.1093/conphys/coac075>

Claunch, N. M., Downs, C. J., Schoenle, L. A., Oakey, S. J., Ely, T. E., Romagosa, C., & Briggs, C. W. (2022). Snap-freezing in the field: effect of sample holding time on performance of bactericidal assays. *Integrative and Comparative Biology*, 62(6), 1693–1699. <https://doi.org/10.1093/icb/icac007>

2022 Presentations

Bourbour, R. P. (2022, September 16). *Beak and talon swabs reveal dietary trends of Sharp-shinned Hawks banded during fall migration* [Conference presentation]. Western Bird-Banding Association Conference, Davis, California.

Bourbour, R. P. (2022, October 11). *Combined citizen science datasets reveal interactions between raptors and prey within a migration corridor* [Conference presentation]. British Ornithology Union Conference, Online.

Ely, T. E., & Varland, D. E. (2022, October 11). *Banding and Auxiliary Marking* [Workshop]. Raptor Research Foundation Conference, Ft. Lauderdale, FL.

Fish, A. M. (2022, March). *The need for conservation biologists: A lens from four decades of raptor research and community science* [Conference presentation]. Empowering Indigenous Communities Symposium, Bear River Tribe of Rohnerville Rancheria/Yurok Tribe, Loleta, CA.

Monroe, M., & Fish, A. M. (2022, October 26). *Closing comments: Reflecting on our past and future in collaborative conservation* [Conference presentation]. One Tam Science Summit, Mill Valley, CA.

Fish, A. M. (2022, November 18). *Revealing the Pacific Raptor Flyway—a 40-year Retrospective of the GGRO* [Conference presentation]. Annual Central Valley Bird Club Symposium, Stockton, CA.

IN MEMORIAM

George Eade

GGRO leader and hawkwatcher George Eade passed away suddenly in July 2022, leaving a gaping hole in the GGRO community fabric. George died during a pelagic birding eco-tour, just a few minutes after the boat had circled the Farallon Islands, where he had photographed a Peregrine Falcon.

A constant and friendly presence on Hawk Hill, George's passing will be especially felt by volunteers and visitors who were used to seeing this tall, smiling man, holding a camera lens half his height. George was always ready to share his excellent raptor photos. He even invented a field-ready photo board system so the GGRO could conduct identification classes on Hawk Hill without electricity. The "George Board" became our gold standard for field instruction in 2022.

Along with his 17-year career as a GGRO hawkwatcher, George was inspired by his volunteer work with YES Nature to Neighborhoods in Richmond, CA, and with Tolay Lake Regional Park in the Sonoma County Parks. George's passion for YES motivated him to work with Parks Conservancy and NPS staff toward developing a meaningful education program on Hawk Hill for kids from underserved neighborhoods. Migratory Story is today a program of



the Parks Conservancy's Crissy Field Center with support from the GGRO, that has hosted more than 1000 kids from 15 schools in the past seven years.

Dave DeSante

In October 2022, California avian conservation biologist Dr. Dave DeSante died suddenly during a birding trip to the Marin Headlands. An internationally known ornithologist, Dave was one of a

generation of highly productive and influential conservation biologists at Point Reyes Bird Observatory in the 1970s-1990s. Dave founded the Institute for Bird Populations and he made constant-effort songbird mist-netting a vital tool for monitoring populations, among his many contributions to conservation biology.

In 1986, I asked Dave to be on the GGRO's first Scientific Advisory Committee, to advise our newly formed NPS-Parks Conservancy team on how to set up our long-term raptor counting and banding programs for maximum scientific impact. Dave was always enthusiastic about GGRO and was consistently generous with his time and ideas. Although I didn't know him well, whenever our paths crossed, he always made me feel like an old friend and co-conspirator for the conservation of native birds.
-Allen Fish

Every Bird Banded Contributes Something Bigger

TERESA ELY

As the 2022 migration field season wound down, I reflected on my master's research at University of Nebraska, Lincoln.

I studied in a lab focused on predator-prey relationships, the only student working with raptors in a group using protists (one-celled organisms such as paramecium, best seen through a microscope) to conduct research. How were these two seemingly unrelated organisms—protists and raptors—connected?

My research focused on how body size changes for a predator whose populations were in decline, the American Kestrel. My lab mates examined how body size changes with the scaling of population density and energy use, but in an entire world that can live in a petri dish. Our lab was dedicated to learning how predator-prey interactions relate to ecosystem health, small and big, and how their populations react and adapt to environmental stressors.



GGRO Senior Biologist Teresa Ely readies a juvenile Broad-winged Hawk for release. Photo: Laura Echávez

To study such systems, it is easiest to work with an organism that reproduces quickly, that is easily observed, and where experimental trials can be completed within days, not decades. Raptors are relatively large-bodied predators, have slower reproduction rates, produce fewer offspring, have large home ranges, and can be secretive in their habits—all of which make raptor research harder. It can take decades to see changes in raptor populations.

However, I had a unique opportunity that researchers who study larger organisms dream of—I had access to decades of data spanning the United States raptor migration network. This gave me a robust sample size to study how body size has changed in a predator that did not require a microscope to be seen.

Raptor banding is often misrepresented as the simple act of putting a band on a hawk's leg and then waiting for it to be found (or not). But it is a powerful tool for learning about raptor biology—their behavior, ecology, and stressors on their lives—at both an individual and population level. Thinking back on my master's work reminds me that every banded raptor is important to our research questions. Every wing chord measurement, every feather sample, and every band that we place provides potential insight into the lives of California raptors. I am grateful to our GGRO community, and counterparts across the country, who create this incredible body of information.

GGRO banding data have contributed to our understanding of many topics, including potential impacts of stressors like climate change, rodenticides, and heavy metals; changes in raptor prey and food webs; and the ecology of raptors. Here we highlight several GGRO publications that show the breadth of our banding program's contributions to conservation biology and how our data can be used.

HEMOLYTIC PARASITES AFFECT SURVIVAL IN MIGRATING RED-TAILED HAWKS

Briggs, C. W., Dudus, K. A., Kwasnoski, L. A., & Downs, C. J. (2022). *Conservation Physiology*, 10(1). <https://doi.org/10.1093/conphys/coac075>

Migration is an energy-intense event for any bird, and healthier birds may have a better chance of surviving. While we often assess health based on how heavy a bird is for its size, we know that a bird's weight varies depending on factors like when they last ate (or didn't). So, we need to look at other indicators of their



Merlins are distinguished from kestrels by their single indistinct mustache. Photo: Cricket Raspet

overall condition at the time we trap them. One important indicator is disease, as migrating birds may be more likely to encounter unfamiliar diseases during their journey. In this case, we examined the blood parasites that cause avian malaria and the strength of the hawks' immune systems including white blood cell counts.

Between 2004 and 2018, GGRO volunteers and staff captured, banded, and measured 353 Red-tailed Hawks, and took blood samples to check for the presence of blood parasites. GGRO band recovery data were also used to understand how these indicators of health were related to mortality of individuals we trapped. We found that individuals with a blood parasite infection had lower survival in the short term, but not in the long term. However, the strength of an individual's immune system, and their weight relative to size, were not related to their likelihood of survival in the months or years that followed capture. In other words, infected birds could recover, but recovery did not appear to be related to the two other health indicators we studied, immune system strength and weight relative to size.

FALCON FUEL: METABARCODING REVEALS SONGBIRD PREY SPECIES IN THE DIET OF JUVENILE MERLINS (*FALCO COLUMBARIUS*) MIGRATING ALONG THE PACIFIC COAST OF WESTERN NORTH AMERICA

Bourbour, R.P., Aylward, C.M., Tyson, C.W., Martinico, B.L., Goodbla, A.M., Ely, T.E., Fish, A.M., Bull, A.C., & Hull, J.M. (2021). *Ibis*, 163. <https://doi.org/10.1111/ibi.12963>

Migration diets are not well understood because raptor foraging and hunting are not easy to observe. GGRO banders commonly notice leftovers on the face and feet of Merlins during the banding process (falcons are notoriously messy eaters). This inspired and facilitated a new method for studying what they eat during migration. Do they prefer abundant migrating songbirds, or something else?

In 2015 and 2016, we collected nearly one hundred diet DNA samples from migrating juvenile Merlins by using a Q-tip swab to gather food remains off the falcons' beaks and talons. Ryan Bourbour and Elisha Hull of UC Davis developed this method to examine which prey species Merlins eat during migration. This novel technique provided a non-invasive way to

collect data from birds while we had them in hand for banding.

The results indicated that migrating songbirds are an important source of food for migrating Merlins as over 80% of the prey detected were migratory songbird species. Bourbour detected DNA from 40 distinct prey species ranging in size from Mourning Doves to Golden-crowned Kinglets, and an average of three prey species per individual Merlin. He also reported that males selected smaller prey on average compared to their larger female counterparts. This study is one of the first detailed analyses of songbird prey species consumed by a migrating raptor, and it supports the hypothesis that migrating Merlins in the Pacific Flyway rely on migrating songbirds to support the energetic demands of their flight.

FALL MIGRATION OF RADIO-TAGGED BROAD-WINGED HAWKS (*BUTEO PLATYPTERUS*) IN CALIFORNIA

Capitolo, P. J., Jesus, L. J., Harper, A. B., Fish, A. M., & Hull, A. C. (2020). *Wilson Journal of Ornithology*, 132(1), 15-21. <https://doi.org/10.1676/1559-4491-132.1.15>



A view from a banding blind as Laura Echavez and Margot Bezrutczyk release a just-banded hawk. Photo: Teresa Ely

Broad-winged Hawks are long-distance migrants that are known to concentrate in large numbers on the East Coast of the United States during fall migration. Much less is known about their migration on the West Coast, but we do know that they migrate through the Marin Headlands because we document them every year during fall migration.

The GGRO tracked its first Broadwing in 1994 using radio telemetry. Between 2012 to 2015, volunteers radio-tracked four more Broad-winged Hawks with support of GGRO Research Director Chris Briggs. In total, four of five Broadwings were tracked from the San Francisco Bay Area to the U.S.-Mexico border. From this work, we learned that the hawks used similar, direct flight lines and crossed into Mexico in four to six flight days. This novel study of Broad-winged Hawk migration along the Pacific Raptor Flyway is important in documenting raptor migration corridors and potential roost locations—especially critical given the potential for future large-scale energy development in coastal and central California.



American Kestrels have two solid black facial marks.
Photo: Teresa Ely

MORPHOLOGICAL CHANGES IN AMERICAN KESTRELS (*FALCO SPARVERIUS*) AT CONTINENTAL MIGRATION SITES

Ely, T. E., Briggs, C. W., Hawks, S. E., Kaltenecker, G. S., Evans, D. L., Nicoletti, F. J., Therrien, J., Allen, O., & DeLong, J. P. (2018). *Global Ecology and Conservation*, 15. <https://doi.org/10.1676/1559-4491-132.1.15>

For my master's research, I purposefully chose a question that allowed me to explore the decades of banding and count data from raptor migration sites across the United States. I collaborated with five organizations beyond the GGRO: HawkWatch International, Intermountain Bird Observatory, Cape May Raptor Banding Program, Hawk Ridge Bird Observatory, and Hawk Mountain Sanctuary. My central question was whether the body size of American Kestrels had changed over time. To answer this, I analyzed wing length and weight data on over 15,000 kestrels.

There are many hypotheses for the current American Kestrel population decline (e.g., habitat loss, West Nile virus, and climate change), and I was interested whether these hypotheses also predicted changes in body size. The analysis showed a decrease in kestrel body size at multiple migration sites and an increase in size at one location, while some locations did not show significant change. Overall, kestrels in the eastern United States are 5 grams lighter, and their wing lengths are 5 millimeters shorter than 50 years ago. This is significant for a bird that only weighs 100 grams. Changes in body size, decreasing or increasing, have been linked with changing climate, food availability, and other environmental factors.

This research could not have been possible without the help of hundreds of community scientists across the country.

Thank you to Chris Briggs, Ryan Bourbour, and Allen Fish who reviewed the literature summaries for accuracy. Thank you to Ben Dudek, Eric Lynch, Erin Fisher, Nancy Mori, and Michael Voeltz for spearheading the GGRO literature reviews. Thank you to everyone who collects these valuable data every year and works to answer the bigger questions.

WHAT FUELS MERLIN MIGRATION?

A MERLIN MYSTERY

WE KNOW VERY LITTLE ABOUT THE DIETS OF RAPTORS, LIKE MERLINS, DURING THEIR VERY ENERGETICALLY EXPENSIVE ANNUAL MIGRATIONS.

LIKE MANY FALCONS, MERLINS SPECIALIZE IN HUNTING BIRDS. BUT IF WE CAN'T SEE THEM CATCH THEIR FOOD, HOW DO WE FIGURE OUT WHAT THEY ARE EATING?

IN THE PACIFIC FLYWAY, MERLINS ARE OFTEN CAUGHT AND Banded DURING FALL MIGRATION AT THE GOLDEN GATE RAPTOR OBSERVATORY (GGRO), NEAR THE GOLDEN GATE BRIDGE — THE PERFECT OPPORTUNITY TO STUDY MIGRATING MERLINS!

I WAS SAVING THAT FOR LATER!

SWABBING FOR EVIDENCE

RYAN BOURBOUR OF UC DAVIS AND THE COMMUNITY SCIENTISTS OF GGRO CAREFULLY SWABBED BITS OF LEFTOVER PREY REMAINS STUCK TO THE BEAKS AND TALONS OF 63 MERLINS IN 2015 AND 2016.

THEY TOOK THE SAMPLES BACK TO THE HULL LAB AND THE GENOMIC VARIATION LAB AT UC DAVIS FOR ANALYSIS.



EMMA REGNIER 2023



THE MARVELS OF DNA METABARCODING

WHAT IS DNA METABARCODING?

BECAUSE EVERY SPECIES' DNA IS UNIQUE, IT CAN BE THOUGHT OF AS A BARCODE THAT CAN BE READ BY A SEQUENCING PROGRAM — A BIT LIKE SCANNING A BARCODE AT THE GROCERY STORE.



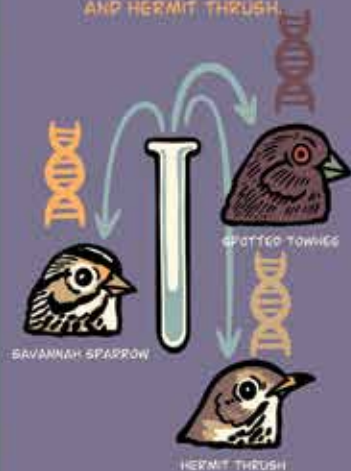
DNA METABARCODING DETECTS MATCHING REGIONS OF DNA BETWEEN THE MYSTERY SAMPLES AND A DATABASE CONTAINING DNA SEQUENCES FROM HUNDREDS OF SPECIES.

BOURBOUR IDENTIFIED DNA FROM 40 DIFFERENT PREY SPECIES.



OVER 80% OF PREY EATEN BY THE MERLINS WERE MIGRATORY SONGBIRDS!

THE SPECIES WITH THE MOST DNA DETECTIONS WERE THE SAVANNAH SPARROW, SPOTTED TOWHEE, AND HERMIT THRUSH.



IRRUPITIVE MIGRANT SONGBIRDS, LIKE RED-BREASTED NUTHATCHES, MADE UP A GREATER PROPORTION OF MERLIN DIETS IN 2015 THAN IN 2016, SUGGESTING THAT MERLINS ADAPT TO HUNT ABUNDANT SPECIES WHEN AVAILABLE.



MALE MERLINS, WHICH ARE SMALLER THAN FEMALES, ATE SMALLER BIRD-PREY ON AVERAGE. ONLY FEMALE MERLINS ATE THE LARGEST PREY: WESTERN MEADOWLARKS, MOURNING DOVES, AND EURASIAN COLLARED-DOVES.



WHAT HAVE WE LEARNED?

RAPTORS, LIKE MERLINS, FOLLOW THEIR FOOD SOUTH DURING THE FALL AND DEPEND ON ROBUST AND HEALTHY SONGBIRD POPULATIONS TO SURVIVE THEIR ENERGETICALLY EXPENSIVE MIGRATIONS EACH YEAR.

UNDERSTANDING THE COMPOSITION OF A MIGRANT RAPTOR'S DIET CAN REVEAL CRYPTIC DIETARY TRENDS WHEN DIRECT FIELD OBSERVATIONS OF PREY CAPTURES AREN'T POSSIBLE.

DNA METABARCODING IS A WAY TO PEEK AT THE HIDDEN LIVES OF BIRDS!



*ADAPTED FROM "FALCON FUEL: METABARCODING REVEALS SONGBIRD PREY SPECIES IN THE DIET OF JUVENILE MERLINS (FALCO COLUMBARIUS) MIGRATING ALONG THE PACIFIC COAST OF WESTERN NORTH AMERICA" BY BOURBOUR ET AL. 2021 (IBIS)

It's Good to Be Back

LORA ROAME

A dark figure flashed quickly over the horizon just north of the Golden Gate Bridge. As my fingers adjusted the focus wheel on my binoculars, the blurry figure came into view. “Adult Peregrine!” I shouted, as our GGRO hawkwatch team turned their attention towards the aerial display near the bridge. On this clear fall day, our team was excited to finally see some birds, since many of our previous bi-weekly gatherings were thwarted by fog and much needed rain. We craned our necks upward watching the drama unfold before us: two adult Peregrine Falcons chasing off a young Peregrine flying too close to their territory. Loud “kek kek kek” calls echoed overhead, the typical sounds of a fussy falcon. We watched the swoops and acrobatic dives as the trio faded to the west, and we resumed scanning the skies for more tiny specks.

Exciting displays like this are one of the many treats I look forward to each time I get out to Hawk Hill, whether it is getting an up-close view of raptor behavior or having a front-row seat to the stream of migrating hawks traveling southward over the iconic bridge. As a GGRO volunteer, I am grateful to be a part of such a large community science program where for one day a week, I get to be a part of the migration story that is written daily here in the Marin Headlands.

2022 was my first season back on Hawk Hill counting raptors since the pandemic, and it was great to be a part of the hawkwatch team again. A few things changed since I last was on the Hill: the teams are smaller, the datasheets are digital, and the shareable snacks and treats are but a distant memory from the pre-COVID-19 days. But I am grateful that the season was possible this year and that the program still

continues to grow. Back in fall 2020, the roster of hawkwatch volunteers was necessarily small and limited, down to only 15 volunteers from the typical 140! Thanks to the hard work from Parks Conservancy and National Park Service staff, the GGRO has slowly been adding more volunteers back into the fold.

Aside from the Peregrine aerial displays, the 2022 season was also characterized by fog, heat waves, gusty winds, and vital rainstorms. Thankfully the season was spared from any bad air quality days caused by wildfires that have been a more common occurrence in recent years in California. Although the 2022 species totals were some of the lowest in the last decade, there was still much excitement to be had on Hawk Hill. Some of those highlights include dark-morph Broad-winged Hawks, Bald Eagles, Merlins, and a flurry of Sharp-shinned and Cooper’s Hawks at the peak of the migration season.



Saturday 2 hawkwatchers, from 12 o'clock: Maryrose Kulick, Mary Malec, Jane Rudebusch, Carmen DeLeon, Krista Fanucchi, Lora Roame, and Michael Voeltz. Photo: Michael Voeltz



Despite the different weather conditions and varying raptor numbers throughout the years, one thing that has always remained consistent for me is the fantastic GGRO community of volunteers and staff that I've come to know as both mentors and friends. When I started with the GGRO as a volunteer hawkwatcher in 2017, I was a fledgling bird enthusiast who thought Red-tailed Hawks were the only raptor species that occurred in California. Actually, there are up to 19 raptor species that can be seen from Hawk Hill. I had so much to learn, and I still do, but I have come a long way since those days thanks to the wonderful training and patient guidance from GGRO staff and volunteer leaders.

Back then, I was a newcomer to the Bay Area, and the GGRO provided a welcoming community of birdwatchers that I could nerd out with. GGRO friends taught me some of the simple things like binocular techniques and how to use a spotting scope, all the way up to the more complex skills of raptor identification, such as how to tell the difference between a Cooper's Hawk and a Sharp-shinned Hawk. Now, as a wildlife biologist and avid naturalist, I spend the majority of my time tracking the ebb and flow of wildlife and birds throughout the Bay Area, and I owe much of my raptor ID skills to what I've learned from the GGRO community.

While hawkwatching has always held a nostalgic place in my heart, I am also a bander with the GGRO and I have been volunteering in both programs concurrently for several seasons. This has given me a unique view of the fall migration each year from two programs which are inherently connected. When counting raptors on Hawk Hill, I feel like I am getting a bigger picture of the migration story. We often get to spot

birds from afar, visually over Mount Tamalpais, and track them as they make a straight flight south over the Golden Gate Bridge and out to the Presidio. Sometimes this flow can be very apparent during the peak season, when you can watch the stream of Cooper's and Sharp-shinned Hawks shooting across the Marin Headlands in waves as if someone has finally turned on the tap.

On the other hand, raptor banding feels smaller in scale. At times, it can feel like a more intimate view into the migration story, as the birds banded in the Marin Headlands are just a small sample size of those that are moving through the landscape. When banding, you collect a long list of information on each individual raptor you get to see up close during a snapshot of their journey. Occasionally, while gathering morphometric data (e.g., tail length, wing length, weight, and presence of ectoparasites), you may get to see what these birds have been hunting by the leftover feather on their beak or fur stuck to their feet, or even sense where they may have been perching by the light smell of pine on their feathers.

Taken together, the data collected from both programs gives a better picture of the full migration story each year, providing additional pieces to the long-term datasets tracking migration numbers and population trends that may help inform conservation efforts.

Overall, coming back to hawkwatch in 2022 after what felt like such a long time was rewarding. This season has been a humble reminder of where I started and how much I have learned along my own journey. While you never quite know what excitement might await you on the hill each season, I can always count on my team and the birds to make it memorable.

The Difference a Year Makes

ALLEN FISH

S

eventy-five volunteers participated in the 2022 GGRO hawkwatch, including 12 apprentice (first-year) volunteers.

Hawkwatchers counted for 411 total hours, sampling the migration for five hours per day, from August 15 to December 4, when conditions allowed. The total time was about 87% of the average hours counted per season from 1992 to 2019 (470 hours), and 73% of the total hours in a full 16-week season.

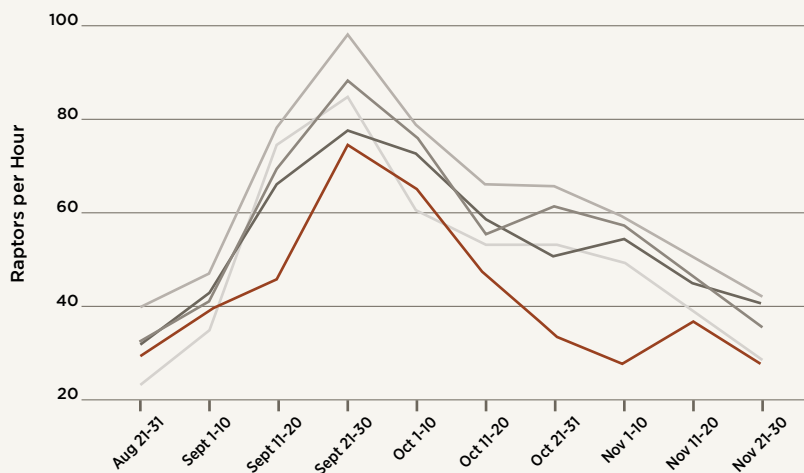
2022 was a recovery year for the GGRO following two years of reduced count efforts due to COVID-19 protocols. We brought our team size up to seven,

sometimes eight people per team. We counted for a full 16-week season, having reduced to 12 weeks in 2021, and even fewer in 2020. Thus, 2022 was a year that can be compared directly with our historical counts. However, by December, we were disappointed that the 2022 raptor sightings were only 76% of an average year. The line graph below shows the low 2022 migration season numbers for all raptor species, compared to previous seven-year averages back to 1992.

Writing about one fall migration season has always felt tenuous to me. Raptor lives can span several years to

ALL RAPTOR SPECIES MIGRATION PROFILE

Based on GGRO hawk counts 1992-2022



Nearly 30 years of GGRO hawkwatch data were compressed into this graph to show the declines we've seen over the past decades. The data are broken into roughly seven-year periods. Visually trace the oldest period (the lightest line), and then the progressively darker lines to the most recent. Then check out the brown 2022 line. We are digging deeper to see which birds are most impacted. Data visualization: Elizabeth Edson.

LEGEND

2022
2015-2021
2006-2014
1995-2005
1992-1998

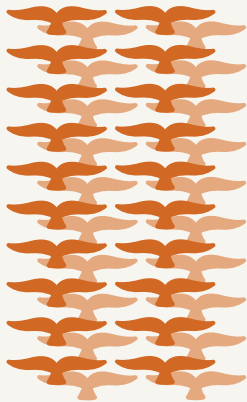
NOTE: Years 2010, 2013, and 2020 are excluded from this analysis.



Hawkwatch dayleader Don Bartling juggles binoculars with a long lens on Hawk Hill. The latter provides us with essential documentation of some of the rare species, plumages, or even flight behaviors. Photo: Laura Echavez

AVERAGE SIGHTINGS FOR RAPTOR SPECIES OBSERVED BY THE GGRO

NOTE: Visual representation only.



COMMON Average annual sightings in the 1000s

Turkey Vulture
Sharp-shinned Hawk
Cooper's Hawk
Red-tailed Hawk



UNCOMMON Average annual sightings in the 100s

Northern Harrier
Red-shouldered Hawk
Broad-winged Hawk
American Kestrel
Merlin
Peregrine Falcon



OCCASIONAL Average annual sightings in the 10s

Osprey
White-tailed Kite
Bald Eagle
Ferruginous Hawk
Golden Eagle



RARE Average annual sightings in the 1s

Northern Goshawk
Swainson's Hawk
Rough-legged Hawk
Prairie Falcon

several decades. Population trends take a while to show themselves. In fact, we often speak in terms of three-year or five-year averages. But the 2022 raptor migration was different and significant—let's explore the numbers to find out why.

In most years (dating back to 1972), 19 diurnal raptors appear in the fall migration at the Golden Gate. These

19 species do not occur in equal numbers, and over the four-decade history of the GGRO, we have gained a pretty good idea of how to classify their abundance relative to one another. The table above shows the order of magnitude of the average annual sightings of each species. This serves as a benchmark for detecting when a change might be occurring.

All four of the most common species declined in number and rate of migration (raptors per hour or RPH), for the first time since we started the GGRO hawkwatch in 1986. Red-tailed Hawks declined by 17% of their previous 10-year average rate, but for Sharp-shinned and Cooper's Hawks the drops were more dramatic (see table). We tallied 2000 fewer Cooper's and Sharp-shinned Hawks in 2022 than the 5000+ sightings in an average year. We have seen counts this low in the past, so we know that accipiter numbers can bounce back. We just haven't seen a simultaneous drop of our four bread-and-butter species like this before.

Counts for eight of the 10 most numerous species (common and uncommon) declined.

One species, Peregrine Falcon, remained static in 2022, and Broad-winged Hawks doubled in migration rate from their average. There is no clear reason right now for the Broadwing increase, but we are investigating the possibility of broad climate change-related hemispheric weather patterns, since this is a truly hemispheric migrating species, traveling from Canada as far south as Argentina.

We recorded declines of greater than 10% for 13 of the 19 species. Of the remaining six, Bald Eagles and Broad-winged Hawks had banner years, while Swainson's Hawks and Prairie Falcons held at average levels. We didn't record any Northern Goshawks in 2022, which is close to this rare species' 10-year average of one per season.

Of the 11 species that had negative trends in 2022, our greatest concerns are Northern Harrier (-69% of their 10-year average), White-tailed Kite (-80%), American Kestrels (-61%), and Merlins (-49%). American Kestrels are already on North American conservation alert lists, but Merlins did increase at the Golden Gate from the 1970s through about 2006 when they hit a plateau. The Merlin plateau stayed steady through 2018 but has declined since then with 2022 being the biggest dip so far.



Erica Harris packs up a scope at the end of a hawkwatch day.
Photo: Laura Echávez

The 2022 count declines are exactly why it is critical to have an annual count of the fall raptor migration at the Golden Gate whenever possible. Losing a year due to COVID-19, or to events like road repairs in 2010, the federal budget shutdown of 2013, and poor air quality following the terrible Sonoma fires of 2017, underscores the value a single year of data makes.

We just haven't seen a simultaneous drop of our four bread-and-butter species like this before.

While we can still track a decades-long species trend even while missing a year or two per decade, we lose sensitivity that helps us figure out cause and effect. We may never learn the cause of a trend such as the reduction of kites in 2022. But if we have annual GGRO migration counts, plus nesting and wintering counts for kites, plus available weather data, plus mouse counts, we may better understand why the 80% decline happened in 2022.

We do need more monitoring of more species to be able to paint that kind of picture—community science and public participation in our national parks would be essential to expanding our efforts. For now, great thanks to the 75 GGRO volunteer hawkwatchers for demonstrating how invaluable such a partnership can be moving forward.

RAPTOR SIGHTINGS - MARIN HEADLANDS

| | COUNT 2022 | RATE 2022 | AVG RATE 2008-2019* | % CHANGE IN RATE |
|---------------------|---------------|--------------|------------------------|---------------------------------|
| | sightings | raptors/hr | raptors/hr | 2022 compared to 10-year avg |
| Turkey Vulture | 5974 | 14.54 | 16.41 | -11% |
| Osprey | 41 | 0.10 | 0.16 | -38% |
| White-tailed Kite | 14 | 0.03 | 0.15 | -80% |
| Bald Eagle | 20 | 0.05 | 0.02 | +150% |
| Northern Harrier | 191 | 0.37 | 1.19 | -69% |
| Sharp-shinned Hawk | 1905 | 4.64 | 7.61 | -39% |
| Cooper's Hawk | 891 | 2.17 | 5.00 | -57% |
| Northern Goshawk | 0 | 0 | <0.01 | N/A |
| Red-shouldered Hawk | 189 | 0.46 | 1.00 | -54% |
| Broad-winged Hawk | 558 | 1.36 | 0.68 | +100% |
| Swainson's Hawk | 8 | 0.02 | 0.02 | 0% |
| Red-tailed Hawk | 6195 | 15.08 | 18.11 | -17% |
| Ferruginous Hawk | 11 | 0.03 | 0.07 | -57% |
| Rough-legged Hawk | 1 | <0.01 | 0.01 | N/A |
| Golden Eagle | 8 | 0.02 | 0.04 | -50% |
| American Kestrel | 115 | 0.28 | 0.72 | -61% |
| Merlin | 87 | 0.21 | 0.41 | -49% |
| Peregrine Falcon | 209 | 0.51 | 0.50 | 0% |
| Prairie Falcon | 4 | 0.01 | 0.01 | 0% |
| Unidentified | 424 | 1.03 | 2.17 | -53% |
| Total | 16,845 | 41.01 | 54.30 | -25% |
| Hours Counted | 411 | | 400 | |

Data compiled by Elizabeth Edson and Allen Fish. If you would like to use these data, please contact ggro@parksconservancy.org.
 *Counts from 2010, 2013, and 2020-21 not used due to gaps in the data.

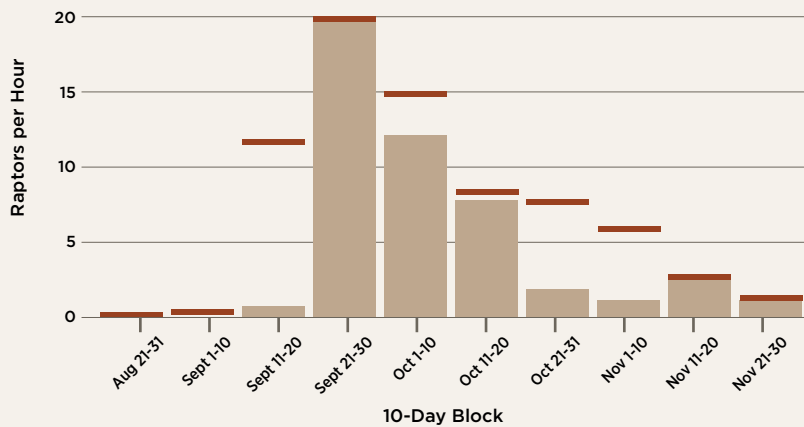
Comparison: 2022 Migration Rates to 10-year Average Rates

ALLEN FISH

The graphs below compare the 2022 migration rates to the 10-year average rates for the four most numerous raptor species seen at the Golden Gate: Sharp-shinned and Cooper's Hawks, Red-tailed

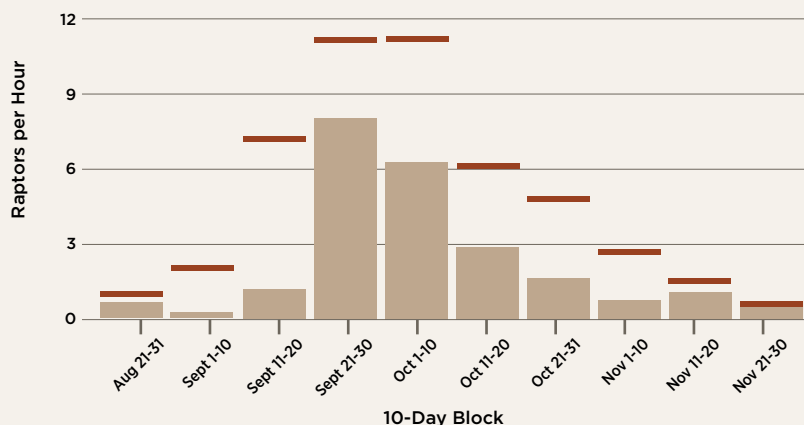
Hawks, and Turkey Vultures. These four account for roughly 87% of the sightings in a single autumn. Additionally, these four largely define how we perceive the magnitude of the migration each year.

SHARP-SHINNED HAWK



The 2022 flight was defined by the lack of Sharp-shinned Hawk sightings in mid-September. For that middle week of September, the average flight is 7 Sharpshins per hour over Hawk Hill. In 2022, we barely touched one hawk per hour. By late September 2022, the Sharpshin peak was solid, just matching an average year, but by late October their rate fell off again.

COOPER'S HAWK



Although the mid-September Cooper's Hawk numbers, like the Sharpie numbers, were also meager, the gap is not as great since the Cooper's peak is not as high as Sharp-shinned Hawks. The 2022 problem was that the Cooper's Hawk rates never got close to their average, peaking at 7.5 Rph in late September as opposed to 11 Rph in an average year. The whole Cooper's season floundered.

LEGEND
 — 10-Year Mean
 ■ 2022

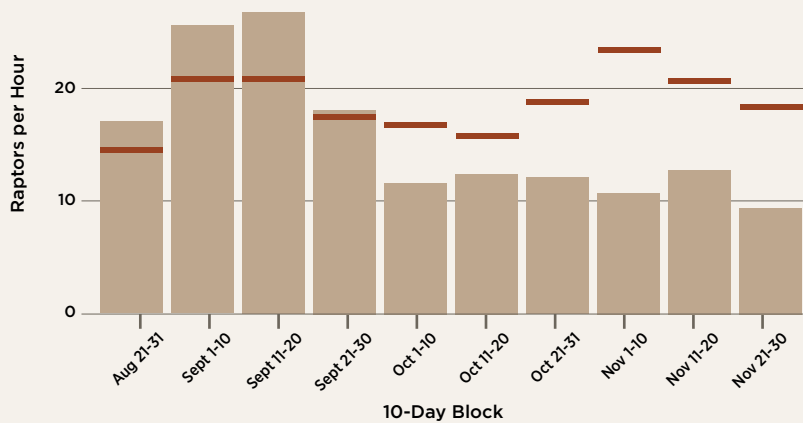
HAWKWATCH 2022

We made these graphs to specifically show the phases within a fall migration for each species. For accipiters (Sharp-shinned and Cooper's Hawks), we see a quick and dramatic rise to a late September peak, followed by a shallow decline, almost a plateau of strong migration, until mid-November when there's a more dramatic drop. For Red-tailed Hawks and Turkey Vultures, the migration is more constant through the fall, with a noticeable peak in vultures in early October, and two peaks for Redtails,

mid-September and mid-November. Also notice the difference in the vertical axes between these species—the magnitude of change this year is different for each.

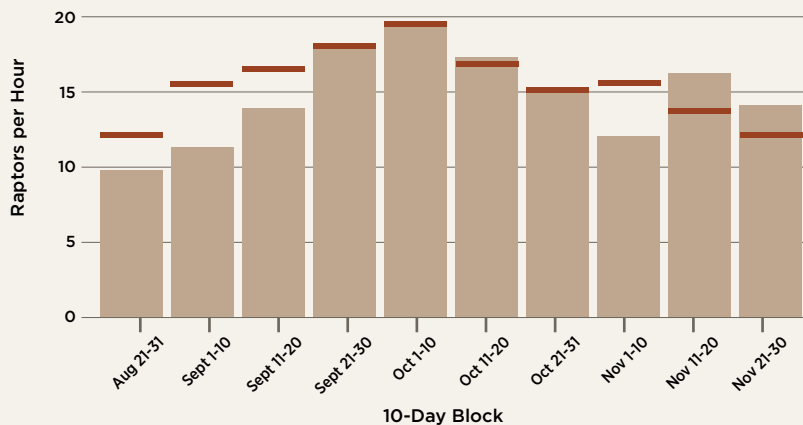
We have dropped 2010, 2013, and 2020 from all the 10-year averages, since the counts from those years were affected by unforeseen circumstances.

RED-TAILED HAWK



Although the bimodal peaks for Red-tailed Hawk migration look subtle here compared to the accipiter peaks, most of the 40+ years of our counts show this pattern. Elisha Hull of UC Davis analyzed the two phases of the Redtail migration in the mid-2000s using GGRO counts, band recoveries, and genetics, determining that the peaks reflect predominantly different Redtail nesting populations and locations. This makes the 2022 story more powerful as it appears that the early Redtails had a banner year, while the late Redtails dropped from 30-50% of average.

TURKEY VULTURE



Like Red-tailed Hawks, Turkey Vultures maintain high numbers throughout the fall migration season at the Marin Headlands. And just as for Redtails, some of them remain local throughout the year, something we know from Teresa Ely's pioneering satellite-tracking studies of San Francisco Bay vulture movements. The 2022 vulture flight seemed close to its previous 10-year average, but with some lapses in early September and early November.

LEGEND
 — 10-Year Mean
 ■ 2022

Data visualization:
 Elizabeth Edson

Learning & Growing

MICHAEL VOELTZ

My first day of volunteering with the GGRO was not with the banding program that I've grown so attached to these last five years. It was instead with the 2017 hawkwatch program. I'll never forget hawkwatch manager Step Wilson joining me on my very first shift and asking, "What bird is that way out in front of you?" I squinted at the bird, and hesitantly answered, "Red-tailed Hawk?" Step smiled and replied, "Raven!" and then gave me the low-down on how to tell the two species at a distance. Over and over at the GGRO, I have been taught and encouraged by someone whose greatest interest was to help me learn. This experience has been even more impactful in my work as a GGRO bander.

This investment in education is one of the profound things that GGRO staff and volunteers do for one another. We have two programs, hawkwatch and banding. Each is dedicated to different tasks, both requiring thousands of hours of collective work annually and multitudes of more granular learning. You can imagine my surprise when, having joined the banding program, I got my first glimpse of the skills and knowledge I was expected to learn. I may have known my birds by this point, but I still had so much to learn about banding!

The protocols followed by the folks within the banding program can feel daunting, but they are necessary for raptor safety as well as handler safety. Broadly, I'd liken them to a vast flowchart of scenarios, a collection of "if-then" statements that account for just about anything that could happen during our field work. If a female Cooper's Hawk flies by, then consider this. If an American Kestrel, then try this. What if it gets too hot? What if it's raining? What tools do you use for each task? So on and so forth. Not to mention the skills requiring dexterity that can simply be built only with time and practice.

Altogether, you've got yourself quite the amount of stuff to take in!

And yet, I had the envious position to have learned from kind and patient instructors. This year, more than any other, it struck me that I've been the beneficiary of six years of instruction from some of the most knowledgeable and kind people I know.

In 2022, for the first time since I joined the banding program, the GGRO took on new banding volunteers. Suddenly, I realized I was now in a position to help others in the same way that experienced volunteers had helped me for the past half-decade. 2022 was my transitional year, not just as a bander and data collector, but as a supporter of new volunteers. I still have much to learn about raptors, but I hope I lent the same support to the apprentice banders who were struggling with a common mistake like "Redtail or Raven."



We take around seven linear measurements on each hawk, like this Cooper's, that provide us with a snapshot of one species' size across time—something that has been shown to change with climate change. Photo: Laura Echavez

Success Despite an Absence of Cooper's Hawks

TERESA ELY

I look forward to the start of every fall, in part because none of us can predict what will happen during the raptor migration season. The migration will happen with or without us. In 2022, there was a familiar feeling of excitement in the air—a feeling I had not felt for a while. This was missing in 2020, and not because the banding season shut down due to COVID-19. It was also missing when we resumed banding in 2021. This unique excitement comes from welcoming a new cohort of apprentice volunteer banders into our raptor banding community.

We added 12 new banding apprentices into the banding program in 2022, the first set of new banding volunteers since 2018! An apprentice recruitment year not only brings a lot of energy, but also can bring challenges (in a good way).

The long-term GGRO banding volunteers, whether they know it or not, radiate renewed energy and love for the program in an apprentice year. They are excited to share their passion, knowledge, and experiences with the new cohort, who are just as excited to learn from them. Since we have not brought in apprentices for four years, we have not been in the mindset to train new people. In 2022, we had to dust off the cobwebs and remember how to train someone to hold the banding pliers just right, or how to hold the ruler to take a tail feather measurement. Training others on specific tasks is a skill itself that needs to be refreshed.

Watching the teams of experienced banders welcome a set of new apprentices, and share their love for raptors and their commitment to conservation, is a very special aspect of GGRO community science. It is unique and unparalleled, volunteers teaching volunteers.



Banders study tail patterns on female American Kestrels to assess age. Photo: Teresa Ely

Staff and volunteers were optimistic in early 2022 because we felt like we were finally moving forward and healing from the impacts of the 2020 banding shutdown. However, a Fort Cronkhite building maintenance problem quickly turned that optimism into anxiety because it prevented us from accessing the storage area where our four banding blinds were located. We cannot operate a banding station without a blind to work in, and as a result, we needed to rebuild the blinds from scratch.

Luckily, a small, dedicated team of GGRO volunteers got to work and built three blinds in just three months! This was a massive accomplishment that demonstrated the motivation and commitment of the volunteers to our long-term migration monitoring and data collection.

BANDING 2022



Laura Echávez gets a selfie of the hardworking pre-banding work crew. From left, behind Laura: our truck The Taco, Oliver Chesley, Ben Dudek, Robyn Boothby, Carmen DeLeon, Diane Horn, and Patrick Coughlin.

Overall, in 2022 we operated a total of three banding stations and banded 601 raptors. We were fortunate that the 2022 fire season did not produce big smoke days, but even still, the total raptors banded was one of the lowest totals in the past 20 years. Part of that was due to using three blinds, not four as we did in the pre-COVID-19 years. There can be many other reasons for shifts in banding totals, so to remove some bias created by the GGRO, I looked at the banding totals without the fourth station when evaluating the banding trends.

Sharp-shinned Hawk banding numbers were below average in 2020, but not the lowest we have experienced. In 2019 ($n=133$), 2000 ($n=200$), and in some years in the 1990s, we banded fewer Sharpies, but these numbers are not as alarming as the drop in Cooper's Hawk numbers banded this year. This was the lowest Cooper's Hawk season since 1990, when numbers dipped below 200. Could this be a result of the years of drought and numerous California fires? Or something else? We hope to see an increase in their numbers in 2023 after last winter's unprecedented rain.

We continued to see a decline in American Kestrels in 2022, but we hope that part of this was due to starting our fieldwork two weeks later, which is when we often see a good number of kestrels. We also had fewer Merlins in 2022, but this could be due in part to the loss of the fourth blind, a blind that will trap up to 30% of the total Merlins in a single season.

In all, the 2022 GGRO banding season was full of accomplishments by staff and volunteers, and we all stepped back into the cycle of recruiting and training apprentices, something that energized us all and is necessary for the GGRO's future health. And while we did not band record-breaking numbers of hawks, we did collect meaningful data on each individual raptor safely. As disappointing as a slow day at a banding station can be, this is exactly why we study migration—to monitor changes in raptor numbers. We observe peaks and valleys, highs and lows, and fluctuations not just within a single season, but from year to year, and decade to decade.

RAPTORS BANDED MARIN HEADLANDS

| | 2022* (3 blinds) | 10-YEAR AVERAGE 2011-2021 (3 blinds) | 10-YEAR AVERAGE 2011-2021** (4 blinds) | TOTAL ALL BLINDS ALL YEARS 1983-2022 |
|---------------------|---------------------|---|---|---|
| Northern Harrier | 1 | 5.8 | 8.2 | 337 |
| Sharp-shinned Hawk | 238 | 304.5 | 386.4 | 13,664 |
| Cooper's Hawk | 197 | 410 | 507.7 | 17,212 |
| Northern Goshawk | 0 | 0.2 | 0.2 | 7 |
| Red-shouldered Hawk | 12 | 17.2 | 20 | 512 |
| Broad-winged Hawk | 1 | 2.2 | 2.8 | 48 |
| Swainson's Hawk | 0 | 0.2 | 0.2 | 11 |
| Red-tailed Hawk | 127 | 229.1 | 264.5 | 10,769 |
| Ferruginous Hawk | 0 | 0.2 | 0.2 | 4 |
| Rough-legged Hawk | 0 | 0.2 | 0.2 | 7 |
| American Kestrel | 10 | 23.7 | 35.3 | 1,482 |
| Merlin | 8 | 25.5 | 33.4 | 864 |
| Peregrine Falcon | 7 | 3.9 | 5.3 | 136 |
| Prairie Falcon | 0 | 1.1 | 1.6 | 51 |
| Total | 601 | 1023.6 | 1266 | 45,104 |

*In 2022, the GGRO had three banding stations in operation.

**GGRO banding was suspended during the first COVID-19 year in 2020 and is not included in the 10-year average. This 10-year average is based on a full season (mid-August through December) with four blinds.

Banding data compiled by Teresa Ely. If you would like to use the data above, please write Teresa at ggro@parksconservancy.org.

Thirty Years of Sleuthing Band Recoveries

MARION WEEKS



Marion Weeks. Photo: Courtesy of Marion Weeks

EDITOR'S NOTE:

Marion Weeks started banding at the GGRO in 1992. As a lead nurse at a research hospital, it was a natural fit to become the volunteer who checked and re-checked the band recovery data that we received from the USGS Bird Banding Lab. After all, each band recovery account was a case study that could either be placed in a binder just as received or checked for correctness and deeper insights. Who found the band? What was their experience of the bird encounter? Did dates, locations, and circumstances all line up?

Mostly they did, but sometimes there were inaccuracies. It was Marion who took the time to do this intensive data proofing for us, and thus brought the true GGRO band recovery stories full circle.

We celebrate here Marion's pioneering work for the GGRO for more than three decades. She made human connections with our band finders and kept excellent and corrected data on the Pacific Raptor Flyway. Thank you, Marion.

"All raptors have a powerful wild presence. To be near any of them is a very deep spiritual, psychological, religious experience. When we're around raptors, who live in a different, wild world, we get that lost something back—we reconnect to something deep. We get a renewal."

BUZZ HULL, GGRO RESEARCH DIRECTOR EMERITUS

Buzz's words resonate with me, and I am sure they do for all the GGRO band recovery team members over the years, as well as band finders and wildlife rehabilitators.

Talking to the band finder or observer not only gives us a story about a raptor's life, but also provides details that can correct or refine the data reported to us by the USGS Bird Banding Laboratory, such as the codes for circumstances of recovery, sometimes location, frequently current status of the bird, and even, rarely, the species. In this way, the band finders partner with us in community science.

While most of our recoveries are of raptors that have been observed or found downed or dead in their first year of life, we documented a few that have been found from 15 to 25 years post-banding. Also impressive is where the banded hawks have flown—Alaska, British Columbia, Washington, Oregon, Idaho, Nevada, Arizona, Baja California, and mainland Mexico. Their migration journeys have been awe-inspiring for me.

Band recovery research takes time, persistence, patience, and occasional investigative skills. But the rewards are wonder, sadness, admiration, inspiration, and amazement for raptors, for their finders and their caregivers. GGRO banding and band recovery data collection work gave me purpose and has enriched and changed my life forever.

Here are a few of my most memorable recoveries from the past three decades. They reveal fascinating details not only about the lives of the hawks, but also about the lives of the people who encountered them.

Recovery 148 Two hawks, a juvenile and an adult Redtail, were found dead, tightly locked to each other beneath some powerlines. The hawks were difficult to separate when they were examined at the California Raptor Center at UC Davis. The postmortem exam revealed that the depth of the wounds might not have been deadly to the juvenile hawk, but the effect of the electrocution increased the depth of all the wounds by muscle contraction and killed both birds.

Recovery 468 While hiking at Point Reyes National Seashore, the finder came across a dead Cooper's Hawk "in perfect condition." She took it to the Ranger Station at Bear Valley and requested that an autopsy be performed and that she be notified of the results. It had "a parasitic worm in its intestinal tract that caused it to starve to death."

Recovery 1104 A paramedic stopped on a rural two-lane highway to investigate a "dead Red-tailed Hawk" lying on the center line, but when he picked it up, "It gave me a handshake. I got it in my right index finger—very sharp talons." Unfortunately, it was dead upon arrival at the wildlife rescue center.

Recovery 1165 A Red-tailed Hawk was found dead under a power pole with no evidence of electrocution. The wildlife rehabilitator reported: "electrocution injuries can take days to show up. It takes time for the cooked tissue to look as dead as it really is." She recalled a Golden Eagle found standing, unable to fly for some days that didn't show signs for nearly a week. The necropsy revealed its organs were dying from being electrocuted.

Recovery 1567 A mother reported to me that her four-year-old son found two bones, one with a Sharp-shinned Hawk band on it. She said that he had become interested in bones and skeletons during Halloween when he was two, and now wants to become an archeologist. A bit after the band recovery event, he asked his mother, "Can we go on an adventure to find more bones?"

Recovery 1568 A Red-tailed Hawk, banded in 2004, was hit by a car in early July 2019, and picked up by the late Brad Marsh of Santa Rosa Bird Rescue Center (SRBC). The SRBC veterinarian's assessment was: "No fractures, but spinal shock, trauma with central nervous system issues, unable to stand or self-feed." This male Redtail was one of a local pair observed for the past few years. They had fledged several broods in the past, but not in 2019. Brad released the Redtail in early August 2019 at the same place it was rescued. He remembered: "I could hear both joy and awe as the Redtail called out and then the mate flew out and flew with him." The reunion was so moving to him.

EDITOR'S NOTE: This banded Red-tailed Hawk had also been radio-tracked from the Marin Headlands by GGRO volunteers in fall 2004. Over the course of a week, it flew from the Marin Headlands across the Golden Gate, south to Colma, north back to Marin County, and then continued north to Two Rock near Petaluma, its last known location that year.

Recovery 1651 A Sharp-shinned Hawk was found dead on a sundeck at a North Vancouver, BC, home during the COVID-19 pandemic by a mother and two sons that were being home-schooled. She encouraged them to write the story in their journals, and one son turned it into a class project.

Band Recoveries & Encounters

MARION WEEKS & CARMEN DELEON

These moments captured by everyday folks taking the time to be curious about the natural world contribute to our ever-growing understanding of raptor survival. Among the realities of the hawks' migration pathways through both open space and urban areas, we learn clues about the challenges they face and overcome along the way, and at the end of their lives.

Over a third of the encounters reported this past year are of a live raptor where a photo or visual observation of a color band was shared, rather than a band or carcass recovery. We continue to be amazed at the band recoveries that get back to us via social media, thanks to the ease of taking and sharing photos with the smartphone cameras many of us have within a pocket's reach. Our ongoing efforts to apply both metal and color leg bands make it possible to identify a bird with as few details as a color, letter, and two numerical digits. Even partial views of the color band can provide enough information to match up the numbers with a known hawk. Importantly, these views are more easily obtainable without specialized optics than the nine-digit sequence found on a metal band.

Though this section of the *Pacific Raptor* might be thought of largely as raptor obituaries, we hope that a combination of tech-driven information exchange along with color bands will continue increasing our reports of day-to-day raptor life. As you read the following stories, imagine the life of the hawk told through the band finder's experience, and consider the interconnectedness of the spaces that we share.

1543-B Juvenile male Red-tailed Hawk metal and color banded 9/11/18 by Teresa Ely; found 5/29/22 decomposed with its leg in a narrow split of a fallen tree trunk on an undeveloped property in El Sobrante Hills, Contra Costa Co., CA; reported by Edward Knapp.

1714 Juvenile male Red-tailed Hawk banded 11/17/21 by Teresa Ely; found 12/2/21 with feather lice and low body weight in Moss Landing, Monterey Co., CA; brought to SPCA of Monterey County where it was fed and placed in flight conditioning before release on 12/18/21; reported by Mary Billington.

1715 Juvenile female Cooper's Hawk banded 10/8/21 by Jennifer Brown; found 10/22/21 dead under a pear tree in a yard in Santa Rosa, Sonoma Co., CA; reported by Mary Capitelli.

1717 Juvenile male Red-tailed Hawk metal and color banded 8/11/21 by Teresa Ely; photographed 10/23/21 eating a vole on the ground in Buena Vista Park, San Francisco, CA; reported by GGRO Bander Robert Martin.



Encounter 1717. Photo: Robert Martin

1721 Juvenile female Red-tailed Hawk metal and color banded 8/16/19 by Misty Cain; photographed 1/8/22 perched in a tree at Yosemite Slough Park, San Francisco, CA; reported by Jaques Fortier.



Encounter 1721. Photo: Jaques Fortier

1723 Juvenile female Sharp-shinned Hawk banded 9/17/21 by Marc Blumberg; found 12/23/21 with the report that the “small eagle smashed into a window of the house and died” in Todos Santos, Baja California Sur, Mexico; reported by Christian Maroselli.

1735 Second-year male Red-tailed Hawk metal and color banded 10/27/18 by Anastasia Ennis; photographed 3/13/21 flying and displaying courtship behavior in Sebastopol, Sonoma Co., CA; reported by Nick Dunlop.

1736 Juvenile male Cooper’s Hawk banded 9/26/21 by Eric Jepsen; found 11/21/21 with an open fracture to the left wing and brought to the Wildlife Center of Silicon Valley in San Jose, Santa Clara Co., CA; humanely euthanized after examination; reported by Evan Tobin.

1737 Juvenile male Red-tailed Hawk metal and color banded 9/28/21 by Allison Levin; sighted 3/26/22 eating a small mammal on top of a pole alongside the

Great Highway in San Francisco, CA; reported by Dawna Raven Sky Zimbalist.

1738-A, B Juvenile male Cooper’s Hawk banded 9/21/06 by Maggie Edwards; sighted 12/27/21 and photographed 12/28/21 perched in a tree in the Sonora Desert of Hermosillo, Sonora, Mexico; reported by Malcon Bechelani.

1739 Juvenile female Red-tailed Hawk metal and color banded 9/9/21 by Ashley Santiago; found 2/15/22 dead between the road and a fence along Highway 1 by Point Mugu, Ventura Co., CA; reported by Martin Ruane.

1740 Juvenile female Cooper’s Hawk banded 9/21/18 by Eddie Bartley; found 12/26/21 with security footage showing that the hawk hit a home window in Shelton, Mason Co., WA; treated by Raindancer Wild Bird Rescue and released 1/8/21; reported by Stephanie Estrella.

1741 Juvenile female Cooper’s Hawk banded 9/22/19 by Ben Dudek; found 3/8/22 dead in the driveway of a home in Clearlake Oaks, Lake Co., CA; reported by Tina Boggess.

1742 Juvenile male Red-tailed Hawk metal and color banded 9/3/21 by Mike Armer; photographed 11/17/21 from Hawk Hill, Marin Co., CA; reported by GGRO hawkwatcher John Davis.

1743 Juvenile female Red-tailed Hawk banded 9/17/21 by Mike Armer; observed 3/15/22 hopping between runways and the airfield at Oakland International Airport, Alameda Co., CA; depredated for the safety of plane passengers and personnel for failing to disperse despite multiple attempts; reported by Joe Faryniarz.

1744 Juvenile female Cooper’s Hawk banded 10/8/21 by Marc Blumberg; picked up 10/20/21 by Orange County Animal Control and brought to Serrano Animal & Bird Hospital in Lake Forest, Orange Co., CA; the bird died overnight; reported by Scott Weldy.

1745 Juvenile male Red-tailed Hawk metal and color banded 11/14/21 by Ashley Santiago; found 2/23/22 dead on the side of a levee at a duck club in Suisun Marsh, Benicia, Solano Co., CA; reported by Aurora Wellise.

1746 Juvenile female Red-tailed Hawk metal and color banded 10/13/21 by Craig Nikitas; found 2/2/22 dead on a road in La Colonia Benito Juarez, Baja California Sur, Mexico; reported by Cesar Sosa.

1747 Juvenile male Red-tailed Hawk metal and color banded 10/18/21 by Nancy Mori; photographed twice in San Francisco, CA:

- 6/6/22 perched on a landing outside a home window; reported by Jane Super;
- 7/20/22 on a lamppost eating a Rock Pigeon in a Capp St. parking lot; reported by Glenn Nevill.

1748 Juvenile Red-tailed Hawk banded 10/8/03 by Buzz Hull; this 19-year-old bird was rescued, rehabilitated, and released to spend its final months in Golden Gate Park:

- 5/17/22 found unable to fly on a trail by Mallard Lake in Golden Gate Park, San Francisco, CA; brought to WildCare where radiographs showed a broken toe; examination found emaciation with nearly clear talons and one white wing feather; without reaching a definitive cause of the initial ataxia, the bird recovered and became well enough to transfer to a flight mew at The Bird Rescue Center of Sonoma County where it stayed until passing live prey catching tests, reported by Craig Nikitas, GGRO Bander and Founder/Operator of Bay Raptor Rescue;
- 6/24/22 released to Lindley Meadow in Golden Gate Park by Nikitas where he watched the hawk fly across the meadow and perch in a Monterey cypress; another Redtail cried out and flew over to perch in the same tree;



Encounter 1748. Photo: Craig Nikitas

- 11/26/22 carcass found with missing head near Metson Lake in Golden Gate Park; reported by James Addison.

1749 Juvenile female Red-tailed Hawk banded 9/24/21 by Teresa Ely:

- 5/8/22 photographed hunting California ground squirrels in a closed baseball field at Flood Park, Menlo Park, San Mateo Co., CA; reported by Kenneth Lajoie;
- 12/4/22 found dead with no apparent injury at Flood Park; reported by Sid Trujillo.

1750 Juvenile female Red-tailed Hawk metal and color banded 11/10/21 by Susana Czuchra; found 4/19/22 dead with no apparent injury at Pierce College Farm, Woodland Hills, Los Angeles Co., CA; reported by Marcie Sakadijan.



Encounter 1747. Photo: Glenn Nevill

BANDING 2022

1751 Juvenile female Red-tailed Hawk banded 11/21/21 by Ryan Bourbour; found 3/4/22 trapped in a food waste bin at Marin Sanitary Service, San Rafael, Marin Co., CA; emaciated bird was brought to WildCare where it died shortly after, and necropsy revealed widespread aspergillosis; reported by Jacqueline Lewis.

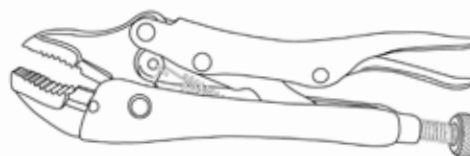
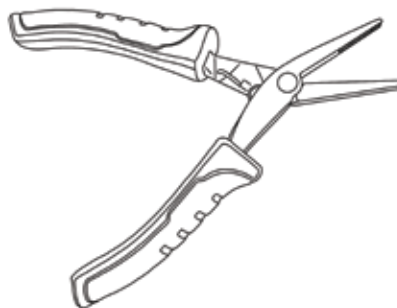
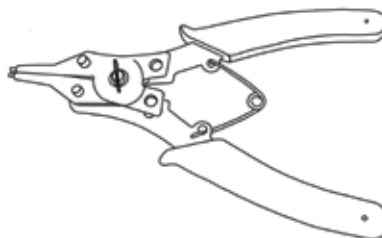
1752 Juvenile male Cooper's Hawk banded 10/4/21 by Kaela Schnitzler; found 5/5/22 partially decomposed in an unincorporated area of San Benito Co., CA; reported by Julie Baldocchi.

1753 Juvenile male Cooper's Hawk banded 9/29/19 by Lynn Bantley; found 9/20/22 in a high-sided water trough alongside a mouse with a similar level of decomposition in an elk hunting area of Chemult, Klamath Co., OR; reported by Brandon Tucker.

1754 Juvenile male Red-tailed Hawk banded 8/27/21 by Mike Armer; photographed 9/30/22 hunting and perching on a road sign at Pillar Point Airport in Half Moon Bay, San Mateo Co., CA; reported by GGRO Bander Cricket Raspet.



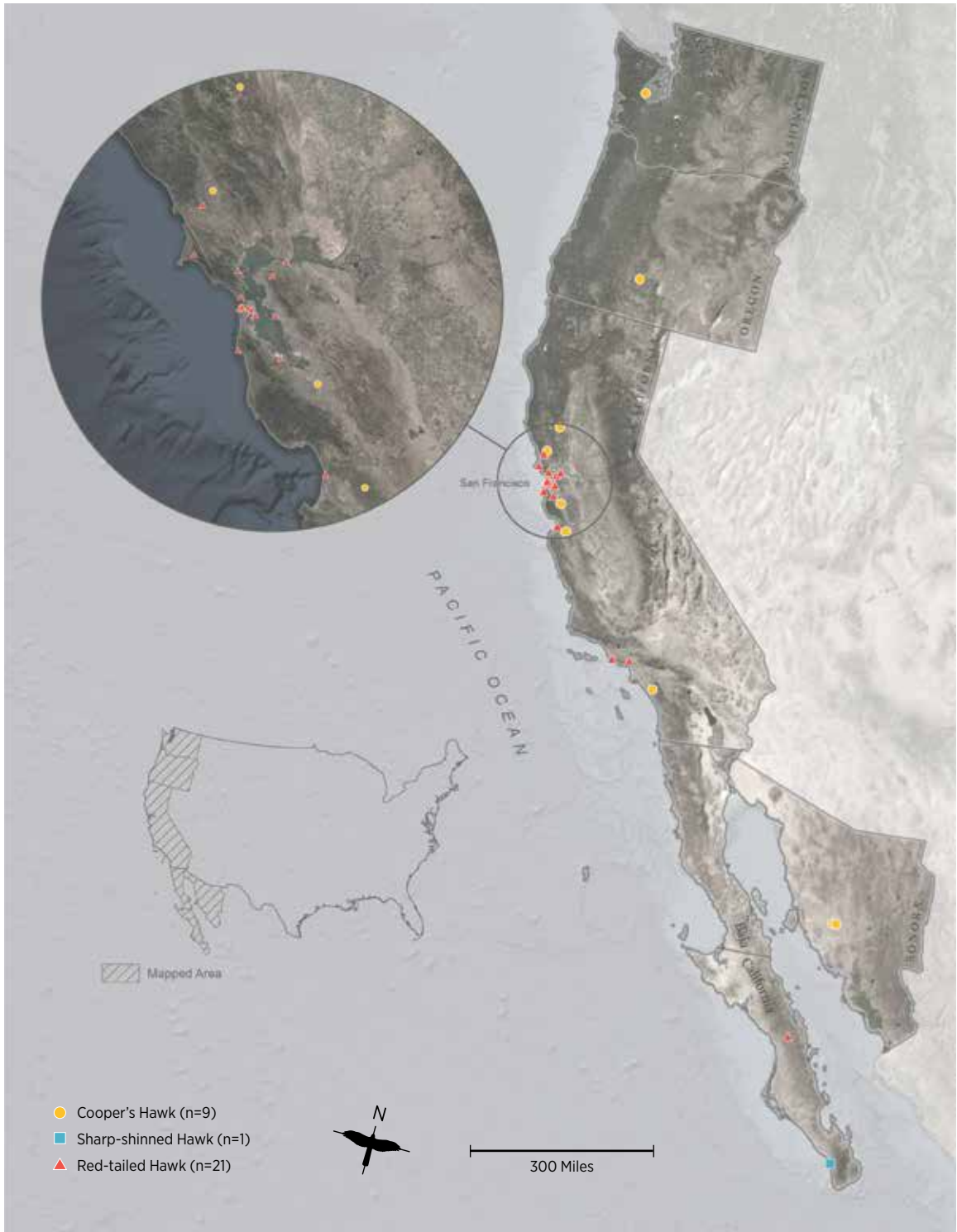
Encounter 1754. Photo: Cricket Raspet



Banding tools illustration: Lora Roame

BANDING 2022

BAND RECOVERIES/ENCOUNTERS 2021-22



Snapshots of a Red-tailed Hawk's Life

CARMEN DELEON, JOHN DAVIS,
CRICKET RASPET & SIOBHAN RUCK

For the 45,000+ raptors that have been banded at the GGRO since 1983, there are just over 1750 encounter and recovery reports. It is rare to encounter any single banded bird once, let alone four times during a 17-year life, as was the case for Red-tailed Hawk 1387-75928. In 2003, GGRO volunteers banded this juvenile Red-tailed Hawk in the Marin Headlands, a hawk that subsequently foraged the coastal grasslands of Half Moon Bay in San Mateo County, CA, 25 miles south of the Golden Gate, and survived an amazing 17 years against the odds. Gathered here are the stories from the four keen observers who crossed paths with Red-tailed Hawk 1387-75928 over a span of two decades.

AUGUST 29, 2003: GGRO Bander Theresa Rettinghouse bands Red-tailed Hawk 1387-75928

The first encounter with the Red-tailed Hawk began on a late summer day with thick fog blanketing the hills. A slight wind ushered the mist along as the scrubland and neighboring ridgelines came in and out of view. Three banders huddled patiently as they scanned the sky for hawks and felt for a change in the wind that could bring some sun. By day's end, they left a few short notes in the GGRO Banders' Journal:

Banded one very mellow RT [Red-tailed Hawk]. A Coop [Cooper's Hawk] got away. Fog in the morning. It was sunny for 2 hours then foggy and windy.

DIAN LANGLOIS, JOHN CRANE, THERESA RETTINGHOUSE

AUGUST 12, 2015: GGRO Bander Cricket Raspet encounters Red-tailed Hawk 1387-75928

I was walking through the raptor heaven that is Wavecrest Open Space, near Half Moon Bay, seeking solace for missing out on what was supposed to be my second year of apprentice training as a bander.

The season was due to start in five days and the reason for my absence was the impending birth of my son who made his appearance only eight days later. Wavecrest in the winter is a magical place, the old agricultural land now producing a bumper crop of rodents for hungry birds. It's beautiful in late summer too, with golden grass leading down to the sea, and plenty of birds to exercise my binocular-lifting muscles.

So, this is where I found myself on that early afternoon in August, walking near the bluffs on the south side, with the Pacific Ocean on my right and the coastal plain rising to the hills on my left. I looked up and there on a powerline was a Red-tailed Hawk, staring down placidly as I was very firmly standing in the splat zone. I backed up, aimed my camera, and that's when I noticed the silver band. This was the first banded hawk I had ever seen, and I was thrilled! The bird was obliging, allowing me to photograph the band front and back. I took it as a sign that I wasn't through with raptors.

Standing with that hawk in that place between land and sea, I was standing in time between my life before parenthood and my life after, knowing everything was going to change but not sure how. That bird gave me hope that I could finish what I started and get back up in a banding blind, because this is what it was all about—this short encounter that could tell us so much about our lives, the hawk's and mine. Obliging though it was, I didn't manage to record enough band numbers to report the sighting that day.

I had my baby, and returned to banding, and it wasn't until six years later that I was hawk gossiping, as one does, with John Davis, GGRO hawkwatcher and spectacular raptor photographer. John mentioned recently photographing a 17-year-old Redtail that



The images on pages 31 to 34 show six years in the extraordinary life of Red-tailed Hawk 1387-75928. Photo: John Davis

BANDING 2022

called Wavecrest home. The band number was a match with the numbers I was able to decipher in my photos, and the mystery was solved.

JANUARY 14, 2017: GGRO Bander Siobhan Ruck encounters Red-tailed Hawk 1387-75928

Three of us (bander Nancy Mori, hawkwatcher Kris Handwerk Wiskes, and myself) were out for a day of birding on the Pacific Coast. We made a stop at the end of Redondo Beach Road, just south of Half Moon Bay. The fields to the north were sometimes a hotspot for raptors—harriers, kites, falcons, buteos. On this day, the field was not so active but there was a gorgeous adult Red-tailed Hawk perched above the parking area. We noticed the bird was banded, so out came the spotting scope and we tried to read the band numbers (no color band, alas!). I managed to digiscope much of the sequence and was able to read other numbers off so that Nancy could write them down.

Proof that we had a car full of raptor lovers: we spent more time observing this Redtail to get the band number than any other bird that day. That's notable because we had really gone to the coast to see a rare Ross' Gull. (We did see the gull before it was eaten by a Peregrine.) I mean, the gull was cool and the first Ross' Gull I had ever seen in my life, but also: we saw a banded Redtail!

SEPTEMBER 25, 2020: GGRO hawkwatcher John Davis encounters Red-tailed Hawk 1387-75928

After enjoying a beautiful September day on Hawk Hill, I headed south to Half Moon Bay for a family walk along the beach. As we arrived, I noticed a pair of adult Red-tailed Hawks perched over the crowded parking lot, one bigger and the other smaller.

I watched the smaller hawk dive into the grassy field below and I hurried out of the car with my camera. The



Photo: John Davis



Photo: John Davis

BANDING 2022

hawk jumped up and flew right towards me to settle back on its perch, and I snapped away. I thought I might have seen a metal band as it was flying. I had stumbled upon a tolerant hawk actively hunting in gorgeous light, and I was starting to have a bad feeling about my involvement in our family outing.

As the hawk scanned the grass below, I reviewed my first images and noticed the shiny metal band on its right leg. Knowing that bird bands are usually marked with nine digits, and that only two or three might be visible at a time as they wrap around the leg, I inspected one of the clearer images and made out a "38." I was drawn into the challenge.

As my understanding family headed down the trail, I watched the perched hawk and hoped for a preen or a stretch or a poop, anything to get those fluffy under-feathers up and out of the way. Car doors

slammed, people stopped to take pictures, bicycles rattled over the path below and neither hawk flinched. I tried for a few more photos of the band from different angles as the bigger hawk pulled a rodent out of the grass and ate it nearby. Finally, the banded hawk launched at something and missed. As it flew to a different perch, I had a few more looks at the band in the fading sunset light and felt like it might be possible to piece it all together. I counted all the known digits and was very excited to hit nine.

My family returned at dusk and got to hear all about how we would soon know when and where this hawk was banded, possibly how old it is, and maybe even where it hatched. On the way out I felt like I redeemed myself by pointing out a silhouetted Great Horned Owl on a cypress tree and a Barn Owl flying overhead just visible by our headlights before we pulled out onto the highway and headed home.





DECEMBER 20, 2020: Half Moon Bay resident encounters Red-tailed Hawk 1387-75928

Around 9:30 am, I saw a hawk standing in the fairway on the fringe of the green on Hole 15 of The Old Course at Half Moon Bay Golf Links. It was screeching and looking in the direction of a dark mound that was about 40 feet away from where it stood. I didn't have my eyeglasses on and thought the mound was a Canada Goose, since they frequent the pond next to the fairway. I looked through my spotting scope and was shocked to see it was a dead Red-tailed Hawk.

There were no golfers in the area at that time so I hurried out to take a closer look as I feared the groundskeepers would dispose of it before it could be examined and reported. Once the golfers start coming through, it can be difficult to go out on the course without fear of getting hit by a ball. As I approached the dead hawk, the live hawk flew up to the closest tree. The dead hawk was warm to the touch and had not entered rigor. The right eye was open, and the left eye was closed.

**EPILOGUE: Parks Conservancy Program Coordinator
Carmen DeLeon investigates final encounter**

The anonymous finder gathered up the freshly dead hawk and contacted GGRO's Senior Biologist Teresa Ely. Ely sent the carcass to Krysta Rogers, Senior Environmental Scientist at the Wildlife Health Laboratory of the California Department of Fish & Wildlife in Sacramento. Rogers is the statewide lead for avian mortality investigations, and responds to reports of dead birds from agencies, wildlife hospitals, and the public. She performed a postmortem examination on the hawk and sent liver samples to the California Animal Health & Food Safety Lab for further testing.

An overall examination of the hawk showed that it was in poor body condition, weighing just 690 grams with no fat reserves and "severe wasting of the pectoral muscles." (The hawk's juvenile weight in 2003 was 918 grams.) The hawk had an injury to the right wing with a fractured carpometacarpus, which is the flattened bone in the wingtip where some of the primary flight feathers attach. The fracture was enlarged and callused meaning there was a buildup of hardened tissue. Additionally, the hawk had abundant feather lice, suggesting its preening ability had declined in its debilitated state. The organs had atrophied and raised plaques were present in the air sacs indicating a fungal respiratory infection.

Routine analysis of the liver tissue revealed that the hawk was exposed to Brodifacoum, a second-generation anticoagulant rodenticide. There was no unexplained internal bleeding or clotting issues, suggesting that this hawk was living with a sublethal amount of Brodifacoum accumulation. Rogers concluded that the cause of death was "apparent trauma resulting in starvation." The wing injury prevented it from effective foraging such that it was unable to obtain sufficient prey to maintain adequate nutrition. Although it is disappointing that this raptor didn't die simply of old age, the rich details provided by the observers give us a picture of what kind of conservation might support a Redtail for many years.

To close the loop on the Redtail-landscape connection, I contacted the Coastside Land Trust (CLT) which manages Wavecrest Open Space, long known for its abundance and diversity of wintering raptors. Reflecting on how the protected habitat might have contributed to the Redtail 1387-75928's long life, CLT Executive Director Jo Chamberlain noted, "Protecting Wavecrest is all about letting the land return to coastal prairie and raising voles. I personally feel responsible to make sure there is enough food out there for the raptors and it's very rewarding to see the birds come and know that we are caring for them. They can stop by Hawk Hill in the morning, then head straight to Wavecrest for lunch."

For final thoughts on the Half Moon Bay Redtail, I return to Cricket Raspet: "The dark, scrappy bird at Wavecrest never had a fan club, or a book devoted to its life, or movie-star neighbors, but it has a legacy. The data that its life provided are invaluable, giving clear scientific justification for banding. What's more, its story as an individual that made its way through the world for 17 long years is profound and amazing."

With permanently protected open spaces like Wavecrest, and new restrictions on Brodifacoum and other second-generation rodenticides through the California Ecosystems Protection Act (AB 1788) of 2020, I find even more reasons to see GGRO band recoveries as a way of keeping a pulse on everyday raptor lives considering stronger conservation measures. Any bird band has the potential to unlock further clues toward better wildlife conservation. By staying observant as you explore the outdoors, I hope that you, too, may someday become part of a raptor's story.



Laura Echávez studies the dorsal plumage of a juvenile Broad-winged Hawk. Prior to 1972, when the Marin Headlands migration was first studied, this species was considered extremely rare in the Pacific Flyway. Since 1983, GGRO volunteers have banded 48 Broadwings and counted an average of 270 sightings per season. Photo: Teresa Ely

Sampling the Pacific Raptor Flyway

ALLEN FISH

Science is a creative process. While every biologist knows this, the creative part is rarely talked about. It's not often captured in the carefully edited, formulaic articles that we publish in journals, or the conference talks squished into 15-minute timeslots. However, one of the beauties of working in a community like the GGRO is that we get to pay attention to the process, and often communicate about it more than in a purely academic landscape.

This is a story about how ideas can sprout into your thinking, especially since we scientists often get stuck in our own "ologies" in a way that keeps us from seeing bigger truths. Stepping outside is important. Imagine if we taught cross-pollination or hybrid expertise as a tenet of being a scientist.

Mine was not so much a new idea as it was practicing seeing the true enormity of what we study from the Marin Headlands—the Pacific Raptor Flyway. To remember that we work to describe a spectacular, complicated, hemisphere-scale map of raptor flights by consistently dipping our buckets in the river. We are like paleoecologists, sampling sediment cores.

THE CLIMATE CONFERENCE

In late February 2023, after a fall and winter of crazy amounts of rain in coastal California, I was invited to speak at a symposium of Pacific region climate scientists (PACLIM 2023). The event was themed "Drought and Deluge" and the conferees were almost all physical scientists, experts in long-ago periods, paleo-weather, and ancient landscapes whether arid or flood-impacted, glacial or volcanic. The speakers measured time in KYA's (thousands of years ago), and their study species were not birds, rather things such as tree rings, sediment cores, stalagmites, tufas, tephra, and even aspen clones.

Safe to say, I was out of my element, invited, I suspect, to provide something different for these specialized paleoscientists. Fortunately, I didn't have to speak until day three of the symposium, so I sat quietly and listened. Being the only student of feathers in a room of 70+ brilliant paleo-detectives was a little intimidating, but these were some of the friendliest people I had met in a while.

I learned about the incredible things that could be learned from a 30-foot sediment core, the story living in that pencil-straight soil sample of mud and dirt. Paleocology is measured in hundreds of thousands, even millions, of years. My meter for long-term migration studies was decades at best.

Sediment cores must be extracted, transported, and stored, and then might be analyzed for years by scientists reading an ancient vellum with no dictionary. They might discover things like the timing of droughts and floods, of cultural burns and wildfires, of volcanic and tidal events. Sediment cores show the existence of former sand dunes and wetlands. They might find great forests that once grew in a present-day desert, or sand dunes and marshlands in the middle of a skyscraper-studded city. They can even find pollen grains that can be told to genus, oak from pine, willow from wax myrtle.

DRAWING A PACIFIC RAPTOR FLYWAY

At the lunch break of day three, I started to re-work my raptor migration talk, intended for these detectives who could deduce rain in an ancient landscape 20,000 years ago by sampling a stalagmite. It was the sampling part that really got me thinking. In the same way that they sampled an immense landscape and time period by pulling a 30-foot core out of the earth, wasn't the GGRO sampling a much bigger raptor migration "landscape"—a Pacific Raptor Flyway—by banding and hawkwatching at the Marin Headlands?

And just how big is the Pacific Raptor Flyway? Is it a narrow pathway of hawks migrating right along the West Coast? Or do hawks migrate east and west as well? I thought about studies I'd read showing how different raptors move to and from California. For example, banded California Swainson's Hawks have been recovered in central Argentina. Pacific Northwest Osprey have been satellite-tracked as far south as Central America and Venezuela. Post-natal dispersing Bald Eagles from Lake Shasta tracked by satellite traveled to late summer food-rich territories in coastal British Columbia and Great Slave Lake, Northwest Territories, before making an autumn migration flight back to California. GGRO volunteer bander Shannon Skalos did her PhD research on Northern Harriers in Suisun Marsh near Davis, California, using satellite telemetry to discover the breeding areas for wintering females. Nest sites were located in five states—California, Oregon, Washington, Idaho, and Alaska. Astonishing flights all around.

Pacific region raptor migrations can be dramatically different from the oversimplistic "south in the fall, north in the spring" flyway models. East-west movements across traditional flyways are seen in Ferruginous Hawks and Prairie Falcons. A nestling Prairie Falcon banded in the San Francisco Bay Area was found just a few months later in Billings, Montana. The reverse also happens—Ferruginous Hawks banded in Alberta, Saskatchewan, and Montana, have been found wintering in coastal California.

For some moderate-winter hawks, any migration may have more to do with finding a significant prey source before the winter kicks in. Raptor biologist Pete Bloom uncovered the phenomenon of recently fledged southern California Red-tailed Hawks making sudden first-summer movements into Idaho and Montana, possibly to feed on the explosion of newly emerged ground squirrels in the Intermountain West. The GGRO's own radio telemetry and satellite studies have also documented such sudden northward Redtail movements in the hawks' first fall of life.

So, we can visualize the northern and southern extremes of a Pacific Raptor Flyway, but how do we find its width? I mentioned some of the species that fly east-west patterns in North America, but we still have much to learn about these longitudinal migrations, and for that matter, about altitudinal migrations as well. Many California raptors have just not been well studied. Merlins, Sharp-shinned Hawks, White-tailed Kites—many species that are too small to carry a satellite transmitter have received little research attention. And thanks to the rapid impacts of climate change, what we concluded about larger, more studied species needs to be re-checked. The world is changing for all species.



Raptor migration sampling takes many forms, from taking measurements and plumage photos of a bird in hand, to using binoculars and scopes to detect hawk numbers, ages, and species as they migrate over the Marin Headlands. Photo: Krista Fanucchi

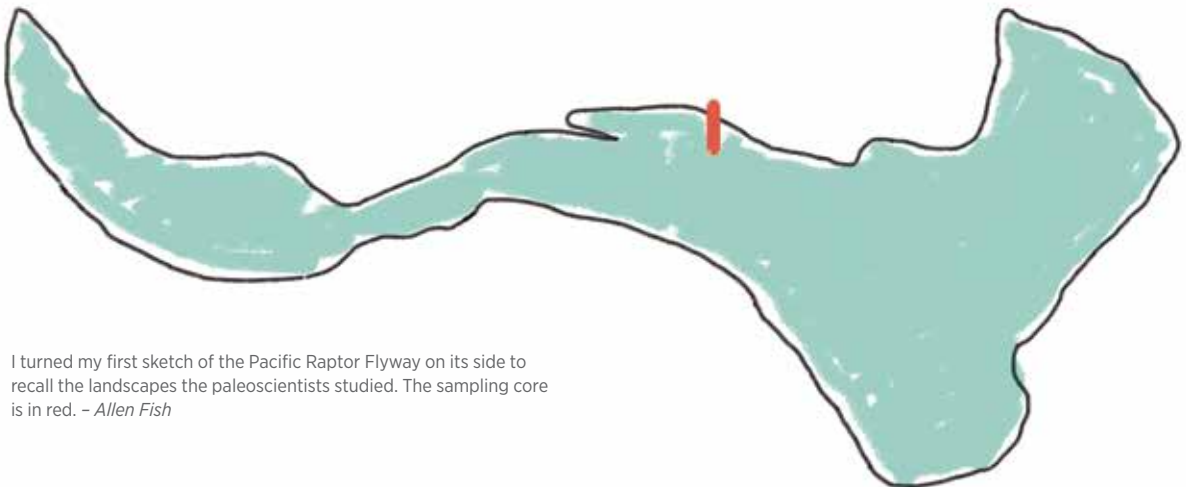
FLYWAY LESSONS

What does all this mean for visualizing a Pacific Raptor Flyway and the detective work we undertake at the GGRO? I take home a few points from these studies and others by dozens of raptor biologists. First, a Pacific Raptor Flyway is not contained by one continent. We know this merely from the immense raptor migrations in Mexico, Belize, and Panama. Millions of southbound raptors are seen in September-October at these locations, demonstrating the huge raptor population shifts between North and South America. The Americas are one landscape as far as raptors, and raptor conservation, are concerned.

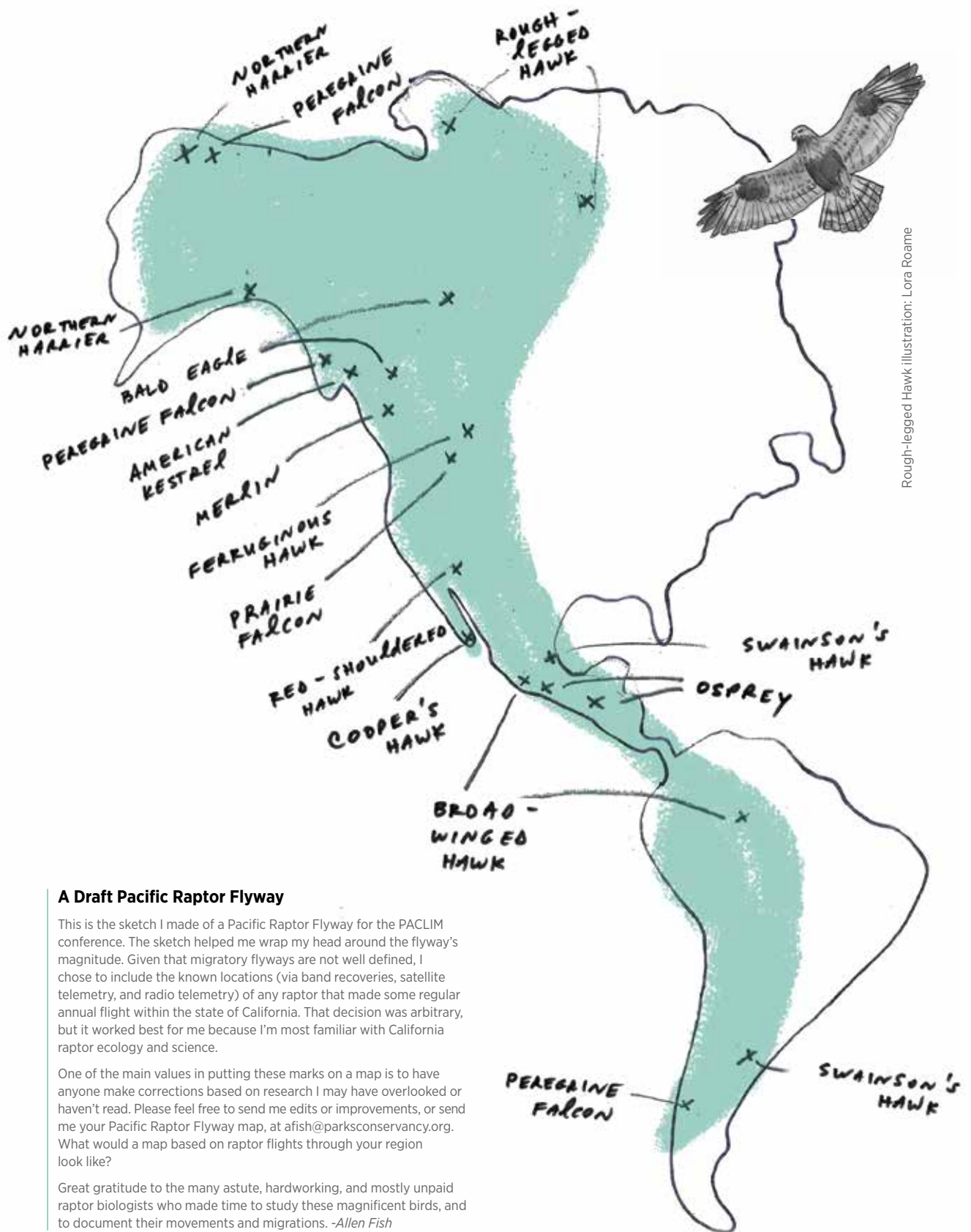
Second, the Pacific Raptor Flyway transcends geopolitical boundaries. A Peregrine Falcon that nests in Alaska and flies south to Argentina might cross as many as fifteen international boundaries, flying over sixteen nations. And this doesn't even include the Indigenous nations enroute.

So, back to the climate symposium. Excited about the analogy of sediment core sampling with hawk counts and banding, I made my first rough sketch of the Pacific Raptor Flyway on a map of the Americas. I included any location that was a breeding or non-nesting ground, or migration route, for a raptor that regularly appeared in California. Would I call this Pacific Raptor Flyway definitive? Not at all. It is a work in progress, and it will need to incorporate new and overlooked research to correct the boundaries over time, especially that squirrely eastern edge.

When I presented this sketch to the paleoscientists, I flopped the long amoeba shape on its side to disguise it a bit, so that it looked like a horizontal landscape. I added a core sampling location marker at the Marin Headlands, a teeny red sliver. As I tilted the amoeba into its familiar vertical shape, and imposed it on a map of the Americas, a ripple of laughter percolated around the room. They got it.



I turned my first sketch of the Pacific Raptor Flyway on its side to recall the landscapes the paleoscientists studied. The sampling core is in red. – *Allen Fish*



Rough-legged Hawk illustration: Lora Roame

A Draft Pacific Raptor Flyway

This is the sketch I made of a Pacific Raptor Flyway for the PACLIM conference. The sketch helped me wrap my head around the flyway's magnitude. Given that migratory flyways are not well defined, I chose to include the known locations (via band recoveries, satellite telemetry, and radio telemetry) of any raptor that made some regular annual flight within the state of California. That decision was arbitrary, but it worked best for me because I'm most familiar with California raptor ecology and science.

One of the main values in putting these marks on a map is to have anyone make corrections based on research I may have overlooked or haven't read. Please feel free to send me edits or improvements, or send me your Pacific Raptor Flyway map, at afish@parksconservancy.org. What would a map based on raptor flights through your region look like?

Great gratitude to the many astute, hardworking, and mostly unpaid raptor biologists who made time to study these magnificent birds, and to document their movements and migrations. -Allen Fish

EPILOGUE

Although I sketched the Pacific Raptor Flyway to build a connection with my fellow conferees, I realized later what the process had connected for me. The complexity and resilience of this amorphous, 10,000-mile-long superorganism is mind-boggling. It is hundreds of millions of birds of dozens of species flying ancient pathways every year. They are guided by temperature and weather, by prey outbreaks and prey crashes, by genetics, and by chance. Despite myriad hazards due to human legacies along the way, today we still have magnificent migratory flyways wrapping the world. And how fortunate we are that here in California, a community of volunteers, staff, donors, and biologists has made a commitment to sampling this Pacific Raptor Flyway, for 40 years and counting.

BIBLIOGRAPHY

Below are some of the salient studies that have captured the Pacific region raptor migrations and movements noted above. Many of them are available in full via Google Scholar; I highly recommend reading them as the original work.

I have also drawn from years of excellent conversations with my raptor mentors, especially Bud Anderson, Butch Olendorff, Buzz Hull, Elisha Hull, Teresa Ely, Pete Bloom, Alida Morzenti, and Carol McIntyre, among others. I stand in awe at the work of Neil Paprocki, Jeff Kidd and others whose Rough-legged Hawk Project is showing is some of the most spectacular raptor migrations on the continent. Please follow them on social media. Appreciation to Scott Starratt (via Ralph Pericoli) for bringing me to the PACLIM conference. Thanks to all the authors below, as well as to the many banders, telemetrists, hawkwatchers, and keen bird observers who have helped document the Pacific Raptor Flyway so far.

Anderson, C. M., et al. (1988). New evidence of a Peregrine migration on the west coast of North America. In Cade, T. J., J. H. Enderson, C. G. Thelander, and C. M. White (Eds.) *Peregrine Falcon Populations: Their Management and Recovery*. The Peregrine Fund, Inc.

Bloom, P. H. (2015). Northward summer migrations of Red-tailed Hawks fledged from southern latitudes. *Journal of Raptor Research*, 49, 1-17.

Elliott, J. E., et al. (2007). Satellite telemetry and prey sampling reveal contaminant sources to Pacific Northwest Ospreys. *Ecological Applications*, 17, 1223-1233.

Harmata, A. R., et al. (2001). Movements and mortality of Ferruginous Hawks in Montana. *Journal of Field Ornithology*, 72, 389-398.

Hunt, W. G., et al. (1992). Northward post-fledging migration of California Bald Eagles. *Journal of Raptor Research*, 26, 19-23.

Houston, C. S., et al. (1998). Ferruginous Hawk banding in Saskatchewan. *Blue Jay*, 56, 92-94.

Howell, J. A., and DiDonato, J.D. (1991). *Assessment of avian use and mortality related to wind turbines*. J. Howell and Associates.

Kochert, M. N., et al. (2011). Migration patterns, use of stopover areas, and austral summer movements of Swainson's Hawks. *Condor*, 113, 89-106.

Linthicum, J., et al. (2007). Annual migrations of Bald Eagles to and from California. *Journal of Raptor Research*, 41, 106-112.

Martell, M. S., et al. (2001). Fall migration routes, timing, and wintering sites of North American Ospreys as determined by satellite telemetry. *Condor*, 103, 715-724.

Skalos, S. M. (2021). Reproductive and migration ecology of breeding and wintering Northern Harriers (*Circus hudsonius*) in Suisun Marsh, California. [Doctoral dissertation, University of California, Davis].

Watson, J. W., et al. (2019). First-year migration and natal region fidelity of immature Ferruginous Hawks. *Journal of Raptor Research*, 53, 266-275.

Woodbridge, B., et al. (1995). An investigation of the Swainson's Hawk in Argentina. *Journal of Raptor Research*, 2, 202-204.

SUPPORTERS 2022

The 2022 season was one of transition for the GGRO—coming out of COVID-19, but not totally. While still operating with some pandemic precautions, we were happily able to increase our hawkwatch and banding volunteer group sizes, and even welcomed apprentice volunteers to our community for the first time in three years. We can't express in words how much we appreciate your dedication and resilience as a community as we have worked through so much together these past years. Your contribution—whether you are a hawkwatcher, bander, advisor, donor, or supporter—sustains the GGRO. On behalf of the Parks Conservancy and the National Park Service, thank you.

The GGRO and our volunteer community benefit immensely from the above-and-beyond commitment of volunteers who lead teams in the field. These dayleaders spend much time and effort supporting both their volunteer teams and GGRO staff. We are grateful for their work and skills.

2022 VOLUNTEERS

Ryan Abusaa
 *Jon Altemus
 Jan Ambrosini
 *Anne Ardillo
 Jennifer Armer
 *Michael Armer
 Stefanie Arthur
 Patricia Bacchetti
 Mary Badger
 Lynn Bantley
 *Eddie Bartley
 *Don Bartling
 Margot Bezruczyk
 *Marc Blumberg
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 *Robyn Boothby
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 *Andy Bradshaw
 *Nancy Brink
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A young Red-tailed Hawk, told by its brown-gray banded tail and creamy breast patch, surveys a patch of California coastal scrub habitat. Photo: John Davis

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Hardworking banders pause to take in a glorious Pacific sunset before heading home: Jennifer Brown, Carmen DeLeon, Rachel Miller, and Laura Echavez. Photo: Allen Fish

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Pacific Raptor 44 Authors & Artists



Hawkwatching on Halloween 2022: Linda Schneider, Roy Pisetsky, Tim Strohane, Allen Fish, Jan Ambrosini. Photo: Krista Fanucchi

Photographer and naturalist **John Davis** is also a hawkwatch dayleader at the GGRO.

As the Parks Conservancy's Conservation & Community Science Program Coordinator **Carmen DeLeon** supports GGRO & One Tam staff and volunteers.

Elizabeth Edson is the data manager for the Parks Conservancy's Conservation & Community Science group, as well as for the National Park Service Inventory & Monitoring Program.

A former GGRO Intern, **Teresa Ely** is the Parks Conservancy's GGRO Senior Biologist & Banding Manager.

Allen Fish is the Parks Conservancy's GGRO Director & Hawkwatch Manager.

East Bay resident **Lora Roame** is an artist, scientific illustrator, and biologist who loves watching birds almost as much as she loves drawing them.

Nudibranch scientist **Cricket Raspet** is also a Curatorial Assistant at California Academy of Sciences specializing in marine mammals, and a volunteer raptor bander at the GGRO.

Former GGRO intern **Emma Regnier** is currently working on a Golden Eagle study in Idaho and returns to California this fall to attend CSU Monterey Bay's Scientific Illustration program.

A GGRO raptor bander and leader for 30 years, artist and birder **Siobhan Ruck** was responsible for the illustrations in the Pyle Guide Part 2.

Lab technician turned wildlife biologist, **Michael Voeltz** happily spends his free time looking for tiny, unique insects, as well as banding raptors for the GGRO.

Retired pediatric RN **Marion Weeks** started banding with the GGRO in 1992, and has led the band recovery data proofing operation since the 1990s.



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The Golden Gate Raptor Observatory is a program of the Golden Gate National Parks Conservancy, in cooperation with the National Park Service.

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Elizabeth Edson, Data Manager
Teresa Ely, Senior Biologist/Banding Manager
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Editor: Allen Fish
Managing Editor: Michela Gentile
Designer: Renée Harcourt
Assistant Editors: Teresa Ely & Ben Dudek
Writers: John Davis, Carmen DeLeon, Teresa Ely, Allen Fish, Cricket Raspet,
Emma Regnier, Lora Roame, Siobhan Ruck, Michael Voeltz, & Marion Weeks
Illustrators: Emma Regnier & Lora Roame
Cartographers: Eddie Fitzsimmons & Zac Stanley
Data Visualizer: Elizabeth Edson

Contact Us

Building 1064, Fort Cronkhite, Sausalito, CA 94965
(415) 426-5290
ggro@parksconservancy.org
ggro.org

All raptors at the GGRO have been handled and banded with appropriate State, Federal, and IACUC permits.

Back cover: Between swirls of October fog, a juvenile Sharp-shinned Hawk suddenly popped out of the gloom, tucked tight into a dive, and disappeared behind Hawk Hill. All in a flash.
Photo: John Davis



Laura Echávez uses the cumulus clouds as a contrasting backdrop to find high-flying raptors in the eastern skies above Sausalito.
Photo: Allen Fish

