LOS ANGELES RAPTOR STUDY

2021 Final Report

*Red-shouldered hawk (*Buteo lineatus*) photographed by Nurit Katz near Mullholland Drive between Sherman Oaks and Beverly Hills. This species experienced unexpected nest failures during 2021, and remains the rarest of the four focal species in study area.*

Prepared for:
Friends of Griffith Park
P.O. Box 27573
Los Angeles, CA 90027

Prepared by:
Daniel S. Cooper and Courtney McCammon
Cooper Ecological Monitoring, Inc.
255 Satinwood Avenue
Oak Park, CA 91377

September 4, 2021

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

This project was made possible through the vision and support of Friends of Griffith Park, including Gerry Hans, [President]. Survey volunteers conducted much of the fieldwork, and provided invaluable ecological information that would have been otherwise difficult to obtain. In particular, we wish to thank the volunteers who completed our training session and tracked active nests for 2021, including Adrine Arakelian, Kristyn Armour, Beth Armstrong-Shikano, Natalie Beckman-Smith, Laurie Bernhard, Allison Brooker, Mary Brooks, Tad Brown, Ann Brunner, Carol Brusha, Kent Bullard, Carolyn Canterbury, Cynthia Castelbanco, Andrea Cavanaugh, Kali Ciesemier, Chip Clements, Richard Davi, Jim Davison, Kchris deGelsey, Stephen DeKeater, Traci DeWilde, Lillian Diaz-Przybyl, Diane Dickey, Ann Dittmer, Michael Dorman, Laura Drabkin, Fred Draper, Sean Dunagan, George Dutton, Barbara Ehrlich, Kristine Eller, Debbie Fagen, Lynn Ferro, Devin Goodwin, Katherine Gould, Leslie Graham, Stephanie Green, Mari Halliday, William Hallstrom, Kat Halsey, Gerry Hans, Sara Harris, Molly Hill, Jon Hofferman, Laurel Hunt, Mark Hunter, Katherine Izumi, Jeffrey Jaimi, Jessi Jones, Nurit Katz, Paul Kaye, Laura Keaton, Kristine Kidd, Whitney Kinnaird, Ken Klotzle, Jon Leaver, Peter Lennon, Greg Macek, Alex MacInnis, Dasha Maghooli, Richard Magram, Lisa Marlowe-Car, Nancy/Marley McKinse, Summer Moore, Andrew Mosema, Kris Mukai, David Mull, Corey Nickerson, Elinor Nissley, Christine Okinaga-Gatica, Katherine Pakradouni, Harry Pallenberg, Abel Pamatz, Kelly Park, Altagracia Perez, Maya Piergies, Susan Proffitt, Shana Rapoport, Danielle Rayne, Gary Regester, Susana Rinderle, Jeremy Rosenberg, Elizabeth Rowin, Larry Russell, Dale Schafe, Jonathan Silsby, Nancy Simpson, Dana Stangel, Kayla Stormont, Susan Streaser, James Strzelinski, Ben Teitelbaum, Stan Thompson, Rebecca Tinker, Sebastian Tobler, Lynne Toby, Brian Tomikawa, Linda Topper, Donald Tursman, Lisa Vebber, Gary Vlahakis, Jen Wang, Cheryl Weinfeld, Vaishali Whales, Debra Wilbur, Heather Wilson, Mark Wilson, Corrin Yep, George Young, Betty Ys, Julia Zepka . The combined effort of all volunteers accumulated to at least 687 hours of monitoring raptor nests for the 2021 season. Stefanie Smith, Griffith Section Superintendent, Department of Recreation and Parks, assisted us with access to several non-public park venues. Los Angeles City Park Rangers provided patrols to protect a sensitive peregrine falcon nesting site in Griffith Park. The Los Angeles Zoo provided access and a group of staff and volunteers provided updates on nests there. In addition, several local birders and bird enthusiasts notified us of local nests and while there are too many to name, we thank them for their information and contribution to this study.

EXECUTIVE SUMMARY

We continued monitoring within an "expanded" study area (including Sepulveda Basin, Baldwin Hills, and Glendale), and again increased the number of monitored nests for the fifth year of the Griffith Park Nesting Raptor Survey (2021). While investigators and volunteers monitored 188 active nests in 2020, in 2021 we confirmed and monitored *294* active nests and territories. As in 2020, we were able to confirm as active many territories by the presence of recently-fledged young and recently-used nests (particularly Cooper's Hawks), using clues learned while more closely observing known nests.

In all, we detected active nests/territories of 128 Cooper's Hawk pairs, 120 Red-tailed Hawk pairs, 24 Red-shouldered Hawk pairs, and 22 Great Horned Owl pairs. We confirmed no active Western Screech-owls or Barn Owl, but found 1-2 active territories of American Kestrel and Peregrine Falcon. These numbers (at least the diurnal species) again more closely reflect actual numbers of active nests in the study than those in surveys prior to 2020.

Nest success was again very high (87% overall), but 20 nests apparently failed during incubation or soon after (vs. 9 in 2020), including 25% of our Red-shouldered Hawk nests. We noted three instances each of nest trees being severely trimmed (or removed altogether) for Red-tailed Hawks and Cooper's Hawks, which apparently resulted in all three Red-tail pairs leaving these territories.

The 101-405 Freeway subregion (including the Santa Monica Mountains between Ventura Blvd. and Sunset Blvd.) again had the most active nests/territories, which was greatly increased in 2021 from 69 to 117. We nearly tripled the number of nests/territories in the Griffith Park subregion (91, up from 34), and more than doubled those from the San Fernando Valley floor (70, up from 33).

As in prior years, we again found ornamental pines (*Pinus* spp.) to be the most common nest tree used. Just five active nests were in native trees other than sycamores (which had 22 nests, including ornamental sycamores and relatives).

In 2021, we analyzed re-use by territory as well as nest, which narrowed the gap between Red-tailed Hawks (high nest re-use) and Cooper's Hawks (high territory re-use; low nest re-use). Increased effort within known and suspected Cooper's Hawk territories will likely yield even higher territory re-use.

1.0 BACKGROUND

Launched as the "Griffith Park Raptor Survey" in 2017 (Cooper et al. 2017), we have officially renamed our effort the "Los Angeles Raptor Study" to reflect the larger current study area now covering most of Los Angeles exclusive of the north and west San Fernando Valley, South Los Angeles, and the Harbor area (see map in Appendix A). This effort is an attempt to build our ecological understanding of the natural history of Los Angeles, and to encourage public stewardship of its resources. By documenting and tracking raptor nests across Los Angeles, we hope to understand how ecological dynamics change from year to year in the natural and built areas of Los Angeles, in particular how human activity is impacting wildlife here. While a handful of Los Angeles-area raptor nesting sites had been documented by prior work (e.g., Allen et al. 2017) and individual nests are generally afforded protection when found during utility line replacement and other agency activities, the data contained in our annual summary reports represent the first comprehensive dataset of an entire raptor community in the urban core of Los Angeles.

Raptors are important apex predators in most of the earth's ecosystems, and coastal Southern California supports (or once supported) around a dozen breeding species (Garrett and Dunn 1981). Of these, eight are known to nest, or formerly nested, in Griffith Park and the central core of Los Angeles. Cooper Ecological Monitoring, Inc. has been conducting surveys on the flora and fauna in Griffith Park since 2007, when the Griffith Park Wildlife Management Plan (Cooper and Mathewson 2009) first documented the park's flora and fauna and suggested best management practices for the future, including improved species monitoring.

Based on prior records (e.g., eBird: www.ebird.org), the Griffith Park area (eastern Santa Monica Mountains and surrounding lowlands) provides potentially suitable nesting habitat for nine resident raptors including Turkey Vulture (*Cathartes aura*), Red-shouldered Hawk (*Buteo lineatus*), Red-tailed Hawk (*Buteo jamaicensis*), Cooper's Hawk (*Accipiter cooperii*), Great Horned Owl (*Bubo virginianus*), Barn Owl (*Tyto alba*), Western Screech-Owl (*Megascops kennicottii*), Peregrine Falcon (*Falco peregrinus*) and American Kestrel (*Falco sparverius*). Turkey Vulture has not been confirmed as breeding in the study area in modern times, though suitable conditions exist to support its nesting. Other former nesters include Golden Eagle (*Aquila chrysaetos*) and Long-eared Owl (*Asio otus*), but both are rare today at any season. Osprey (*Pandion haliaetus*) is frequently seen through the nesting season (mainly along the Los Angeles River) but does not regularly nest in the study area. A handful of species of raptors occur locally in migration and/or winter (e.g., White-tailed Kite (*Elanus leucurus*), but nesting has not been suspected as occurring in the study area in modern times. Life-history summaries of the more commonly encountered nesting raptors in the study area, including our own local observations, are provided in Appendix B.

2.0 STUDY AREA AND METHODS

2.1 Location

The "Study Area" originally centered on Griffith Park, but was expanded in 2020 to include additional portions of the San Fernando Valley and coastal plain that were not covered in prior years (Appendix A). As of 2020, the Study Area extends to the 405 Freeway/Sepulveda Pass in the west, Vanowen Blvd. in the north, Interstate 10 in the south, and the Arroyo Seco/110 Freeway in the east. We also included the entire Sepulveda Basin and the Baldwin Hills as of the 2020 study. This expanded area includes the entire eastern Santa Monica Mountains, as well as Elysian Park, the Los Angeles River, Silver Lake Reservoir, Echo Park, Debs Park, Eagle Rock, Glendale, Burbank, and surrounding neighborhoods. A handful of raptor nests just outside this area were monitored by volunteers (e.g., Encino), but we did not specifically search for nests in these areas.

The City of Los Angeles Department of Parks and Recreation manages Griffith Park, Elysian Park, Echo Park, Debs Park, and Balboa Park; the Los Angeles Department of Water and Power manages Silver Lake Reservoir; Los Angeles County and the State of California manage portions of the Baldwin Hills; and various other agencies operate in the remaining open space of the eastern Santa Monica Mountains (e.g., Mountains Recreation and Conservation Authority). Importantly, the study area – and many nesting sites – are dominated by private property within the City of Los Angeles, mainly occupied by single-family homes and yards, and many nests were located in street trees or backyard trees.

Griffith Park itself contains over 4,300-acres of rugged wilderness and is one of the largest municipal parks in the United States. It sits at the eastern-most end of the Santa Monica Mountain range and is surrounded by three major freeways on its western, northern and eastern borders, and by dense urban development (Hollywood) to the south. Still, the park boasts a large and vibrant wildlife population that includes both diurnal and nocturnal birds of prey. Habitats within the Study Area vary considerably from manicured parks to dense urban neighborhoods, to rugged, deep canyons in isolated, "wilderness-like" areas. Urban habitats are highly variable, with large, estate-like lots in places like Toluca Lake and Beverly Hills, and multi-story high-rises in areas close to downtown and along the Wilshire Corridor. Griffith Park and other large open space areas feature semi-arid native plant communities in the interior, with irrigated landscaping, including very tall trees, at the perimeter.

The climate is Mediterranean, with low or no summer precipitation, cool winters, and periods of drought. February receives the highest levels of precipitation with annual average rainfall of 14 inches. Fairly regular El Niño effects once or twice per decade can result in much higher annual rainfall amounts, and regular droughts can reduce rainfall to half the normal amount (or less in exceptional years). Of note, the year of the project launch (2017) followed an exceptional four-year drought in the Los Angeles area; however, the 2018 – 2019 rainy season saw a total of 18.82 inches in the downtown Los Angeles area, which was 4.09 inches (>20%)

above the seasonal average for the area. The 2019 – 2020 season saw a return to average (14.86 inches), though roughly half of it fell during March and April (2020), which was unusually late (and which coincided directly with the start of our 2020 raptor nesting season). However, rainfall in winter 2020-2021 was less than half normal (5.0 inches)[1], with above-average high temperature spikes in late May and mid-June[2] (coinciding with local raptor fledging).

As in prior years, we were denied access to the large protected habitat area around Stone Canyon Reservoir (Los Angeles Dept. of Water and Power), which has been closed to birders/researchers for many years, but we greatly increased observer coverage, including nest-searching for new nests and territories, in areas such as the San Fernando Valley and eastern Santa Monica Mountains. We again could not access upper portions of Forest Lawn Hollywood Hills Cemetery.

2.2 Survey Methods

Cooper, McCammon and project volunteers (Nurit Katz and Gerry Hans) conducted opportunistic surveys in the Study Area during late winter 2021 to document the status of known and suspected raptor nests, which continued through the spring and summer. Unlike in 2020, streets and businesses had largely reverted to "pre-pandemic" levels of traffic and activity, and if anything, natural areas throughout Los Angeles were even more crowded with people. We attempted to maintain the high level of coverage afforded to the Study Area in 2020, which included scanning online bird reporting platforms such as eBird and iNaturalist for reports of adults and juveniles (the latter particularly evident by June), and visiting the reported areas to track down nests (which yielded several dozen new territories/nests). As in 2020, we also posted several announcements and updates of the project to social media (Facebook, Instagram, Linkedin etc) and local Nextdoor boards, requesting sightings of nests and raptors. This approach is especially useful during the end of the Cooper's Hawk nest period when juveniles are loud and visible in neighborhoods.

Our surveys were performed mostly by foot using 8-10x binoculars, 20x spotting scopes, and "super-zoom" cameras to determine nest activity and the presence or absence of raptors. Surveys were timed to avoid undue disturbance to nesting raptors and other birds during the most critical breeding periods later in spring.

By the end of June, we had more than 400 potential raptor nests/territories located (the 2020 report noted "100" nests/territories, which was an undercount; roughly 350 nests/territories were evaluated in 2020). We held one virtual (Zoom) training session, which was well-attended by volunteer "community-scientists" in late winter (February 20th). As in prior years, we then assigned nests to one or more volunteers based on their location preferences and birding ability. Volunteers were asked to visit their assigned nests twice per month (and no more than weekly to avoid disturbance) to identify nesting stages throughout the season, and were asked

[1] http://www.laalmanac.com/weather/we09a.php
[2] https://www.accuweather.com/en/us/los-angeles/90012/may-weather/347625?year=2021

to send back completed data sheets at least monthly. Each active nest was confirmed (by photograph if possible) by project staff to ensure data reliability. Completed data sheets were kept in a central location for easy access and may be provided upon request. GPS coordinates of nests were collected with Google Maps or Earth app in the field, or later using volunteers' written descriptions and Google Earth Pro. Coordinates were taken as close to the nest tree as possible, but the accuracy of nest coordinates may vary due to access issues, proximity of the edge of a tree to the nest, or the inability to obtain accurate readings under dense tree canopy.

Another addition to this years' survey was the collaboration with Cornell Lab of Ornithology through the use of NestWatch, a nation-wide nest monitoring program designed to track status and trends in the reproductive biology of birds. McCammon input the Griffith Park Raptor Survey nest data into NestWatch in order to contribute to a nation-wide data set increasing our understanding of differences and similarities among hawk species on a larger scale. While NestWatch is a citizen science tool used by the public in monitoring the fate of bird nests around the United States, the LA Raptor Study data has the location kept hidden due to the sensitive nature of the information. The data is mostly used to support other raptor monitoring programs and to provide comparative data to fellow researchers. The public cannot view the location of any nests tracked through the LA Raptor Study.

Please refer to Appendix B for notes on focal species' natural history, including insights gained from the 2021 field season.

2.3 Classifying Nest Structures

We refined our definitions and classification of nests and territories in 2020, to account for new information learned through our more intensive monitoring and nest-searching this year. The following designations were again used to classify nesting success for the 2021 survey, and refer to *nests* (rather than territories).

- Active – A physical nest in good condition with at least one individual of the appropriate species engaged in clear breeding behavior at the nest (e.g., nest-building, incubation, etc.);
- Inactive – A likely or known/historical raptor nest in which no current nesting activity is observed (e.g., no birds present, cobwebs covering the nest, no whitewash below the nest);
- Fledged – A known nest where one or more young successfully left the nest. Typically, this was confirmed by observations of large young in the nest, then an empty nest shortly thereafter, with copious whitewash and down feathers near the nest, and usually with at least one fledgling (dependent on adults and incapable of sustained/smooth flight) in the area. In some cases, a successful nest was identified based on whitewash/down even if no fledgling was observed nearby.
- Failed – An active nest that produced no young, but where nesting activity had been observed in the current year;
- Unknown – Ambiguous observations, such as one or both adults at the nest possibly incubating or tending young, but where no fledglings were detected later in the season; or where we did not have enough observations to make a determination of success due to scheduling/access issues.

For 2021, we again increased our effort to determine the breeding status of territories where nests had not been located, but where we found a pair of raptors exhibiting breeding behavior such as tandem flights, copulation, stick-carrying, etc.; in some cases, we identified a territory based on the presence of a single adult, such as an adult Cooper's Hawk delivering a territorial call, but most nests were deemed active by the presence of a pair during the nesting season. We again included as "active territories" those areas where we found fledglings in the current year that appeared to have been hatched very close by (see "Fledged", above), but where we could not locate a physical nest. Several of these territories were later confirmed as "nests" and assigned a nest number when a physical nest (appropriate to the species and clearly from the current year) was located.

3.0 RESULTS

3.1 Nest Success and Phenology

Nest Success

Our 2021 survey evaluated 434[3] potentially active nests and territories of 8 raptor species: Red-tailed Hawk, Red-shouldered Hawk, Cooper's Hawk, Great Horned Owl, Western Screech-owl, Barn Owl, Peregrine Falcon and American Kestrel. This represents a 23% increase in sites evaluated from 2020 (*n* = 352). By the season's end, we had monitored 294 nests/territories, having excluded the others for lack of activity (Table 1a).

We confirmed very few nests and territories of the latter four species in 2021 (<5 each), so these are not analyzed quantitatively here. Thus our "focal species" were again the three hawk species and Great Horned Owl.

Tables 1a – 1b provide a breakdown of species and outcomes for 2020 and 2021.

Table 1a. Nests Monitored and Outcome, 2021[4].

Species	# Active nests/territories	# Fledged[5]	# Fledglings[6] (mean, SD)	# Failed/ Abandoned[7]	# Unknown outcome
Red-tailed Hawk	120	108 (90.0%)	2.11 ± 0.71	7 (6%)	5
Red-sh. Hawk	24	15 (62.5%)	1.73 ± 0.70	6 (25%)	3
Cooper's Hawk	128	112 (87.5%)	2.16 ± 0.97	7 (6%)	-
Great Horned Owl	22	21 (95.5%)	1.94 ± 0.66	-	1
Total	294	257 (87.1%)	n/a	20 (6.8%)	9

[3] This number includes nests from prior years (to 2017), as well as suspected raptor nests that were later confirmed during the current field season.

[4] We include nests that were discovered post-fledging (i.e., with copious whitewash and down, indicating successful fledging), and for the first time in 2021, we included territories that produced young, even if we did not find a physical nest there (in prior years, we essentially ignored fledglings except to note to check them the following year).

[5] Includes presumed-fledged nests, i.e., large young seen in nest on last visit, but no final visit made to confirm fledging.

[6] COHA and RTHA nests had a range of 0-4 chicks produced in 2021, while GHOW and RSHA nests had a range of 1-3 chicks produced.

[7] Includes pairs/territories that were active early in the season, but which never settled on a nest, and which never (based on our observations) produced young.

Table 1b. Nests Monitored and Outcome, 2020.

Species	# Active nests	# Fledged[4]	# Fledglings[8] (mean, SD)	# Failed/ Abandoned	# Unknown outcome
Red-tailed Hawk	80	77 (96.3%)	2.19 ± 0.91	3 (4%)	-
Red-shouldered Hawk	17	16 (94.1%)	1.92 ± 0.83	1 (6%)	-
Cooper's Hawk	76	67 (88.1%)	2.18 ± 1.06	5 (7%)	4
Great Horned Owl	15	15 (100%)	2.27 ± 0.88	-	-
Total	188	175 (93.0%)	n/a	9 (4.8%)	4

For 2021, the number of fledglings for all four focal species ranged to four chicks (Table 1a). The highest average number of fledglings on average were from nests of Cooper's Hawk and Red-tailed Hawk (> 2 young per nest), followed by Great Horned Owl (1.9) and Red-shouldered Hawk (1.7). In general, the data suggest that the average number of chicks across all species is somewhat similar, but we found a narrower range in fledgling number among Red-tailed Hawks, Red-shouldered Hawks, and Great Horned Owls (S.D. = 0.66 – 0.71) as compared to Cooper's Hawks (S.D. = 0.97).

Nest Phenology

Phenology data (timing of life history events) were gathered mainly by volunteers, so this information was again somewhat incomplete, owing to variation in data-gathering abilities and timing of visits. This was particularly apparent in the 2021 data due to the ongoing COVID pandemic. Since we only asked volunteers to visit the nests every two weeks, certain gaps emerged with respect to start dates of the nesting phenomena. And, it seemed that the various COVID-related directives during 2021 (including relaxing travel restrictions) resulted in erratic participation by many volunteers, with perhaps more dropping out mid-project than in prior years (possibly simply to travel).

For the phenology analysis, we excluded nests that fledged prior to their discovery, and only included nests where we felt the data were reliable (various reasons). We compared the first date of incubation (female/adult sitting still in the nest), first date chicks were seen, first date that at least one nestling was observed "branching" (climbing up out of the nest), and the first date that the nest was empty (with evidence of successful fledging).

As in prior years, Red-shouldered Hawk nestlings have appeared a few weeks after those of the first Red-tailed Hawk chicks, and Cooper's Hawk nestlings appeared much later (c. 6 weeks after Red-tails). We again noted that Cooper's Hawk chicks fledged in a relatively shorter amount of time as compared to Red-tailed or Red-shouldered Hawks, as all three hawk species saw their mean first fledging dates in the same month (June). The mean dates for nesting events in 2021

[8] COHA and RTHA nests had a range of 0-4 chicks produced in 2020, while GHOW and RSHA nests had a range of 1-4 chicks produced.

were remarkably similar to those in 2020 (Tables 2a and 2b); note especially the nearly identical mean 2020 and 2021 fledging dates for Red-tailed Hawk and Cooper's Hawk!

Table 2a. Nesting success and phenology by species, 2021, showing mean date and range of *first* observation for each nest monitored (for each nest where we had data).

Species	# Nests with data	Incubation	Nestlings	Branching	Fledging
Red-tailed Hawk	58	March 18 (2/5 to 5/2)	April 29 (3/23 to 6/17)	May 24 (5/10 to 6/8)	June 5 (5/9 to 7/3)
Red-sh. Hawk	11	March 28 (3/2 to 4/27)	May 16 (3/30 to 6/4)	May 30 (5/23 to 6/4)	June 13 (5/30 to 7/1)
Cooper's Hawk	57	April 25 (3/30 to 6/6)	June 4 (5/17 to 6/21)	June 15 (6/5 to 6/28)	June 28 (6/11 to 7/27)
Great Horned Owl	13	March 7 (2/5 to 4/12)	April 12 (3/5 to 4/25)	April 25 (4/6 to 5/4)	May 5 (4/5 to 6/1)

Table 2b. Nesting success and phenology by species, 2020, showing mean date and range of *first* observation for each nest monitored (for each nest where we had data).

Species	Incubation	Nestlings	Branching	Fledging
Red-tailed Hawk	March 15 (2/11 to 4/12)	April 25 (3/20 to 6/14)	May 18 (4/22 to 7/5)	June 5 (5/3 to 7/9)
Red-sh. Hawk	March 24 (3/15 to 4/4)	May 10 (4/16 to 5/24)	May 29 (5/24 to 6/10)	June 9 (5/23 to 6/20)
Cooper's Hawk	April 23 (3/27 to 5/28)	June 3 (5/14 to 7/27)	June 16 (6/1 to 7/11)	June 29 (6/6 to 7/19)
Great Horned Owl	March 10 (2/15 to 4/7)	March 31 (2/15 to 4/7)	April 14 (3/15 to 5/7)	April 28 (3/26 to 5/23)

3.2 Geographic and Habitat Patterns

We provide the geographic setting of our active nests and territories (even where outcome was unknown) in Tables 3a – 3b, and the nesting substrate (tree type) in Tables 4a – 4b. Because of the greatly increased effort put into searching out new nests in 2020 and 2021, the breakdowns during these two years are more accurate than in any prior survey year. While our subareas vary in size and search effort, clear patterns have emerged. The eastern Santa Monica Mountains, which includes the extensive area of hills between Sepulveda Pass (405 Fwy.) and Cahuenga Pass (101 Fwy.), again supported the largest number of active raptor nests/territories in 2021 (*n* = 117), followed by Griffith Park (*n* = 91) and the San Fernando Valley (*n* = 70).

Species distribution within each subarea is very different, with Red-tailed Hawks again most numerous in the Santa Monica Mountains and Griffith Park (and still a dominant species in Northeast L.A. and in Silver Lake/Echo Park), with relative few nests on the floor of the San Fernando Valley and in the urban Los Angeles Basin between Westwood and Downtown Los Angeles.

Cooper's Hawks again showed essentially the opposite pattern, with the largest number found in the (urban) San Fernando Valley and in Westwood-Downtown. In terms of representation, Cooper's Hawks were again found to comprise roughly a quarter (28%) of the breeding raptor nests/territories in Griffith Park and the Santa Monica Mountains, yet comprised 77% of nests/territories found in the San Fernando Valley/Westwood-Downtown. Red-shouldered Hawks and Great Horned Owls occur in much lower numbers and are more evenly distributed, but appear to avoid these more urban areas favored by Cooper's Hawks. Though Cooper's Hawks are clearly more common than the other species in urban areas, the lower number of Cooper's Hawk nests in the study in canyon and hillside areas may be at least in part due to the difficulty of locating Cooper's Hawk nests in these areas. Unlike Red-tailed Hawks that nest in tall trees, Cooper's Hawk nests are often hidden in relatively lower trees and can be difficult to locate in dense canyon areas and hillside neighborhoods with large inaccessible private areas located far from the street.

Confirming 2020 patterns, the apparent ubiquitous-ness of Red-tailed and Cooper's hawks across the Los Angeles Basin (e.g., Allen et al. 2017) was not reflected in the even placement of their nests. Large open space areas (such as Griffith Park and parkland within the eastern Santa Monica Mountains) appear to be *very* important for the persistence of Red-tailed Hawks, yet are of little relative importance to Cooper's Hawks. Even in (relatively) highly-urbanized Northeast Los Angeles (e.g., Mount Washington, Eagle Rock, and Highland Park), Hollywood, and Silver Lake/Echo Park, Red-tails are still finding enough resources to nest and raise young. Yet, this is clearly not the case across the floor of the San Fernando Valley nor the urban Los Angeles Basin (Westwood-Downtown subregion), where we located only a handful of Red-tailed Hawk nests, mainly associated with large open areas (e.g., Sepulveda Basin and Los Angeles Country Club).

As noted in 2020, both Red-shouldered Hawks and Great Horned Owls appear to be thinly distributed across the study area, with both nearly absent from the floor of the San Fernando Valley as well as from the Westwood-Downtown subregion, indicating the importance of hilly, undeveloped open space areas like the Griffith Park area in keeping them around.

Table 3a. Geographic distribution of nests and territories, by species, 2021 (includes old/inactive nests and territories)[9].

Species	Griffith Park[10]	Eastern SMM[11]	Silverlake/ Echo Park[12]	Glendale-Burbank	Northeast L.A.[13]	San Fernando Valley	Westwood-Downtown[14]	Baldwin Hills
Acres	8,780	20,285	6,382	9,361	11,348	19,795	29,098	9,572
Red-tailed Hawk	35	59	20	12	23	14	6	8
Red-sh. Hawk	10	16	7	3	9	4	2	4
Cooper's Hawk	32	27	21	22	22	51	46	12
Great H. Owl	14	15	6	0	9	1	2	0
TOTAL	**91**	**117**	**54**	**37**	**63**	**70**	**56**	**24**

Table 3b. Geographic distribution of active nests and territories, by species, 2020.

Species	Griffith Park	Eastern SMM	Silverlake/ Echo Park	Glendale-Burbank	Northeast L.A.	San Fernando Valley	Westwood-Downtown	Baldwin Hills
Acres	8,780	20,285	6,382	9,361	11,348	19,795	29,098	9,572
Red-tailed Hawk	18	41	12	5	12	4	2	0
Red-sh. Hawk	3	7	3	2	3	0	1	2
Cooper's Hawk	9	16	6	5	7	28	19	3
Great H. Owl	4	5	3	0	3	1	1	0
TOTAL	**34**	**69**	**24**	**12**	**25**	**33**	**23**	**5**

[9] East L.A. (not included in table) had 2 Cooper's Hawk nests/territories and 8 Red-tailed Hawk nests/territories surveyed in 2021 (and none of Red-shouldered Hawk or Great Horned Owl).

[10] Includes all area of hills and adjacent lowlands between 101 Fwy. and I-5

[11] Includes hills between 405 and 101 Fwy., generally south of Ventura Blvd. and north of Sunset Blvd. (i.e., all or portions of Sherman Oaks, Beverly Hills, Bel Air, Studio City, West Hollywood, Hollywood)

[12] Includes Elysian Park

[13] Includes Mt. Washington, Eagle Rock, and Debs Park area.

[14] Includes entire "coastal plain" extending from vic. 405 Fwy. in Westwood east through Mid-City into Downtown L.A.

Looking at nest tree and substrate type (Tables 3c – 3d), as in prior years, (non-native) pines (*Pinus* spp.[15]) were the most common nest tree used in 2021 (99 of 266 observed nests; 37%), followed by gums (*Eucalyptus* spp.) and related species (*n* = 54), Shamel ash (*Fraxinus udhei*) with 30 nests, sycamores with 22 nests, and figs (*Ficus* spp.) with 19 nests. A total of 21 tree species were represented in the final tally of active raptor nest sites in 2021 (similar to 2020), with just four being native trees: western sycamore *Platanus racemosa*[16], Fremont cottonwood *Populus fremontii*, coast live oak *Quercus agrifolia* and willow *Salix* sp. Just seven active nests, all of Cooper's Hawks, were in native trees other than sycamores, including five nests in coast live oak, and single nests in cottonwood (*Populus* spp.) and willow (*Salix* sp.). These low rates of native tree use were also noted in 2020 and in prior years.

We again documented two Glendale Red-tailed Hawk nests in transmission towers, two nests in rock ledges/caves (single pairs of Great Horned Owl and Peregrine Falcon), and one nest on a building ledge (Great Horned Owl).

As noted in 2020, the low usage rate of native trees must correlate strongly with availability, as native trees are almost non-existent as street trees (except for sycamores), and large specimens of most native trees (e.g., coast live oak) are largely restricted to patches of open space like the eastern Santa Monica Mountains, and sparingly elsewhere. And, while sycamores were more commonly used by raptors as nest trees in 2021, many of these are likely non-native London Plane trees or hybrids, which are found widely as street trees. Pericoli and Fish (2004) also report high usage of non-native trees as nest sites by Cooper's Hawks in the urban San Francisco Bay area, with American Elm (*Ulmus* sp.) the most-used tree in 2002 and 2003 (again, presumably reflective of availability there).

As we wrote in 2019, by virtue of their abundance across the urban and suburban landscape of the study area, pines and eucalyptus "accounted for a relatively large proportion of our local nests, highlighting the importance of the very large, non-native trees in and around the park, many of which have matured – and are now the tallest trees around – since they were planted decades ago. While non-native, they clearly provide excellent nesting opportunities to the local raptor community, and have essentially outpaced native substrates locally, perhaps enabling native raptors to continue using the habitats."

[15] While some pines are native to higher elevations in the mountains above Los Angeles, the species widely planted in the city are Old World taxa, including Canary Island pine (*Pinus canariensis*) and Aleppo pine (*P. haleppensis*). Norfolk Island pine (*Auracauria heterophylla*), Redwood (*Sequoia sempervirens*), and deodar (*Cedrus* sp.) supported a handful of nests.

[16] Many (most) sycamore nests were in the non-native ornamental London plane tree (*Platanus* x *acerifolia*) rather than in the native western sycamore, though native sycamore nests were confirmed as used in a handful of cases, including by Great Horned Owl in Franklin Canyon, and by Red-tailed Hawks in and around Griffith Park and in the eastern Santa Monica Mountains.

Table 4a. Substrate (tree) usage, by species (active nests only), 2021.

Species	Pine	Eucalyptus	Shamel Ash	Ficus	Sycamore[17]	Oak[18]	Other/Unk.
Red-tailed Hawk	66	28	0	0	7	0	13
Red-shouldered Hawk	2	11	2	1	4	0	1
Cooper's Hawk	19	10	27	18	10	5	19
Great Horned Owl	12	5	1	0	1	0	4
TOTAL	**99**	**54**	**30**	**19**	**22**	**5**	**37**

Table 4b. Substrate (tree) usage, by species (active nests only), 2020.

Species	Pine	Eucalyptus	Shamel Ash	Sycamore	Oak	Other/Unk.
Red-tailed Hawk	47	19	0	4	0	10
Red-shouldered Hawk	1	8	2	6	0	0
Cooper's Hawk	10	12	18	8	3	25
Great Horned Owl	10	3	1	0	0	1
TOTAL	**68**	**42**	**21**	**18**	**3**	**36**

[17] Includes the native western sycamore (*Platanus racemosa*) as well as non-native/hybrid plane trees (*Platanus* sp.), which are planted as street trees.
[18] Coast live oak (*Quercus agrifolia*) unless noted.

3.3 Nest and Territory Re-use

We re-analyzed nest (and territory) re-use trends for the 2020-2021 period, considering how many more nests we found in those years vs. prior years (Table 5). Looking separately at territories vs. nests provides a more detailed picture of how often each species remains in the same territory, remains in the territory but uses a new nest, or abandons the territory altogether. Red-tailed Hawks have the highest "site fidelity", with 75% of 2020 territories re-occupied again in 2021 (this does not include newly-found 2021 territories whose 2020 status was unknown, but probably approximates the actual territory re-use level overall). Red-tailed Hawk *nest* re-use was nearly as high as its territory re-use (68%), supporting our supposition that more Red-tail nests are re-used each year than those of other species.

Cooper's Hawk showed fairly high territory fidelity from 2020 to 2021 (65% of 2020 territories were also active in 2021). However, nest re-use was much lower (28%), reflecting the fact that Cooper's Hawks shift nests from year to year more frequently than do Red-tails. Our findings for Cooper's Hawks in 2021, when coverage was similarly high as compared with the year prior, were more line with those of Pericoli and Fish (2004), who found four of 12 nests re-used between the two years studied (33%), and 10 of 12 territories active from one year to the next (83%). As our data suggested in 2020, Cooper's Hawks do appear to be shifting their nest trees more (from year to year) compared to other species – and presumably establishing new territories, perhaps taking advantage of more rapidly changing urban conditions, or after depleting a locally abundant food resource.

Red-shouldered Hawk and Great Horned Owl had lower *territory* fidelity than either Red-tailed or Cooper's hawks between 2020 and 2021 (59% and 39%, resp.), and both had low *nest* fidelity (Table 5). The poor reproduction of Red-shouldered Hawk we observed 2021 was likely related to this low nest fidelity value, as many nests simply went unoccupied by Red-shouldered Hawks throughout the study area and pairs were not re-found nesting nearby. Great Horned Owls often usurp nests of other species (and initiate incubation earlier than other raptors).

The 2021 findings counter what we had speculated might be a tendency toward high territory fidelity in Red-shouldered Hawk in 2020; it is possible that the high rate of nest abandonment in this species is indicative of a year in which the species is having a difficult time nesting, leaving many vacant territories (note: we coded failed/abandoned-mid-season territories as "active", so any "inactive" territories would refer to be pairs that simply vanished between 2020 and 2021). It is possible some of these pairs will re-appear in future years, as a handful of reports on iNaturalist/eBird show both adult and younger individuals wandering through old territories, and we noted several singles and "2020 birds" (i.e., those in immature plumage) in territories this year that had been active in past years. But, as noted last year, Red-shouldered Hawks remain uncommon across the study area, and much remains unknown about the limiting factors of the species locally.

Table 5. Nest and territory re-use, 2021.

Species	Territories (nests) active 2020	2020 Territories re-occupied in 2021	2020 Nests re-occupied in 2021	New active territories in 2021
Red-tailed Hawk	96 (80)	72 (75%)	54 (68%)	40
Red-sh. Hawk	22 (17)	13 (59%)	3 (18%)	9
Cooper's Hawk	96 (76)	62 (65%)	21 (28%)	60
Great Horned Owl	18 (15)	7 (39%)	6 (40%)	11

As in past years, it may be instructive to review why the few failed nests did so. We summarize all the nests believed to have failed or that were apparently abandoned mid-season in Table 6. We continue to suspect rodenticide the deaths of several adult and fledgling raptors, but many other factors could be at work, which are yet to be explored.

Analyzing the cause of nest disuse prior to the start of nesting activity is difficult, particularly for Cooper's Hawks, which appear to normally switch nests from year to year. And, a "missing nest" from the prior year in an otherwise intact tree could result from the pair pulling sticks from an older nest to build a new one, and not (necessarily) the result of some disturbance. However, we noted three instances of Cooper's Hawk nest trees severely trimmed just prior to the start of the 2021 nesting season, two in the San Fernando Valley and one in Westwood. In two cases, we found what was presumably the original pair nesting nearby. Three Red-tailed Hawks also had nest trees removed following the 2020 breeding season, all in or near Beverly Hills: one dead-topped deodar pine was removed at Greystone Mansion, one dead-topped Canary Island pine was severely trimmed near upper Franklin Canyon, and one blue gum nest tree was removed along Coldwater Canyon. Notably, we failed to locate alternate (new) nests, or adult birds, in each of these Red-tailed territories.

We learned about just one adult raptor fatality during nesting season, a Cooper's Hawk found dead in a territory in Silver Lake in May 2021 (territory failed to produce young, and no 2021 nest was ever located). Volunteers (including Nurit Katz and Gerry Hans) were able to rescue injured and displaced hawks, including an adult male Cooper's Hawk that had likely been hit by a vehicle in Burbank and found by the resident who originally reported the territory. After rehabilitation at Ojai Raptor Center it was released near the nest tree and reunited with its mate (and fledged four young!). The study provided a unique opportunity to monitor a rescue hawk post release. Three Cooper's Hawk fledglings were rescued from various parts of the study area, two of which were rehabilitated by Ojai Raptor Center, and one was placed back in the nest tree, as it was un-injured. Volunteers also rescued two Great Horned Owl fledglings, one of which was returned to its nest. Ojai Raptor Center also rehabilitated a juvenile Red-tailed Hawk that was apparently rescued by a homeless man in Downtown Los Angeles and transported by a study volunteer. It is possible the high heat during the end of the Cooper's Hawk nesting period led to near fledgling nestlings to leave the nest early (as it did in the Pacific

Northwest making national news in what one rehabilitation center called a "Hawkpocalypse"[19]). At least one of the fledglings rescued had a broken tibia, presumably from a fall to the concrete below the nest.

[19] https://www.washingtonpost.com/nation/2021/07/17/heat-wave-baby-hawks/

Table 6. Observations of failed/abandoned nests (does not include territories where nesting was suspected but where no nest was found, where nest trees were trimmed/removed prior to the 2021 breeding season, or where a dead adult/juvenile was found).

Species	Location	Tree type	Explanation
Cooper's Hawk	Mt. Washington	Acacia	Unk; no activity after incubation early in season.
Cooper's Hawk	Elysian Park	Shamel ash	Unk; no activity after nest-building.
Cooper's Hawk	North Hollywood	Chinese elm	Female appeared to abandoned the territory in mid-June, possibly with very small young in nest (observed dive-bombing observer, a behavior normally present once chicks have hatched). Loud fireworks preceded the apparent abandonment.
Cooper's Hawk	Encino	Coast live oak	Unk; multiple visits with adult incubating; no activity observed subsequently on multiple visits throughout the season.
Cooper's Hawk	Hollywood	Sycamore	Unk; no activity after incubation.
Red-shouldered Hawk	Los Feliz	Eucalyptus	Nest tree severely trimmed early in season while adults were present near nest.
Red-shouldered Hawk	Baldwin Hills	Eucalyptus	Unk; no activity after incubation.
Red-shouldered Hawk	Cahuenga Pass	Eucalyptus	Unk; no activity after incubation.
Red-shouldered Hawk	Griffith Park	Eucalyptus	Unk; no activity after incubation.
Red-shouldered Hawk	Mt. Washington	Norfolk Isl. pine	Unk; no activity after incubation.
Red-shouldered Hawk	Beverly Hills	Sycamore	Unk; no activity after incubation.
Red-tailed Hawk	Griffith Park	Eucalyptus	Unk; no activity after brief visits to nest early in season.
Red-tailed Hawk	Griffith Park	Eucalyptus	Unk; no activity after nest-building.
Red-tailed Hawk	Echo Park	Eucalyptus	Nest was in large tree in center of Echo Park homeless encampment; nest failed around the time of heavy equipment used during clearing of encampment and/or tree-trimming[20].
Red-tailed Hawk	Elysian Park	Pine	Nest went missing during study, possibly having blown down in windstorm.

The full spreadsheet with location information will be provided to Friends of Griffith Park separately due to the sensitive nature of the data. FoGP shares nest locations with park managers to encourage them to avoid disturbances during nesting season, including filming and tree maintenance.

[20] In 2021, Friends of Griffith Park shared the locations of all raptor nests in and adjacent to city parks with staff from the Forestry Division of Los Angeles Department of Recreation and Parks. Our hope is that incidents like the Echo Park nest failure can be avoided in the future.

3.4 Rare Species

In addition to the four focal species, we documented one (successful) territory of Peregrine Falcon, again at a rock ledge in Griffith Park, and two successful territories of American Kestrel. One kestrel family group was in and around Rio de Los Angeles State Park near Glassell Park, where birds may have nested again in a building or pole; a second was found late in the season in downtown Los Angeles, where a family group of birds was found using a gap in the roof of a building. Downtown Los Angeles may have held a second breeding pair of Peregrine Falcons, but difficulty of observing their rooftop nest sites precluded our confirming this.

Incidental sightings of American Kestrel in at least two cemeteries in East L.A. (Calvary and Evergreen) and in residential El Sereno in early summer (near large, old palm trees) suggest that the far southeastern portion of the study area may be a productive area to search for this declining species in future years.

No confirmed territories of Western Screech-owl or Barn Owl were documented in 2021, but we made no particular effort to find these cryptic species.

4.0 LITERATURE CITED

Allen , L.W., K.L. Garrett, and M.C. Wimer. 2017. Los Angeles County Breeding Bird Atlas. Los Angeles Audubon Society.

Artuso, Christian, C. Stuart Houston, Dwight G. Smith and Christoph Rohner.(2013).Great Horned Owl (*Bubo virginianus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna-org.bnaproxy.birds.cornell.edu/SpeciesAccount/bna/species/grhowl

Beebe, F.L. 1974. Field studies of the falconiformes of British Columbia: vultures, hawks, falcons, eagles. British College Proceedings Museum Occasional Paper No. 17. Victoria, BC, Canada.

Bennett, J.R. and P.H. Bloom. 2005. Home range and habitat use by great horned owls (*Bubo virginianus*) in southern California. Journal of Raptor Research. 39 (2):119-126.

Bloom, P.H. 1985. Raptor movements in California. pp. 99 – 123. In Harwood, M. ed. Proceedings of Hawk Migration Conference IV. Rochester, NY.

Bloom, P.H., M.D. McCrary, and M.J. Gibson. 1993. Red-shouldered Hawk home range and habitat use in southern California. J. of Wildlife Manage. 57:258-265.

Bloom, P.H. and J. Catino. 2016. Nesting Raptors of the Irvine Ranch Wildlands and Associated Environs. Unpublished.

Boarman, W.I. and B. Heinrich. 1999. Common Raven (Corvus Corax), The Birds of North America (P.G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna-org.bnaproxy.birds.cornell.edu/Species-Account/bna/species/comrav

Chiang, S.N., P.H. Bloom, A.M. Bartuszevige, and S.E. Thomas. 2012. Home Range and habitat use of Cooper's Hawks in urban and natural areas. Urban bird ecology and conservation. Studies in Avian Ecology (no. 45).

Clark, R.J. 1977. Cooper's Hawk hunting in the city. Auk 94:142-143.

Cooper, D.S. and P. Mathewson. 2009. Griffith Park Wildlife Management Plan. Retrieved from the Friends of Griffith Park: http://www.friendsofgriffithpark.org/wp-content/uploads/2016/10/GP-WMP-Final.pdf

Cooper, D.S., C. Aiken and A. Spyrka. 2017. Nesting raptors of Griffith Park and the surrounding area, 2017. Report to Friends of Griffith Park, July 15, 2017.

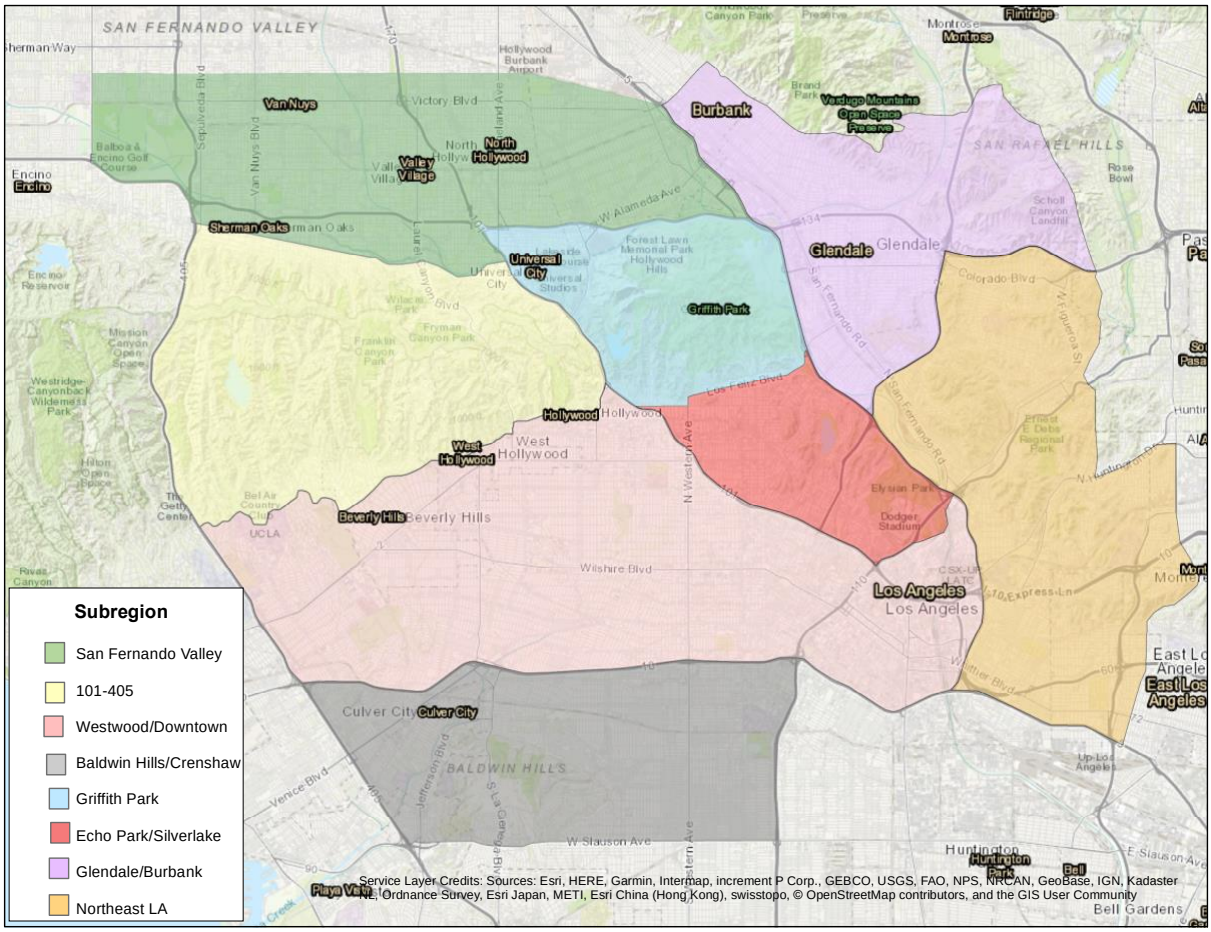
Garrett, K. and J. Dunn. 1981. Birds of Los Angeles County: Status and Distribution. Los Angeles Audubon Society.

Pericoli, R.V. and A.M. Fish. 2004. GGRO's East Bay Cooper's Hawk Intensive Nesting Survey – 2003. Golden Gate Raptor Observatory/Golden Gate National Parks Conservancy. Unpublished Report. May 2004.

Preston, C. R. and R. D. Beane.(2009).Red-tailed Hawk (*Buteo jamaicensis*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna-org.bnaproxy.birds.cornell.edu/Species-Account/bna/species/rethaw

Rosenfield, R.N (2018). The Cooper's Hawk: Breeding Ecology &Natural History of a Winged Huntsman.

APPENDIX A. Study Area boundaries



APPENDIX B. Maps of nest sites, by subregion.

[Please contact Friends of Griffith Park for updated maps]

APPENDIX C. Life history information on locally-nesting raptors, including new information learned in 2020.

1.1.1 Red-tailed Hawk

General notes (published): One of the most common large raptor species in North America, Red-tailed Hawks are abundant nesters in Los Angeles. They can nest in almost any habitat and on a variety of structures including buildings, cliffs and rock outcrops, native and non-native trees, and power line towers, but prefer very high sites, often somewhat protected from the elements (e.g., along a canyon bottom or toe of a slope, but with a broad/unobstructed view of the surrounding landscape. Breeding populations in Southern California are comprised primarily of resident birds that migrate only during their first few years (Bloom and Catino 2016). Mating for life, pairs typically visit two or more nests from previous years before rebuilding one for the current season. Nest building can begin as early as December in some cases, and the female begins incubation once the first egg is laid. Usually a clutch of 2-3 eggs but Red-tailed Hawks can sometimes have a clutch of 4. Incubation lasts about 30 days with young fledging at 7 weeks of age. Young hawks may disperse up to 1,000 miles from their nest site, however studies indicate most return to breed within 50 miles of where they fledge (Bloom 1985; this distance may be much smaller in urban populations). They primarily feed of small mammals, but they have also been known to forage on small birds and snakes. They seem particularly affected by rodenticide, with poisoned, "tame" individuals appearing around golf courses and parks.

General notes (this study): Red-tailed Hawk nests were predictably placed in the tallest trees in an area, often near, but not at, the head of the drainage or the crest of a ridge. In canyons where more than one pair was active, there would typically be an "upper" nest toward the head of the canyon, and a "lower" one farther down toward the valley/basin floor. Within the trees (usually pines or eucalyptus), Red-tail nests were placed roughly 3/4 –way up the tree, though occasional nests were placed in the crown of the tree (in the case of deodars and some pines), but other times would be located lower down, in the heavy boughs roughly 2/3-way up the tree – provided a clear "flight path" in and out of the tree was present. Red-tail nests were virtually never located in the dense center of any tree (vs. Cooper's Hawks, which virtually always were). They were sometimes very visible, but often were only visible from one specific location (usually not from an obvious spot), suggesting that the adult birds strategically locate nests in such a way that people are not staring at them constantly (even though they may be located in a rather high-traffic area, such as along a major road). There were several exceptions, but these may be nests that have persisted for decades such that the nest tree, and the immediate surroundings, have changed somewhat. We only observed adult Red-tails (i.e., with red tails and dark eyes) breeding; several one-year-old birds were around during the spring, but these were always unpaired, and often in places where breeding pairs were not present (they'd be mercilessly harassed by adults when they entered active territories).

Nesting behavior (early): We rarely observed local Red-tailed Hawk pairs nest-building, though when seen carrying sticks/grass, they almost always flew directly to the nest (provided we weren't standing too close or looking directly at them, in which case they'd circle for a while and almost invariably drop the material). Stealth is key; hiding behind bushes/houses is usually important for watching Red-tails approach the nest. Local Red-tails are quite vocal before, during and following nesting, and nearly all pairs observed were actively nesting. Vocalizations include the "classic" descending "keeeeeeer" call, but also more emphatic, almost panting calls ("eeeh, eeeh, eeeh"), that sound like juvenile vocalizations were given by breeding birds throughout the season, often from the nest (or while perched very close by). During the nesting season, adults were frequently seen perched either in the nest tree (usually above the nest) or in an adjacent tree; this was so reliable that any observation of a perched Red-tailed Hawk during March – May usually resulted in the discovery of a nest. During the breeding season, adults tended to soar/circle very high overhead, but often directly over the nest. However, certain pairs would forage fairly far from the nest, occasionally in an adjacent canyon/open space, which was confusing since one could search for days near a foraging Red-tailed Hawk, but still miss the nest. Adult Red-tails were extremely good at slipping away, seeming to wait until the observer would look in the other direction before gliding to/from a nest tree. Flights to the nest tree were fairly distinctive, usually a long, gliding swoop fairly low over the territory with a brief lift at the end as the bird alighted on the nest. This flight was so characteristic, that a glimpse of a bird doing it during March – May usually indicated an active nest at the end point of the flight. During the egg stage, adults frequently do not incubate, especially on warm days, and may be seen perched around the territory – but always within "eyeshot" of the nest.

Nesting behavior (late): As chicks hatch and are fed, adults appeared to take turns foraging, and were often not present together. During April and May, as chicks get larger, their loud cries will help locate a nest (these are often louder as the adults approach, but some nests/broods were extremely quiet, and we virtually never heard them call). As with birds carrying nesting material, any Red-tail seen carrying prey in spring almost invariably flew directly to the nest structure to feed young. As young Red-tails fledged, they seemed to disperse fairly quickly out of the natal territory, appearing in the nest canyon over, with the young sometimes far apart (out of ear/eye-shot). Fledglings remained fairly vocal out of the nest (though not as vocal as most Cooper's Hawks).

1.1.2 Red-shouldered Hawk

General notes (published): In California, the Red-shouldered Hawk is strongly associated with riparian and forested habitat (Dixon 1928, Bloom et al. 1993). While they continue to nest locally in lush residential areas with large, old trees, increased development has likely affected its distribution. The Red-shouldered Hawk has been shown to have one of the smallest average home ranges of any diurnal raptor in North America, 0.25 square miles or less (Bloom et al. 1993); however, our Red-shouldered Hawk territories appear to be very large, with wide gaps in between pairs.

General notes (observed): As one of our rarer raptors, we made relatively few observations of Red-shouldered Hawks. They seemed especially partial to dense groves of large trees, especially big, old eucalyptus groves with ample shedding bark, leaf litter, and shady canopy. Nesting territories were usually associated with a creek or spring, or a former one. Red-shoulder territories were very widely spaced, several miles apart (unlike Red-tails, which we found nesting within a quarter mile of each other if a ridge separated two canyons). While Red-shoulders are typically loud hawks, several of our pairs were very quiet, rarely flying together or delivering the usually gull-like vocalizations (which may be an urban adaptation?).

Nesting behavior: We observed most Red-shoulder nests fairly low in trees, usually on substantial limbs (like right at the first division of the trunk). However, some nests (including those just outside the study area) were small structures in the uppermost branches of trees – almost unbelievably flimsy structures that didn't seem like they could support a nesting hawk. Indeed, some of the nests are large limbs had relatively little nesting material visible other than a few stray sticks or bark sticking out. Red-shoulders were typically very hard to actually see when incubating – we often could see just a tip of a bill or tail (unlike Red-tails, where much more of the bird – and the nest – is usually visible). In 2020, most nests produced just a single chick (unlike Red-tails, which produced 2-3, or Cooper's which produced 3-4).

1.1.3 Cooper's Hawk

General notes (published): Over past decades, Cooper's Hawk populations have increased in urban and suburban habitats such as Los Angeles. Because of the apparent "boom" in urban populations, researchers have found their home ranges to be smaller than that of non-urban habitat. These species could also be benefitting greatly from their urban nesting pattern because there are fewer natural nest predators. The presence of domestic dogs and the lack of natural predators, such as the raccoon (*Procyon lotor*) and bobcat (*Lynx rufus*), might have enabled Cooper's Hawks to have high nesting success (Chiang et al., 2012), but certainly the decline in shooting hawks and taking their young for falconry (prevalent into the 1980s) has resulted in local increases as well. Cooper's Hawks use a combination of prey-capture methods that include brief perch-and-scan episodes to locate prey, followed by a sudden burst of speed in addition to hunting from higher flight (Beebe 1974, Clark 1977, Fischer 1986). They primarily prey on smaller bird species but it is not uncommon for them to forage on small mammals and reptiles.

Nesting behavior (early): Cooper's Hawk nests were almost impossible to find during the early/incubation season. Adults might call occasionally, but due to the dense foliage in which they prefer to place their nest, we could rarely find nests early away from known territories. As they tend to shift nest sites each year, we caution against assuming a territory (or a nest) is inactive just because a bird isn't observed after multiple visits early in the season (i.e., before May). Incubating adults tend to sit very low in nests, with only a tail tip sticking up and visible (and they sit stone-still, unlike Red-tails, which often shift around a bit, and fly in and out of nests during the egg stage. During this incubation period, sometimes the nest can be located by finding the male guarding or "standing sentry" while the female incubates, or by observing the

male bringing food to the female. The male often has a food perch near the nest tree where it will pluck and clean the prey as well as eat some, then calling to the female who will leave the nest inconspicuously and meet the male to eat before returning to incubation. Sometimes the detritus and feathers under a food perch can be helpful in locating the nest. These perches develop a distinctive splatter of whitewash below them. The whitewash drops below these nests are roughly the size of a quarter. By contrast, droppings from corvids, which share the same types of perches, are more "goopy", and often have greenish and gray tones, presumably due to a more varied diet. As young hatch, adult/pair behavior becomes more conspicuous. Males seem to spend increasing time away from the nest, presumably foraging, with females "standing sentry" in a nest tree, usually a tall deodar/pine, or utility pole, usually with a few hundred feet of the nest (and almost always staring directly at the nest)

Nesting behavior (late): As the young fledge, they become extremely vocal, and tend to spend weeks within c. 100' of the nest. During this post-fledging period, their behavior can be extremely conspicuous and even "goofy", as they might jump down off a perch to "attack" a bird or object they have dropped. They fly together and play together and have been observed cooperatively hunting (Rosenfield, 2018). They often perch on low fences, patio furniture, and cars – and so are often photographed by the public and posted to iNaturalist, NextDoor, etc. Nests with fledglings/large nestlings tend to become festooned with white down cover the entire rim of the nest and often the sides of the nest and nearby leaves/twigs. A large "spray" of chalk-white whitewash in small neat circular drops develops below the nest, which is easily seen if the nest is over black asphalt of a roadbed or a house roof, but can be easily missed if over lawn or vegetation (or if within a natural habitat such as an oak grove). Similarly large areas of Corvid whitewash is most often located between trees, as they will release droppings while flying between trees in the territories, whereas Cooper's Hawk whitewash is more often directly below the nest tree or at the perch.

1.1.4 Great Horned Owl

General notes (published): A large owl species, Great Horned Owls are habitat generalists allowing them to have the most flexibility in nesting sites of any American owl (Houston et al., 2013). They often nest in abandoned hawk or raven nests, as well as cliff ledges and manmade structures. Great Horned Owl nesting season begins earlier than other diurnal or nocturnal raptors, laying 2-4 eggs per clutch, often initiating nesting in fall. The Great Horned Owl diet consists primarily (90%) of small mammals, but can include rabbits, gophers, squirrels, and other bird species. Their home ranges in California can range from 135 ha (0.6 square miles) to as high as 1198 ha (4.5 square miles) depending on the sex of the bird and the surrounding habitat (Bennett and Bloom 2005).

Nesting behavior: Great Horned Owl courtship begins early with distinctive call and response between the pair. The males will bring the females food both prior to and during incubation. Great Horned Owl prey in Los Angeles has been observed to include a range of small mammals- native wood rats, non-native rats, squirrels, and desert cottontails. With larger prey like rabbits

the Owls will often have a cache nearby where they will store unfinished prey and retrieve it. Great Horned Owl nests sites were usually in dense foliage and difficult to find, especially before the light colored owlets are visible – most sites were reported to us by locals (often homeowners with owls in their backyard/front yard trees).

Nesting Behavior (late): Fledgling owls tend to stay in the natal territory for weeks after leaving the nest. The family usually moves together as a unit a few hundred feet from the nest tree where the owlets practice short flights, as adults bring them food and teach them to hunt. They will usually roost together in one tree during this period. Sometimes before learning to fly the young may end up on the ground for a period while the adult feeds them, as with songbirds, often leading to well-meaning but unnecessary rescues. In busy parks or campuses this can be a vulnerable period. The later nesting season can be a productive time to find owl nesting locations as the young can be more conspicuous than the adults.