WESTERN BIRDS

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Western Specialty:
Spotted Owl

Photo by Craig Swolgaard of Georgetown, California: Female Northern Spotted Owl (*Strix occidentalis caurina*) with fledgling, Mendocino National Forest, Glenn County, California, 23 June 2022. The Northern Spotted Owl is famed for its association with old-growth forest in the Pacific Northwest—a region becoming prone to large-scale fires as temperatures rise. Burned forest seems antithetical to the Spotted Owl's needs as long understood. Yet in this issue of *Westerrn Birds* Tonja Y. Chi tells the story of a pair that not only survived two years in a large stand of severely burned forest but nested successfully, fledging two, probably three young—one of which you see here. Thus in spite of the decades of intensive study directed at the Spotted Owl, its fire ecology is insufficiently understood.

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Front cover photo by © Mark J. Rauzon of Oakland, California: Sulphur-bellied Flycatcher (*Myiodynastes luteiventris*), Santa Rosa Creek, Sonoma Co., California, 16 August 2021, representing the 10th record for northern California and only the third for California in summer.

Back cover photo by © Deborah J. House of Bishop, California: Mono Lake, California, 22 October 2020, when the lake's level was 1945.1 m above mean sea level. In the foreground is the Wilson Creek delta along the northwest shore, site of most Northern Shovelers (*Spatula clypeata*) counted on regular lakewide surveys each fall 2002–2022. Features that may be attracting shovelers there include the protected bay, abundant flow from springs, and shallows for foraging.

Western Birds solicits papers that are both useful to and understandable by amateur field ornithologists and also contribute significantly to scientific literature. The journal welcomes contributions from both professionals and amateurs. Appropriate topics include distribution, migration, status, identification, geographic variation, conservation, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, and techniques for censusing, sound recording, and photographing birds in the field. Papers of general interest will be considered regardless of their geographic origin, but particularly desired are reports of studies done in or bearing on North America west of the 100th meridian, including Alaska and Hawaii, northwestern Mexico, and the northeastern Pacific Ocean.

Send manuscripts to Daniel D. Gibson, P. O. Box 155, Ester, AK 99725; avesalaska@gmail.com. For matters of style consult the Suggestions to Contributors to *Western Birds* (at https://westernfieldornithologists.org/publications/journal).

WESTERN BIRDS

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THE 47TH ANNUAL REPORT OF THE CALIFORNIA BIRD RECORDS COMMITTEE: 2021 RECORDS

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ABSTRACT: From its last report through 2021, the California Bird Records Committee reached decisions on 177 records involving 184 individuals of 71 species and one species group, endorsing 151 records of 158 individuals. The first accepted records for California of the Mexican Duck (*Anas diazi*) are outlined in this report. The committee also voted to add naturalized populations of the Nanday Parakeet (*Aratinga nenday*), Mitred Parakeet (*Psittacara mitratus*), Red-masked Parakeet (*Psittacara erythrogenys*), and Lilac-crowned Parrot (*Amazona finschi*) to the state list. These additions bring California's total list of accepted species to 681, of which 17 represent established introductions. Other especially notable records detailed in this report include those of California's second through fifth Tundra Bean-Geese (*Anser serrirostris*), second Purple Sandpiper (*Calidris maritima*), third Ross's Gull (*Rhodostethia rosea*), fourth Eurasian Skylark (*Alauda arvensis*), and fourth Common Crane (*Grus grus*).

This 47th report of the California Bird Records Committee (CBRC), a committee of Western Field Ornithologists, summarizes evaluations of 177 records involving 184 individuals of 71 species and one species group. The committee accepted 151 records, involving 158 individuals of 63 species and one species group, for an acceptance rate of 86%. A record is considered accepted if it receives no more than one "not accept" vote from the nine voting members on the grounds of questionable identification, or no more than two "not accept" votes on the grounds of questionable natural occurrence. We considered eight records of eight individuals of four species to represent likely returning or continuing birds that had been accepted previously. Twenty-five

records, involving 25 individuals of 13 species, were not accepted because the identification was not considered to be substantiated. In one case, involving one individual of one species, we considered the species correctly identified but did not accept the record because we questioned the bird's natural occurrence. For review, reports of multiple individuals together are given the same record number; we report the total number of accepted individuals, which may be different from the number of accepted records. Most of the records in this report are of birds first documented in 2021, although a few are earlier.

Since the period covered by this report, the committee has accepted the first California records of the Ainley's Storm-Petrel (*Hydrobates cheimomnestes*), Small-billed Elaenia (*Elaenia parvirostris*), Willow Warbler (*Phylloscopus trochilus*), Wood Warbler (*Phylloscopus sibilatrix*), and Siberian Rubythroat (*Calliope calliope*), the details of which are covered in the CBRC's 48th report, and the White-tailed Eagle (*Haliaeetus albicilla*) and Blue Rock Thrush (*Monticola solitarius*), to be covered in the 49th. These additions bring the California list to 687 species.

At its January 2022 meeting, the committee revised its criteria for species included on the review list from an average of four occurrences per year over the most recent 10-year period to an average of two occurrences per year over the most recent 10-year period or 50 occurrences total. This change is intended to increase the amount of attention the committee can give to species with less well-established patterns of occurrence in California. As a result the CBRC deleted these 17 species from the review list as of January 2022: Ruddy Ground Dove (*Columbina talpacoti*), Bar-tailed Godwit (*Limosa lapponica*), Hudsonian Godwit (*Limosa haemastica*), Yellow-billed Loon (*Gavia adamsii*), Masked Booby (*Sula dactylatra*), Tricolored Heron (*Egretta tricolor*), White-eyed Vireo (*Vireo griseus*), Blue-headed Vireo (*Vireo solitarius*), Redpoll (*Acanthis flammea*), Snow Bunting (*Plectrophenax nivalis*), Common Grackle (*Quiscalus quiscula*), Worm-eating Warbler (*Helmitheros vermivorum*), Connecticut Warbler (*Oporornis agilis*), Mourning Warbler (*Geothlypis philadelphia*), Kentucky Warbler (*Geothlypis formosa*), Cape May Warbler (*Setophaga tigrina*), and Grace's Warbler (*Setophaga graciae*).

Species-account headings are organized with the English followed by the scientific name first, followed in parentheses by the total number of individuals accepted for California (this report included) and the number of new individuals accepted in this report. Accounts summarize records accepted, followed by records not accepted because the identification was not established, the date or location was uncertain, or the natural occurrence was questionable (as applicable). A double asterisk (**) following the number of accepted individuals indicates that the species has been reviewed for a restricted period, so the number of accepted individuals does not represent the total number known for the state. When the observer(s) who originally discovered the bird provided documentation, their initials are listed first in italics, followed by the initials of subsequent observers supplying documentation. A symbol following an observer's initials indicates he or she submitted a photograph (†), sketch ($), audio recording (§), and/or video (‡). The absence of a symbol following the observer's initials indicates the submission of written documentation only. Following the initials of the observer(s) is the identifying number assigned by the CBRC's secretary. A (#) precedes a

preserved specimen's catalog number; in this report we cite the collections of the California Academy of Sciences (CAS), Humboldt State University (HSU), Royal British Columbia Museum (RBCM), and San Diego Natural History Museum (SDNHM).

As of the CBRC's 43rd report (Singer et al. 2020), age terminology follows that of Humphrey and Parkes (1959) as modified by Howell et al. (2003) and Howell and Pyle (2015). Age determinations largely follow the criteria of Pyle (2008, 2022). First-year birds are indicated as in juvenile, formative, or first alternate plumage. We refer to birds in definitive basic plumage as "adults," indicating definitive alternate plumage where appropriate. If, in the species accounts, we do not specify a bird's age or sex, those characteristics could not be assessed from the information available. Definitions of abbreviations and additional details regarding minutiae of formatting may be found in the CBRC's previous annual reports and in *Rare Birds of California* (CBRC 2007), both available via the CBRC's website, www.californiabirds.org. For a key to the abbreviations for California counties, see https://rarebirds.westernfieldornithologists.org/Appendix_C.html. Also available through https://www.californiabirds.org/ are the California bird list, the review list, an online form for submitting documentation of review species, committee news, the CBRC's bylaws, and a form for querying the CBRC's database. Observers are encouraged to submit documentation for all species on the CBRC's review list to the secretary via e-mail (secretary@californiabirds.org) or via the website. Documentation of all records is archived at the Western Foundation of Vertebrate Zoology (www.wfvz.org) and is available for public review by appointment or by contacting the CBRC's secretary.

SPECIES ACCOUNTS

BLACK-BELLIED WHISTLING-DUCK *Dendrocygna autumnalis* (35, 0). NATURAL OCCURRENCE QUESTIONABLE: One photographed at the West Fulkerth Road wetlands near Turlock, STA, 6 Aug 2021 (2021-071) was near a property known to keep exotic waterfowl, and in a year without additional out-of-range records in California or Arizona. All but one member inferred that this bird was likely to be an escaped captive.

EMPEROR GOOSE *Anser canagicus* (102, 3). One in formative plumage was in Gerber, TEH, 4–10 Oct 2021 (LHub†; 2021-110), and two adults were at Humboldt Bay National Wildlife Refuge (NWR), HUM, 10 Dec 2021–1 Jan 2022 (*BH*†, EE†; 2021-158).

TUNDRA BEAN-GOOSE *Anser serrirostris* (5, 4). The four records detailed here are California's second through fifth of the Tundra Bean-Goose. Prior to 2021, the committee had reviewed only two records of the species pair Taiga/Tundra Bean-Goose (*A. fabalis/serrirostris*). California's first Taiga/Tundra Bean-Goose, at the Salton Sea NWR, IMP, 9 Nov 2010–12 Jan 2011 (2010-141; Nelson et al. 2013) was never identified beyond this species pair. A different bean-goose that showed up at the same location approximately three years later was accepted as the state's first Tundra Bean-Goose (2013-181; Rottenborn et al. 2016). Nelson et al. (2013) and Rottenborn et al. (2016) discussed previous records and identification criteria in detail.

Outside experts assisted with the assessment of all five bean-goose records considered in this report, including the four accepted as representing the Tundra. The identification of an adult shot by a hunter at the Arcata bottoms, HUM, 8 Nov 2015

(*TD*†, RFo†, HSU #9678; 2015-173) was corroborated by genetic analysis (James Maley pers. comm.). An adult was at the Cosumnes River Preserve, SAC, 14–15 Nov 2020 (*PG*†, DBr†, LK, CM†, EM†; 2020-172); one in formative plumage was at the Arcata and McKinleyville bottoms, HUM, 14 Oct–6 Nov 2021 (*JA*†, DH†, SH†, AL†, JT†; 2021-126; Figure 1); and one in formative plumage was shot by a hunter near Meridian, SUT, 27 Dec 2021 (CG†; 2021-176; specimen's disposition unknown).

TAIGA/TUNDRA BEAN-GOOSE *Anser fabalis/serrirostris* (2, 1). One in formative plumage shot by a hunter at Sutter NWR, SUT, 11 Jan 2020 (*JAd*†; 2020-011; specimen's disposition unknown), was clearly one of this species pair but could not be identified to species on the basis of the single photograph submitted.

BAIKAL TEAL *Sibirionetta formosa* (9, 1). California's ninth Baikal Teal was an adult male shot by a hunter at Delevan NWR, COL, 20 Jan 2021 (*IH*†; 2021-008; specimen's disposition unknown).

GARGANEY *Anas querquedula* (30, 0). The CBRC considered the adult female at the Salton Sea State Recreation Area, RIV, 24 Nov–15 Dec 2021 (*RLM*†; 2021-152) to be the same bird that was there the previous two winters (2019-174; Benson et al. 2021).

MEXICAN DUCK *Anas diazi* (9, 9). As a result of its re-elevation to species status (Chesser et al. 2020), the committee now reviews all reports of the Mexican Duck. These nine records, all of males, are the first of this taxon the CBRC has accepted. An adult was at Earp, SBE, 26 Oct 2011 (DVP†; 2011-285); one in formative plumage was in the Parker Strip, SBE, 17 April–9 May 2011 (TAB†, *DVP*†; 2011-286); one in formative plumage was near Blythe, RIV, 31 Mar 2015 (DG†; 2015-178); an adult was near Desert Center, RIV, 2 Jun 2015 (*CM*†; 2015-179); one in formative plumage was at Furnace Creek Ranch, INY, 25 Dec 2016–15 Jan 2017 (JLD†, CBH†; 2016-153; Figure 2); an adult was shot by a hunter at the San Luis NWR, MER, 5 Dec 2016 (DH†; 2016-154; specimen's disposition unknown); one was at the Whitewater River delta, RIV, 11 Aug 2018 (*CAM*; 2018-256); an adult was shot by a hunter at the Piute Ponds, LA, 18 Dec 2019 (DE†; 2019-214; specimen's disposition unknown); and an adult was at Desert Center, RIV, 14 Nov 2020 (*DS*, AH†, CL†, RW†; 2020-205).

Beginning with its original description in 1886, the Mexican Duck was, like the other North American "black ducks," the Mottled (*A. fulvigula*) and American Black (*A. rubripes*), treated as a species, until the AOU (1983) designated it a subspecies of the Mallard (*A. platyrhynchos*). The change was based primarily on work by Hubbard (1977), who concluded that hybridization was "extensive" and that most Mexican Ducks in both the United States and Mexico were of hybrid origin. Subsequent molecular studies (e.g., Lavretsky et al. 2015, 2019) have shown that, in spite of some hybridization, the mixed traits of most Mexican Ducks are a result of introgression and past hybridization rather than widespread current hybridization. Through the 20th century, the Mexican Duck's range in the United States was limited to the border region of southeastern Arizona, southwestern New Mexico, and central western Texas (Phillips et al. 1964, Aldrich and Baer 1970, Monson and Phillips 1981). Within Mexico, the Mexican Duck ranges throughout the central highlands, becoming less common farther north toward the border with the United States (Howell and Webb 1995, Drilling et al. 2020). In the 21st century it has spread within Mexico, west into the lowlands of Sonora and east along the Rio Grande (Drilling et al. 2020). It is now being reported with more regularity beyond the former northern and northwestern limits of its range, into Colorado, Utah, Nevada, and California (Frisch et al. 2019, Peterson and Leukering 2020, Martin Meyers pers. comm.). See Leukering and Mlodinow (2012) and Reeber (2015) for thorough analyses of the criteria for distinguishing the Mexican Duck from other "black ducks" and the male Mallard in eclipse plumage.

FIGURE 1. This Tundra Bean-Goose in formative plumage was photographed on 15 Oct 2021 along Jackson Ranch Road in Arcata, Humboldt County (2021-126), representing California's third record of this apparently increasing species.

Photo by Derek Hameister

FIGURE 2. This male Mexican Duck (background) at the Furnace Creek sewage ponds, Death Valley (2016-153), photographed here 25 Dec 2016 with a female Mallard, was the first recorded for Inyo County.

Photo by Jon L. Dunn

There are two California records from the early 1900s that have not been reviewed, of a female collected at Grafton, YOL, July 1900 (Phillips 1923), and a male collected at Alviso, SCL, 27 July 1927 (Patten et al. 2003). The provenance of the former was questioned by Grinnell and Miller (1944), and Hubbard (1977) treated the latter as a hybrid. IDENTIFICATION NOT ESTABLISHED: The committee concluded that the documentation of a male at the south end of the Salton Sea, IMP, 22 Aug 2018 (2018-257) and another male near Imperial Dam, IMP, 4 Feb 2019 (2019-213) did not rule out the possibility of hybrid Mallard × Mexican Duck.

KING EIDER *Somateria spectabilis* (47, 1). An adult female was at Humboldt Bay NWR, HUM, 5–8 Dec 2021 (*SMcA*†; 2021-156).

RUDDY GROUND DOVE *Columbina talpacoti* (120**, 0). IDENTIFICATION NOT ESTABLISHED: The report of one from Palo Verde Ecological Reserve, RIV, 23 Oct 2020 (2020-196) lacked details sufficient for acceptance.

RUBY-THROATED HUMMINGBIRD *Archilochus colubris* (23, 1). One in its first plumage cycle, photographed in Berkeley, ALA, 29 Aug 2020 (*JHa*†; 2020-080), was likely a male from its seemingly short tail and bill. First-cycle birds may be in formative or first alternate plumage, depending on the terminology used for first-cycle molts (Pyle 2008).

COMMON CRANE *Grus grus* (4, 1). An adult associated with Sandhill Cranes (*Antigone canadensis*) on Staten Island, SJ, 14–21 Dec 2021 (*LBW*†, DH†, LW†; 2021-174; Figure 3). It represents the southernmost record of the Common Crane in California and first for the Central Valley. California's previous three records are from the extreme northern end of the state with one in Del Norte County and two in Modoc County.

COMMON RINGED PLOVER *Charadrius hiaticula* (6, 1). A juvenile at Lake Tolowa, DN, 5–10 Sep 2021 (*LB*§, TK†; 2021-086), was the second for Del Norte County. A recording of the call was helpful in distinguishing this individual from the similar Semipalmated Plover (*C. semipalmatus*).

SIBERIAN SAND-PLOVER *Anarhynchus mongolus* (16, 1). A juvenile at Laguna Creek Beach, SCZ, 17–24 Sep 2021 (*WG*B†, MF†, EI†, AMR†, BT†; 2021-095; Figure 4) was the second for Santa Cruz County. Previously classified in the genus *Charadrius*, this species was also formerly grouped with *A. atrifrons* (dubbed the "Tibetan Sand-Plover") as the Mongolian Plover (*Charadrius mongolus*) before being split by Chesser et al. (2024; see also Wei et al. 2022). The Siberian Sand-Plover is a long-distance migrant along the eastern Asian flyway and the only of this pair of species to have been recorded in North America. See Schweizer and Liu (2023) for additional information on distribution and identification.

BAR-TAILED GODWIT *Limosa lapponica* (62, 3). An adult female, molting out of definitive alternate plumage, at the Napa-Sonoma Marshes Wildlife Area, SOL/NAP, 3 Jul–10 Oct 2021 (*EI*, EGM†, ZP†; 2021-056), was the first Bar-tailed Godwit recorded for Solano and Napa counties. A second female, in worn first alternate plumage, was at the Elk Creek mouth and Lake Tolowa, DN, 5–10 Sept 2021 (*LB*†, TK†; 2021-085). A juvenile was on the shore of Monterey Bay from Moss Landing, MTY, north to Seacliff State Beach, SCZ, 9 Sep–1 Oct 2021 (*AL*, AMR†, SBT†; 2021-088). The committee has discontinued reviewing reports of the Bar-tailed Godwit after 2021.

HUDSONIAN GODWIT *Limosa haemastica* (63, 1). A juvenile was at Lake Tolowa and the mouth of Elk Creek, DN, 29 Aug–27 Sep 2021 (*TK*†; 2021-080). The committee has discontinued reviewing reports of the Hudsonian Godwit after 2021.

CURLEW SANDPIPER *Calidris ferruginea* (57, 2). A juvenile was photographed

FIGURE 3. This adult Common Crane on Staten Island, San Joaquin County (2021-174), photographed here 16 Dec 2021, represented the first record of this Asian species for California's Central Valley.

Photo by Lynette B. Williams

at the Ventura County Game Preserve, VEN, 23 Sep 2021 (*LS*†; 2021-135; Figure 5). One in formative plumage at the Palo Alto Baylands, SCL, 20 Dec 2021–15 Mar 2022 (*MMR* †$, MLB†, MF, JM†, MR†, RWR†, SCR†, ANW†; 2021-165) was the first Curlew Sandpiper known to have wintered in California, though one in Kings County (2020-129; Benson et al. 2022) was recorded into November and may have overwintered as well.

FIGURE 4. This juvenile Siberian Sand-Plover was photographed 21 Sep 2021 at Laguna Creek Beach, Santa Cruz County (2021-095).

Photo by William G. Bousman

RED-NECKED STINT *Calidris ruficollis* (28, 2). One in alternate plumage was at the Elsie Roemer Bird Sanctuary, ALA, 15–20 Jul 2021 (EGM†, MR†, EI†, HG; 2021-059), and an adult in definitive alternate plumage was at Malibu Lagoon, LA, 22–29 Aug 2021 (DJB†; 2021-077).

PURPLE SANDPIPER *Calidris maritima* (2, 1). An adult at North Shore (of the Salton Sea), RIV, 30 Dec 2020–17 Feb 2021 (*RLM*†$, TAB†, MAG†, AH†, GM; 2020-199; Figure 6) was only the second for California, but also the second for Riverside County. The state's only previous Purple Sandpiper was just 12 km away at Salt Creek Beach, Salton Sea, RIV, 25 Mar–17 Apr 2016 (2016-028; McCaskie et al. 2018), then discovered again approximately 800 km north at Kehoe Beach on Pt. Reyes, MRN, 25 Apr 2016 (2016-029; McCaskie et al. 2018). The discrimination of the Purple from the Rock Sandpiper (*C. ptilocnemis*) in formative and basic plumages is difficult. The Purple Sandpiper is casual in the interior of North America away from the Great Lakes, and only one inland occurrence of the Rock Sandpiper is known, based on a specimen collected at Atlin, British Columbia, on 29 October 1932 (RBCM #5798, Campbell et al. 1990.).

LITTLE STINT *Calidris minuta* (36, 0). An adult in the south San Diego Bay saltworks, SD, 11 Aug 2021–25 Apr 2022 (*MS*†; 2021-073) was presumably returning for its fourth consecutive winter (2018-219; Benson et al. 2020). During its stay it molted from definitive alternate to definitive basic and back to definitive alternate plumage.

WHITE-RUMPED SANDPIPER *Calidris fuscicollis* (35, 4). A flock of three in alternate plumage at the Baker sewage ponds, SBE, 6–7 Jun 2021 (*EI*†, TAB†, AEK†, TGM†; 2021-047) provided the second record of the White-rumped Sandpiper for San Bernardino County and were the largest group so far seen in California. One in alternate plumage was at the Salinas water-treatment plant, MTY, 29 May 2021 (*ST*†; 2021-069). As this species undergoes a complete preformative molt, first alternate and definitive alternate plumage cannot be distinguished (Pyle 2022).

BLACK-HEADED GULL *Chroicocephalus ridibundus* (34, 1). An adult was at the Modesto wastewater-treatment plant, STA, 21 Nov–11 Dec 2021 (*HMR*†; 2021-145). Another adult at Thermal, RIV, 8 Dec 2021–9 Mar 2022 (*RLM*†; 2021-175) was presumably a returnee, first seen in January 2014 (2014-003; Singer et al. 2016).

ROSS'S GULL *Rhodostethia rosea* (3, 1). An adult at Albany State Marine Reserve, ALA, 14 Dec 2021 (*DRL* †; 2021-162) was the third for California and a first for Alameda County. All records are of adults.

SLATY-BACKED GULL *Larus schistisagus* (84, 5). An adult was at Tiburon, MRN, 24–26 Jan 2021 (*LC*†; 2021-010). A bird in second alternate plumage along the San Leandro shoreline, ALA, 11 May 2021 (*NA*†; 2021-034) represents the first time this species has been recorded in California as late as May. One in third basic plumage was at Bodega Bay, SON, 23–25 Nov 2021 (*LH*†, RS ANW†; 2021-147). One in its first plumage cycle was at the Pilarcitos Creek mouth, SM, 11 Dec 2021–14 Feb 2022 (*AJ*†, MD†, CH†; 2021-160). The committee also re-evaluated the report of a first-cycle Slaty-backed Gull at Lower Otay Reservoir, SD, 16–21 Jan 2017 (*JP*†, NC†, GM, MS†; 2017-006A). In an earlier review it was not accepted on the basis that a hybrid could not be eliminated and identification criteria for first-cycle Slaty-backed Gulls were not well established (2017-006; Singer et al. 2020). Subsequently, birders' understanding of identification criteria for this plumage and age class have improved (Jaramillo 2020), and upon reconsideration the committee agreed that this bird was indeed a first cycle Slaty-backed Gull. IDENTIFICATION NOT ESTABLISHED: An adult photographed at Half Moon Bay State Beach, SM, 23 Dec 2021 (2021-166) appeared atypical for this species, having a relatively pale mantle and lacking a dark smudge around the eye. Although the plumage of second-cycle

FIGURE 5. This photo provides a nice comparison of a juvenile Curlew Sandpiper (left) in complete juvenile plumage with a Dunlin (*Calidris alpina*) in formative plumage at the Ventura County Game Preserve, Ventura County, 23 Sep 2021 (2021-135). Unlike North American populations of the Dunlin, the Curlew Sandpiper tends to begin its preformative molt in the winter.

Photo by Larry Sansone

Slaty-backed Gulls can be distinctive, several committee members concluded that the documentation for one described from the Marina landfill, MTY, 28 Nov 2020 (2020-182) was insufficient.

SANDWICH TERN *Thalasseus sandvicensis* (3, 0). IDENTIFICATION NOT

FIGURE 6. This Purple Sandpiper was photographed 30 Dec 2020 at North Shore, Salton Sea, Riverside County (2020-199). Although the Purple and Rock Sandpipers overlap in characteristics, the latter is eliminated by the lack of a pale supraloral spot and dull bare parts, as seen in this photo.

Photo by Matthew A. Grube

ESTABLISHED: Several committee members believed that a tern reported as the Sandwich at the San Diego River mouth, SD, 6 Oct 2021 (2021-169) may have been an Elegant Tern (*T. elegans*) × Sandwich Tern hybrid because the extent of yellow on the tip of the bill exceeded what is expected for a pure Sandwich Tern.

YELLOW-BILLED LOON *Gavia adamsii* (113, 8). One in formative plumage photographed along the South Mokelumne River, SJ, 14 Jan–2 Mar 2021 (*LBW*†, KD†, JM†; 2021-006; Figure 7) represented a first record for San Joaquin County and only the 11th inland California record of this species that typically winters along the coast. Fitting the more expected pattern of coastal occurrence were one in Humboldt Bay, HUM, 11 Jan 2021 (*AL*; 2021-005); one in formative plumage in Tomales Bay, MRN, 18 Jan–14 May 2021 (*LS*, LC†, EW†; 2021-007); and an adult 5.3 km west of Cypress Point, MTY, 9 Feb 2021 (JM†; 2021-018). The Yellow-billed Loon in formative or first alternate plumage off Rodeo Beach, MRN, 12 May 2021 (*WL*†; 2021-037) may have been the same individual as the one off Crissy Field, SF, 17 May 2021 (*CVV*†; 2021-065), though the committee treated them as different. One in second alternate plumage was at Limantour Beach, MRN, 21 Jul 2021 (DL †; 2021-066), and one in second basic plumage was in Crescent City harbor, DN, 23 Oct 2021 (AS†; 2021-099). The committee discontinued review of records of the Yellow-billed Loon after 2021.

SHORT-TAILED ALBATROSS *Phoebastria albatrus* (47, 5). Recent years have seen an uptick in records of the Short-tailed Albatross in California in tandem with continued population growth (U.S. Fish and Wildlife Service 2020). One bird undergoing its second prebasic molt, 14 km southeast of Point Fermin, LA/ORA, 5–7 Jun 2021 (TAB†, CAD†, CJ†; 2021-046) had been banded as a nestling on Torishima Island, Japan, on 29 Feb 2020 (Yoshiya Odaya pers. comm.). This same individual was later observed off California's central coast on Monterey Bay, SCZ, 24 Jul 2021 (BSc†; 2021-060) and 14–15 Sep 2021 (AL†; 2021-093). Another Short-tailed Al-

FIGURE 7. This Yellow-billed Loon in formative plumage along the South Mokelumne River, San Joaquin County (2021-006), photographed here 14 Jan 2021, represents a first county record and only California's 11th inland record.

Photo by Konshau Duman

batross undergoing its second prebasic molt was 15 km west of Mussel Point, SON, 22 May 2021 (*MF*†; 2021-063), while first-cycle birds were 23 km south-southeast of Southeast Farallon Island, SF, 1 May 2021 (*MF*†; 2021-061), 16 km southwest of Davenport, SCZ 1 May 2021 (*MF*†; 2021-062), and on Monterey Bay, MTY, 8 Nov and 3 Dec 2021 (*JM*†; 2021-157).

WEDGE-RUMPED STORM-PETREL *Hydrobates tethys* (15, 1). One was photographed 250 km west-southwest of San Miguel Island, SBA, 31 Jul 2021 (*CW*†; 2021-067). The experienced observer also satisfactorily described the bird's bill shape and flight style to distinguish it from the very similar Townsend's (*H socorroensis*), Leach's (*H. leucorhous*), and Ainley's (*H. cheimomnestes*) Storm-Petrels.

WOOD STORK *Mycteria americana* (1**, 0). Following the precipitous decline of this once common post-breeding visitor to California, the committee began reviewing Wood Stork reports in 2020 (Benson et al. 2021). It inferred that reports of an adult at the San Diego Zoo's Safari Park at San Pasqual and at Lake Hodges, SD, 4 May–28 Jun 2021 (NC†, AN† 2021-032); Lake Elsinore, RIV, 1 Jul 2021 (*CH*†; 2021-055); Prado Basin, RIV, 15 Jul–8 Oct 2021 (*JEP*†; 2021-058); and back at the Safari Park, SD, 12 Oct 2021 (*KC*†; 2021-123) represented the same wandering individual that summered in San Diego and Riverside counties in 2020 (2020-043, Benson et al. 2022).

MASKED BOOBY *Sula dactylatra* (61, 7). One in second basic plumage was at the Los Angeles harbor, LA, 9–10 Oct 2021 (*MAS*†; 2021-121). One undergoing its third prebasic molt was at Point La Jolla, SD, 25–26 Jan 2021 (JB†, MS†; 2021-011). Adults were 16.9 km southeast of Cabrillo Beach, LA, 13 Jun 2021 (*AB*†, *NS*†; 2021-049); on Bird Rock at San Clemente Island, LA, 3 Jun 2021 (*JTS*†, *NJD*†; 2021-050); and 6.5 km west of Border Field State Park, SD, 31 Jul 2021 (*DP*; 2021-072). Masked Boobies in third basic plumage at Bolsa Chica State Beach, ORA, 28 Jan 2021 (DM†; 2021-014) and at Moonstone Beach, SLO, 22 Jun 2021 (*EB*†, TME†; 2021-052) were both taken to rehabilitation facilities. The CBRC has been unable to ascertain the ultimate disposition of the Bolsa Chica bird; the one from Moonstone Beach died in captivity, and the specimen was given to California Polytechnic State University, San Luis Obispo. IDENTIFICATION NOT ESTABLISHED: The description of one 7 km northeast of Point San Pedro on Santa Cruz Island, SBA, 16 Jun 2021 (2021-078) did not adequately eliminate the Nazca Booby (*S. granti*). A booby in its third plumage cycle photographed 8 km west of Mission Bay, SD, 17 Aug 2021 (2021-076) showed some features suggesting the Nazca Booby. Committee members were unwilling to identify to species photos of three additional Masked/Nazca Boobies: one offshore from Newport Beach, ORA, 25 Jun 2020 (2020-067), another 15.6 km west of Point Loma, SD, 3 Oct 2021 (2021-109), and a third at the Thirty-Mile Bank, SD, 16 Oct 2021 (2021-127). The committee discontinued reviewing reports of the Masked Booby after 2021.

TRICOLORED HERON *Egretta tricolor* (97**, 7). In northern California, an adult at Younger Lagoon, SCZ, 31 Jul 2021 (*LG*†, AMR †; 2021-068) provided a first record for Santa Cruz County. California has few inland reports of this species away from the Salton Sea, so adults at Calipatria, IMP, 3 Apr 2021 (*GM*; 2021-026) and at Lower Otay Reservoir, SD, 31 Aug–15 Sep 2021 (*BC*†, PEL†; 2021-082) are notable. Others accepted from 2021 were along the coast of southern California, where more expected: an adult at the Tijuana Slough NWR, SD, 4–18 Sep 2021 (*MN*†; 2021-084); a juvenile at San Elijo Lagoon, SD, 13 Sep 2021 (*SB*†; 2021-091); a juvenile at Upper Newport Bay, ORA, 23 Sep 2021–4 May 2022 (*SMcA*†, CC†; 2021-102); and an adult at Bolsa Chica Ecological Reserve and Seal Beach NWR, ORA, 6–8 Nov 2021 (*SO*†; 2021-139). An adult at Point Mugu Naval Air Station, VEN, 4 Nov 2019–24 Feb 2020 (*MR*†; 2019-216) and 8 Nov 2021–17 Mar 2022 (*MR*†; 2021-141) was consid-

ered a returnee that had wintered there 2018–2019 (2018-205; Benson et al. 2020). IDENTIFICATION NOT ESTABLISHED: One bird photographed at a distance in Granite Bay, PLA, 30 Jun 2021 (2021-064) and another described at Torrey Pines State Beach, SD, 19 Sep 2021 (2021-100) could not be attributed to this species. The committee reviewed records of the Tricolored Heron only from 1990 to 2021.

GLOSSY IBIS *Plegadis falcinellus* (49, 7). Accepted as representing the Glossy Ibis were reports of adults in the Prado Basin, RIV, 7 Apr 2021 (*JEP*†; 2021-033); at Fort Bidwell, MOD, 29–30 May 2021 (KMcK†; 2021-042); along E. Catlett Road, PLA/SUT, 29 May–4 Jun 2021 (*ZVZ*†; 2021-043); and near Niland, IMP, 16 Aug 2021 (*CS*†; 2021-075). IDENTIFICATION NOT ESTABLISHED: The committee considered several other reports to not represent phenotypes acceptable as the Glossy Ibis, of second-year birds in the Prado Basin, RIV, 13 Jul 2020 (2020-207), 27 Jul 2020 (2020-208), and 25 Mar 2021 (2021-024) and at the Fillmore Fish Hatchery, VEN, 11 Apr 2021 (2021-054), as well as adults at the San Diego Zoo's Safari Park, San Pasqual, SD, 7 Mar 2019 (2019-211), 22 Jun–11 Jul 2020 (2020-066), and 25 Mar–5 May 2021 (2021-025) and at the Cosumnes River Preserve, SAC, 5–7 May 2020 (2020-038).

ROSEATE SPOONBILL *Platalea ajaja* (152, 2). Two at the Cienaga Ecological Reserve, Fillmore, VEN, 15–30 Sep 2021 (*LH*, *DS*†; 2021-171; Figure 8) represented the first record of the Roseate Spoonbill in California north of Los Angeles County since the 1970s. Another was photographed at Sonny Bono Salton Sea NWR, IMP, 23 Sep 2021 (*SR*†; 2021-101).

BLACK VULTURE *Coragyps atratus* (13, 2). Reports of an adult from the vicinities of Point Reyes National Seashore and Mount Tamalpais, MRN, 10 Apr–15 Oct 2021 (PP†, DB†; 2021-028) as well as Bolinas, MRN, 13 Nov 2021–24 Feb 2022 (*EM*†; 2021-172) were considered to represent the same bird that has been frequenting this general area since 2014 (2014-027; Singer et al. 2016). Another adult in Klamath, DN, 14–17 Apr 2021 (*KR*†, RN†; 2021-029) was considered by a majority of committee members to likely represent the same Black Vulture observed at Andy McBeth Airport, Klamath Glen, DN, 10 Sep 2021 (*LB*; 2021-089). One undergoing its second prebasic molt was around Owens Lake and Lone Pine, INY, 13 Oct–21 Nov 2021 (*RK*†; 2021-124).

MISSISSIPPI KITE *Ictinia mississippiensis* (59, 2). One in formative plumage was at the Tijuana River Valley Regional Park, SD, 19 Jun 2021 (*DT*†, NC†, GM; 2021-051), and a juvenile was at the Sonny Bono Salton Sea NWR, IMP, 21 Sep 2021 (*JV*†; 2021-098).

GRAY HAWK *Buteo plagiatus* (2, 0). IDENTIFICATION NOT ESTABLISHED: The report of one described from Cathedral City, RIV, 5 Nov 2021 (2021-143) received little support.

ELF OWL *Micrathene whitneyi* (14, 2). Two in formative plumage wintered in a residential area in Indio, RIV, 10 Dec 2020–5 Mar 2021 (*BD*†; 2020-195; Figure 9). This represents California's first December record of the Elf Owl, which has not been reported in December or January farther north than Lo de Campa (28.55° N, 109.74° W) in central Sonora (Russell and Monson 1998).

CRESTED CARACARA *Caracara plancus* (21, 1). One was photographed at Owens Lake, INY, 26 May 2015 (RR†; 2015-180).

GREAT CRESTED FLYCATCHER *Myiarchus crinitus* (72, 4). One in definitive alternate plumage photographed at the Imperial Irrigation District Wetlands in Niland, IMP, 23 Jun 2021 (*CAM*†, *TEW*†; 2021-057) was the first recorded in Imperial County and only the second in California in spring or summer. The primary coverts were of the basic plumage, indicating an adult, whereas the tertials had been replaced during the definitive prealternate molt. Nearly all other California records

FIGURE 8. These two Roseate Spoonbills near Fillmore, Ventura County, on 15 Sep 2021 (2021-171) represented the first record of this species in California north of Los Angeles County since the 1970s.

Photo by Devina Schneider

FIGURE 9. This Elf Owl photographed 10 Dec 2020 in a private yard in Indio, Riverside County (2020-195), was the first recorded wintering in California.

Photo by Brett Daniels

of the Great Crested Flycatcher are from September and October, so one in preformative molt along Atascadero Creek, SBA, 9–21 Nov 2021 (*MAH*†; 2021-140) and one in formative plumage wintering at John Baca Park, Huntington Beach, ORA, 10 Dec 2021–1 Jan 2022 (TAB†§, CC†, JH; 2021-167) were unusual. Rounding out an above-average year for this species was one at Corona Heights Park, SF, 19 Sep 2021 (*RM*†; 2021-177).

SULPHUR-BELLIED FLYCATCHER *Myiodynastes luteiventris* (23, 1). The black chin, yellow wash to the underparts, and high-pitched call helped distinguish a worn adult along Santa Rosa Creek, SON, 10–24 Aug 2021 (*LV*§, EI†§, ZP†§, MJR†, ANW†; 2021-074; this issue's front cover) from the similar Streaked Flycatcher (*M. maculatus*), which is still unrecorded north of Mexico. Only once before has the Sulphur-bellied Flycather been recorded farther north in California.

THICK-BILLED KINGBIRD *Tyrannus crassirostris* (28, 2). One in formative plumage at Flood Park in Menlo Park, SM, 29 Oct 2021 (*RF*†, MD†, CH†, JM†§, DP†§, RWR†, BT†; 2021-134) was the second recorded in San Mateo County and only the fourth recorded in northern California. An adult was in the Tijuana River valley, SD, 23 Nov–13 Dec 2021 (*JP*†§; 2021-148).

GREATER PEWEE *Contopus pertinax* (47, 1). Wintering individuals included one at Lacy Park, San Marino, LA, 8 Jan–26 Mar 2021 (*JW*†; 2021-004) and an adult at Balboa Park, San Diego, SD, 4 Oct 2021–13 Feb 2022 (*MHR*†; 2021-111) that returned for its fourth winter (2017-151; Singer et al. 2020).

EASTERN WOOD-PEWEE *Contopus virens* (18, 2). One at the Point Reyes Lighthouse, MRN, 16–19 Sep 2021 (*BA*§, *DS*, PBC†, EI§, AM, EGM, BT†§; 2021-094) and another at Furnace Creek Ranch, Death Valley, INY, 30 Sep–2 Oct 2021 (*EWH*†, *LK*§, MAG†, CBH†, RH†; 2021-106) were at well-known vagrant traps. Sound recordings of both individuals captured the upslurred, clear "puree" call, which is the vocalization the Eastern Wood-Pewee makes most often during fall and winter (J. L. Dunn pers. comm.) and unlike the flat or descending vocalization typically made by the Western Wood-Pewee (*C. sordidulus*).

ALDER FLYCATCHER *Empidonax alnorum* (11, 2). One was closely studied but silent at Primm Valley Golf Club, SBE, 29 May 2021 (*AH*†, *EI*†, *DS*; 2021-041). Another was calling and singing at Butterbredt Spring, KER, 6 Jun 2021 (*RST*†§, SBT, JCW; 2021-048). Eight of California's 11 Alder Flycatcher records come from the southeastern, desert region of the state.

WHITE-EYED VIREO *Vireo griseus* (95, 1). An adult at Antonelli Pond, SCZ, 25 Sep–7 Oct 2021 (AR†, SBT†, BT†; 2021-104) was the second recorded for Santa Cruz County. Only 17 (18%) of California's records represent fall migrants. Late spring migrants and summering birds, usually singing persistently, are more frequent—and easier to detect. The committee discontinued reviewing records of the White-eyed Vireo after 2021.

BLUE-HEADED VIREO *Vireo solitarius* (92, 2). The early spring date of a male in formative plumage at Carlsbad, SD, 7 Apr 2021 (*JM*†, DH†; 2021-027) suggests the bird may have been wintering. A male in formative plumage was at Doyle Community Park, San Diego, SD, 12–13 Sep 2021 (*JD*†; 2021-090). IDENTIFICATION NOT ESTABLISHED: The plumage brightness and contrast of a vireo photographed at the Point Reyes Lighthouse, MRN, 17 Sep 2021 (2021-096) did not conclusively distinguish the bird from a Cassin's Vireo (*V. cassinii*). The indentation in the white fringe on the outermost tail feather (R6)—a field mark useful for distinguishing between some adult male Blue-headed and Cassin's Vireos (Buckley and Mitra 2003)—could not be confidently assessed from the one photo showing this characteristic. The committee discontinued reviewing records of the Blue-headed Vireo after 2021.

EURASIAN SKYLARK *Alauda arvensis* (4, 1). One in formative plumage at the Loleta bottoms, HUM, 3 Jan–14 Feb 2021 (*TK*§, RFo†, RN†; 2021-003), occasionally observed with Western Meadowlarks (*Sturnella neglecta*), was the third recorded in northwestern California since 2018. Like that of California's other skylarks (see Benson et al. 2022), the plumage of this individual was consistent with the boldly patterned and russet-colored Asian subspecies *A. a. pekinensis* (Vaurie 1951).

CAVE SWALLOW *Petrochelidon fulva* (15, 1). One was at Mystic Lake, RIV, 10 Feb 2021 (*DTR*; 2021-017). Twelve (80%) of California's 15 records of the Cave Swallow are from Riverside and Imperial counties, and seven of the 15 are during winter.

DUSKY WARBLER *Phylloscopus fuscatus* (23, 2). One in formative plumage at Corte Madera, MRN, 4–8 Oct 2021 (*AM*, LC†, EI†, EGM, MJR†, AMR†, DSS†, BT†, ANW†; 2021-112) and another in the Sepulveda Basin, LA, 9–16 Oct 2021 (*JF*†, TAB†, CBH, RH†, KR†; 2021-118) reinforced the Dusky Warbler's pattern of reaching California in October, the month of 20 of the state's 23 records.

WINTER WREN *Troglodytes hiemalis* (29, 2). One in formative plumage photographed and sound recorded at Olema Campground, MRN, 3 Jan–8 Mar 2021 (*LS*, *MS*†, DSS§; 2021-001) was the second recorded in Marin County, and another at Bolinas Lagoon, MRN, 25 Nov 2021–14 Mar 2022 (MM§, EC†§, MD†§, AM, LN†§; 2021-153) was the third.

CURVE-BILLED THRASHER *Toxostoma curvirostre* (42, 4). Four records of this species in 2021 were considerably more than the recent ten-year average of one per year. Individuals were at Palo Verde Ecological Reserve, RIV, 20 Jan 2021 (*BS*; 2021-009); at Needles, SBE, 14 Mar 2021 (*GZ*†; 2021-023) and 30 Dec 2021 (*KF*†; 2021-168); and at Fort Piute, SBE, 14 Apr 2021 (*KH*†; 2021-161). All appeared to be of the western subspecies *T. c. palmeri*. IDENTIFICATION NOT ESTABLISHED: A photo of a thrasher from Black Meadow Landing, SBE, present November 2019 through 30 Jan 2020 (2019-206), lacked detail sufficient to eliminate Bendire's Thrasher (*T. bendirei*).

RUFOUS-BACKED ROBIN *Turdus rufopalliatus* (28, 3). One in formative plumage at Point Loma, SD, 17 Nov 2021 (*SZ*†; 2021-150) was the second recorded for San Diego County and just the second along California's coast. An adult and an immature in formative plumage at the Lake Tamarisk Golf Club, Desert Center, RIV, 19 Nov 2021–25 Mar 2022 (*BW*†, LW†; 2021-151) represented only the third record of multiple individuals at one location.

WHITE WAGTAIL *Motacilla alba* (51, 7). On the heels of a good showing in 2020 (Benson et al. 2022), a record seven White Wagtails were found in California in 2021. Five showed characteristics of the subspecies *M. a. lugens*: a female in definitive alternate molt along the Los Angeles River in Los Angeles, LA, 27 Feb–21 Mar 2021 (*BR*†; 2021-021); a female in definitive alternate plumage at Crissy Field, SF, 14–15 May 2021 (HC†, PP†, PS†; 2021-036), inferred to be the same as the one found a few days later at the Redwood Creek mouth, HUM, 18 May 2021 (*KMS*†; 2021-038); and a female in definitive basic plumage at Southeast Farallon Island, SF, 17–22 Oct 2021 (*JG*†, JRT†; 2021-131). Striking males of *M. a. lugens* in definitive alternate plumage at South Lake Tahoe, ED, 17 Apr 2021 (*JS*†; 2021-030) and at the north end of the Salton Sea, RIV, 2 Jun 2021 (*RLM*†, TAB†, MAC†, GM; 2021-044; Figure 10) were the first recorded for El Dorado and Riverside counties, respectively, and the latter was also the first recorded for the Salton Sink. Through 2021, all four White Wagtails accepted from the interior of the California have been males of *M. a. lugens* during spring migration. A formative-plumaged female evidently of the subspecies *M. a. ocularis* was at Swanton Pond, SCZ, 17 Oct 2021 (*GM*†; 2021-128), and another, possibly of *ocularis*, was at the Elk Creek mouth, DN, 9 Oct 2021 (*ZH*†;

FIGURE 10. This male White Wagtail of the black-backed subspecies *Motacilla alba lugens* in definitive alternate plumage was at the north end of the Salton Sea, Riverside County (2021-044). Photographed here on 2 Jun 2021, it represents the first record of the White Wagtail for the Salton Sink.

Photo by Mark A. Chappell

2021-122). IDENTIFICATION NOT ESTABLISHED: A cell-phone video of one reported at Pudding Creek Beach, MEN, 2 Nov 2020 (2020-165) was of low quality, leading four members to not endorse the record after four rounds of voting.

BRAMBLING *Fringilla montifringilla* (9, 1). A male in formative plumage discovered on the Quincy Christmas Bird Count was at a residential feeder in Quincy, PLU, 18 Dec 2021–18 March 2022 (JLD, MF†, DL†, MM†, NO†, AP†, MR†, SBT†; 2021-163; Figure 11). This was the first Brambling for Plumas County and the first for California since 2015.

REDPOLL *Acanthis flammea* (184, 4). A male in formative plumage was found along lower Rock Creek, MNO, 2–7 Dec 2021 (JLD†, DJH†, RH†, NJO†; 2021-154), and two males (in formative and definitive basic plumage) were in Chester, PLU, 19 December 2021–8 Jan 2022 (DH†; 2021-164). A record of a Common Redpoll that the CBRC did not accept because it may have represented a Hoary Redpoll (*A. hornemanni*) (2013-011A; Rottenborn et al. 2016) is now accepted following the lumping of those two species by the American Ornithological Society (Chesser et al. 2024). IDENTIFICATION NOT ESTABLISHED: Reports of one near Honey Lake, LAS, 21 Nov 2021 (2021-155) and another in Bishop, INY, 10 Dec 2021 (2021-159) failed to garner acceptance with a majority of members. In both cases the observation was brief and no photos or audio recordings were submitted to support the identification. The CBRC discontinued reviewing records of the Redpoll after 2021.

SNOW BUNTING *Plectrophenax nivalis* (155, 3). Two were found in inland: an adult male near Los Banos Reservoir, MER, 3 Feb 2021 (*JT*†; 2021-016) and a male in formative plumage near Lake Almanor, PLU, 7 Feb 2021 (*LC*†; 2021-015). A female in formative plumage was found along the coast at Limantour Beach, MRN, 26 Oct 2021 (*LN*†; 2021-132). 2021 was the first year since 2017 when none were reported

Figure 11. This male Brambling in formative plumage, here photographed 18 Feb 2022, overwintered in a yard in Quincy, Plumas County (2021-163), representing a first county record.

Photo by Mark J. Rauzon

from northwestern California. The committee discontinued reviewing records of the Snow Bunting after 2021.

CASSIN'S SPARROW *Peucaea cassinii* (100, 1). A female in formative plumage was found dead and somewhat damaged in a swimming pool in the neighborhood of Allied Gardens, San Diego, SD, 22 Oct 2021 (PU†, SDNHM #56893; 2021-133).

COMMON GRACKLE *Quiscalus quiscula* (106, 2). A male in formative plumage wintered in Crescent City, DN, 4 Jan–19 Mar 2021 (*TK*†, TAB†, RN†; 2021-002). Another male (age unknown) was at the Point Reyes Lighthouse, MRN, 14 Oct 2021 (*RM*†; 2021-125). The committee reviews records of the Common Grackle only through 2021. All accepted records in California have pertained to the western and northern subspecies *Q. q. versicolor*.

WORM-EATING WARBLER *Helmitheros vermivorum* (144, 2). One in formative plumage was in Blythe, RIV, 29 Apr 2021 (*BW*†, JJS†; 2021-031), and another was in Encinitas, SD, 7–16 Oct 2021 (*KAA*†; 2021-137). The committee discontinued its review of records of the Worm-eating Warbler after 2021.

LOUISIANA WATERTHRUSH *Parkesia motacilla* (23, 1). One at Struve Slough, SCZ, 28 Sep 2021 (*NU*†; 2021-107; Figure 12) was the first recorded for Santa Cruz County.

GOLDEN-WINGED WARBLER *Vermivora chrysoptera* (86, 2). Two males in formative plumage were found in the fall: one in Thousand Oaks, VEN, 24 Sep 2021 (*CB*†; 2021-103), the other at Meadow Park, SLO, 5–10 Oct 2021 (*NB*†, TAB†, MS†; 2021-113).

CONNECTICUT WARBLER *Oporornis agilis* (128, 0). IDENTIFICATION NOT ESTABLISHED: The committee did not accept the description of one from Southeast Farallon Island, SF, 7 Oct 2020 (2020-125). It discontinued review of records of the Connecticut Warbler after 2021.

FIGURE 12. This Louisiana Waterthrush at Struve Slough, Santa Cruz County, on 28 Sep 2021 (2021-107) represented a first county record and only the fifth record of the species for northern California.

Photo by Norman Uyeda

MOURNING WARBLER *Geothlypis philadelphia* (171, 2). One in formative plumage was on Southeast Farallon Island, SF, 2 Sep 2021 (*KH,* JRT; 2021-083), and another was at the Mal Paso Creek mouth, MTY, 8–9 Nov 2021 (DR†; 2021-173). The committee reviews records of the Mourning Warbler through 2021 only.

KENTUCKY WARBLER *Geothlypis formosa* (123**, 2). The two accepted in 2021, both in formative plumage, were a female in willows along Pecho Road, Los Osos, SLO, 26–28 Sep 2021 (*CM*§, PC†; 2021-105) and a male at Ventura High School, VEN, 10 Oct 2021 (TE†; 2021-130). The committee reviewed records of the Kentucky Warbler up through 1994 and from 2019 to 2021.

CAPE MAY WARBLER *Setophaga tigrina* (57**, 3). One male at Furnace Creek, INY, 31 May–4 Jun 2021 (*EI*†, *EM*†, *DS*, RST†; 2021-040) was joined by a second male on 4 Jun 2021 (*RST*†; 2021-045); both were in first alternate plumage. An adult female was at Lake Elizabeth, ALA, 26–29 Aug 2021 (*BC*†, VR†; 2021-079). IDENTIFICATION NOT ESTABLISHED: A report from Garden Grove, ORA, 12 May 2021 (2021-039) received no support. The committee reviewed records of the Cape May Warbler from 1972 to 1974 and 2011 through 2021.

GRACE'S WARBLER *Setophaga graciae* (90, 5). An adult male at Struve Slough, SCZ, 18 Sep 2021 (*AR*†§, SBT†, BT†; 2021-097) was the first recorded for Santa Cruz County. An adult female at Mentone Basin Park, SLO, 8 Oct 2021–18 Jan 2022 (*OH*†; 2021-117A) was joined by a second bird of unknown age and sex 25 Dec 2021 (*MLB*; 2021-117B). The rest of the accepted records came from San Diego County. A female in formative plumage in residential Point Loma, 20 Jan–28 Feb 2021 (*SBM,* JP†; 2021-019) returned the following fall, 28–29 Oct 2021 (*SBM*; 2021-136). Likewise, one at Vacation Isle, Mission Bay, 6 Mar–12 Apr 2021 (*JB*†, MHR†; 2021-022) returned the following winter, 17 Oct 2021–2 Feb 2022 (*JP*†; 2021-129). Three additional returning wintering birds were a female at La Jolla Colony Park, 3 Feb–1 Apr 2021 (*JDe*, JDu†; 2021-013; same bird as 2019-148; Benson et al. 2021); an adult male at Encinitas, 11 Oct 2021–13 Mar 2022 (ML†; 2021-120; same bird as 2018-223; Benson et al. 2020), and an adult male at Del Mar, 20 Nov 2021–26 Mar

2022 (TH†; 2021-142; same bird as 2018-019; Benson et al. 2020). The committee discontinued its review of records of the Grace's Warbler after 2021.

RED-FACED WARBLER *Cardellina rubrifrons* (28, 2). One in formative plumage was in the Tijuana River valley, SD, 6–9 Sep 2021 (DWA†, DH†, KR†; 2021-087), and one was at Fort Rosecrans National Cemetery, Point Loma, SD, 9 Oct 2021 (*GN*†; 2021-119).

PYRRHULOXIA *Cardinalis sinuatus* (32, 2). California's first Pyrrhuloxias since 2013 were a male in formative plumage at Palm Springs, RIV, 19 Mar–8 Jun 2021 (*SME*†, BM†; 2021-035) and another male (possibly adult) at Indio Hills, RIV, 11 Aug 2021 (*SBR*†; 2021-081).

POPULATIONS ACCEPTED

In addition to evaluating and archiving records of birds that rarely occur in California, the CBRC also maintains the California bird list, which includes introduced species considered to be established in the state. For a species to be added to the list, its identification must be established and its population in California must be considered "viable." The committee's criteria for viability are (1) that the species has bred in the state for 15 consecutive years, (2) that the population is increasing or stabilized after an initial period of increase, (3) that the species occupies enough geographically contiguous suitable habitat that the population is unlikely to diminish significantly, and (4) that the occupied environment is ecologically similar enough to the species' native habitat, or to that of other successful introductions, that permanent establishment seems likely. Populations maintained primarily by continued releases or requiring intensive management are not considered viable. The CBRC's Introduced Birds Subcommittee (T. A. Benson, J. S. Feenstra, J. F. Garrett, K. L. Garrett, K. N. Nelson, and A. J. Searcy) gathered evidence that naturalized population of the following four species have met the criteria for addition the California list, and the voting members of the committee accepted all four proposals.

NANDAY PARAKEET *Aratinga nenday* (2021-149; Figure 13). The monotypic Nanday Parakeet is native to central South America from southwestern Brazil and southeastern Bolivia to southern Paraguay and northeastern Argentina. Thousands of birds were imported for the pet trade in the 1960s and 1970s (Clapp and Banks 1973), allowing for the establishment of introduced populations in southern California. The core range of this species in California is defined by the Santa Monica Mountains, but occurrences are scattered throughout the coastal slope of Los Angeles and Ventura counties. This species was first noted in California in the late 1960s near San Bernardino, but that family of two adults and four young did not persist (Fisk and Crabtree 1974). Nanday Parakeets first appeared in single-digit numbers in the Santa Monica Mountains in the 1980s, increased and expanded throughout the late 1990s to approximately 200 by the turn of the century (Garrett and Mabb 2002, Pranty and Garrett 2002), and now number several hundred (Garrett 2018). Unlike other psittacids in California, Nanday Parakeets make extensive use of native habitats; the majority of confirmed and suspected nest sites are in western sycamore (*Platanus racemosa*) cavities (Garrett and Mabb 2002, Allen et al. 2016, Searcy unpubl. data). The species forages in native sycamore and oak (*Quercus agrifolia*) woodlands as well as in the urban landscape (Garrett and Mabb 2002, Pranty and Garrett 2011, Searcy unpubl. data).

FIGURE 13. Nanday Parakeets, photographed here 19 Sep 2019 (2021-149), feeding on fruits of the native laurel sumac (*Malosma laurina*) in Sycamore Canyon, Ventura County.

Photo by Adam J. Searcy

MITRED PARAKEET *Psittacara mitratus* (2021-115). During the 1980s, over 140,000 Mitred Parakeets were exported from Bolivia and Argentina to the United States (Collar et al. 2020). Through subsequent escape or intentional release, free-flying populations became established in the greater Los Angeles area in the 1980s (Garrett 1997). This population increased steadily over the next three decades, growing to an estimated 1000 (or more) individuals (Pranty and Garrett 2011, Garrett 2018). A smaller population in Sunnyvale, Santa Clara County, has been present since at least the mid-1990s (Bousman 2007) and now numbers around 70–80 individuals. In California, Mitred Parakeets inhabit urban areas where they forage on the fruits, seeds, and flowers of mostly non-native trees (Garrett et al. 1997). The species has been observed nesting in Canary Island date palms (*Phoenix canariensis*) and cavities in buildings (Bousman 2007, Allen et al. 2016, Garrett 2018). The subspecific taxonomy of the Mitred Parakeet is unresolved and in need of rigorous study (South American Checklist Committee 2010).

RED-MASKED PARAKEET *Psittacara erythrogenys* (2021-116). Over 42,000 Red-masked Parakeets were imported to the United States from Peru and Ecuador between 1981 and 1990 (Traffic 1987, Collar 1997). By the 1990s these birds had established free-flying populations in San Francisco, Los Angeles, and San Diego. The total statewide population is currently estimated at over 500 individuals, with 250–300 in San Francisco and "hundreds" in the greater Los Angeles area (Garrett 2018), as well as in San Diego. Like the Mitred Parakeet, the Red-masked Parakeet inhabits urban landscapes. Identification of this monotypic species from others of *Psittacara* can be difficult, especially in young birds in which the red face has not fully developed, and in southern California might be complicated by hybridization with the Mitred Parakeet (Kalodimos 2020). Careful study is still needed to clarify the ranges and status of the species of *Psittacara* in southern California.

LILAC-CROWNED PARROT *Amazona finschi* (2021-114). Native populations of the Lilac-crowned Parrot are endemic to the forested foothills and lowlands of the

Pacific slope of western mainland Mexico (Renton and Iñigo-Elias 2003). Naturalized populations are widespread in southern California where they utilize urban and suburban areas with large, mostly non-native, fruiting and flowering trees, though they have been recorded breeding in native habitats. The Lilac-crowned Parrot was first recorded in California in the 1970s when Froke (1981) estimated 22 birds in the San Gabriel Valley, Los Angeles County. Since then it has steadily spread and increased in abundance and geographical distribution. The greater Los Angeles area remains the area of core abundance with 400–500 birds, but populations exceeding 100 individuals also occur in San Diego, Orange, and San Bernardino counties, while much smaller numbers occur in Ventura and Santa Barbara counties. Lilac-crowned Parrots co-occur with Red-crowned Parrots (*A. viridigenalis*) in southern California and occasionally hybridize with them. Most authorities consider this species to be monotypic (Renton 2020).

RE-EVALUATION OF MASKED AND NAZCA BOOBY RECORDS

In an attempt to establish identification criteria for predefinitive plumages of the Masked and Nazca Boobies, Peter Pyle re-examined the CBRC's records of them through 2019. After evaluating records of 134 photographed boobies, Pyle (2020) published provisional identification criteria for subadults based on bill color: "Masked Boobies have bluish-green bill bases with greenish-yellow tips, and these colors appear to be relatively consistent while becoming brighter with age, from juvenile to definitive plumage," whereas "Nazca Boobies … have horn-colored bill bases (mixed dusky or occasionally bluish) that become mixed horn and orange, then orangish or pinkish-orange, with brighter orangish-yellow or golden bill tips, a combination of colors not shown by Masked Boobies at any age." As a result of this analysis, at the CBRC's annual meeting in 2021 he recommended that 28 records be re-evaluated by these criteria, and the committee voted to re-evaluate 20 of them. The results of these re-evaluations are summarized in Table 1. In cases where the committee reversed itself, the record was first re-evaluated as the same taxon so it could be "not accepted" before being reviewed and accepted as the other taxon or as a Masked/Nazca Booby. Including these re-evaluations, the total numbers of accepted records of the Masked Booby is 52, of the Nazca Booby is 73, and of the Masked/Nazca Booby is 56.

MISCELLANEOUS

The long-staying Northern Gannet (*Morus bassanus*) first seen at Southeast Farallon Island, SF, 25 Apr 2012 (2012-058; Pike et al. 2014) was still present at the time of the preparation of this report in September 2024 (J. R. Tietz pers. comm.).

CORRIGENDA

Two incorrect dates were published in the CBRC's 46th report (Benson et al. 2022): the correct date span for the Thick-billed Kingbird at Horsethief Canyon Park, LA, is 7 Feb–*28* Mar 2020 (2020-012), and the correct date range for the Northern Wheatear at the Loleta bottoms, HUM, is 18–*19* Sep 2020 (2020-093). The committee reviewed additional documentation for two

Table 1 Results of the CBRC's Re-evaluation[a] of Records of Subadult Masked and Nazca Boobies

Date	Location	Previously accepted identification	Record[b]	Re-evaluated identification	Record
16 Feb 1998	San Miguel I., SBA	Masked	1998-063[25]	Masked/Nazca	1998-063B
5–24 Jun 2000	San Nicolas I., VEN	Masked	2000-113[26]	Masked/Nazca	2000-113B
17 Jan–29 Mar 2003	San Clemente I., LA	Masked	2003-065[29]	Masked/Nazca	2003-065B
1 Nov 2007	25 km nw of San Clemente I., LA	Masked/Nazca	2008-070[35]	unchanged	
17 Nov 2012	San Lorenzo River mouth, SCZ	Masked	2012-187[38]	Masked/Nazca	2012-187B
6–27 Oct 2013	Entrance to Long Beach harbor, LA	Masked/Nazca	2013-287[39]	Nazca	2013-287A
1 Sep 2015	11 km wsw of Point Loma, SD	Masked/Nazca	2015-088[42]	Nazca	2015-088B
26 Oct 2015	Santa Barbara I., SBA	Masked	2015-126[44]	Masked/Nazca	2015-126C
31 Aug 2015	offshore from San Diego, SD	Masked/Nazca	2015-163[42]	Nazca	2015-163A
6 Aug 2017	5 km w of Seal Rocks, SF	Masked	2017-068[43]	Nazca	2017-068D
22 Sep 2017	La Jolla Cove, SD	Masked	2017-112[43]	Masked/Nazca	2017-112B
1 May 2018	San Diego harbor, SD	Masked	2018-040[44]	Masked/Nazca	2018-040B
31 May 2018	9 km wsw of Dana Point, ORA	Masked	2018-052[44]	Nazca	2018-052B
10 Jun 2018	27 km w of Point Loma, SD	Masked	2018-059[44]	Nazca	2018-059B
11 Jun 2018	Santa Catalina I., LA	Masked	2018-063[44]	Masked/Nazca	2018-063B
1 Jul 2018	12 km sw of Bolsa Chica, ORA	Masked	2018-071[44]	Masked/Nazca	2018-071B
17 Aug 2018	43 km w of Point Loma, SD	Masked/Nazca	2018-098A[44]	Nazca	2018-098B
19 Aug 2018	Thirtymile Bank, SD	Masked	2018-099[44]	Masked/Nazca	2018-099C
22 Aug 2018	4 km s of Point Fermin, LA	Masked/Nazca	2018-106[44]	Masked	2018-106A
31 Aug 2018	Santa Monica Bay, LA	Masked/Nazca	2018-117[44]	Masked	2018-117A

[a]Based on criteria in Pyle (2020).

[b]Records were originally published in the following CBRC reports: [25]Rogers and Jaramillo (2002), [26]McKee and Erickson (2002), [29]San Miguel and McGrath (2005), [35]Pyle et al. (2011), [38]Pike et al. (2014), [39]Rottenborn et al. (2016), [42]McCaskie et al. (2018), [43]Singer et al. (2020), and [44]Benson et al. (2020). In cases where the committee re-evaluated a previously accepted Masked Booby, the record was first re-evaluated as a Masked Booby so it could be "not accepted" before being reviewed and accepted as a Nazca Booby or as a Masked/Nazca Booby; these re-evaluations reversing acceptance as a Masked Booby are not shown in the table. Three records (2008-070A, 2015-126B, 2018-099B) were also re-evaluated as representing prospective Nazca Boobies but not accepted.

records at its meeting in January 2022 and voted to extend the date ranges for both records. The date span for the Tricolored Heron at Point Mugu Naval Air Station, VEN, is corrected to 5–*16* Oct 2017 (2017-102; Singer et al. 2020), and the date range of a Crested Caracara on Santa Catalina Island, LA, is amended to 6 Apr 2014–*13 Feb 2016* (2014-031; Singer et al. 2016). Paul Lehman provided documentation for date corrections to a number of

Table 2 Corrections to Dates of Certain San Diego County Records

Record	Species	Location	Date range[a]	CBRC report[b]
2013-008	Curlew Sandpiper	Imperial Beach	22–*27 Jan* 2013	39
2006-095	Tricolored Heron	San Diego River mouth	1 Aug 2006–*4 Apr* 2007	32
2006-152	Tricolored Heron	San Elijo Lagoon	16–*19 Oct* 2006	32
2006-154	Tricolored Heron	Imperial Beach	8 Oct 2006–*10 May* 2007	32
2007-261	Tricolored Heron	San Diego River mouth	15 Nov 2007–*3 May* 2008	33
2008-026[c]	Harris's Hawk	Pauma Valley	7 Feb–*4 Mar* 2008	34
2008-086[c]	Harris's Hawk	Bonita	27 Jun–*7 Jul* 2008	34
2010-124	Harris's Hawk	Borrego Springs	6–*24 Oct* 2010	36
2011-184	Thick-billed Kingbird	Chula Vista	25 Oct 2011–*9 Apr* 2012	37
2013-193	Thick-billed Kingbird	Chula Vista	18 Oct 2013–*7 Apr* 2014	39
2017-151	Greater Pewee	Balboa Park	5 Dec 2017–*26 Apr* 2018	43
2013-213	Blue-headed Vireo	Point Loma	16 Nov 2013–*12 Mar* 2014	39
2008-218	Pine Warbler	Chula Vista	7 Dec 2008–*5 Apr* 2009	34
2010-167	Pine Warbler	Bonita	11 Dec 2010–*6 Feb* 2011	36
2013-222	Pine Warbler	Greenwood Cemetery	16 Nov 2013–*11 Mar* 2014	39
2011-216	Grace's Warbler	San Diego	16 Dec 2011–*20 Feb* 2012	37
2013-163	Grace's Warbler	San Diego	6 Oct 2013–*15 Mar* 2014	39
2004-177	Scarlet Tanager	Tijuana River valley	31 Oct–*2 Nov* 2004	30
2007-262	Scarlet Tanager	Point Loma	15–*20 Nov* 2007	33

[a]Corrected dates in italics.

[b]Records were originally published in the following CBRC reports: 30 (Cole et al. 2006), 32 (Heindel and Garrett 2008), 33 (Singer and Terrill 2009), 34 (Pike and Compton 2010), 36 (Johnson et al. 2012), 37 (Nelson et al. 2013), 39 (Rottenborn et al. 2016), and 43 (Singer et al. 2020).
[c]Record not accepted as natural occurrence questionable.

San Diego County records that the committee approved at its meeting in January 2021 (Table 2).

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FALL MIGRATION OF THE NORTHERN SHOVELER AT HYPERSALINE MONO LAKE, CALIFORNIA

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ABSTRACT: From 2002 to 2022, waterfowl were surveyed at Mono Lake to evaluate the their response to lake-level changes under the State Water Resources Control Board's landmark Decision 1631, in which the public trust doctrine was first applied to water rights. From September through mid-November, the total numbers of Mono Lake's most numerous dabbling duck, the Northern Shoveler (*Spatula clypeata*), averaged 13,018 ± 1571 (standard error), ranging from a high of 27,400 in 2008 to a low of 2719 in 2018. Annual peak counts averaged 5562 ± 709, ranging from a low of 768 in 2018 to the highest single-day count of 13,793 in 2012. Annual totals were higher under conditions of monomixis than under the stratified condition of meromixis. In a generalized linear model, the combined effects of survey period, biomass of Mono Lake brine shrimp (*Artemia monica*), and regional drought explained 67.8% of the variation in Northern Shoveler numbers at Mono Lake, i.e., higher *Artemia* biomass and more severe drought in northeast California resulted in higher shoveler counts. Lake level, a key component of waterfowl-habitat restoration, showed no effect within the range of lake levels observed. These results suggest that food resources and regional drought have been the most important factors influencing Northern Shoveler use of Mono Lake, so far overriding any small-scale influences of habitat variation due to lake-level changes.

Mono Lake is a high-elevation hypersaline lake located on the east slope of the Sierra Nevada in the hydrologically closed Mono Basin, in Mono County, California (Figure 1). The Mono Basin experiences wide seasonal and annual variations in temperature and precipitation (Ficklin et al. 2012). Mono Lake lies within a larger geographic region, the Intermountain West, the vast arid region between the eastern slopes of the Sierra Nevada and Cascade Range and the western slope of the Rocky Mountains. The lake is large and deep, with a surface area of 180 km^2 at (1945.1 m elevation) and an average depth of over 18 m (Scholl et al. 1967, Melack 1983, Vorster 1985). Since 1996, the salinity of Mono Lake has averaged 83 g/L, or over twice that of seawater.

Mono Lake is highly productive and widely known for its value to waterbirds, a value due to the seasonal abundance of aquatic invertebrates, mainly the Mono Lake brine shrimp (*Artemia monica*) and alkali flies (*Cirrula* spp.). For example, the islands and numerous islets support one of the two largest nesting populations of California Gulls (*Larus californicus*) in California (Doster and Shuford 2018). The lake also functions as a fall staging area for an average of 40% of the North American population of the Eared Grebe (*Podiceps nigricollis*) (Roberts et al. 2013) and a staging area and migratory stopover location for up to 140,000 Wilson's (*Phalaropus tricolor*) and Red-necked Phalaropes (*P. lobatus*) during fall migration (Jehl 1986, 1988).

Waterfowl also use Mono Lake, including an established breeding population and larger numbers of migrating waterfowl in autumn. Waterfowl habitat at Mono Lake occurs in discrete patches around the perimeter of the lake in the vicinity of sources of fresh or brackish water. Wetland vegetation,

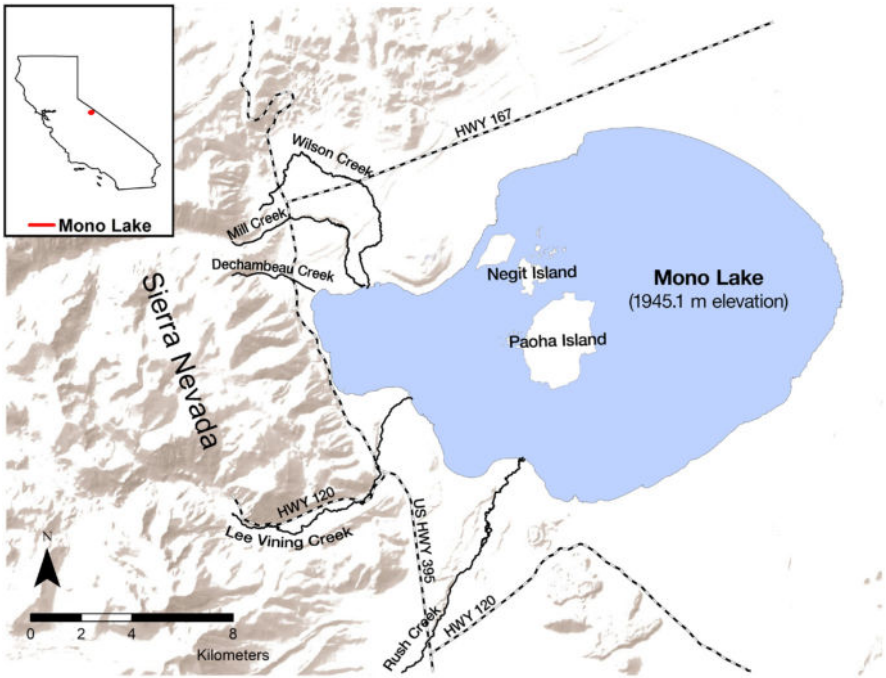

FIGURE 1. Mono Lake, California study area. Depicted are the five main perennial creeks, all originating from the east slope of the Sierra Nevada, the two main islands (Paoha and Negit), and the shoreline configuration at an elevation of 1945.1 m above mean sea level, which was the average level in September over the period of study from 2002 to 2022. (Relief map source: ESRI, USGS, and NOAA.)

primarily wet meadow and alkaline wet meadow, covers about 20% of the shoreline (Jensen 2015) and is best developed around the sources of fresh and brackish water. The 256 acres of marsh mapped in 2014 amounted to only 2% of all the shoreline's land types. The numerous fresh and brackish springs scattered around the entire shoreline also support small temporary and semi-permanent fresh and brackish ponds. In 2014, fresh and brackish water ponds totaled 38 ha or less than 1% of the shoreline of Mono Lake (Jensen 2015). Along the west shore are several perennial creeks and their deltas, the largest of which is that of Rush Creek.

The potential food resources for waterfowl at Mono Lake are primarily animal in nature, although various forms of algae and plants are found in the wetlands, ponds, and nearshore habitats. Aquatic plants are lacking in the open water because of its hypersalinity. In the pelagic zone (offshore), littoral zone (nearshore), and the fresh and brackish ponds aquatic invertebrates are an abundant food resource for waterfowl at Mono Lake. *Artemia monica* occurs in both the pelagic and littoral zones. *Artemia* densities can be higher nearshore than offshore, but nearshore densities are more variable spatially because nearshore areas are more heterogeneous in terms of substrates and

fresh-water inflows (Conte et al. 1988). High-density plumes of brine shrimp can occur near submerged tufa, underwater springs, near shore over mud or gravel substrates, along foam lines, and in spring channels or at the interface between fresh and hypersaline lake water (Conte et al. 1988, pers. obs.). The other dominant invertebrate, *Cirrula hians*, occurs primarily in the littoral zone, with higher concentrations near submerged hard surfaces such as tufa or pumice blocks (Herbst and Bradley 1993). The fresh and brackish ponds along the shoreline support a range of aquatic invertebrates including water boatmen (Corixidae), beetles (Coleoptera), alkali flies, and water mites (Hydrachnidia) depending on the salinity, persistence, and presence of vegetation (pers. obs).

Waterfowl diets at Mono Lake have not been studied formally (Jones and Stokes 1993), though anecdotal reports of stomach contents from hunter-killed birds in the mid-1900s and observations of foraging birds suggest Northern Shovelers feed primarily on brine shrimp and algae, while other waterfowl species consume mostly larvae and pupae of alkali flies (DeChambeau, Taylor, Banta, and McPherson *in* Jones and Stokes 1993). At Great Salt Lake, another hypersaline lake that hosts large numbers of waterbirds, about 70% of the Northern Shoveler's diet (biomass) consists of adults and cysts of brine shrimp (Vest and Conover 2011).

In the Intermountain West, wetlands such as Mono Lake typically serve as breeding and migratory stopover sites for waterfowl, but severe weather often limits waterfowl use in winter (Intermountain West Joint Venture 2013). Despite the severe winters the Mono Basin experiences, the lake does not freeze over because of its high salinity, although the shoreline ponds and wetlands do.

Mono Lake's communities of breeding and migrating waterfowl are fairly distinct. The Gadwall (*Mareca strepera*) has been the dominant breeding species, whereas the Northern Shoveler and Ruddy Duck (*Oxyura jamaicensis*) have been the most abundant species in fall (Jones and Stokes Associates 1993, LADWP 1996, House and Honda 2018). At least since the inception of my surveys in 2002, the Northern Shoveler has been the single most abundant waterfowl species at Mono Lake in fall, accounting for over 50% of all waterfowl observed between September and mid-November (House and Honda 2018).

Like many other saline lakes around the world (Wurtsbaugh et al. 2017), Mono Lake has been affected by water use for agricultural and municipal purposes. Starting in the 1800s, early agriculture in the Mono Basin involved diversions within the basin such as spreading water to grow crops or forage for livestock (Jones and Stokes Associates 1993). In 1941, however, transfers out of the basin began when the city of Los Angeles obtained appropriative water rights to divert flows from Lee Vining, Rush, Walker, and Parker creeks for its municipal water supply. Water diverted from these creeks was transferred from the Mono Basin into the Owens River basin and ultimately into the Los Angeles Aqueduct. From 1941 to 1988, water diversions from the Mono Basin averaged over 65,000 acre-feet per year, peaking at over 140,000 acre-feet in 1979 (Los Angeles Department of Water and Power [LADWP] unpubl. data). This diversion rate resulted in a 13.7-m vertical drop in the lake's level, which fell to a historic low of 1941.8 m above sea level in 1982 (SWRCB 1994).

A 1983 ruling by the Supreme Court of California resulted in the State

Water Resources Control Board (SWRCB) amending Los Angeles' water rights with Mono Lake Basin Water Right Decision 1631 (SWRCB 1994). Decision 1631 severely restricted water exports, established a target lake level of 1947.9 m above sea level, and restored perennial flow to Mono Lake's major tributaries. Decision 1631 was significant in that it was the first time the public trust doctrine was applied to water rights. Since implementation of Decision 1631 in 1995, the annual average export has dropped from 65,000 acre-feet to 13,000 acre-feet. This export reduction has resulted in an increase in and the stabilization of Mono Lake's level, which nevertheless remains below the target. Since 1999 the level of Mono Lake has fluctuated between 1945.8 and 1943.7 m above sea level, with elevational changes now largely driven by annual variation in weather and runoff. The reestablishment of waterfowl habitat at Mono Lake has as its most important objective achieving the target lake level of 1947.9 m above sea level (LADWP 1996).

Although historical information on waterfowl numbers was lacking, the SWRCB concluded that excessive water diversions and the associated drop in lake level had severely degraded habitat for migratory waterfowl (SWRCB 1994). Effects cited include an increase in the lake's salinity, stream incision, a reduction in "hypopycnal" environments (areas where fresh and brackish water mix nearshore), and the loss of delta lagoons and shoreline coves (Jones and Stokes Associates 1993, Stine 1995, LADWP 1996). The cessation of irrigation for livestock feed resulted in the loss of irrigated pastures and meadows on shore that were also likely to have attracted foraging and migrating waterfowl.

Despite the lack of data on waterfowl numbers prediversion, the SWRCB concluded that waterfowl populations had been more affected by the ecological changes associated with excessive water diversion than other taxa such as the Eared Grebe, California Gull, or phalaropes (*Phalaropus* spp.) and thus mandated the development of the Mono Basin Waterfowl Restoration Plan (LADWP 1996). The plan requires the monitoring of hydrology, limnology, brine shrimp, and waterfowl. Here I report on results of waterfowl surveys conducted as part of the plan, focusing on the Northern Shoveler because of its dominance of the fall waterfowl community of Mono Lake. I present the number of shovelers using Mono Lake each fall from 2002 to 2022, discuss trends, and analyze environmental factors potentially contributing to annual and seasonal variation in Northern Shoveler totals at Mono Lake, including the availability of *Artemia monica*, a likely food source.

WATERFOWL SURVEY METHODS

I surveyed the waterfowl of Mono Lake annually each fall from 2002 to 2022, six times per year at two-week intervals starting the first week of September and ending in mid-November. Over the entire study period, two scheduled surveys, the mid-September surveys of 2020 and 2022, were missed. Over the length of the study, consistency of observers was high, as I directed and took part in all but one survey over the 21-year period. On all surveys, waterfowl were identified to species or to the lowest identifiable category, e.g., "unidentified teal." Here I summarize and analyze data for the Northern Shoveler only.

From 2002 to 2019, surveys were conducted from a four-passenger high-winged aircraft traveling at 130 km/hr at a height of ~60 m above ground level (House and Honda 2018). From 2020 to 2022 the fixed-wing aircraft was no longer available and surveys combined observations from a boat, a helicopter, and occasionally the ground. Despite this variation in method, each survey encompassed all shoreline and nearshore areas around the entire perimeter of Mono Lake where virtually all Northern Shovelers have been encountered over the years. In addition, the visibility of the shoreline and nearshore areas is very good and unobstructed, allowing adequate detection with each method. Thus I consider the data from the different survey methods comparable for this species.

Aerial surveys took place in the morning, starting no later than 09:00 Pacific Time, and were completed in 90 minutes. The plane flew counter-clockwise around the entire perimeter of the lake at a distance of ~150–250 m from shore with the observers looking shoreward, covering the shoreline and nearshore areas. Immediately after the perimeter flight, open-water areas were surveyed by means of eight fixed parallel transects spaced at 1.8-km intervals. During fixed-wing surveys two observers were present on most flights. During the perimeter flight, the observers positioned themselves on the same side of the aircraft. When flying the parallel transects over the open water, the observers sat on opposite sides of the aircraft. During fixed-wing surveys I used a voice recorder to record waterfowl numbers and species composition by shoreline area, and the second observer recorded data by hand.

In 2020 the shoreline was surveyed primarily by boat (a 5-m Boston Whaler), but at Warm Springs on the east side of the lake a ground survey was needed because shallow waters prevented a close approach to shore. The boat traveled at low speed around the perimeter of the lake about 150–250 m from shore with the observers looking shoreward. Surveys started at ~08:30 Pacific Time and required 5 to 6 hours to complete. Starting in 2020, a subset of the fixed parallel transects were surveyed by boat.

In 2021 and 2022, I used a helicopter to survey the entire shoreline and a boat for the offshore transects. The protocol by helicopter was the same as by plane in that the shoreline and nearshore areas were surveyed counter-clockwise around the entire perimeter of the lake at a distance of ~150–250 m from shore with the observer looking shoreward. Surveys were in the late morning (11:00 Pacific Time), and data were recorded by hand during the flight. Boat surveys of the cross-lake transects generally took place the following day, starting at 08:30 Pacific Time and requiring 4 to 5 hours to complete.

DATA SUMMARY AND STATISTICAL ANALYSIS

The objective of the statistical analysis was to find a set of environmental factors that best explained the annual variation in the number of Northern Shovelers using Mono Lake in fall. The environmental factors evaluated included lake level, mixing regime, *Artemia* biomass, and drought. As the defined primary means for restoring waterfowl habitat, lake level was included because of its influence on lake salinity and nearshore habitats in terms of the connectivity of lake waters to wetland and spring habitats. The mixing regime was evaluated because of its influence on nutrient cycling and *Artemia*

populations (Melack et al. 2017). *Artemia* biomass was included as the brine shrimp is a potential food resource for shovelers. Indices of drought were included to represent larger-scale environmental factors that may influence wetland resources and the distribution of migrating waterfowl.

Over the course of this study, Northern Shovelers occurred in high numbers in September, followed by a rapid decline. This species does not breed at Mono Lake, and is a very rare breeding species at other wetland sites in southern Mono County (Shuford and Metropulos 1996, pers. obs.), thus the birds arriving in fall represent migrants from other regions. Mono Lake's *Artemia* population also varies seasonally, reaching peak annual density in July or August, then declining rapidly through the remainder of the fall (Lenz et al. 1986). Determining how variation in biomass of *Artemia* affects Northern Shoveler numbers was a key objective of this analysis, taking into account the underlying pattern of the species' migration chronology.

Northern Shoveler Survey Data

For each of the six survey periods—early (first week), middle, and late September (or early October some years), mid-October, late October, and mid-November—I calculated the total number of Northern Shovelers for each period by summing numbers recorded on both shoreline and open-water transects. For the two missing surveys of mid-September 2020 and mid-September 2022, I estimated the numbers by cubic spline interpolation (SRS1 Software). The total annual fall abundance of shovelers was derived by summing the totals for the six survey periods. The length of the shoveler's stopovers at Mono Lake is unknown, but from a review of survey totals, most or all of large flocks seen on one survey typically departed within two weeks. Assuming that if conditions are favorable, birds might remain longer and be recorded on subsequent surveys, I evaluated yearly totals for their relationship to lake level and mixing status. For each survey period and year I calculated the mean, standard error, and low and high counts.

Shoveler counts were not normally distributed over the 21-year period and included three values of zero on the mid-November survey. An examination of the residuals from linear regression analysis indicated heteroscedasticity, or non-random changes in the residuals, due to the strong seasonality of the data and a large range in values between the highest and lowest numbers observed. This data structure did not lend itself to my using linear regression models, and data transformation was needed. Because of the late-fall zero counts, I transformed the data by adding +1 to all values prior to $\log_{10}$ transformation. This transformation resulted in normally distributed data that were still heteroscedastic, and I used a generalized linear model to evaluate variables influencing Northern Shoveler numbers.

Environmental Variables

Mono Lake surface elevation. LADWP recorded the surface elevation of Mono Lake monthly with a staff gauge located on the west shore. I downloaded the data, recorded in feet, from the Mono Basin Clearinghouse (https://www.monobasinresearch.org/data/levelmonthly.php) and converted them to meters for analysis. I used simple linear regression to evaluate the relationship

between the level of Mono Lake in September, or the beginning of the annual fall survey, and total annual shoveler numbers.

Lake mixing regime. Deep saline lakes such as Mono Lake typically "turn over" or mix once a year in a process known as monomixis. Mono Lake currently does not mix every year, and depending on the amount of fresh-water input alternates between being meromictic (chemically and thermally stratified) or monomictic, in which complete mixing occurs in late fall (often November), after the end of the seasonal waterfowl surveys. When complete, this mixing eliminates the chemocline and thermocline and brings bottom-dwelling nutrients into the water column (Melack et al. 2017). I categorized each of the survey years as either meromictic or monomictic, depending on whether the lake was stratified or mixed between September and mid-November. The assignment of mixing-regime type was based on an evaluation of the water-column profiles for temperature, conductivity, dissolved oxygen, and ammonium (Jellison et al. 2024).

The dynamics of Mono Lake's mixing influence *Artemia* abundance through nutrient cycling (Melack et al. 2017). *Artemia* feeds on phytoplankton, and the phytoplankton requires inorganic nitrogen, which is a limited substance in Mono Lake. The main sources of nitrogen are brine shrimp excretion and the vertical mixing of ammonium-rich deep water (Melack et al. 2017). The release of nutrients associated with vertical mixing under monomictic conditions can result in an algal bloom, and a subsequent boom in the *Artemia* population the following summer, though the magnitude of the post-mixing population booms has varied.

If shovelers are responding to *Artemia* abundance or some other underlying factor related to the lake's productivity or monomixis, their totals may likewise show a response to its mixing status. I used a Mann–Whitney *U* test to compare median values of total Northern Shovelers observed under meromictic vs. monomictic conditions.

Artemia *biomass.* I have frequently observed shovelers feeding in the water column near fresh-water outflows, the interface of fresh and hypersaline waters being a microhabitat where brine shrimp, a primary food (Jones and Stokes 1993), have also been observed to congregate (Conte et al. 1988, pers. obs.). These anecdotal observations along with a documented dominance of shrimp in the diet of shovelers at other hypersaline lakes such as Great Salt Lake (Vest and Conover 2011) and Lake Abert, Oregon (Boula 1986), encouraged me to explore the link between annual and seasonal variation in numbers of Northern Shovelers and *Artemia* biomass.

As part of a continuing program of limnological monitoring at Mono Lake, the University of California, Santa Barbara, or the Los Angeles Department of Water and Power have sampled populations of *Artemia monica* (House and Honda 2018). Samples were collected with a plankton net once monthly February through December at 12 buoyed stations. For determination of biomass, samples were rinsed with tap water, dried in aluminum pans at 50 °C for at least 48 hr, and then weighed to the nearest 0.1 g on an analytical balance immediately upon removal from the oven (Jellison 2011, House and Honda 2022)

To evaluate the relationship between Northern Shoveler totals per survey period and brine shrimp populations, I used the mean biomass of *Artemia*

throughout the lake. For each round of *Artemia* sampling, I calculated a lake-wide index of *Artemia* biomass by averaging the dried weights of the samples from the 12 stations. Since *Artemia* was seldom sampled on the same day as waterfowl surveys, I estimated values of *Artemia* biomass for each waterfowl survey date by one-way spline interpolation (SRS1 Software). Like the shoveler counts, the shrimp biomass data included some zero values and were heteroscedastic because of strong seasonality, so I added +1 to all values prior to $\log_{10}$ transformation. This transformation resulted in normally distributed data in which heteroscedasticity was still evident, thus use of a generalized linear model was still appropriate.

Assessing drought. I assessed the influence of regional and local drought on Northern Shoveler numbers at Mono Lake with the Palmer drought severity index (PDSI). The PDSI is a monthly index that incorporates both air temperature and precipitation data to evaluate the severity of hydrologic drought (Alley 1984, NCAR 2020). The combined effects of air temperature and precipitation influence evapotranspiration, which is the major factor controlling water balance in wetlands (Zhao and Liu 2016). The PDSI ranges from +10 (extremely wet) to –10 (extremely dry) (NCAR 2020). Monthly PDSI indices are available for all nine U.S. climate regions, all states except Alaska, and also divisions within states

The PDSI may serve as a surrogate indicator of the extent or availability of wetlands in a region. I was interested in whether the variation in totals suggests that in drought years Mono Lake may serve as a refuge to shovelers migrating through this desert region. In my initial evaluation of drought I used Pearson's correlation to look for relationships between shoveler numbers and the PDSI at various regional and time scales to determine which PDSI value to incorporate into the model. In addition, to avoid multicollinearity, I also looked for correlation among PDSI values, since widespread drought may result in correlation among PDSI values across regions. I examined ten regional, state, and divisional spatial scales and five time scales ranging from monthly to intervals of 24 months. Ultimately, I selected the August PDSI values for California Climate Division 3 (CA3; Northeast Interbasin) as their correlations were the strongest and they performed best in the model. CA3 covers northeastern and east-central California east of the Sierra Nevada and Cascade Ranges, including the Mono Basin.

To evaluate the combined effects of drought, date (survey), and *Artemia* biomass on Northern Shoveler numbers, I used a generalized linear model, evaluating its performance with r^2 and the log-likelihood values for each variable. Parameter coefficients were standardized (β) to allow comparisons of the magnitude of effect each variable had on shoveler numbers. All values are reported as mean ± standard error unless noted otherwise.

RESULTS

Summary of Northern Shoveler Data

Over the 21-year study period, 124 surveys were completed. From 2002 to 2022 the total number of Northern Shovelers counted at Mono Lake each fall (results of the six surveys summed) averaged 13,018 ± 1571 (Figure 2, Table

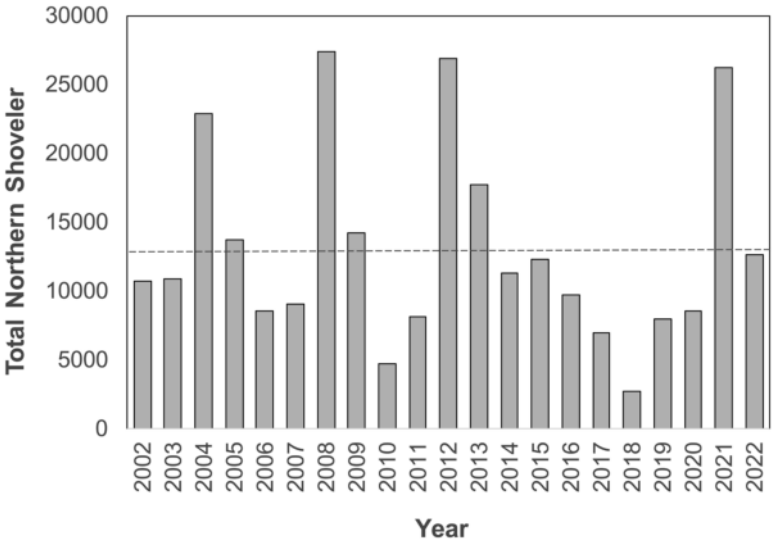

FIGURE 2. Total number of Northern Shovelers recorded annually during fall surveys at Mono Lake, California, 2002–2022. The dashed line represents the mean across all surveys each year.

1). There was strong seasonality in use, with total numbers highest in early to mid-September and significant and steady declines thereafter (Figure 3).

The peak count for the year on a single survey averaged 5562 ± 709 and ranged from a low of 768 in 2018 to a high of 13,793 in mid-September 2012. The vast majority (99%) of shovelers were recorded <250 m from shore, with <0.1% found on the open water. During the period of peak use in September, shovelers typically gathered at the Wilson Creek delta along the northwest shore, where the total yearly lakewide counts have been highest in 18 of the 22 survey years. When not at the Wilson Creek delta, high numbers were observed along the south shore, along the north shore in the DeChambeau Embayment, or at Mill Creek, which is just west of Wilson Creek.

In five survey years (2004, 2008, 2012, 2013, 2021), shoveler totals for the entire survey period were significantly higher than the average (Figure 2).

TABLE 1 Abundance of the Northern Shoveler at Mono Lake, 2002–2022

Survey period	Mean	SE	High count	Low count
Early Sep	4333	585	8998	455
Mid-Sep	4432	659	13,793	768
End Sep	2696	634	11,567	211
Mid-Oct	1069	399	7037	0
End Oct	260	103	2031	3
Mid-Nov	198	86	1354	0
Annual peak count	5562	709	13,793	768
Annual total	13,018	1571	27,400	2719

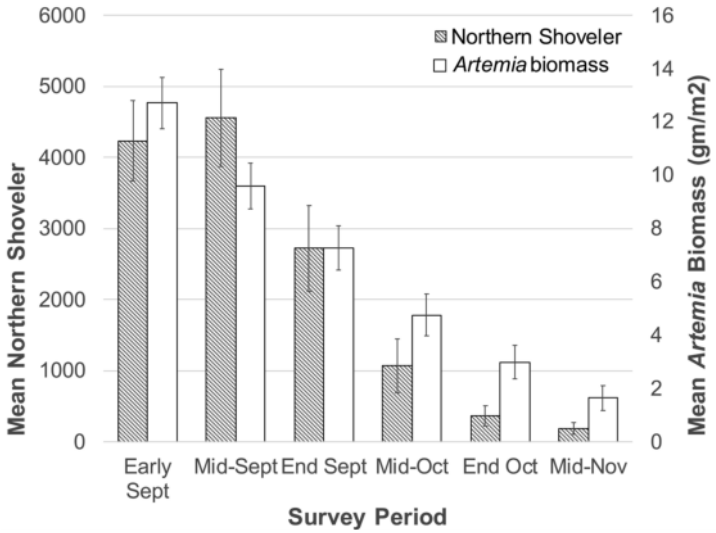

FIGURE 3. The mean (±SE) number of Northern Shovelers and mean lakewide biomass of brine shrimp (*Artemia monica*) recorded during each of six autumn waterfowl survey periods at Mono Lake, California, 2002–2022.

Abundance was highest in 2008, when 27,400 shovelers were tallied over the six surveys, and lowest in 2018, when only 2,719 were tallied. Across years, the numbers appeared somewhat cyclical (Figure 2), but there was no long-term trend ($r^2_{adj} = 0.035$, $p = 0.277$).

Environmental Variables

Lake level. From 2002 to 2022 the level of Mono Lake in September averaged 1945.1 m, ranging from 1943.9 to 1946.1 m, for a total elevational range of 2.2 m over the study period. The highest September elevation of 1946.1 m occurred in 2006, and the lowest in 2016, following a severe multi-year drought.

Mixing regime. Mono Lake was meromictic during the surveys from 2002 to 2003, 2005 to 2007, in 2011, and from 2017 to 2020 and monomictic in 2004, from 2008 to 2010, from 2012 to 2016, and from 2021 to 2022.

Regional drought. Over the 21-year study period, the August PDSI for CA3 ranged from –5.12 (extreme drought) to 4.16 (extremely wet). The region experienced six years of severe to extreme drought (PDSI ≤ –3.0), four years of moderate drought (PDSI –2.9 to –2.0), nine normal to near-normal years (PDSI –1.9 to 1.9), one moist year (PDSI 2.0 to 2.9), and one extremely wet year (PDSI ≥ 3.0).

Artemia *biomass*. In early September, at the start of the fall waterfowl-survey period, the mean biomass of *Artemia* averaged 12.8 ± 1 g/m^2. By mid-October, it declined to an average of 4.8 ± 0.8 g/m^2, and by mid-November this measure averaged 1.8 ± 0.6 g/m^2.

Environmental Variables vs. Northern Shoveler Numbers

Lake level. Mono Lake's elevation in September had no direct effect on its total number of Northern Shovelers each year ($r^2_{ad} = 0.000$, $p = 0.564$), so I excluded this variable from the final model.

Mixing status. The median number of Northern Shovelers under meromictic conditions was 8726 and 16,921 under monomictic conditions, a significant difference ($U = 15.0$, $p = 0.004$, mean difference of 6577 and effect size = 0.727, Figure 4). Shoveler totals varied more widely when the lake was monomictic than when it was meromictic (Figure 4), as numbers were highest the first year of monomixis, then lower in subsequent years, but remained on average higher than when Mono Lake was stratified.

Generalized Linear Model Results

The model that best explained the variation in Northern Shoveler numbers at Mono Lake in fall involved the combined effects of survey period, *Artemia* biomass, and the August PDSI in CA3 ($r^2_{ad} = 0.658$, $p < 0.001$). Survey period was negatively correlated with shoveler totals ($\beta = -0.453 \pm 0.0801$), reflecting numbers decreasing through the fall (Figure 3). The seasonal pattern of *Artemia* biomass mirrored that of shovelers (see Figure 3); *Artemia* biomass was positively correlated with shoveler totals ($\beta = 0.445 \pm 0.0806$) in that greater *Artemia* biomass was associated with higher numbers of shovelers even with the effect of survey period held constant. The August value of PDSI for CA3

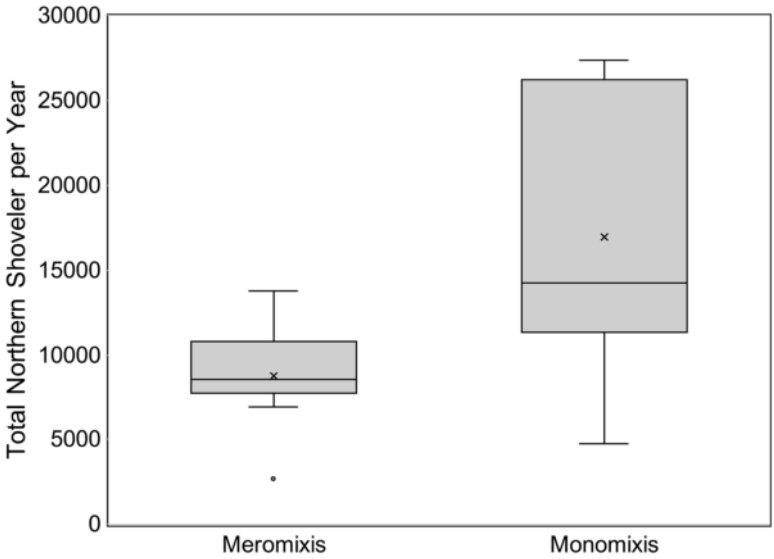

FIGURE 4. Total numbers of Northern Shoveler recorded annually under regimes of meromixis ($n = 10$) and monomixis ($n = 11$) at Mono Lake, California (2002–2022). Box plots show mean (×), median (solid line), interquartile range (shading), minimum and maximum (whiskers), and outliers (filled circles).

was negatively correlated with shoveler totals ($\beta = -0.111 \pm 0.0555$), as higher PDSI values (i.e., wetter conditions, less severe drought) were associated with fewer shovelers (Figure 5). Of these variables, survey period ($\chi^2 = 32.01$, df = 1, $p < 0.001$) and *Artemia* biomass ($\chi^2 = 30.57$, df = 1, $p < 0.001$) were the most influential and roughly equal in strength (Figure 3). Relative to biomass and survey period, PDSI had a weak but significant influence on shoveler totals ($\chi^2 = 4.02$, $p = 0.045$) (Figure 5). This model suggested that, with the effect of survey period held constant, the influence of the *Artemia* biomass was also significant, with higher biomass resulting in more Northern Shovelers. PDSI values for CA3 were negatively correlated with totals, suggesting that the stronger the drought, the more Northern Shovelers at Mono Lake.

DISCUSSION

These surveys document that Mono Lake currently supports an average of 13,018 Northern Shovelers each fall, with peak numbers in early-to-mid September. Though the surveys began in early September when use was near its peak (Figure 3), the number of shovelers recorded in August has not exceeded about 400 birds on any one count (J. Jehl Jr. unpubl. data). Thus my surveys from 2002 to 2022 likely captured most of the shovelers passing through Mono Lake in those years. The only baseline data available with which Northern Shoveler numbers prior to implementation of Decision 1631 can be compared are from two all-lake surveys on 30 August and 14 September 1976 (Winkler 1977), when 1080 and 2230 birds were recorded, respectively, and the level

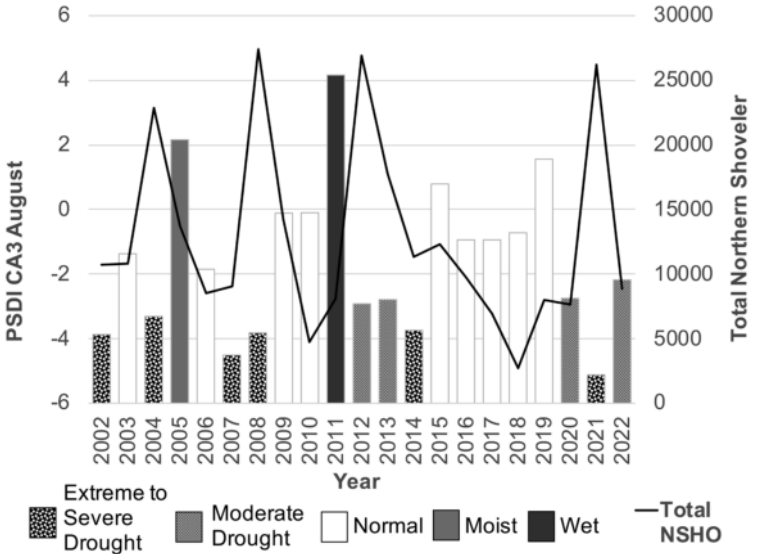

Figure 5. Rankings of the Palmer Drought Severity Index (PDSI) for the month of August for California Division 3 (CA3) vs. the total number of shovelers at Mono Lake, California, 2002–2022.

of Mono Lake was ~1944 m, or just 1 m less than the average September lake level during my 21-year survey period. The mean numbers on my early and mid-September counts, 4333 and 4432, respectively, are four and two times higher than the 1976 counts prior to the limitation of water diversions, though the dearth of historic data limits the inferences that can be drawn regarding the shoveler's response to restoration at Mono Lake thus far.

The yearly totals observed at Mono Lake averaged 45%, and in some years up to 80%, of all Northern Shovelers counted at the three largest water bodies in Mono County: Mono Lake, Bridgeport Reservoir, and Crowley Reservoir (House and Honda 2022). Given these data, Mono Lake is an important local resource for migrating Northern Shovelers, serving as one of their three main fall migratory stopover locations in Mono County.

For a broader context Mono Lake's average annual Northern Shoveler count of 13,018, and annual peak count of 5562, may be compared to flyway numbers and to counts at other saline lakes in the Intermountain West. The totals at Mono Lake each fall averaged just 0.3% of the Pacific Flyway's breeding population in 2019 (U.S. Fish and Wildlife Service 2021). The average fall (August–September) population at Great Salt Lake, Utah, of 56,950 from 1997 to 2001 (Paul and Manning 2008), was over four times that observed at Mono Lake. At Lake Abert, a small shallow terminal lake in eastern Oregon, about 22,000 shovelers were estimated in September of 2011 and 2012 (East Cascade Audubon Society, http://bit.ly/2s3Kwgt). Surveys of Owens Lake from 2012 to 2022 yielded peak fall counts averaging over 18,000 and total fall counts (September and October) averaging ~28,000 birds (LADWP unpubl. data). These comparisons suggest that the number of Northern Shovelers using Mono Lake is, in general, not major from a population standpoint, nor as compared to these other sites in the Intermountain West, particularly when the relatively large size of Mono Lake is considered.

The Northern Shoveler is currently an early-season fall migrant at Mono Lake, with peak numbers in September. In most years the species largely departs the Mono Basin by mid-October. Its seasonality and period of peak abundance in fall are similar to those observed at other Mono County sites, including Bridgeport Reservoir (House 2021) and Crowley Reservoir (unpubl. data). Northern Shoveler totals at Mono Lake peak slightly earlier in the fall than at other sites in the Intermountain West both north and south of Mono Lake. At Lake Abert, in eastern Oregon, shoveler numbers peak perhaps slightly later than at Mono Lake, in mid- to late September (East Cascade Audubon Society, http://bit.ly/2s3Kwgt). Peak fall numbers of these birds at Stillwater National Wildlife Refuge, to the north in western Nevada, occur in October (Bundy 2002). At Owens Lake, in Inyo County to the south, numbers have been highest in October as well (LADWP unpubl. data). Local differences in migration phenology such as these may reflect a species' response to local resources or differing source populations. The phenology observed at Mono Lake is likely due in part to the seasonal abundance patterns of a potential food resource, *Artemia monica*.

At high elevations with severe winter weather, Mono Lake's resources are highly seasonal. The annual population cycles of *Artemia* contribute to the seasonal pattern of Northern Shoveler use. By August of each year, the *Artemia* population starts declining as individuals die off and females switch

to ovoviviparous reproduction, producing overwintering cysts. Few shrimp persist as adults through the winter. My hypothesis is that the seasonal reduction in *Artemia* biomass through the fall encourages Northern Shovelers to migrate out of the Mono Basin, but higher fall values of *Artemia* biomass contribute to higher shoveler numbers, even when the effect of survey period is held constant.

Artemia biomass partly explains the variation in Northern Shoveler numbers, but unfortunately data are not available for other potential foods, in particular alkali flies, which are a preferred food of many waterbird species in saline environments. Shovelers are known to eat both brine shrimp (adults and cysts), and alkali flies (larvae, pupae, and adults), but the degree to which they rely on either of these important food sources at Mono Lake has not been quantified. I have observed shovelers feeding in fresh-water outflows and deltas more frequently than other waterfowl species, which tend to stay on or much closer to shore. Thus I suspect shovelers are feeding on shrimp to a greater degree than are the other waterfowl species using Mono Lake in fall, as has also reported by hunters (Jones and Stokes 1993). Studies at other saline lakes, however, have shown that shovelers not only consume more shrimp than other waterbird species, but they consume proportionally more shrimp than alkali flies. For example, at Lake Abert, the shoveler was the only waterbird species that fed extensively on brine shrimp (Boula 1986). Brine shrimp constituted 31% of the biomass of the shoveler's diet, a proportion over twice that of the Eared Grebe at 13.7%. Alkali flies were, in general, birds' preferred food at Lake Abert, and constituted at least 65% of the biomass consumed by all species studied except the shoveler, for which the value was 25%. Similar results were obtained from a more limited study of the diet of wintering waterfowl at Great Salt Lake, where adult brine shrimp and cysts represented 72% and alkali fly larvae and adults 8% of the shoveler's diet (Vest and Conover 2011, Vest 2013). The diet of the Green-winged Teal (*Anas crecca*) also included a large amount of brine shrimp, but that species consumed fewer adult shrimp (1.5% of the biomass vs. 20.2% for the shoveler). This winter study at Great Salt Lake found a greater reliance on shrimp cysts than on adult shrimp, presumably because at that season adult shrimp are few. At Mono Lake, *Artemia* cysts sink to the bottom (Melack et al. 2017), leaving them inaccessible through winter, and adult shrimp are virtually absent. Initial data exploration did reveal a positive correlation of shoveler numbers and *Artemia* fecundity (average number of cysts per female) at Mono Lake, but I did not include this variable in the model because of autocorrelation with shrimp biomass. Thus at Mono Lake shovelers may also consume *Artemia* cysts when available and accessible, their abundance influencing the shoveler's numbers.

In fall, many dabbling duck species rely more heavily on carbohydrates than on proteins, consuming seeds and vegetative parts of wetland and aquatic plants to increase fat reserves for winter (Baldassarre and Bolen 1994). As a hypersaline lake lacking aquatic vegetation, Mono Lake does not support such resources in abundance, limiting its attractiveness to many waterfowl. The Northern Shoveler's adaptations, including lamellae not only more numerous but longer and more closely spaced than in other waterfowl

(Kooloos et al. 1989), allow them to feed on small aquatic invertebrates such as brine shrimp, copepods, and water fleas (*Daphnia* spp.). When comparing the feeding efficiency of two dabbling duck species—the Northern Shoveler and Mallard (*Anas platyrhynchos*)—and the diving Tufted Duck (*Aythya fuligula*), Kooloos et al. (1989) found that neither Mallards nor Tufted Ducks were able to retain shrimp pulp (the smallest food item tested) in their bills during feeding experiments. Shovelers retained about 40% of the shrimp pulp, however. So, although the Northern Shoveler retains only a portion of the shrimp that enter its bill, it is significantly better at harvesting shrimp than the other two species tested. The shoveler's specialized bill morphology thus allows for the effective filtering of small aquatic invertebrates, such as brine shrimp, and for them to exploit this resource at Mono Lake, when other species cannot. The limited availability of alternative food items at Mono Lake could lead to greater reliance and association between shoveler numbers and shrimp populations.

At Mono Lake the abundance of *Artemia* has, of late, been associated with periods of declining lake levels induced by drought. The increases in *Artemia* after mixing of the lake's water are short-lived, evident for only one or two years. Thus the effect of drought on Northern Shoveler use of Mono Lake may be through this indirect effect on *Artemia* population, large numbers of shovelers being attracted to *Artemia* population spikes, or birds may stay longer in response to greater food availability, resulting in higher seasonal totals. A similar relationship to lake productivity with respect to the *Artemia* population has been seen in the nesting population of the California Gull at Mono Lake. The gulls' nesting productivity has been linked to the lake's productivity, which has been higher under monomictic conditions and declining lake levels, but lower when the lake's level rises and productivity decreases in association with meromictic conditions (Burnett et al. 2021).

At Mono Lake, I found regional drought to have a weak positive influence on Northern Shoveler numbers: the less intense the drought, the fewer shovelers observed. This pattern differs from that observed during the same time period at nearby Bridgeport Reservoir (House 2021), where waterfowl numbers were negatively correlated with regional drought. Since the PDSI for northeastern California (CA3) is highly correlated with that of other western states, drought conditions in northeastern California were likely similar to those at other regional sites important to migratory waterfowl. Perhaps wetter, improved regional conditions attract shovelers away from Mono Lake, particularly if shrimp populations are low.

Mono Lake's *Artemia* populations have been showing signs of decline recently, despite the gains in lake level and subsequent decrease in salinity (House and Honda 2022). This decline is not completely understood, but it has been accompanied by a decline in the lake's transparency and increased dominance by the eukaryotic alga *Picocystis* strain ML (Stamps et al. 2018), even though *Picocystis* is a food source for *Artemia*. Declines in *Artemia* population peaks may also be due, in part, to shorter wet periods resulting in less accumulation of nutrients. The prolonged severe drought from 2012 to 2016 had a profound negative effect on the *Artemia* population (House and Honda 2022). The long-term effects of changes in the algal community

or nutrient cycling on shrimp populations remain unknown in the context of climate change.

Although the target lake level has not yet been achieved, waterfowl habitats have improved since implementation of Decision 1631 as a result of the restoration of perennial flow in Rush, Lee Vining, and Mill creeks. Also, the connectivity of spring and creek outflows with wetland vegetation has been ameliorated by the increases in lake level observed so far. Raising the level of Mono Lake to the target elevation of 1948.2 m set by the SWRCB is the most important objective for restoring waterfowl habitat, and it is expected to enhance waterfowl habitats by improving the physical linkage between shoreline marshes, ponds, and freshwater outflows that produce estuary-like habitats.

The lack of association between fall Northern Shoveler numbers and Mono Lake's level could be due to the lake's not yet reaching some threshold below or above which its level may have a greater influence on fall waterfowl use. Such a threshold has been documented for waterfowl breeding at Mono Lake, where duck productivity varied with lake level when that level was above 1945 m but not below (House and Honda 2022). At higher lake levels than have been observed to date, connectivity to wetland vegetation should be greater, enhancing food resources and cover. In contrast to fall migrant shovelers, breeding waterfowl, whose abundance and distribution are more directly tied to shoreline features influenced by lake level—such as ponds and suitable nesting and brood-rearing sites—have been favored by the rise in the level of Mono Lake (House and Honda 2022). Although the suitability of deltas and nearshore areas for shovelers' foraging and resting is influenced by lake level (as through changes in water depth), within the range of lake elevations observed during my study these small-scale effects may have been swamped by variations in lake productivity and *Artemia* biomass.

Despite the productivity of Mono Lake, access of these food resources to dabbling duck species like the Northern Shoveler is somewhat limited. The range of water depths optimal for dabbling ducks' foraging is 10 to 25 cm (Fredrickson and Taylor 1982). Prey are generally less accessible to dabbling ducks in water deeper than about 25 cm, decreasing their foraging efficiency. The topography and bathymetry at Mono Lake (Raumann et al. 2002) are such that shallow-water feeding areas, especially those near fresh-water sources such as springs, are widely spaced around the lake's perimeter and are generally not extensive. I have observed dabbling ducks to feed almost exclusively near shore, and more specifically where the bathymetry implies shallow water for feeding, usually in combination with fresh-water input from springs or creeks. The shoreline of Mono Lake is dynamic, and slight changes in lake level alter waterfowl habitats by altering springs' flow patterns, the connectivity of wetland vegetation to the shoreline, and feeding areas of suitable depths. These factors undoubtedly contribute to the quality of waterfowl habitat, but invertebrate productivity and regional factors including drought may be crucial to how many waterfowl Mono Lake can support. To improve our understanding of the response of waterfowl to changes in Mono Lake's level, we need better documentation of how variation in that level influences the shoreline's topography, as well as the abundance and distribution of resources waterfowl use, including alkali flies and filamentous algae.

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MITOCHONDRIAL DNA DEMONSTRATES THAT A HEN HARRIER (*CIRCUS CYANEUS*) REACHED ATTU ISLAND, ALASKA

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ABSTRACT: A partial wing of a juvenile male harrier salvaged at Attu Island, Aleutian Islands, Alaska in June 1999 has long been discussed as an example of the Old World taxon *Circus* (*cyaneus*) *cyaneus* on the basis of morphological features and a geographic deduction. This identification took on additional weight after many taxonomic authorities decided to treat the Old and New World forms as separate species—*C. cyaneus* and *C. hudsonius*, respectively. Mitochondrial DNA (1887 base pairs) clearly group the specimen with *C. cyaneus*, and thus the specimen represents the first record for North America of the Hen Harrier.

Gibson and Byrd (2007) inferred that at least eight observations of the Northern Harrier in the western Aleutian Islands, Alaska, likely represented the Old World *Circus cyaneus cyaneus*, at the time considered the nominate subspecies of a polytypic, Holarctic harrier (see also Gibson and Withrow 2015). The only physical evidence of such an occurrence was a distal right wing and associated feathers picked up at Attu Island in early June 1999 (the bird presumably having died the previous fall/winter, but phenology uncertain; Figure 1). The specimen was "identified to species [i.e., *C. cyaneus*, *sensu lato*] by C. J. Dove" at the U.S. National Museum of Natural History (Gibson and Byrd 2007:284), and "its length (chord 318 mm) points to this subspecies [i.e., nominate *cyaneus*]" (Gibson et al. 2013:185).

In 2017 the American Ornithological Society's North American Classification Committee split the Northern Harrier (*Circus cyaneus*, *sensu lato*) into two species, the Hen Harrier (*C. cyaneus*) occurring in the Old World and the Northern Harrier (*C. hudsonius*) in North America (Chesser et al. 2017), but the committee preferred to wait for additional confirming evidence regarding the Attu Island wing. Thus *Circus cyaneus*—as a now purely extralimital species—was removed from the North American list. A report of a "probable" Hen Harrier from New Jersey (Duffy et al. 2012) had not, as of early 2023, been submitted to the New Jersey Bird Records Committee (K. Duffy, B. Clark, and J. Hough in litt. 2023).

The Attu Island wing's plumage color, pattern, size, and shape, assessed in direct comparison with specimens, point to its belonging to the genus *Circus*. Details of wing formula, primary emargination, and size rule out all other migratory species of Palearctic harriers other than *cyaneus* (i.e., *spilonotus*, *aeruginosus*, *pygargus*, *macrourus*, and *melanoleucos*; see Dement'ev and Gladkov 1966, Nieboer 1973, Cramp 1980, Baker 1993). Phenotypic differentiation of nominate *cyaneus* and *hudsonius* is more difficult (e.g., Grant 1983, Wallace 1998, Martin 2008, Pyle 2008, Mullarney and Forsman 2010, Duffy et al. 2012, Etherington and Mobley 2016), but several criteria have

FIGURE 1. A, lower surface; B, upper surface. Right distal wing of a harrier salvaged at Attu Island, Aleutian Islands, Alaska in June 1999 and subsequently confirmed to belong to a Hen Harrier (*Circus cyaneus*) by comparison of mtDNA sequences. Note that most of the primary coverts are missing, and counting the bars on undersides of the primaries from the photo is complicated by this and the disheveled condition of the feathers (see text), but the underwing barring strongly suggests *cyaneus*.

been advanced that involve characteristics of the outer wing, namely, wing length and the number of bars on the underside of the outer primaries. We did not find the relative darkness of the trailing edge to the inner primaries, the width of the inner primary bars (both Martin 2008), or the ground color of the primaries (Cramp 1980) to be useful criteria.

The wing measured 318 mm (chord; Gibson et al. 2013) and 327 mm (flat; it no longer has any chord left, as a result probably of both its decomposed state and being bagged and stored flat for 24 years). This is shorter than any female *cyaneus* or *hudsonius* (Nieboer 1973, Scharf and Hamerstrom 1975, Schultz 1996, Etherington and Mobley 2016), and the barred (not black) primaries indicate a juvenile male. North American *hudsonius* is often described as longer winged than nominate *cyaneus*; some of the best comparisons come from Scharf and Hamerstrom (1975), who reported flat wing length for breeding (adult) male *cyaneus* as 322–340 mm (mean = 332.3) and for *hudsonius* as 334–370 mm (mean = 351.3), measurements used in the past to suggest the Attu wing belonged to *cyaneus* (Gibson et al. 2013). However, Cramp (1980:126) described nominate *cyaneus* as "clinally larger from western Europe to east Asia." Measurements given by Nieboer (1973:51, 89) demonstrate this cline in wing length and that east Asian birds have wings just as long as North American birds. Furthermore, some juvenile males of *hudsonius* can apparently have wings as short as the Attu wing (Schultz 1996, Duffy et al. 2012), although this appears to be rare (as it might be for east Asian *cyaneus* as well). Thus wing length is of little value in distinguishing the two species in this instance.

The number of dark bars on the undersides of the outer primaries in the two species differs. Nominate *cyaneus* generally has three or four (sometimes five) bars on the longest primaries (P7 and/or 8), as opposed to five to seven in *hudsonius*. Nominate *cyaneus* usually has three on P10 in contrast to normally four on that primary in *hudsonius* (e.g., Martin 2008, Pyle 2008, Mullarney and Forsman 2010, Duffy et al. 2012). In the Attu wing, the number of bars (not including the dark tip) on the underside of primaries 6 through 10 is as follows: 5, 5, 6, 5, and 3. However, the innermost bar on P6–9 is usually very faint, and probably invisible in the field in all but exceptional views. It may be concealed by the primary coverts (as many inner bars are on specimens and presumably live birds as well). Most of the primary coverts on the Attu wing are missing, and the generally disheveled nature of the feathers—several detached—impairs reconstruction of the look of a live bird. Nevertheless, in life (from which most work on this character has been based), the bar count would probably have been seen as 4, 4, 5, 4, and 3. A fair amount of individual variation exists in this trait, and there has been no rigorous assessment of its use in diagnosing species or in its potential geographic variation across the Holarctic, although the taxa certainly appear to differ on average. The number of bars in the Attu wing strongly suggests nominate *cyaneus*.

Thus identification of this partial wing specimen rested on a geographic deduction (see Discussion) and identification criteria whose limits of diagnosability have not been quantified and/or are inadequately validated across the Bering Strait. Because it would represent the sole incontrovertible evidence of *C. cyaneus* in North America, we sequenced a combined total of 1887 base pairs (bp) of mitochondrial DNA (mtDNA) from three gene regions to

verify the identity of the specimen (or at least the clade to which its mother belonged). We selected these three mtDNA markers—NADH dehydrogenase subunit 1 (ND1), NADH dehydrogenase subunit 2 (ND2), and cytochrome oxidase I (COI)—because of their ability to distinguish between *C. circus* and *C. hudsonius* and their successful use in avian "barcode" identifications (Hebert et al. 2004, Kerr et al. 2007, Gaber et al. 2020, Luttrell et al. 2020).

METHODS

For amplification and sequencing of the mitochondrial genes ND1, ND2, and COI, we isolated DNA from the Attu specimen and seven additional reference specimens. The resulting DNA sequences were compared and evaluated to identify the maternal clade of origin for the Attu specimen. We also included in the comparisons sequences publicly available via GenBank (National Center for Biotechnology Information; Table 1).

To prevent cross-contamination, we completed all sampling, extraction, amplification, and sequencing steps for the quill of the Attu specimen prior to work on reference specimens. All reagents and consumables were new, and we included three negative controls—an extraction blank, a reagent blank, and an amplification blank—for all mtDNA-sequencing steps to confirm the absence of contamination.

We obtained vouchered reference-tissue specimens from two representatives of *cyaneus* and four representatives of *hudsonius* from museum collections (Table 1). One additional sample of *hudsonius* tissue specimen was obtained post-necropsy from the California Department of Fish and Wildlife following a mortality investigation.

We used two different extraction protocols, one for a quill tip from the Attu specimen, the other for the reference-tissue specimens. From the Attu specimen, we removed the proximal tip of a single quill (~0.5 cm) with a sterile razor and with clean forceps placed it into a 2.0-mL EZ1 sample tube. The quill tip was digested in 400 µL of a dithiothreitol-based digestion buffer (78 mM dithiothreitol; 100 mM NaCl; 0.5 mg/mL proteinase K; 2 g/mL sodium dodecyl sulfate; 3 mM $CaCl_2$; and Tris-EDTA buffer, pH 8.0) and incubated for 24 hours at 56 °C at 1000 revolutions per minute on an Eppendorf Thermomixer C (Eppendorf AG). The DNA was extracted with a Qiagen EZ1 Advanced XL DNA extraction robot (Qiagen, Inc.) according to the manufacturer's protocol for trace samples and eluted in 50 µL of water. Reference-tissue specimens were incubated in 200 µL (190 µL G2 buffer and 10 µL proteinase K) of manufacturer-supplied reagents for EZ1 DNA Investigator trace samples and followed the same incubation and extraction conditions as the quill tip, with the exception that they were eluted in 100 µL of water.

We amplified the resulting genetic material by using a combination of primer sequences shown in Table 2. All sequences were amplified in 25-µL reaction volumes containing 2.5 µL 10× PCR buffer (Applied Biosystems), 1.3 µL deoxynucleotide triphosphate mix (2.5 mM each), 0.5 µL forward and reverse primers (10 µM each) tagged with M13F or M13R, respectively, 2.0 µL $MgCl_2$ (25 mM; Applied Biosystems), 0.4 µL bovine serum albumen (10 mg/mL), 0.26 µL AmpliTaq Gold (Applied Biosystems), 2.5 µL template DNA,

Table 1 Specimens of Harriers Sampled for Comparison of Sequences of Mitochondrial DNA

Species and mtDNA gene region	Location	Source	Institution[a] and voucher number	GenBank accession(s)
Circus cyaneus				
ND1, ND2, COI	Alaska: Attu Island	this study	UAM 9062	PQ508332, PQ508340, PQ499575
ND1, ND2, COI	France	this study	AMNH DOT 7157	PQ508333, PQ508341, PQ499576
ND1, ND2, COI	Japan: Suruga	this study	AMNH SKIN 535911	PQ508334, PQ508342, PQ499577
ND1, ND2, COI	South Korea	Choi et al. (2021)	NIBR GEIBGR0000289530	KU237286
ND1, ND2, COI	China: Inner Mongolia	Gao et al. (2018)	unknown	KX925606
ND1	Sweden: Norrbotten	Oatley et al. (2015)	NRM 966543	KP857894
ND1	France: Languedoc-Roussillon	Oatley et al. (2015)	MNHN 6365	KP857866
Circus hudsonius				
ND1, ND2, COI	Alaska: Paxson area	this study	UAM 15027	PQ508335, PQ508343, PQ499578
ND1, ND2, COI	Alaska: Livengood	this study	UAM 38477	PQ508336, PQ508344, PQ499579
ND1, ND2, COI	Alaska: Seward Peninsula	this study	UAM 43070	PQ508337, PQ508345, PQ499580
ND1, ND2, COI	Alaska: Seward Peninsula	this study	UAM 49053	PQ508338, PQ508346, PQ499581
ND1, ND2, COI	California: San Diego Co.	this study	CDFW NOHA001	PQ508339, PQ508347, PQ499582
ND1	California, Kern Co.	Oatley et al. (2015)	CAS 90674	KP857846
ND1	New Jersey	Oatley et al. (2015)	AMNH DOT 7204	KP857851
ND1	New York	Oatley et al. (2015)	AMNH DOT 5970	KP857852
ND1	California: Alameda Co.	Oatley et al. (2015)	MVZ 181753	KP857870
COI	Canada: Ontario	Kerr et al. (2007)	ROM CWSL95-71859-02	DQ433513
COI	Mississippi	Kerr et al. (2007)	LSU 0496	DQ432854
COI	Canada: Ontario	Hebert et al. (2004)	ROM 1B-2778	AY666437
COI	Canada: Ontario	Hebert et al. (2004)	ROM 1B-2912	AY666427

[a]AMNH, American Museum of Natural History, New York; CAS, California Academy of Sciences, San Francisco; CDFW, California Department of Fish and Wildlife, Sacramento; LSU, Louisiana State University, Baton Rouge; MVZ, Museum of Vertebrate Zoology, University of California, Berkeley; NIBR, National Institute of Biological Resources, Incheon, South Korea; NRM , Swedish Museum of Natural History, Stockholm; ROM, Royal Ontario Museum, Toronto; UAM , University of Alaska Museum, Fairbanks.

Table 2 Primers Used to Amplify and Sequence the Mitochondrial Genes ND1, ND2, and COI of Harriers

mtDNA gene region and primer[a]	5′ to 3′ primer sequence	Reference
ND1		
ND1-L3827	GCAATCCAGGTCGGTTTCTATC	Sorenson et al. (1999)
ND1-H5201	CCATCATTTTCGGGGTATGG	Oatley et al. (2015)
ND1 degraded		
ND1-JF-Cir16sL	GTAAGGCCAATGCYACATGAC	Oatley et al. (2015)
ND1-JF-Circus140L	ATTGCCGTAGCTTTCCTCACAT	Oatley et al. (2015)
ND1-JF-Cir400L	CTCCTAGCCATATCAAGCCTA	Oatley et al. (2015)
ND1-JF-Cir600L	ACCATCTCCTACGAAGTCAC	Oatley et al. (2015)
ND1-JF-Cir900L	GGATTCTTATGARTCCGCGCC	Oatley et al. (2015)
ND1-JF-Circus340H	GGATTCAAATGGTTAGTGCTAG	Oatley et al. (2015)
ND1-JF-Cir450H	TTGAGTTTGAGGCYCATCCAGA	Oatley et al. (2015)
ND1-JF-Cir640H	ATTATTATAAGGGGTCAGGAG	Oatley et al. (2015)
ND1-JF-Cir960H	GTGYATYAGYTGRTCATAGCG	Oatley et al. (2015)
ND1-JF-Cir1250H	GYGTAGGTTCGATYCCTACTT	Oatley et al. (2015)
ND2		
ND2-L5216	GGCCCATACCCCGRAAATG	McCracken and Sorenson (2005)
ND2-H5766	RGAKGAGAARGCYAGGATYTTKCG	McCracken and Sorenson (2005)
COI		
CirCOIF1	GCTTCGGAAACTGACTAGTC	Martin Collinson (pers. comm.)
CirCOIR2	GGTGTTTGGTATTGAGAGAGG	Martin Collinson (pers. comm.)
Not applicable		
M13F	TGTAAAACGACGGCCAGT	Messing (1983)
M13R	CAGGAAACAGCTATGAC	Messing 1983

[a]M13F tags were added to the 5′ end of L-strand (L) and forward (F) primer sequences; M13R tags were added to the 5′ end of H-strand (H) and reverse (R) primer sequences. PCR-amplified products were subsequently sequenced with M13F and M13R primers.

and PCR-grade water to volume. The thermocycling regimen for COI and ND1 was as follows: 95 °C for 10 min, followed by 40 cycles of 95 °C for 30 sec, 55 °C (COI)/56 °C (ND1) for 30 sec, 72 °C for 60 sec, and a 5 min final extension at 72 °C. The regimen for ND2 was 95 °C for 10 min, followed by 40 cycles of 95 °C for 60 sec, 54 °C for 60 sec, 72 °C for 60 sec, and a 5 min final extension at 72 °C.

Next we purified the products with ExoSAP-IT PCR product-cleanup reagent (Applied Biosystems), following a low-volume protocol in a 5-μL reaction volume containing 0.40 μL ExoSAP-IT, 4.60 μL Tris buffer, pH 8.0 (50 mM), and 1–2 μL of PCR amplification product with thermocycling conditions of 37 °C for 30 min, followed by 85 °C for 15 min. Using the BigDye Terminator version 3.1 Cycle Sequencing Kit (Applied Biosystems), we sequenced the purified amplification products with M13F and M13R primers and purified them with the BigDye XTerminator Purification Kit (Applied Biosystems). For electrophoresis we used an ABI 3500xL Genetic Analyzer with POP-7 polymer, 50-cm capillary array, and default instrument settings (Applied Biosystems). We aligned the forward and reverse sequences, checked them for quality, and trimmed primer sequences with Sequencher

version 5.4.6 (Gene Codes Corporation). For specimens that failed to yield sufficiently long sequences with the primer pair ND1-L3827 and ND1-H5201, we assembled a contiguous sequence from overlapping sequences obtained from the degraded ND1 primer pairs. We aligned and compared the resulting sequences of the Attu specimen and vouchered reference specimens and identified variations between them in Sequencher version 5.4.6 (Gene Codes Corporation). We deposited our original sequences in GenBank with accession numbers PQ508332–PQ499582 (Table 1).

To assess interspecific and intraspecific variation, we evaluated differences among the sequences of ND1, ND2, and COI. To show the differences between species graphically, we used PopART version 1.7 (Leigh and Bryant 2015) to construct a median-joining network.

RESULTS

We successfully sequenced 1234 bp of ND1, 549 bp of ND2, and 275 bp of COI from all specimens sampled, with one exception: American Museum of Natural History (AMNH) 535911 yielded an incomplete ND2 sequence of 455 bp (Table 1). For simplicity's sake, we trimmed all other ND2 sequences to 455 bp in subsequent comparisons. Similarly, we trimmed ND1 sequences to 1157 bp (*cyaneus*) or to 1156 bp (*hudsonius*) to align with the sequences available through GenBank. A deletion at consensus bp position 1145 in reference sequences of ND1 of *hudsonius* resulted in a 1156-bp trimmed sequence when it was aligned with that of *cyaneus*.

With the sequences trimmed, the numbers of parsimony-informative sites between the *Circus* species were 21 for ND1, 13 for ND2, and 4 for COI. For all three mtDNA regions interspecific variation was greater than intraspecific. In *C. hudsonius*, sequences in all three mtDNA gene regions were identical. In *C. cyaneus* ND1 had the greatest number of haplotypes, with KX925606 from the Inner Mongolia region of China diverging the furthest from its conspecifics. The Attu specimen shared an ND1 haplotype with KP857894 from Sweden. The ND2 and COI haplotypes of *C. cyaneus* were invariant, aside from a unique haplotype in KX925606 from Inner Mongolia.

To compare the sequences of ND1 and COI of *cyaneus* and *hudsonius* with those of the Attu specimen, we used a combination of sequences in publicly available databases and those that we generated for this study (Table 1). Because publicly available sequences of ND2 of *hudsonius* were lacking, comparisons for this marker relied on specimens sequenced for this study. In both ND1 and ND2 genetic divergence between *cyaneus* and *hudsonius* was sufficient to identify the Attu specimen's maternal species of origin as *cyaneus*, and to exclude *hudsonius*. The shorter COI fragment had the fewest informative differences between the two *Circus* species, but it still corroborated the grouping of the Attu wing with *cyaneus*. Of these three mtDNA markers, ND1 was the most variable with each of the five reference specimens of *C. cyaneus* representng a unique haplotype. Based on a concatenated dataset of 1887 bp from the ten individuals for which we had all three genes, Figure 2 represents the relationships of the sequenced haplotypes and demonstrates the affinities of the Attu wing.

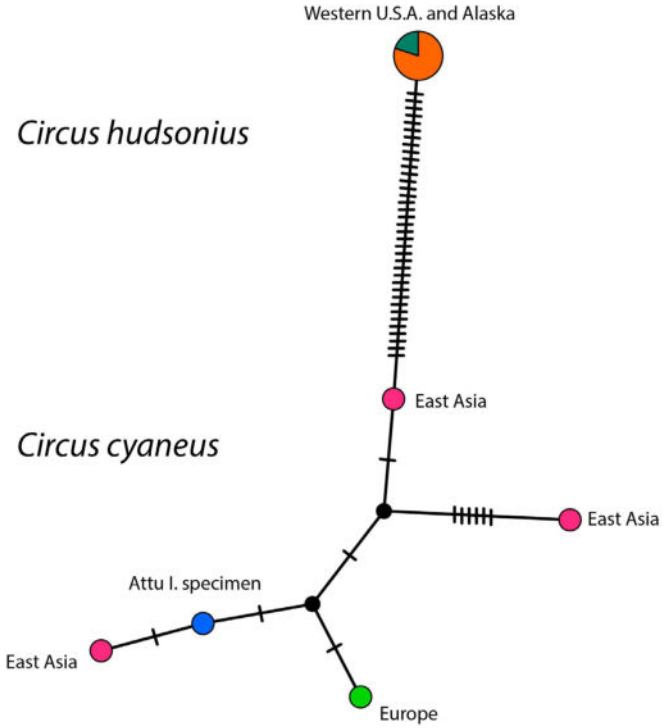

FIGURE 2. Median-joining haplotype network created in PopART software representing the relationship of haplotypes in a concatenated data set of 1887 bp of ND1, ND2, and COI from *Circus cyaneus* and *Circus hudsonius*. For *C. cyaneus*, each colored circle represents one specimen; for *C. hudsonius*, it represents the entire set of that taxon, which comprised only one haplotype. Each crossbar represents a difference in one base pair; black dots represent unsampled haplotypes. The Attu specimen clusters with the reference specimens of *C. cyaneus*.

DISCUSSION

Northern Harriers nest widely in mainland western Alaska from the Alaska Peninsula (Gill et al. 1981, Savage 2018) north through the Yukon–Kuskokwim delta (e.g., Petersen et al. 1991) and Seward Peninsula (Kessel 1989) to the Point Hope region (see Williamson et al. 1966). Despite this wide distribution and the highly migratory nature of Alaska populations, there are no records of any *Circus* from St. Lawrence Island (Lehman 2019), and the sole harrier reported from St. Matthew Island was not identified to (then) subspecies (Winker et al. 2002). Farther south, in the Pribilof Islands, where the Northern Harrier is best known (recently?) as a casual or intermittent fall migrant, all those identified to species are thought to represent *hudsonius* (S. Schuette in litt. 2019). Only slightly better known in the Aleutian Islands

since the publication of Gibson and Byrd (2007)—who assessed both taxa as casual, predominantly fall migrants throughout—there are now photographs of birds from the eastern and central Aleutians that appear to be *hudsonius* (Unalaska, 28 Dec 2014, S. Golodoff, e.g., Macaulay Library [ML] 232648091; Adak, 24 Sep 2017, F. Hass, e.g., ML 69903381; Adak, 22 Nov 2024, M. Kramer, e.g., ML 626610800). A photo of an apparent female on 10 Apr 2012 at Shemya Island in the western Aleutians (B. Trotter in litt. 2023) is not identifiable to species, as was another harrier there on 18 Apr 2002 (M. Schwitters, Tobish 2002). However, both would have been seasonally early for an Alaska migrant (see Swem 1982, Mindell and Mindell 1984), particularly female-plumaged birds, which tend to migrate later than adult males (Swem 1982, Palmer 1988, MacWhirter and Bildstein 1996). Whether this implies an origin in Asia or interisland movements of a bird that wintered in the Aleutians is unknown (Gibson and Byrd 2007). Harriers have reached the Hawaiian and Leeward islands numerous times, and those well documented have been reported as *hudsonius* (Clapp and Woodward 1968, Pyle and Pyle 2017, Rutt 2017). In Japan, *hudsonius* has been recorded at least three times (Morioka 1999, Brazil 2009, Tanuma et al. 2018, Y. Odaya in litt. 2023). A collection of feathers salvaged from near Meinypil'gyno, Chukotka, Russia, in 2021 represented *hudsonius* (Zinevich and Tomkovich 2023). This pattern of extralimital occurrence of North American birds vitiates inference of the origin of unidentified harriers in the western Aleutians, particularly in fall.

The Hen Harrier breeds across Eurasia east to the northern and western coasts of the Sea of Okhotsk, generally migrating south for the winter (e.g., Vaurie 1965, Cramp 1980). In extreme northeast Asia, it apparently nests as far east as the Kolyma River (Dement'ev and Gladkov 1966, Brazil 2009). Vaurie's (1965:203) statement that "the range becom[es] uncertain farther east [from the Kolyma] where this bird has been seen, but not found breeding, on the middle Anadyr [River] and in Kamchataka" remains largely true today, as we could still find no evidence for nesting east of the Kolyma River. For example, Tomkovich (2008) did not mention it from the middle Anadyr River, nor has he seen it in many years of field work in eastern Chukotka. In all likelihood the only specimen from Chukotka is a hatching-year bird taken on 7 Sep 1905 (Gregorian) on the middle Anadyr River (Zoological Museum of Moscow University [ZMMU] R-42416, photos examined; P. Tomkovich in litt. 2023). Lobokov (1986) did not mention *Circus cyaneus* as a breeding bird in Kamchatka, and Artyukhin et al. (2000) discussed it as a migrant there, including on Karaginsky Island. At least one specimen from western Kamchatka (Ust-Kamchatsk) is *cyaneus* as expected (Zoological Institute of Russian Academy of Sciences, St. Petersburg [ZIN] 118286; photos examined). Syroechkovsky et al. (2019) listed *Circus cyaneus* as a stray in the Koryak Highlands, outlining the first records in that region. There is apparently only one record from the Commander Islands (Gibson and Byrd 2007 and citations therein); the specimen from there mentioned by Shul'pin (1936) is *cyaneus* (ZIN 118287; photos examined). Migrants/winter visitants are known from the southern Kurile Islands (OSJ 2012) and (mostly northern) Japan (Brazil 1991).

On the other side of the continent, the lone *Circus* report from Greenland is thought to represent *hudsonius* (D. Boertmann in litt. 2023). In Iceland,

there are three records of *hudsonius,* including two specimens, and roughly five times that many records of nominate *cyaneus* (Y. Kolbeinsson in litt. 2023). Still farther east, *hudsonius* has reached the British Isles (Mullarney and Forsman 2010, McInerny et al. 2022) and the Azores (Alfry et al. 2018). As far as we are aware Duffy et al. (2012) is the only suggestion that Hen Harrier has reached North America from the east.

In a comparison of 1887 bp of mtDNA from three gene regions (ND1, ND2, and COI), the Attu specimen unequivocally groups with *cyaneus.* But mitochondrial DNA alone cannot exclude the possibility the bird was a hybrid. However, there were no morphological features of the Attu specimen suggest a hybrid origin. Therefore, our comparisons of mtDNA sequences identify the Attu specimen as the first confirmed Hen Harrier in North America, presumably originating somewhere in east Asia.

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FIRST RECORD OF THE NORTHERN SPOTTED OWL NESTING IN FOREST BURNED AT THE HIGHEST LEVEL OF SEVERITY

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ABSTRACT: An instance of the Northern Spotted Owl (*Strix occidentalis caurina*) nesting successfully in severely burned forest indicates that under some circumstances, such habitat may indeed provide the species suitable habitat. Current forest-management approaches treat wildfire as the primary cause of habitat loss for both the Northern and California (*S. o. occidentalis*) Spotted Owls. Assumptions that severely burned forest does not provide any viable nesting or roosting habitat for these Spotted Owl subspecies has resulted in substantial post-fire logging and removal of burned trees throughout both owls' ranges. In addition, forest management intended to prevent severe fires may entail thinning of unburned Spotted Owl habitat to reduce tree density and potential fuel loads. In the Mendocino National Forest of western Glenn County, California, I followed a pair of Northern Spotted Owls nesting and roosting deep within a large patch of severely burned forest two years after a fire, in a stand with no post-fire salvage logging, pre-fire thinning, fuels reduction, or attempts at restoration. A pair of Spotted Owls had used this location consistently since 1990, and the territory remained occupied with owls roosting and nesting successfully in 2022, despite 73% of the territory burning at high severity in 2020.

Under the Federal Endangered Species Act, the United States Fish and Wildlife Service (USFWS) designated the Northern Spotted Owl (*Strix occidentalis caurina*) a threatened subspecies in 1990 (USFWS 1990). Despite 25 years of this designation the subspecies has continued to decline precipitously throughout its range. In 2020, the USFWS reexamined the Northern Spotted Owl's vulnerability to extinction and confirmed severe and significant downward population trends, with declines of 32–77% since the early 1990s (USFWS 2019). The USFWS (2020) concluded that an elevating the owl's status from "threatened" to "endangered" was "warranted but precluded," meaning that although the Northern Spotted Owl met the requirements to be designated "endangered," the agency lacked the resources to take action at that time. The USFWS (2019) recognized the primary threats to the Northern Spotted Owl as competition with the Barred Owl (*Strix varia*), past and present habitat loss from timber management, and stated that "the primary loss of habitat is due to wildfire." Although the USFWS (2019) briefly mentioned post-fire logging, the agency failed to consider loss of potential *Strix occidentalis* habitat caused by logging of severely burned forest because such burned forest is not recognized as suitable habitat for the Spotted Owl's nesting or roosting. Here I document the successful nesting and roosting by a pair of Northern Spotted Owls in a large severely burned patch of forest, which indicates not only that such burned areas need closer examination, as they may offer breeding Spotted Owls viable habitat, but that the practice of logging severely burned forest should be reevaluated.

The Spotted Owl is recognized as having high site fidelity to established territories that meet fundamental biological needs and may remain in a terri-

tory even after a fire (Lee and Bond 2015). Although the Spotted Owl activity center I monitored was not surveyed every year, records such as those available through the California Natural Diversity DataBase (CNDDB: htpps://wildlife.ca.gov/Data/CNDDB/Spotted-Owl-Info; accessed on 20 February 2024) attest to stable long-term occupancy of this site (confirmed occupancy: 1977, 1980, 1982, 1990, 1992, 2002, 2006, 2008, 2021, 2022; confirmed reproductive success: 1980, 1990, 1992, 2002, 2008, 2022). In 2020 this entire Northern Spotted Owl activity center was burned in the August Complex Fire at high severity, typically defined as 76–100% mortality of the basal area of trees (USDA 2021b). In 2022, two years following the August Complex Fire, I returned to this site and confirmed Northern Spotted Owls nesting and roosting more than 1.5 km from the edge, within the deep interior of a 4500-ha swath of severely burned forest where 100% of the trees within at least 50 m of the nest and roost trees were killed. This may be the first report of a Northern Spotted Owl nest located in a large severely burned patch of mixed conifer forest.

The recent increase of wildfire in the Spotted Owl's habitat raises the question of the relationship between fire and the owl's habitat use over both the short and long term (CDFW 2016, Lesmeister et al. 2018, USFWS 2019). This increase raises concern for loss of high-quality nesting and roosting habitat, the scarcity of which has historically limited the number of Spotted Owl territories. Although the increase of fire has created more opportunity for study of the relationship between the Spotted Owl and burned forest (Clark et al. 2013, Rockweit et al. 2017, Bond et al. 2022), there remains little conclusive information about effects of fire *only*, unencumbered by logging pre- or post-fire (Bond et al. 2022, Hanson et al. 2021).

Most studies reporting fire to have negative effects on the Spotted Owl have have not been able to distinguish between the effects of fire itself versus those of post-fire logging (Hanson et al. 2021). The few studies that have separated the two effects have shown that the effects of fires of mixed levels of severity are neutral or positive, while those of post-fire logging are consistently negative (Lee 2020, Hanson et al. 2021). The Northern Spotted Owl's use of severely burned forest has not been investigated, yet in the absence of published evidence such forest has been broadly assumed to be unsuitable for nesting or roosting habitat. Implicit in this assumption is the inference that the owl nests and roosts only in habitat traditionally considered suitable.

The Northern Spotted Owl's traditional nesting and roosting habitats in unburned forests of northwestern California are well documented, being characterized by structural complexity, decadent features, old conifers of large diameter, high basal area of live trees, trees of mixed ages, a multi-storied canopy, a high percentage of canopy cover, and coarse downed woody debris (Blakesley et al. 1992, Folliard et al. 2000, LaHaye and Gutiérrez 1999). With little information on how Spotted Owls respond to wildfire, these characteristics of unburned forest have been assumed to be the same requirements the owl needs to nest and roost in burned forests, fostering the idea that forests burned at high severity are unsuitable habitat (USFWS 2019). However, widespread assumptions that *Strix occidentalis* does not use burned habitats are inconclusive and untested because of widespread logging of severely burned forests, including those encompassing Northern Spotted Owl territories

(Bond et al. 2022). As reported by many (Brown 2008, Lee et al. 2013, Hanson et al. 2018) and statistically supported by other research (Bond et al. 2009, Clark 2007, Clark et al. 2011, 2013), *Strix occidentalis* avoids areas logged after fire. Whether Spotted Owls may nest or roost within severely burned areas that have not been logged after the fire, however, has not been investigated.

Many studies of the California Spotted Owl's relationship with wildfire have been similarly faced with the challenge of isolating the effects of wildfire from those of other factors. California Spotted Owl studies able to distinguish between these factors have found fire to be either neutral or slightly positive for territorial occupancy and survival (Bond et al. 2002, Roberts et al. 2011, Lee et al. 2012, Lee and Bond 2015, Hanson et al. 2018, Schofield et al. 2020). Studies that failed to document post-fire logging and distinguish between behavioral responses to post-fire logging versus severe fire (Comfort et al. 2016, Jones et al. 2016, 2020, Rockweit et al. 2017) may also have failed to recognize the ecological role such burned forests may play in the Spotted Owl's biology.

METHODS

Study Area

The Mendocino National Forest is located in northwestern California on the inland eastern spur of the northern California's Coast Range. It is about 320 km north of San Francisco and 195 km northwest of Sacramento. My observations took place at elevations from 1425 to 1460 m in Glenn County, on a west-facing slope within a patch burned at high severity in the 417,898-ha August Complex Fire of 2020. The fire burned hot through this entire area, including a 40-ha "late-successional reserve" composed of mature mixed coniferous forest. The reserve was surrounded by early- to mid-successional forest heavily logged in the mid-1980s, when approximately 85 ha of forest was removed. Draining into Butte Creek on a moderate slope are multiple year-round and ephemeral waterways.

Spotted Owl Surveys

In May and June 2002, my Spotted Owl surveys followed the protocol specified by the USFWS (1992), whereas those in May and June 2022 adhered to the updated "Protocol for Surveying Proposed Management Activities that May Impact Northern Spotted Owls" (USFWS 2012). All observations and data for each field visit were recorded and compiled on individual field outing forms with attached United States Geologic Survey (USGS) topographic 7.5-minute quadrangle maps, showing coordinates obtained from a handheld Garmin GPS unit (global positioning system).

RESULTS

In 2002, I was one of a two-person team documenting a pair of Northern Spotted Owls with two successfully fledged young in the Mendocino National Forest. The habitat within the core area (within 1126 m of the nest) consisted of traditional nesting/roosting habitat in late-successional forest.

In 2022, after the area burned in the August Complex Fire of 2020, I located

a Northern Spotted Owl nest ~325 m downslope and west of the nest used in 2002 and identified several of the male's day-roost sites. The Northern Spotted Owl nest and roosts were >1300 m from the perimeter of a ~4500-ha patch burned at high severity (Figures 1–4). The nest contained three nestlings, of which two successfully fledged (Figure 2). It was situated in a cavity within a Douglas fir (*Pseudotsuga menziesii*) tree (diameter at breast height 105.5 cm) that was fire-scorched and moribund (Figure 1). The nest tree and some others in the same stand were not immediately killed by the fire but subsequently died between 2021 and 2022, as dead needles remained on branches. The nest tree stood approximately 30 m tall, with the south-facing nest cavity approximately two-thirds up the trunk, midway up a ~30° west-facing slope. The nearest live tree was ≥50 m north of the nest along a large perennial creek. In addition, I observed the male roosting by day on two separate days in burned snags ~38 m southwest and ~33 m southeast of the nest (Figure 3). Concentrated accumulations of recent whitewash and pellets indicating routine owl use lay around the trunks of many other burned trees within 40 m of the nest tree and throughout the burned stand. Chew marks observed on feather shafts found on the ground ~30 m south of the nest tree implied mammalian predation of the third chick.

The severity of the fire in these owls' home range, based on the USGS's Monitoring Trends in Burn Severity Project (www.mtbs.gov; accessed on 13 March 2024), is shown in Figures 4a and 4b. Within the home range (radius 2092 m), the severity of the fire was 73% high, 20% moderate, 6% low, and 1% unburned.

DISCUSSION

For the California Spotted Owl, Lee and Bond (2015) found an 87% probability of a pair occupying a previously identified territory even when 100% of the 121-ha activity center had been burned severely. Though I found no previous records of Spotted Owls nesting in such burned forest, my results here add to those of Lee and Bond (2015) regarding the California Spotted Owl. Mine may be the first documentation of the Northern Spotted Owl nesting within severely burned forest, but the findings of Lee and Bond (2015) with the California Spotted Owl imply that nesting under such conditions is unlikely an isolated event. The lack of previous documentation of Northern Spotted Owl nests inside large patches of forest burned at high severity may reflect the very high proportion of such areas that are logged shortly after wildfires (Bond et al. 2022), as well as the long-standing assumption by land managers and Spotted Owl survey crews that severely burned forest is not suitable for Spotted Owl nesting or occupancy (USFWS 2019). This assumption may lead to nest-site surveys within the few large severely burned patches that are not largely clearcut soon after the fire being inadequate or lacking (Bond et al. 2022).

The 2022 Northern Spotted Owl nest that I documented in the area burned in the August Complex Fire had three nestlings, of which two fledged successfully (Figure 2). Spotted Owls typically rear one or two young and have been rarely known to fledge three in any given season (Bond et al. 2013). Thus a brood of three offspring suggests that this severely burned forest provided

FIGURE 1. Northern Spotted Owl cavity nest in mixed conifer forest severely burned in the 2020 August Complex Fire, Mendocino National Forest, 1 June 2022.

Photo by Maya Khosla

FIGURE 2. Adult Northern Spotted Owl with two fledglings in mixed conifer forest severely burned in the 2020 August Complex Fire, Mendocino National Forest, 3 July 2022.

Photo by Tonja Chi

FIGURE 3. A northeast-facing view of two roost trees (indicated by yellow arrows) of a male Northern Spotted Owl in mixed conifer forest severely burned in the 2020 August Complex Fire, Mendocino National Forest, 19 May 2022.

Photo by Tonja Chi

prey sufficient to support a brood of at least typical size (Bond et al. 2013). Lee (2020) found that Spotted Owl productivity increased as the proportion of the pair's territory burned severely increased. Examples of increased prey abundance resulting in increased brood sizes and larger clutches are common in other raptor species, for example, the Great Horned Owl (*Bubo virginianus*;

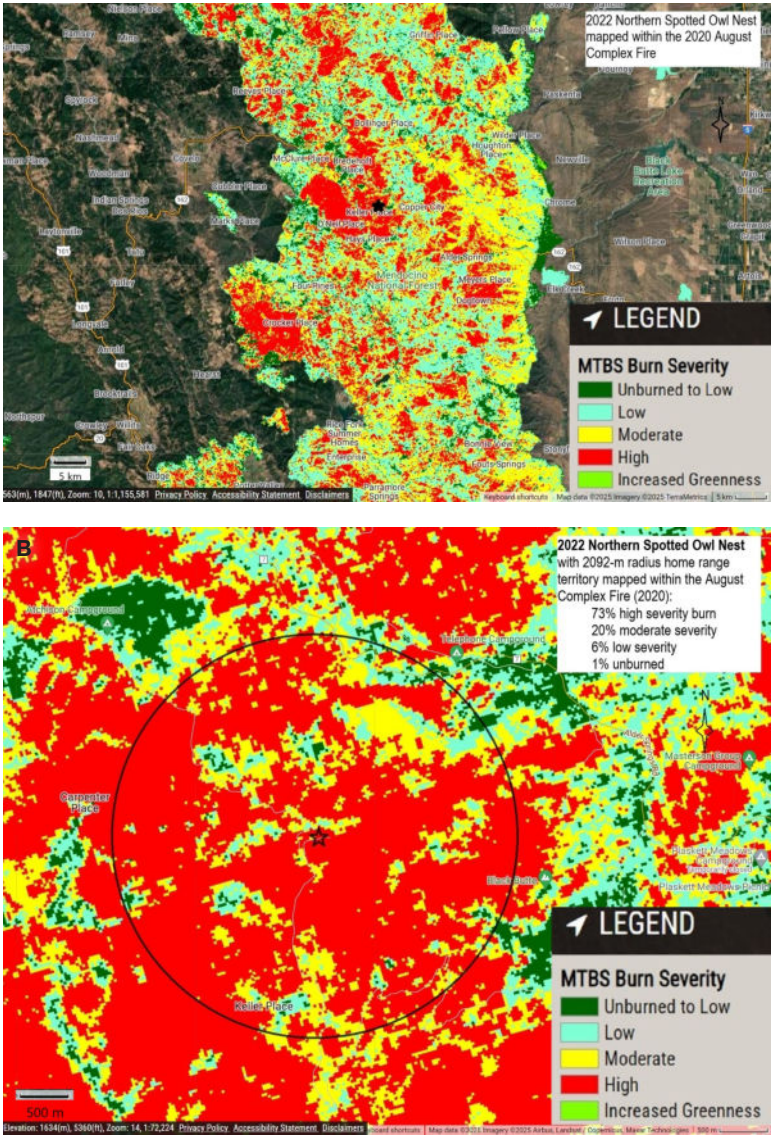

FIGURE 4. Location of Northern Spotted Owl nest (black star), plotted on a map of levels of fire severity in areas burned in the August Complex Fire of 2020. Fire-severity data obtained from the Monitoring Trends in Burn Severity Project of the USGS (2024). (A) The southern half of the 2020 August Complex Fire, Mendocino National Forest. (B) Closer view, showing a radius of 2092 m around the nest, defining the pair's home range or activity center (indicated black circle).

Reynolds et al. 2021), Eurasian Eagle Owl (*Bubo bubo*; Hadad et al. 2024), Tengmalm's or Boreal Owl (*Aegolius funereus*; Korpimäki 1990), and Eurasian Kestrel (*Falco tinnunculus*; Korpimäki and Wiehn 1998).

My surveys in 2022 were a response to the Mendocino National Forest's proposal, in the wake of the August Complex Fire, to salvage-log 306 ha (Plaskett-Keller Phase I Project) around the Northern Spotted Owl nest I found active. This proposal would have resulted in the removal of one quarter of the burned forest within 2.1 km of the nest or one quarter of the 1372-ha territory. The project's environmental assessment (USDA 2021a) also specified logging much of the severely burned forest in two other Northern Spotted Owl activity centers. The following excerpt from the proposal is a common example of the assumptions have been frequently applied to severely burned forest: "All three of these [activity centers] have the most habitat loss from fire. Nesting and roosting habitat has been greatly diminished, and new nests are not expected to occur in these activity centers" (USDA 2021a). The Northern Spotted Owls I observed were roosting (Figures 2 and 3) and nesting (Figure 1) in a long-established territory deep within the perimeter of the August Complex Fire in which tree mortality two years after the fire was 100% (Figure 4a).

SUMMARY

A successful Northern Spotted Owl nest located in a patch of severely burned forest suggests an unrecognized value to such burned forest—it may be not only beneficial but essential to Spotted Owls after a wildfire. Currently, this habitat is regularly undervalued, overlooked, and routinely removed, be the forest federally, state, or privately owned (Bond et al. 2022). This finding of a successful Spotted Owl nest within a large patch of severely burned forest introduces a new dialog to evaluation of the species' use of burned landscapes. It emphasizes the need for further research into such use, as well as a need for establishment of new protections of such sites from post-fire logging. It appears that the high-quality conditions for nesting and roosting observed at this site in 2002 (unmanaged from 2002 to 2022) persisted in a different form after the territory burned in 2020.

Most public lands on which the Spotted Owl has been studied have a long history of management and timber harvest, with national parks being the exception. This emphasis on logged forest has likely led to the habitat at a large percentage of study sites being complex and heterogeneous, a baseline variable not considered when different regions are compared. Schofield et al. (2020), who studied the Spotted Owl in areas burned at mixed levels of severity within national parks protected from logging, compared their results to those of other studies conducted in wildfire-burned and managed forests. They surmised that pre-fire forest structure was likely paramount to the legacy of post-fire habitat conditions the owls need. My findings, in a stand of high-quality habitat pre-fire, demonstrate that severely burned forest can not only provide nesting and roosting habitat for Northern Spotted Owl but may supply an enhanced food abundance, allowing for an increase in fecundity, as indicated by Lee (2020). This finding suggests not only the need to increase protection of severely burned forest but also protection of the

habitat's structural complexity pre-fire, essential for resilience in maintaining habitat value for *Strix occidentalis* post-fire. It further highlights pre- and post-fire forest conditions as aspects of *Strix occidentalis* territories that must be protected to slow the continuing loss and degradation of Northern Spotted Owl habitat, identified as a top contributing factor to the Northern Spotted Owl's population decline range wide (USFWS 2019).

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NOTES

ANNUAL VARIATION IN HABITAT SELECTION OF LECONTE'S THRASHER

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ABSTRACT: Surveys of Tule Springs Fossil Beds National Monument near Las Vegas, Nevada, in 2021, after an exceptionally dry winter, revealed LeConte's Thrasher (*Toxostoma lecontei*) only in uniform stands of *Atriplex polycarpa* on flat terrain. But in 2022, after a winter of rainfall 2.7 times greater than average, several LeConte's Thrashers, including at least one nesting pair, appeared in Mojave Desert scrub on a rockier substrate and more sloped terrain, in an area where they had been absent the previous year. Thus habitat use by LeConte's Thrasher may vary in response to annual fluctuation in rainfall.

LeConte's Thrasher (*Toxostoma lecontei*) is a cryptic and difficult-to-detect species inhabiting some of the driest and sparsest habitats in the southwestern United States and Mexico (Fletcher 2009, Sheppard 2020). Land development for energy and agriculture, wildfires, climate change, and all-terrain-vehicle usage all significantly damage the habitat and prey base critical to the thrasher, which thrives in undisturbed environments (Sheppard 2018). Tule Springs Fossil Beds National Monument

FIGURE 1. Flats dominated by cattle saltbush (*Atriplex polycarpa*), the most common nesting habitat for *Toxostoma lecontei*. Photo taken at boundary of Tule Springs Fossil Beds National Monument and Desert National Wildlife Refuge after recent rain.

Photo by John Mark Simmons

FIGURE 2. Mojave Desert scrub at Tule Springs Fossil Beds. Larger and more abundant rocks, numerous rocky washes, higher diversity of flowering plants, and taller vegetation distinguish this habitat from to the saltbush-dominated survey plots.

Photo by John Mark Simmons

(National Park Service) in southern Nevada preserves 9170 hectares of the Mojave Desert in the urban Las Vegas Valley and represents a mosaic of disturbed and undisturbed sites. The population of LeConte's Thrasher at Tule Springs and the neighboring Corn Creek Important Bird Area is well known to birders and ornithologists. Reports posted to https://eBird.org provide a snapshot of the thrasher's occurrence in the Las Vegas Valley, where many occur along Corn Creek Road in uniform stands of allscale or cattle saltbush (*Atriplex polycarpa*), perching atop shrubs, fences, and signs. This habitat is characterized by alkaline soils and low plant diversity (Figure 1) (Sheppard 1970, Laudenslayer et al. 1992, Williams et al. 1998, Fletcher 2009) but also includes small buckhorn and silver chollas (*Cylindropuntia acanthocarpa* and *C. echinocarpa*), and creosote bush (*Larrea tridentata*). During a set of targeted surveys (n = 33 plots, each of 90,000 m^2) within the national monument, I found a breeding pair of LeConte's Thrashers in an atypical habitat.

LeConte's Thrasher surveys in the monument followed the area-search protocol developed by the Desert Thrasher Working Group (https://borderlandsbirds.org/projects/desert-thrasher/). During the 2022 season, I detected *T. lecontei* exclusively within saltbush-dominated plots, as expected. In 2022, no LeConte's thrashers were observed in Mojave Desert scrub habitat (n = 3 plots; Figure 2), which is much rockier, slightly steeper, and supports greater diversity of plant species than does the saltbush-dominated habitat. On a rockier substrate, these plots have varying amounts of desert pavement and gravel and much less bare ground than do the saltbush plots. This habitat is dominated by eastern Joshua trees (*Yucca brevifolia jaegeriana*), Mojave yucca (*Y. schidigera*), silver cholla, creosote bush, Mojave indigobush (*Psorothamnus arborescens*), and several other species of cacti and wildflowers

(Figure 2). In 2023, LeConte's thrashers bred on a surveyed plot in Mojave Desert scrub habitat with steeper slopes (>5°). I initially recorded *T. lecontei* at this plot on 24 March 2023, then again on 4 May, and finally on 8 June with recently fledged young. I also observed several individuals outside of the survey plot in this same habitat type. This represents an uncharacteristic terrain and vegetation preference compared to studies at Maricopa, Kern Co., California, where about 80% of nests were in cholla or saltbush (Sheppard 2018). Fletcher (2009) did not observe LeConte's Thrasher on slopes >5°. While this species is known to inhabit flatter Joshua tree-dominated habitats (Sheppard 1970, Laudenslayer et al. 1992, Fletcher 2009), the apparent shift of territories into this new habitat type is notable and may be a response to drought. LeConte's Thrasher's behavior during extreme drought years is still unknown and requires further study (Sheppard 2018).

The winter of 2021–2022 was very dry. From December through February, sensor 3954, Tule Springs NW, the closest and most relevant gauge (accessed 9 July 2024 via https://www.regionalflood.org/programs-services/rainfall-and-weather/historical-rainfall/rainfall-history-lookup) received zero rain, compared to the average for those three months of 12.95 mm. In the winter of 2022–2023 the station received 35.05 mm of precipitation, a notable increase from the previous season when I found no thrashers in the novel Mojave Desert scrub habitat. Droughts, influenced by the Pacific Decadal Oscillation and El Niño, are known to be significant drivers of the biodiversity of the Mojave Desert ecosystem and its birds (Hereford et al. 2006).

In the Las Vegas Valley, *T. leconteii* appears to preferentially select uniform stands of saltbush, on the basis of Tule Springs survey data, reports via eBird from the neighboring Corn Creek Important Bird Area, as well as available literature, such as Sheppard (2018). Nevertheless, it is worth considering that this species is extremely cryptic; many birders who report LeConte's Thrasher in this stand of saltbush spot the birds along Corn Creek Road, open to the public. As a result, observer effort in the easily accessible saltbush habitat is disproportionately higher than in the more remote areas farther from public roads, such as the adjacent Mojave Desert scrub. Land managers should not rely solely on eBird data to identify where thrashers decide to breed. An improved understanding of the annual and seasonal changes in the thrasher's habitat selection can help developers and land managers make appropriate decisions to benefit species conservation in the face of threats. Since desert thrashers are so cryptic and accurate surveys are challenging, additional phenological knowledge might improve detection rates. Better data should enable us to better predict the thrashers' responses to habitat loss (i.e., land conversion to agriculture or solar fields), which is the primary threat to this group of species (Williams et al. 1998, Shuford and Gardali 2008, Sheppard 2018). Finally, *T. lecontei* remains an understudied species. Given the current paucity of contemporary information and management strategies in the face of development, this reported observation can help build on our knowledge of the species and its ecology.

I thank Erin Eichenberg and the rest of the staff at Tule Springs for the opportunity and means to conduct these surveys. Dawn Fletcher and Lauren Harter from Great Basin Bird Observatory set me on the course of thrasher surveys in 2022, and I have been grateful for their continued involvement and expertise on this species. Liam Wolff and Lauren Parry provided knowledgeable edits and insight. I appreciate my association with the Desert Thrasher Working Group, which continues to accumulate valuable data on LeConte's and Bendire's Thrashers throughout the Southwest. I also thank the staff at Desert National Wildlife Refuge for their collaboration, and I would be remiss if I did not thank the reviewers and editors of *Western Birds* and specifically Jay M. Sheppard for their dedication and effort.

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NORTHERN HARRIER BREEDING IN BAHIA DE SAN QUINTIN, BAJA CALIFORNIA

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ABSTRACT: The Northern Harrier (*Circus hudsonius*) reaches the southern limit of its current breeding range at San Quintín Bay, Baja California Mexico, where the tidal salt marsh is home to possibly as many as 15 pairs. In 2023 one pair had a nest with three eggs hatching 25–26 April. Two young fledged by 17 June.

The Northern Harrier (*Circus hudsonius*) is a dimorphic raptor widely spread through North America, wintering regularly as far south as Central America, rarely to Colombia and Venezuela (Smith et al. 2020). In Mexico, it breeds only in the state of Baja California (Howell and Webb 1995, Smith et al. 2020), but records of nesting in Baja California have been few. Massey and Palacios (1994) reported it as formerly breeding in Baja California but specified no records. Unitt et al. (1995) listed historic nesting in the 19th century near the border with California, possible breeding at El Rosario in 1925 based on observations in April and May, and likely breeding at the mouth of the Rio San Telmo in 1967 and east of San Telmo de Arriba in 1991. Erickson et al. (2002) reported a nest with three eggs at the mouth of the Río San Telmo, and Erickson et al. (2016) reported a sighting of a nest with five young on the Maneadero plain. We report here on successful nesting at the Bahía de San Quintín, Baja California, Mexico.

On 4 April 2023, while surveying bird species in San Quintín Bay, we observed three pairs of Northern Harriers flying over 0.5 ha with central coordinates 30.4083° N, 115.9358° W, in the Cielito Lindo area in the southeast corner of the bay, in wetland dominated by *Salicornia* sp. and *Spartina* sp. (Delgadillo et al. 1992). The breeding activities of the Northern Harrier pairs observed in San Quintín were asynchronous. The closest pair to us was defending a territory from other harriers and birdwatchers. We observed a second pair in nuptial flight and also a flight in which the male provided the female with food; the third and farthest pair was not engaging in nuptial behaviors but was patrolling their territory. Smith et al. (2020) mentioned that loose colonies of the Northern Harrier have been reported in Seal Beach, California (Hall 1947), and the province of Manitoba, Canada (Hecht 1951).

Given the overtly aggressive behavior of the first pair, we assumed they might

have been nesting, and we decided to explore the area where they were defending the territory to find the nest, but we failed to find the nest on this date.

Some 150 km north of San Quintín, we have also observed nuptial flights and fledglings at Estero de Punta Banda between April and June, 2014 to 2023, but have not looked for nests.

On 25 April 2023, we returned to the suspected nest location and found a nest within the Cielito Lindo wetland in a patch of *Salicornia* and *Spartina* at coordinates 30.41044° N, 115.93410° W. The nest was approximately 60 cm in diameter, sitting on a bed of *Salicornia* and dry sea grasses; no anthropogenic material was found in the nest. The height of the *Salicornia* plants surrounding the nest was approximately 50 cm, providing good cover. In the nest, we found a chick and two eggs. We returned the next day, 26 April, to place a camera and photograph the chicks—of which a second had hatched (Figure 1).

A fourth trip on 17 June revealed two fledglings that were being fed by the male after a feeding flight and calling. The fledglings were observed approximately 200 m northeast of the nest (Figure 2).

The Northern Harrier is a species of least concern under the International Union for Conservation of Nature and does not have protected status in Mexico,

Figure 1. Northern Harrier chicks on their nest at the Cielito Lindo wetlands in Bahía San Quintín, 26 April 2023.

Photo by Hiram Moreno

FIGURE 2. Northern Harrier fledgling at the Cielito Lindo wetlands in Bahía San Quintín, 17 June 2023.

Photo by Xavier Moreno

but it is listed as a species of special concern by the California Department of Fish Wildlife and as a species of conservation concern by the U.S. Fish and Wildlife Service (CNDDB 2024). Its most significant threat is the disappearance of wetlands. Northern Harriers nest on the ground, usually in dense vegetation associated with open wetlands, but rarely in saltmarshes (Smith et al. 2020). Our observations confirm that there is a nesting population at San Quintín Bay with successful nesting in saltmarsh habitat. The population around San Quintín Bay may be as large as 15 pairs, on the basis of our observations at various localities from 2022 through 2024. The area apparently represents the current southernmost extreme of the Northern Harrier's breeding range, as there are no recent reports from El Rosario from April to July, and farther south on the Baja California Peninsula are only a few reports of single individuals straggling as late as May (Ruiz-Campos et al. 2005).

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BOOK REVIEWS

The Birds that Audubon Missed: Desire and Discovery in the American Wilderness, by Kenn Kaufman. 2024. Avid Reader Press. 387 pp. Many drawings by both Audubon and the author. Hardcover, $32.50. ISBN 978-1-6680-90759-4.

I was prepared to NOT like this book. So much so that I first downloaded a free Kindle sample. I am most certainly not a fan of Audubon or his art. I find the setting of his paintings often overly dramatic or just plain wrong (Mountain Plovers shown in the mountains…). The grossly contorted poses of the birds are bothersome, even though I understand they are intended to show all the key features for identification. Art aside, the man's difficult relationship with the truth and overwhelming ambition led him to commit several acts of gross scientific fraud.

My concern was that this book would be yet another fawning tribute to Audubon's genius. That notion was dispelled in the very first pages where Kaufman relates Audubon's story of how he discovered the Lincoln's Sparrow in Labrador by its song and immediately knew he had found a new bird. Great story, however, Kaufman cites some excellent detective work by Matthew Halley revealing that Audubon was on board the ship drawing the day Thomas Lincoln collected the bird, and Audubon didn't even look at it for a few days…only suspecting that it was something new once he held the specimen.

However, this book is neither an indictment of Audubon, nor a tribute. Kaufman provides a balanced and finely nuanced mixture of examples of the man's flaws and his talents. The basic premise of the book is based on Kaufman's attempts to paint, in the Audubon style, several birds that Audubon and other naturalists of the time missed, or saw but failed to recognize as different. Birds that were certainly present and relatively common at the times and places Audubon frequented. But that premise is merely the framework that Kaufman uses to produce an excellent history of the naturalists who first described and categorized the birds of North America. At a time when we may see the names of some of these pioneers of American ornithology removed from many common bird names (Wilson, Bonaparte, and so on), this book is a timely tribute to those naturalists who deserve to be recognized for their contributions.

Kaufman explains the importance of the taxonomic system created by Linnaeus in the 1700s and how, when finally broadly adopted, it ended years of chaos and confusion about names of organisms and the relationships between them. He deftly deals with the notion of priority and how a genus such as *Dendroica*, one that included a large proportion of our warblers, can suddenly disappear through a single taxonomic decision.

We get to learn about nearly everyone who made important contributions to the creation of American ornithology from Mark Catesby's foundational work in the southeast in the early 1700s to Spencer Baird, who organized and inspired a remarkable group of ornithologists and collectors to create the preeminent specimen collection of the 19th century. The museum created by George Willison Peale gets the credit it deserves as a place that provided Alexander Wilson (the true "father of American ornithology") a source of inspiration and discovery that was fundamental to all his accomplishments. We get to see the key role that Wilson and his legacy played in Audubon's career. Although they met only briefly and Wilson had been dead many years before Audubon's key publications, Audubon was obsessed with outdoing Wilson…an obsession that led to some of his most egregious acts of scientific fabrication and intellectual theft. Charles Bonaparte, whom most birders know only through the handsome gull that bears his name (or his relationship to that more famous Bonaparte), finally gets acknowledged for his careful and meticulous

attention to detail, a trait that allowed him to correct several misidentifications made by both Wilson and Audubon.

The historical narrative is interrupted several times with chapters called, "Interlude: Channeling the Illustrator." In these, Kaufman describes his attempts to mimic the style of Audubon's art as he tries to create a painting of each of the species that Audubon missed. I suspect that anyone who has ever tried drawing birds will find these of interest, and some of the more technical points may be fascinating to serious artists. For me, his insights allowed me to better appreciate Audubon's skill at composition, the challenges presented by his intent to paint each bird at life size, and his feather-perfect reproduction of the details of the specimens from which he worked. Indeed, the feather mistakes obvious in his painting of an enormous eagle that certainly existed nowhere but in Audubon's imagination help to confirm his most outrageous fabrication.

Kaufman is careful to point out that all the "discoveries" made by these naturalists were of birds that had been well-known to America's indigenous people for thousands of years. He also does not shy away from Audubon's owning of enslaved people. He tells us how, after traveling down to New Orleans with two of his "servants," taking them hundreds of miles from their families, he then had no compunction about selling them when he needed money for the return trip.

There are black-and-white reproductions of many examples of Audubon's and Kaufman's art throughout the text and a section at the end with full-color versions of the author's paintings of the ten "missed" birds, all in the Audubon style. Having only seen Kaufman's line drawings in his book *Advanced Birding*, I was very impressed with these paintings.

All in all, this is a lively and well-written book that I think anyone with an interest in birds, whether a student of ornithological history or a beginning birder, will find a rewarding read.

Edward R. Pandolfino

Small Mountain Owls, by Scott Rashid. 2009. Schiffer Publishing. 160 pp. 166 illustrations. Hardcover, $39.99. ISBN 978-0764332821. This review is based on the original 2009 edition. A revised and expanded edition was published in 2022.

Some ornithology books are one-offs. How would one review Dawson's *Birds of California*, or Pyle's *Identification Guide to North American Birds*? Such works fall into the category of "here's everything I know" and are as much a reflection of the author as the material. There's also the phenomenon of a researcher's "permanent place"—Alexander Skutch in Costa Rica, Glen Woolfenden in central Florida—your mental list of these pairings is probably as long as mine, since a researcher's geographical setting frequently becomes inextricably linked to his or her output. Scott Rashid, who majored in art in college but who has spent his entire career in ornithology, is one such place-expert. His place is the Rocky Mountains of Colorado, and *Small Mountain Owls* is the culmination of four decades of banding, photographing, rehabilitating, and searching for the nests of owls around Rocky Mountain National Park.

Bursting with his paintings and photographs, *Small Mountain Owls* devotes 175 pages to four species Rashid knows best (and which you've probably seen least)—the Northern Pygmy Owl, the Flammulated Owl, the Saw-Whet Owl, and the Boreal Owl. I can't imagine seeing all of these species regularly, much less studying dozens of their nests, as he has. The chapters are tailored to the species, in that section headings differ depending on what's known about each one. Their titles hint at

the level of detail Rashid has poured into this work, and are reminiscent of the observation-rich descriptions of ornithology books from a century ago: "Catching a Fledgling Off Guard," "Interaction Between Neighbors," "The Male Provides for the Family," "Trapping Boreal Owls." This is a non-standard book, but with ample published literature cited throughout, mixed in with Rashid's hard-won personal observations from nights afield.

One might ask for an editor to tidy things up in terms of organization, such as standardizing sections across species accounts, but to me, that would rob the book of heart (*Birds of the World* it's not!). I would urge anyone studying nesting birds or breeding ecology to give this a read, if only to enjoy the stories and artwork of a master field biologist.

When I visited Scott this past summer, I asked for advice finding nests of another small owl that was occupying my own thoughts lately—the Western Screech Owl. "Find the right tree. Then just keep visiting until an owl shows up." Oh, right. I was doing it in reverse. I bought the book.

Daniel S. Cooper

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Photo by Xavier Moreno of San Felipe, Baja California, Mexico: Northern Harrier (*Circus hudsonius*), Cielito Lindo, Bahía de San Quintín, Baja California, Mexico, 17 June 2023. The southern limit of the harrier's breeding range on the Pacific coast has long been vague, but as Xavier Moreno et al. report in this issue of *Western Birds*, that limit is currently at the Bahía de San Quintín. From 2022 to 2024 the bay's extensive salt marshes were home to possibly as many as 15 pairs. In 2023 one pair had a nest with three eggs hatching 25–26 April. Two young fledged by 17 June.