

RECOLONIZATION OF THE FLICKER AND OTHER NOTES FROM ISLA GUADALUPE, MEXICO

PAUL R. SWEET and GEORGE F. BARROWCLOUGH, Department of Ornithology, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024

JOHN T. KLICKA, J. F. Bell Museum of Natural History, University of Minnesota, St. Paul, Minnesota 55108 (current address Barrick Museum, University of Nevada, Las Vegas, Nevada 89154)

LILIANA MONTAÑEZ-GODOY and PATRICIA ESCALANTE-PLIEGO, Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, 04510 Distrito Federal, México

ABSTRACT: During a visit to Isla Guadalupe from 31 May to 3 June 1996, we documented three species new to the island, the Barn Owl, Swainson's Thrush, and Hooded Oriole, and established first breeding records for the European Starling and Western Meadowlark. Red-shafted Flickers are now breeding on the island, representing a recent recolonization from the mainland following the extinction of the endemic population. We investigated the validity of *Colaptes auratus rufipileus* and concluded that it does not meet the standard for phylogenetic species but differs from *C. a. collaris* at the 75% level usually associated with subspecific rank. Damage to the cypress forest by goats continues, and all species dependent on these trees are threatened by loss of habitat.

Isla Guadalupe is a volcanic oceanic island lying 260 km west of the coast of Baja California (29° 00' N, 118° 20' W). It is some 37 km long with an area of 250 km² and reaches an elevation of 1298 m. The history and status of the avifauna have been reviewed by Howell and Cade (1954) and more recently by Jehl and Everett (1985). Subsequent observations have been reported by Dunlap (1988), Oberbauer et al. (1989), Mellink and Palacios (1990), Howell and Webb (1992), and Gallo and Figueroa (1996). Here we report on birds observed and collected on a visit to Isla Guadalupe between 31 May and 3 June 1996. Maps of the island, showing localities mentioned here, have been provided by Jehl and Everett (1985) and Moran (1996). Three of the species we recorded represent first records for the island; in addition, we confirmed the breeding of two recently colonizing species and noted the recolonization of a previously extirpated species whose taxonomic status we reexamined.

ITINERARY

We spent a few hours at the naval base (Melpómene Cove or Punta Sur) upon our arrival on the island and then traveled the dirt road from there to the airstrip (Campo Pista: 29° 01' N, 118° 17' W), where we spent one night and a morning observing and collecting. We then continued to the cypress grove (29° 07' N, 118° 20' W, 1165m), near the highest point on the island, where we spent two nights. One night was spent at the fishing village (Campo Tepeyác or Campo Oeste). We returned to the naval base by launch.

NOTES FROM ISLA GUADALUPE

CONSERVATION

Unfortunately the decimation of the island's vegetation by feral goats is continuing; we saw large numbers of goats throughout the island. They appeared to be most numerous in the central and northern portions of the island, nearer the major source of fresh water. Moran (1996) reviewed the history of goat damage to the flora of the island and estimated that the youngest of the endemic Guadalupe Cypress (*Cupressus guadalupensis*) were well over 100 years old. Apparently, in excess of 20,000 goats were removed from the island in 1971, reportedly leaving only 239 animals at that time (Agraz García 1978). Moran (1996) estimated that the population had rebounded to at least 7000 in 1994. Low-intensity hunting by fishermen and marines has had little impact on the population in recent years. In addition, attempts at protecting the remaining cypress forest fragment with a wire fence have failed. The fence is breached in many places, and a gate is missing; large herds of goats were observed trooping through the cypresses at all hours, leaving virtually no vegetation of consequence within the understory of the grove (Figures 1 and 2). In addition, the bark of many of the trees showed evidence of damage by goats. Clearly only the complete removal of goats from the island or a secure fence with a full-time warden will guarantee long-term survival of the cypresses and the birds dependent on them. We also saw feral dogs and cats on the island, but only in small numbers.

ANNOTATED LIST

Laysan Albatross (*Phoebastria immutabilis*). First recorded breeding on Isla Guadalupe in 1986 (Dunlap 1988). Its status up to 1992 was reviewed by Gallo and Figueroa (1996). We briefly surveyed the rocky plateau above the naval base and observed six full-grown chicks and one adult bird. The young birds were close to fledging with down remaining only on the head and neck.

Brandt's Cormorant (*Phalacrocorax pencillatus*). A pair was seen flying past Islote Zapato at the south anchorage.

American Kestrel (*Falco sparverius*). Fairly common and observed throughout the island.

Western Gull (*Larus occidentalis*). A few were seen along the coast between Campo Tepeyác and Melpómene Cove.

Mourning Dove (*Zenaida macroura*). Common throughout the island. Many were observed coming to drink at the fresh water spring below the north end of the cypress grove.

Barn Owl (*Tyto alba*). A single flank feather (Colección Nacional de Aves 25550) found near the airstrip provides the first documentation of the occurrence of this species on the island, although we saw or heard none. There have been several anecdotal reports of large owls on the island, and previous authors assumed that these refer to the Great Horned Owl (*Bubo virginianus*).

During Edward Palmer's initial study of the avifauna of the island (Ridgway 1876), two unidentified species of owls were observed but not collected.

NOTES FROM ISLA GUADALUPE

Accounts of *B. virginianus* on the island appear to originate with Palmer's assistant (Bryant 1887) who reported a "Horned Owl (*Bubo*)" and that "the Mexicans" reported a "large owl ("*Tecolote*")." It is possible this represents a misunderstanding on behalf of the assistant: *tecolote* in Mexican Spanish could refer to any small owl, *buho* (interpreted as *Bubo*?) to any large owl. Presumably the *tecolote* is the Burrowing Owl, and Bryant (1887) assumed that the large owl was a Great Horned. However, it now appears plausible that these early reports refer to the Barn Owl, a species that is known for its ability to colonize islands, including Isla Socorro some 500 km from the southern tip of Baja California. No Great Horned Owls were heard during our visit.

Burrowing Owl (*Athene cunicularia*). Fairly common; several pairs were seen between the south end and the cypress grove.

Anna's Hummingbird (*Calypte anna*). Common in the cypress grove.

Northern Flicker (*Colaptes auratus* [cafer group]). Fairly common in the cypress grove; we found several active nests and collected two birds. A male (CNAV 24795) had enlarged testes and a female (CNAV 24794) had yolking eggs. The endemic form, *C. a. rufipileus*, has not been collected since 1906 and has been considered extinct. We believe the birds we saw and collected were mainland Red-shafted Flickers and that Isla Guadalupe has been successfully recolonized by flickers following the extirpation of the endemic subspecies (see below).

Rock Wren (*Salpinctes obsoletus*). Abundant from the beaches up to the cypress forest.

Swainson's Thrush (*Catharus ustulatus*). We collected a male with moderately enlarged testes (CNAV 24746) in the cypress grove; no other individuals were seen or heard. This is the first record of this species on Isla Guadalupe. Presumably it represents a vagrant; Swainson's Thrush occurs throughout Baja California as a migrant (Howell and Webb 1995) and has been recorded and presumed to be migrating in the mountains of Baja California as late as early June (Wilbur 1987). Escalante-Pliego compared the specimen to series at CNAV and tentatively identified it as nominate *C. u. ustulatus*, common in migration on the nearby mainland.

Northern Mockingbird (*Mimus polyglottos*). We saw two together in an open area near the cypress grove but could not determine if they were a pair. Bryant (1887) observed two birds in 1886, and subsequently individuals were seen near the airstrip in January 1988 (Howell and Webb 1992) and November 1989 (Mellink and Palacios 1990).

European Starling (*Sturnus vulgaris*). This species is now common on Isla Guadalupe. We saw a flock of over 100 birds near the spring below the cypress grove. Previous authors noted a few starlings on the island but suspected that they might represent only winter visitors (Howell and Webb 1992). However, we confirmed nesting in tree cavities in the cypress grove and collected one juvenile (CNAV 24826).

Guadalupe Junco (*Junco insularis*). This distinctive, endemic taxon has been recognized as a species in recent treatments (Howell and Webb 1995). We found it common within the cypress grove but did not see it anywhere else on the island. At the time of our visit, fledglings in streaky juvenal plumage were abundant and some males were still singing. Although other

NOTES FROM ISLA GUADALUPE

authors have found juncos down to sea level outside of the nesting season, we saw them only in the remnant stand of cypress.

Western Meadowlark (*Sturnella neglecta*). Jehl and Everett (1985) reported only a record from 1886, but Howell and Webb (1992) saw 35-40 near the airstrip in January 1988 and suggested that the species might breed. Mellink and Palacios (1990) also observed it in November 1989. We found this species to be common throughout the island, particularly in the extensive grasslands of the central plateau, with flocks of up to 50 birds. Males were singing from prominent perches. We collected two birds, a male with enlarged testes (CNAV 24798) and a female with a regressing brood patch (CNAV 24836). Evidently this species has successfully colonized the island.

Hooded Oriole (*Icterus cucullatus*). We saw and collected a single male, which had slightly enlarged testes, in a solitary eucalyptus tree at Campo Pista (CNAV 24756). This is the first island record and presumably a vagrant; however, we were unable to reach the palm grove on the north slope of the island (Moran 1996), which perhaps could harbor a small breeding population.

House Finch (*Carpodacus mexicanus*). Common from sea level to the cypress grove. Recently fledged young were abundant during our visit and males were singing.

SYSTEMATIC STATUS OF THE FLICKERS OF ISLA GUADALUPE

Ridgway (1876) originally described the subspecies of the Red-shafted Flicker from Isla Guadalupe, emphasizing the "bright tawny forehead"—hence the name *rufipileus*—as the diagnostic character. He suggested rump color, bill length, wing length, tail length, and the amount of black on the underside of the tail as additional characters. Bryant (1886) treated the flickers of Isla Guadalupe as a full species.

Here we reevaluate the taxonomic status and characteristics of the Guadalupe Flicker in order to determine the provenance of the flickers we observed on the island. A series of *C. a. rufipileus* is available in the ornithological collections of the American Museum of Natural History; these birds were collected in the months of May, July, and August. For comparative material of mainland flickers that might represent the source for a possible recolonizing population, we borrowed specimens from a number of museums (see Acknowledgments). To ensure that we were working with individuals from breeding populations, and not migrants, we used adult specimens of both sexes from late spring and summer from mainland breeding localities. Few specimens were available from any one locality for the breeding season; therefore, our mainland sample was composed of Red-shafted Flickers from the mountains of northern Baja California, the southern California ranges from San Diego north to the San Bernardino, the coastal ranges north to Monterey, and a few birds from the Sierra Nevada. These samples represent *C. a. collaris*, a form with a range proximal to and a phenotype similar to the recent Guadalupe birds (a comparison of extremes of *C. a. collaris* and the paler *C. a. canescens*,

NOTES FROM ISLA GUADALUPE

courtesy P. Unitt, indicates that the two recent island birds are not typical of the highly migratory *canescens*). In all, our final sample consisted of one recent male and one recent female flicker from Isla Guadalupe, which we treated as of unknown origin, 11 males and 13 females from Isla Guadalupe from the late 19th and early 20th centuries, representing *C. a. rufipileus*, and 13 male and 15 female specimens from Baja California and southern California, representing *C. a. collaris*.

Sweet and Barrowclough independently measured, for all specimens, culmen length (from base of skull), wing chord (bend of wing to longest primary), tail length (to tip of longest central rectrix), and width of the terminal black band on the ventral surface of one of the central rectrices; some measurements could not be taken because of molt or broken feathers or bill. In addition, we independently arranged the specimens into graded series of crown/forehead color, by sex, from most to least rufescent; we then assigned the value of one to the most reddish bird, the value two to the next bird in the series, etc. (R. W. Dickerman, pers. comm. suggested that foxing was not a significant problem in flickers). In this way, we obtained two estimates for each of four mensural characters and a color character for the Guadalupe, mainland, and two new flickers. We averaged the two values, reducing measurement sampling error.

We used the computer package SAS (Windows version 6.12: procedure univariate; SAS Inst. 1988) to produce box plots for the crown color estimates. Because the color scores we assigned the birds are on an arbitrary scale, which is undoubtedly nonlinear, we used a nonparametric, descriptive technique for analyzing those data. Box plots simply encode frequency information and require no assumptions about the underlying distribution: the heavy vertical lines indicate the range, the solid lower and upper edges of the box correspond to the 25th and 75th percentiles of the distribution, the dashed line is the 50th percentile (median), and the cross is the mean of the distribution (Figure 3). Crown color, the principal character originally used to diagnose the Guadalupe Flicker, clearly varies substantially between the mainland and the island for both sexes. The two new specimens, a male and a female, both have scores unequivocally placing them with the mainland series.

Ridgway (1876) also mentioned a pink wash on the rump as a character for the island race, but we were unable to find a consistent difference in rump color and did not investigate that trait further. In the four measurements, the island and mainland forms completely overlapped in culmen and tail length. In wing length and width of the black tail bar, the means of the two samples for males and females differed, though with substantial overlap in the distributions (box plots not shown here). However, neither measurement had as great a power for discrimination as the crown color. Because these four measurements showed varying patterns of correlation (Table 1), we used a principal-component (PC) analysis to determine whether there was a linear combination of measurements that, independent of crown color, yielded a segregation of the island birds. We adopted a PC rather than a discriminant-function analysis (DFA) because our sample sizes were small and PC analysis identifies the "natural" combinations of the measurements representing

NOTES FROM ISLA GUADALUPE



Figure 1. View northwest from remaining cypress grove. Young trees do not exist and older trees (such as the one in foreground) have had pieces of bark stripped by goats.

Photo by Paul R. Sweet



Figure 2. View into remnants of cypress grove, showing lack of understory.

Photo by Paul R. Sweet

NOTES FROM ISLA GUADALUPE

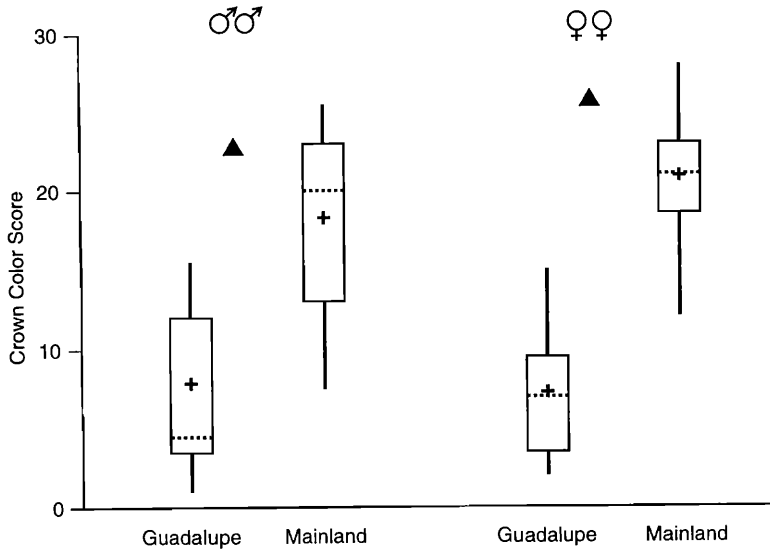


Figure 3. Box plots for crown color scores for male and female specimens of Red-shafted Flickers from Isla Guadalupe (historical sample), the southwestern mainland, and two recent Isla Guadalupe specimens, (triangles).

most of the variation in a set of data; in DFA, desired groupings are made on an *a priori* basis and high discrimination among groups that represents a very small fraction of the actual total variation is sometimes found. Using the matrix of character correlations, we found PC axes, separately for the two sexes, that summarized most of the variation in measurements with two vectors (SAS Inst. 1988: procedure princomp). For males, the first two PC axes explain 45% and 27% of the total variation, respectively; for females, the corresponding values are 41% and 38%. The character loadings on the first two PC axes are available from the authors. In Figure 4 we have plotted

Table 1 Matrix of Correlation Coefficients between Mensural Measurements of Isla Guadalupe and Mainland Red-shafted Flickers^a

	Culmen	Wing	Tail	Tail Tip
Culmen	—	-0.076	-0.031	0.292
Wing	-0.182	—	0.091	-0.640
Tail	0.276	0.515	—	0.372
Tail Tip	0.409	-0.321	0.198	—

^aMales above and females below diagonal.

NOTES FROM ISLA GUADALUPE

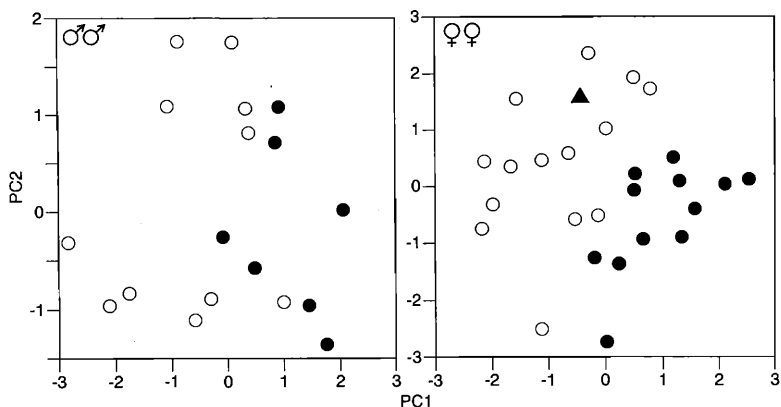


Figure 4. Scores of Isla Guadalupe (solid circles) and mainland (open circles) Red-shafted Flickers on first two PC axes based on measurements only. The recent female from Isla Guadalupe is indicated by a triangle; the recent male specimen was incomplete and so cannot be included.

the PC scores for the Isla Guadalupe, mainland, and recent flickers for which a full set of measurements were available. Unfortunately, some birds, including one of the recent specimens from Isla Guadalupe, had missing values and could not be included in the PC analysis.

For both sexes, the first PC axis yielded a good, but not perfect discrimination between the island and mainland specimens. In both cases the island birds have greater average PC1 scores than do the mainland specimens. The pattern of character loadings indicates that for both sexes the PC1 axis is largely a contrast of wing length vs. tail tip. For the males, sample location appears to be independent of the second PC axis; for females, island specimens have somewhat lower average scores on PC2 than do those from the mainland. The pattern of character loadings indicates that PC2 is at least in part a wing length plus tail length axis. The recent island female is clearly associated with the mainland specimens.

Our analysis of crown color plus four measurements indicates that the two recent flickers collected on Isla Guadalupe have characteristics placing them with mainland flickers rather than with the historical population. Greenway (1967) summarized the historical status of the Guadalupe Flicker; it was last collected in June 1906. None were recorded after that in spite of a number of expeditions and searches. However, Jehl and Everett (1985) reported that in late 1972 flickers were once again seen on the island; such observations have continued (e.g., Howell and Webb 1992), but the subspecific status of the recently observed birds was in doubt. The long historical gap in observations of flickers between 1906 and 1972, the continuing presence of flickers since then, and our character analysis, taken together, suggest that Isla Guadalupe was recolonized by mainland Red-shafted Flickers in the late 1960s or early 1970s and that the endemic subspecies is extinct.

NOTES FROM ISLA GUADALUPE

Like most birds, the Guadalupe Flicker was described before the invention of statistical tests and quantitative studies of population variability. In part our detailed analysis of these flickers was based on an interest in ascertaining whether the subspecies *C. c. rufipileus* actually designates a distinctive endemic population (e.g., Barrowclough 1982). One modern, statistical standard for the recognition of subspecies is the "75% rule" (e.g., Mayr 1969). One interpretation of this rule is that subspecific recognition is warranted if 90% of one subspecies can be distinguished from 90% of the second (this is the 75% rule for symmetrical distributions). For crown color, the box plots indicate that females meet this standard, but males do not. For the PC analysis, based on measurements alone, the results are even less conclusive; no single PC axis can separate the island and mainland birds in accord with the 75% rule for either sex. For the females, a linear combination of PC1 and PC2 can do so, but the pattern of Figure 4 is such that it appears this would not hold up with an increased sample size. With the specimens currently available—that is, with few specimens from Isla Guadalupe in fresh (recently molted) plumage—the now extinct Guadalupe Flicker does not approach the 100% diagnosably different status required for recognition of a phylogenetic species (e.g., McKittrick and Zink 1988). However, females meet the 75% standard for subspecies. We therefore believe that subspecies status is (was?) warranted for this island form. It is clear that the flickers of Isla Guadalupe differed on average from those of the mainland; however, we did not find the degree of differentiation to be extensive. There may have been sufficient continuing gene flow to prevent complete isolation. An alternative possibility is that a series of fresh August or September specimens would have been largely diagnosable. Molecular methods may someday have the power to address such questions.

ACKNOWLEDGMENTS

Our trip to Isla Guadalupe would not have been possible without the assistance of the Armada de México, which provided transport to and from Isla Guadalupe; we particularly thank Commandante Francisco Pérez-Rico and the officers and crew of C-81 Zarco for their hospitality while we were at sea. The fishermen of Cooperativa de Langosteros y Abulonerros de Ensenada provided much needed logistic support on the island and taught us the noble art of "chivo" hunting. We thank the curatorial staffs of the U.S. National Museum of Natural History (Philip Angle), the Los Angeles County Museum of Natural History (Kimball Garrett), the California Academy of Sciences (Karen Cebra), and the Museum of Vertebrate Zoology (Carla Cicero) for providing loans of flickers under their care. We thank the Secretaría del Medio Ambiente, Recursos Naturales y Pesca, for providing permits. We are grateful to Jeffrey Groth for preparing two figures and to Philip Unitt, William Everett, and an anonymous reviewer for helpful comments on an earlier version of this paper. This research was supported in part by the Leonard J. Sanford Trust.

LITERATURE CITED

- Agraz García, A. A. 1978. La cabra cimarrona (*Capra hircus*) en la Isla de Guadalupe, B. C. Ganadero 3:35–49.
- Barrowclough, G. F. 1982. Geographic variation, predictiveness, and subspecies. Auk 99:601–603.

NOTES FROM ISLA GUADALUPE

- Bryant, W. E. 1887. Additions to the ornithology of Guadalupe Island. *Bull. Calif. Acad. Sci.* 2:269–318.
- Dunlap, E. 1988. Laysan Albatross nesting on Guadalupe Island, Mexico. *Am. Birds* 42:180–181.
- Gallo-Reynoso, J.-P., and Figueroa-Carranza, A.-L. 1996. The breeding colony of Laysan Albatrosses on Isla de Guadalupe, Mexico. *W. Birds* 27:70–76.
- Greenway, J. C., Jr. 1967. *Extinct and Vanishing Birds of the World*, 2nd ed. Dover Publ., New York.
- Howell, S. N. G., and Webb, S. 1992. Observations of birds from Isla Guadalupe, México. *Euphonia* 1:1–6.
- Howell, S. N. G., and Webb, S. 1995. *A Guide to the Birds of Mexico and Northern Central America*. Oxford Univ. Press, Oxford, England.
- Howell, T. R., and Cade, T. J. 1954. The birds of Guadalupe Island in 1953. *Condor* 56:283–294.
- Jehl, J. R., and Everett, W. T. 1985. History and status of the avifauna of Isla Guadalupe, Mexico. *Trans. San Diego Soc. Nat. Hist.* 20:313–336.
- Mayr, E. 1969. *Principles of Systematic Zoology*. McGraw-Hill, New York.
- McKittrick, M. C., and Zink, R. M. 1988. Species concepts in ornithology. *Condor* 90:1–14.
- Mellink, E., and Palacios, E. 1990. Observations on Isla Guadalupe in November 1989. *W. Birds* 21:177–180.
- Moran, R. 1996. The Flora of Guadalupe Island, Mexico. *Memoirs Calif. Acad. Sci.* 19.
- Oberbauer, T. A., Cibit, C., and Lichtwardt, E. 1989. Notes from Isla Guadalupe. *W. Birds* 20:89–90.
- Ridgway, R. 1876. Ornithology of Guadalupe Island, based on notes and collections made by Dr. Edward Palmer. *Bull. U.S. Geol. Geogr. Surv. Terr.* 2:183–195.
- SAS Institute Inc., 1988. *SAS Language Guide for Personal Computers*, release 6.03 ed. SAS Inst., Cary, NC.
- Wilbur, S. R. 1987. *Birds of Baja California*. Univ. Calif. Press, Berkeley.

Accepted 30 October 2000