Chapter 13
The Owls of Guatemala

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Abstract This compilation of recent data on the distribution, ecology, and conservation status of owls (Strigiformes) in Guatemala is based on an extensive literature review and numerous unpublished observations. Twenty species of owls have been recorded in Guatemala, of which 18 are resident. Breeding has been reported for 17 species, and it is assumed for one species. Two species are considered rare or accidental nonbreeding visitors to Guatemala during the northern winter. Guatemala's region with the highest species richness in owls is the highlands, where 17 species have been recorded. Twelve species have been recorded in the Pacific slope lowlands and 13 species in the Atlantic slope lowlands. We analyzed the data in the presence and relative abundance of owls from 105 sites from 1989 to 2016. According to the weighted mean value of the relative abundance index across three ornithogeographic regions, the most common owls in the country are (abundance ranking in descending order): Mexican wood owl (*Strix squamulata*), Ridgway's pygmy owl (*Glaucidium ridgwayi*), Guatemalan screech owl (*Megascops guatemalae*), black-and-white owl (*Strix nigrolineata*), American barn owl (*Tyto furcata*), Central American pygmy owl (*Glaucidium griseiceps*), Guatemalan pygmy owl (*Glaucidium cobanense*), great horned owl (*Bubo virginianus*), fulvous owl (*Strix fulvescens*), unspotted saw-whet owl (*Aegolius ridgwayi*), whiskered screech owl (*Megascops trichopsis*), crested owl (*Lophostrix cristata*), and Pacific screech owl (*Megascops cooperi*). Guatemala has an adequate legal framework to protect owl species (32% of the country is legally protected), but the conservation is not efficient, causing threats to owl populations. Of 18 resident owl species, 12 are forest specialists. In a vulnerability assessment applying IUCN Red List criteria on a national level, one species has been evaluated as Critically Endangered (CR), one as Endangered (EN), nine as Vulnerable (VU), five as Near Threatened (NT), two as Least Concern (LC), and two as not applicable. Habitat alterations through agriculture, mining, and oil drilling are the main threats. Of the remaining forests, 14% (5500 km^2) were lost from 2000 to 2010, and the pressure on natural habitat will further increase. In addition, owls in Guatemala are threatened by direct persecution because of popular superstitions. The network of 21 Important Bird Areas (IBA) in Guatemala includes populations of all owl species. Three species have been recorded

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P.L. Enríquez (ed.), *Neotropical Owls*, DOI 10.1007/978-3-319-57108-9_13

in at least 10 IBAs, 12 species in 5–9 IBAs, 4 in 2–4 IBAs, and 1 species in only one IBA. We consider the increase of the education level among the Guatemalan society the main key to protect habitats within the IBAs. A higher level of education would help to slow down population growth, increase environmental awareness, and consequently diminish pressure on natural areas.

Keywords Conservation status • Distribution • Relative abundance • Strigiformes

Fulvous Owl (*Strix fulvescens*)

13.1 Introduction

Although owls (Strigiformes) belong to the most popular birds, they also belong to the least known. Because of the nocturnal activity of most of the species, much of their natural history remains to be discovered by us humans adapted to diurnal activity. In Guatemala, more than 740 bird species have been reported (Eisermann and Avendaño 2007, KE unpub. data). The study of owls in the country began with the first specimen collections in the nineteenth century, compiled in the *Biologia Centrali-Americana* (Salvin and Godman 1897–1904), the first thorough regional biodiversity inventory for Middle America. Seventeen of the currently known 20 owl species of Guatemala were reported therein. Ridgway (1914) added stygian owl (*Asio stygius*), and Griscom (1932) added striped owl (*Asio clamator*) to the list of Guatemalan owls. Land (1970) included 19 species in his field guide to Guatemalan

birds and suggested that Pacific screech owl (*Megascops cooperi*) should occur in the country, which was also mentioned earlier by Marshall (1967). Dickerman (1975) reported this species for the first time in Guatemala. Thus, recent compilations on the bird diversity of Guatemala contain 20 species of owls (Howell and Webb 1995; Eisermann and Avendaño 2007, 2015). This chapter is a translated, revised, and updated version of the Spanish original work which was based on data until 2013 (Eisermann and Avendaño 2015). This update contains data until 2016, enhancing the information on the distribution and residency status of several species. The objective is to provide a compilation of current data on the distribution and natural history of owls in Guatemala, to identify threats, and to recommend conservation strategies. Based on a thorough literature review and own data from 1989 to 2016, we provide here an updated classification of the relative abundance and residency status of all owl species recorded in Guatemala.

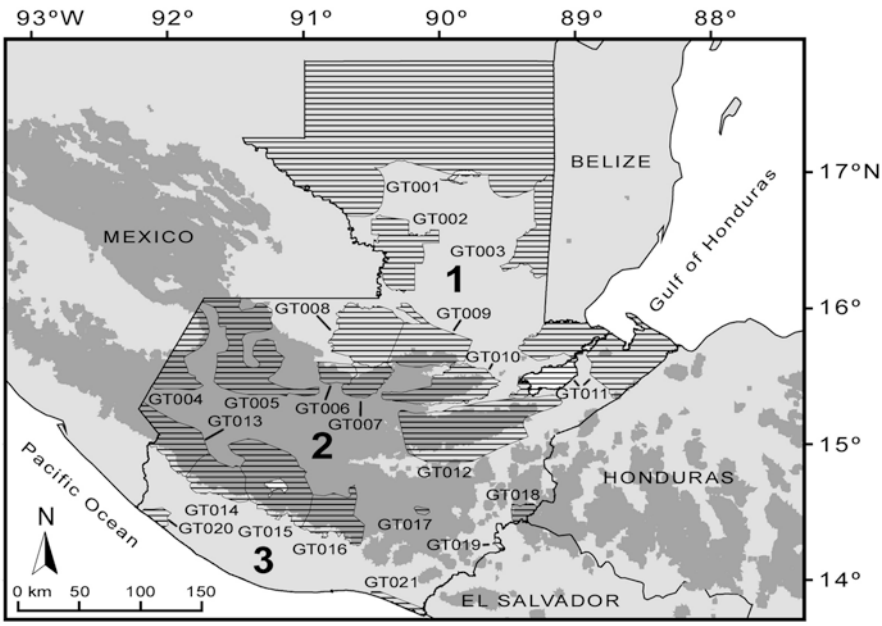
13.2 Study Area and Methods

13.2.1 Study Area

Guatemala covers an area of 108,900 km^2, bordering to the Mexican states of Chiapas, Tabasco, Campeche, and Quintana Roo and the Central American countries Belize, Honduras, and El Salvador. The Guatemalan Caribbean coastline is approximately 150 km long and the Pacific coastline 250 km. The elevation of the land area of Guatemala ranges from sea level to 4220 m. In ornithology, a reasonable biogeographic classification divides the country in three regions (Fig. 13.1). The highlands (1000–4220 m) cover approximately 37,500 km^2 (34% of the country), the lowlands (<1000 m) of the Pacific slope and interior valleys cover 19,000 km^2 (18%), and the lowlands of the Atlantic slope cover 52,400 km^2 (48%). According to a nationwide land cover mapping at the scale 1:50,000 (Ministerio de Agricultura, Ganadería y Alimentación 2006), 38% (41,580 km^2) of Guatemala is covered with forests, of which 31,554 km^2 are broadleaf forests, 2496 km^2 coniferous forests, 6316 km^2 mixed forests, 206 km^2 mangroves, and 1007 km^2 forest-covered wetlands. A more recent forest cover mapping identified 34% of the country covered with forest, with annual deforestation rate of 1% from 2006 to 2010 (Regalado et al. 2012). Almost half of the country is used for agriculture (see Sect. 13.4). Geographic coordinates of all sites mentioned in the text are listed in Appendix 13.1; sites and limits of departments are mapped in Fig. 13.2.

13.2.2 Data Source

Historic and current distribution of owls was compiled based on a thorough literature review, our own data, and unpublished museum specimen records. We reviewed publications and "gray literature" (i.e., unpublished reports, thesis) based on a



IBA GT001 Maya-Lacandón (9 species of Strigiformes)
IBA GT002 Río La Pasión (5)
IBA GT003 Chiquibul (2)
IBA GT004 Cuilco (1)
IBA GT005 Cuchumatanes (9)
IBA GT006 Cerro El Amay (7)
IBA GT007 Sacranix (8)
IBA GT008 Lachua-Ik'bolay (8)
IBA GT009 Candelaria-Campur (2)
IBA GT010 Yalijux (11)
IBA GT011 Caribe de Guatemala (9)
IBA GT012 Sierra de las Minas-Motagua (12)
IBA GT013 Tacaná-Tajumulco (5)
IBA GT014 Volcán Santiaguito (11)
IBA GT015 Atitlán (14)
IBA GT016 Antigua Guatemala (13)
IBA GT017 Cerro Miramundo (0)
IBA GT018 Montecristo (7)
IBA GT019 Lago de Güija (5)
IBA GT020 Manchón-Guamuchal (5)
IBA GT021 Monterrico-Río La Paz (5)

Fig. 13.1 Ornithogeographic regions of Guatemala: 1, Atlantic slope lowlands; 2, highlands; 3, Pacific slope lowlands. *Light-gray shade*, elevation ≤1000 m; *dark-gray shade*, elevation >1000 m; *horizontal hatching*, Important Bird Areas (IBAs) according to Eisermann and Avendaño (2009b). The list includes the international code and the name of the IBAs, and in parenthesis, the number of owl species recorded

bibliography of ornithological literature (Eisermann and Avendaño 2006) and more current literature up to 2016. Data for some sites were enhanced by recent observations published in eBird (Sullivan et al. 2009; eBird 2016). We used data of our own observations from 1989 to 2016. We reviewed specimens in the Zoological Museum Berlin, Germany, Zoological Collection of the Universidad Del Valle de Guatemala, and Natural History Museum of Universidad de San Carlos de Guatemala and reviewed databases of specimens accessible through VertNet (Constable et al. 2010; VertNet 2016). Acronyms of museums mentioned in the text are AMNH, American Museum of Natural History, New York; LACM, Natural History Museum of Los Angeles County, Los Angeles, California; MVZ, Museum of Vertebrate Zoology, Berkeley, California; and ZMB, Zoological Museum Berlin, Germany.

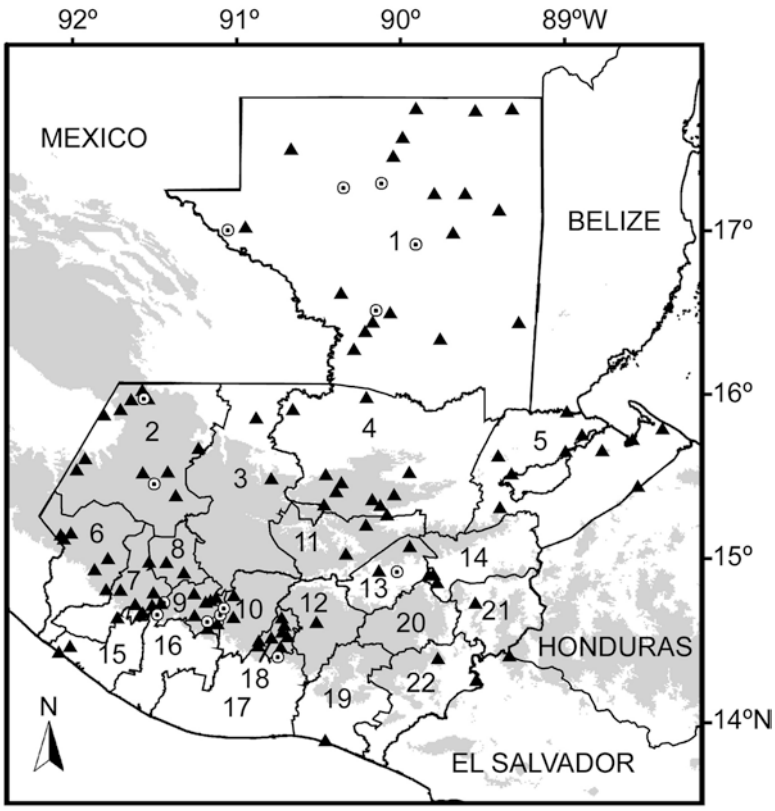


Fig. 13.2 Localization of sites with recent owl records (1989–2016) in Guatemala. *Triangles* mark sites used for relative abundance estimate; *circles* mark other sites with recent records. *Gray shade* marks highlands >1000 m. Departments of Guatemala: 1, Petén; 2, Huehuetenango; 3, Quiché; 4, Alta Verapaz; 5, Izabal; 6, San Marcos; 7, Quetzaltenango; 8, Totonicapán; 9, Sololá; 10, Chimaltenango; 11, Baja Verapaz; 12, Guatemala; 13, El Progreso; 14, Zacapa; 15, Retalhuleu; 16, Suchitepéquez; 17, Escuintla; 18, Sacatepéquez; 19, Santa Rosa; 20, Jalapa; 21, Chiquimula; and 22, Jutiapa

13.2.3 Estimation and Classification of Relative Abundance

To estimate current relative abundance, we considered data from 1989 to 2016 for 105 sites (Fig. 13.2): 55 sites from the highlands, 40 sites from the Atlantic slope lowlands, and 10 sites from the Pacific slope lowlands. Because standardized abundance data have been published for only a few sites, we apply a simplified abundance index divided into four classes for each site: common (numerical value 4), high probability to detect several individuals or territories in a day of observation; fairly common (numerical value 3), high probability to detect an individual or territory in a day of observation; uncommon (numerical value 2), high probability to detect the species in a week of observation; and rare (numerical value 1), few records, low probability to detect the species in a week of observation, or single

record for a site. We used a numeric value 0 for unrecorded species. To determine a ranking of relative abundance in each region, we calculated the arithmetic mean of index values across all sites. To rank relative abundance across the entire country, we used weighted mean for each region according to the percentage area (Atlantic slope lowlands 48%, highlands 34%, Pacific slope lowlands 18%), hence $I_c = 0.48*I_a + 0.34*I_h + 0.18*I_p$, with I_c relative abundance index for the country, I_a relative abundance index for Atlantic slope lowlands, I_h relative abundance index for highlands, and I_p relative abundance index for Pacific slope lowlands.

13.2.4 Taxonomy and Nomenclature

The taxonomy of Neotropical owls has not yet been fully resolved (Enríquez et al. 2015); thus, nomenclatural changes are expected in the future. In this chapter, we follow the taxonomy and nomenclature of common and scientific names of owls by König et al. (2008). Scientific names of all species mentioned in the text are listed in Table 13.1.

13.3 Results

13.3.1 Owl Diversity

Two families of owls (Strigiformes) occur in Guatemala: barn owls (Tytonidae), in Spanish locally known as *lechuzas*, and true owls (Strigidae), locally known as *tecolotes* or *búhos*. According to modern taxonomy (König et al. 2008), 20 species of Strigiformes have been recorded in Guatemala (Eisermann and Avendaño 2006, 2007): one species in the genus *Tyto*, one *Psiloscops*, four *Megascops*, one *Bubo*, one *Pulsatrix*, three *Strix*, one *Lophostrix*, three *Glaucidium*, one *Aegolius*, one *Athene*, and three *Asio* (Table 13.1). Guatemala covers part of the distribution range of 25% of the approximately 80 Neotropical owl species and 8% of the approximately 250 owl species of the world.

13.3.2 Spatial Distribution

Of the three ornithogeographic regions of Guatemala, species richness of owls is highest in the highlands (17 species). In the lowlands, 12 species have been recorded on the Pacific slope and 13 species on the Atlantic slope (Table 13.1). Endemism in birds is sometimes defined to areas <50,000 km^2 (Terborgh and Winter 1983; Bibby et al. 1992; Wege and Long 1995; Stattersfield et al. 1998). Two of the owl species of Guatemala have a restricted range: bearded screech owl (*Megascops barbarus*), restricted to the Atlantic slope highlands of Guatemala and the Mexican state of

Table 13.1 Residency status, distribution, and vulnerability of owls in Guatemala

Taxa[a]	Subspecies in Guatemala[b]	Residency status in Guatemala[c]	Distribution in ornithogeographic regions[d]	Habitat[e]	Vulnerability on a national level[f]	Distribution in IBAs[g]
TYTONIDAE						
American barn owl *Tyto furcata* (Temminck) 1827	*T. f. guatemalae* (Ridgway) 1874, *T. f. pratincola* (Bonaparte) 1838	R (*T. a. guatemalae*), r (*T. a. pratincola*)	A, H, P	S, A, P, U	NT	GT001, GT007, GT008, GT010, GT011, GT015, GT016, GT019, GT021
STRIGIDAE						
Flammulated owl *Psiloscops flammeolus* (Kaup) 1852		R	H	Fc, Fm	CR D	GT005, GT015, GT016
Pacific screech owl *Megascops cooperi* (Ridgway) 1878	*M. c. cooperi* (Ridgway) 1878	R	P	S, A	VU A3c	GT012, GT019, GT020, GT021
Whiskered screech owl *Megascops trichopsis* (Wagler) 1832	*M. t. mesamericanus* (van Rossem) 1932	R	H	Fm, Fc, U	VU A3c	GT005, GT007, GT014, GT015, GT016, GT018
Bearded screech owl *Megascops barbarus* (Sclater & Salvin) 1868		R	H	Fm, Fb, Fc	VU A3c	GT005, GT006, GT010, GT012
Guatemalan screech owl *Megascops guatemalae* (Sharpe) 1875	*M. g. guatemalae* (Sharpe) 1875	R	A, H, P	Fb, Fm, S, P	VU A3c	GT001, GT002, GT006, GT007, GT008, GT010, GT011, GT012, GT014
Great horned owl *Bubo virginianus* (Gmelin) 1788	*B. v. mesembrinus* (Oberholser) 1904	R	A, H, P	Fc, Fm, S, A, U	NT	GT004, GT005, GT007, GT012, GT013, GT014, GT015, GT016, GT018, GT019

(continued)

Table 13.1 (continued)

Taxa[a]	Subspecies in Guatemala[b]	Residency status in Guatemala[c]	Distribution in ornithogeographic regions[d]	Habitat[e]	Vulnerability on a national level[f]	Distribution in IBAs[g]
Spectacled owl *Pulsatrix perspicillata* (Latham) 1790	*P. p. saturata* Ridgway 1914	R	A, H, P	Fb, P	VU A3c	GT001, GT008, GT011, GT014, GT015, GT018
Mexican wood owl *Strix squamulata* (Bonaparte) 1850	*S. s. centralis* (Griscom) 1929	R	A, H, P	Fb, Fm, Fc, S, A, P, U	LC	GT001, GT002, GT003, GT005, GT006, GT007, GT008, GT010, GT011, GT012, GT014, GT015, GT016, GT018, GT019, GT020, GT021
Black-and-white owl *Strix nigrolineata* (Sclater) 1859		R	A, H, P	Fb, Fm, P	VU A3c	GT001, GT002, GT008, GT010, GT011, GT014, GT015, GT016
Fulvous owl *Strix fulvescens* (Sclater & Salvin) 1868		R	H	Fb, Fm	VU A3c	GT006, GT010, GT012, GT013, GT014, GT015, GT016, GT018
Crested owl *Lophostrix cristata* (Daudin) 1800	*L. c. stricklandi* Sclater & Salvin 1859	R	A, H, P	Fb	VU A3c	GT001, GT002, GT008, GT010, GT011, GT012, GT018, GT020
Guatemalan pygmy owl *Glaucidium cobanense* Shape 1875		R	H	Fc, Fm, Fb, S, A	NT	GT005, GT006, GT007, GT010, GT012, GT013, GT014, GT015, GT016
Central American pygmy owl *Glaucidium griseiceps* Sharpe 1875		r	A, P	Fb, P	VU A3c	GT001, GT006, GT007, GT008, GT011, GT015

Ridgway's pygmy owl *Glaucidium ridgwayi* Sharpe 1875		R	A, H, P	S, A, P, U	LC	GT001, GT002, GT003, GT005, GT007, GT008, GT009, GT010, GT011, GT012, GT013, GT014, GT015, GT016, GT018, GT019, GT020, GT021
Burrowing owl *Athene cunicularia* (Molina) 1782	*A. c. hypugaea* (Bonaparte) 1825	vagM	A, H, P	A	NA	GT005, GT009, GT012, GT015, GT016
Unspotted saw-whet owl *Aegolius ridgwayi* (Alfaro) 1905		R	H	Fm, Fb, Fc, S, A	NT	GT005, GT006, GT010, GT012, GT013, GT014, GT015, GT016
Stygian owl *Asio stygius* (Wagler) 1832	*A. s. robustus* Kelso 1934	R	H, A	Fc, Fm, Fb, P	EN D	GT010, GT012, GT014, GT015, GT016
Striped owl *Asio clamator* (Vieillot) 1807	*A. c. forbesi* (Lowery & Dahlquest) 1951	R	A, P	S, A	NT	GT001, GT011, GT020, GT021
Short-eared owl *Asio flammeus* (Pontoppidan) 1763	*A. f. flammeus* (Pontoppidan) 1763	vagM	H	A	NA	GT016

[a]Nomenclature according to König et al. (2008)
[b]Subspecies in Guatemala: see species accounts in the text, nomenclature according to Dickinson and Remsen (2013)
[c]Residency status according to Eisermann and Avendaño (2007) and recent data: R–breeding resident, r–resident, breeding presumed, V–non-breeding visitor, vagM–migratory vagrant
[d]Ornithogeographic region: A–Atlantic slope lowlands, H–highlands >1,000 m, P–Pacific slope lowlands
[e]Habitat: A–open and agricultural area, Fc–coniferous forest (including pine plantations), Fm–mixed coniferous/broadleaf forest, Fb–broadleaf forest, S–scrub (including arid forest, thorn scrub, and secondary growth scrub), P–permanent plantations with shade trees (coffee and cardamom plantations), U–urban area
[f]Vulnerability according to Eisermann and Avendaño (2006) and recent data. Categories and criteria according to IUCN (2003, 2012a, b): LC–Least Concern: Common and widely distributed species which does not qualify under the Critically Endangered, Endangered, Vulnerable, or Near Threatened categories. NT–Near Threatened: Species not yet qualifying for the categories Critically Endangered, Endangered, or Vulnerable, but likely to qualify in the near future. VU A3c–Vulnerable: A reduction in population size ≥ 30% projected or presumed within the next 10 years or three generations, whichever is longer (up to a maximum of 100 years); based on a reduction of area of occupancy, area of occurrence, or quality of habitat. EN D–Endangered: Total population size in Guatemala estimated to be <250 mature individuals. CR D–Critically Endangered: Total population size in Guatemala estimated to be <50 mature individuals. NA–Not applicable: Species occurring only as vagrants in Guatemala were not evaluated
[g]Delimitation of Important Bird Areas (IBA) according to Eisermann and Avendaño (2009a, b). See Fig. 13.1 for localization of IBAs

Chiapas, and Guatemalan pygmy owl (*Glaucidium cobanense*), restricted to the highlands of Guatemala, Honduras, and the Mexican state of Chiapas. Fulvous owl (*Strix fulvescens*) occurs mainly in the highlands of Guatemala, Honduras, El Salvador, and the Mexican state of Chiapas, but it has also been recorded in the highlands west of the Isthmus of Tehuantepec in the Mexican state of Oaxaca (Gómez de Silva 2010; Ramírez-Julián et al. 2011).

Of the 20 species of owls in Guatemala, five have been recorded mainly in the lowlands below 1000 m and seven mainly in the highlands above 1000 m. The records of eight species range from the lowlands to the highlands (Fig. 13.3).

13.3.3 Temporal Distribution

Of the 20 owl species in Guatemala, 18 are residents. Breeding has been confirmed for 17, and it is presumed for one species: Central American pygmy owl (*Glaucidium griseiceps*). Flammulated owl (*Psiloscops flammeolus*) has been considered a non-breeding visitor previously (Eisermann and Avendaño 2015), but nesting has been evidenced recently (Eisermann et al. 2017). Burrowing owl (*Athene cunicularia*) and short-eared owl (*Asio flammeus*) have been recorded as vagrants (Table 13.1). Short-distance migrations, including elevational migrations, have not been reported from owls in Guatemala.

13.3.4 Habitat Associations

Most of the owl species of Guatemala occur at least partially in forest habitats. Of the 18 resident species, 12 are forest specialists, including forest-like plantations such as coffee *Coffea arabica* and cardamom *Elettaria cardamomum* plantations shaded by a canopy of trees. Some of these owl species also occur in small forest patches in urban areas, such as the whiskered screech owl (*Megascops trichopsis*) (Table 13.1).

13.3.5 Relative Abundance

Only five species, Guatemalan screech owl (*Megascops guatemalae*), bearded screech owl, Mexican wood owl (*Strix squamulata*), fulvous owl (*Strix fulvescens*), and Ridgway's pygmy owl (*Glaucidium ridgwayi*), have been classified as locally common at some of the 105 sites. At most sites, however, these species were recorded as rare, or not recorded at all (Appendix 13.1); thus, the mean relative abundance indices per region are low. Mexican wood owl and Ridgway's pygmy owl are the species with the highest mean values (1.9 and 1.7) in some of the ornithogeographic regions, thus classifying as uncommon (Table 13.2). The mean

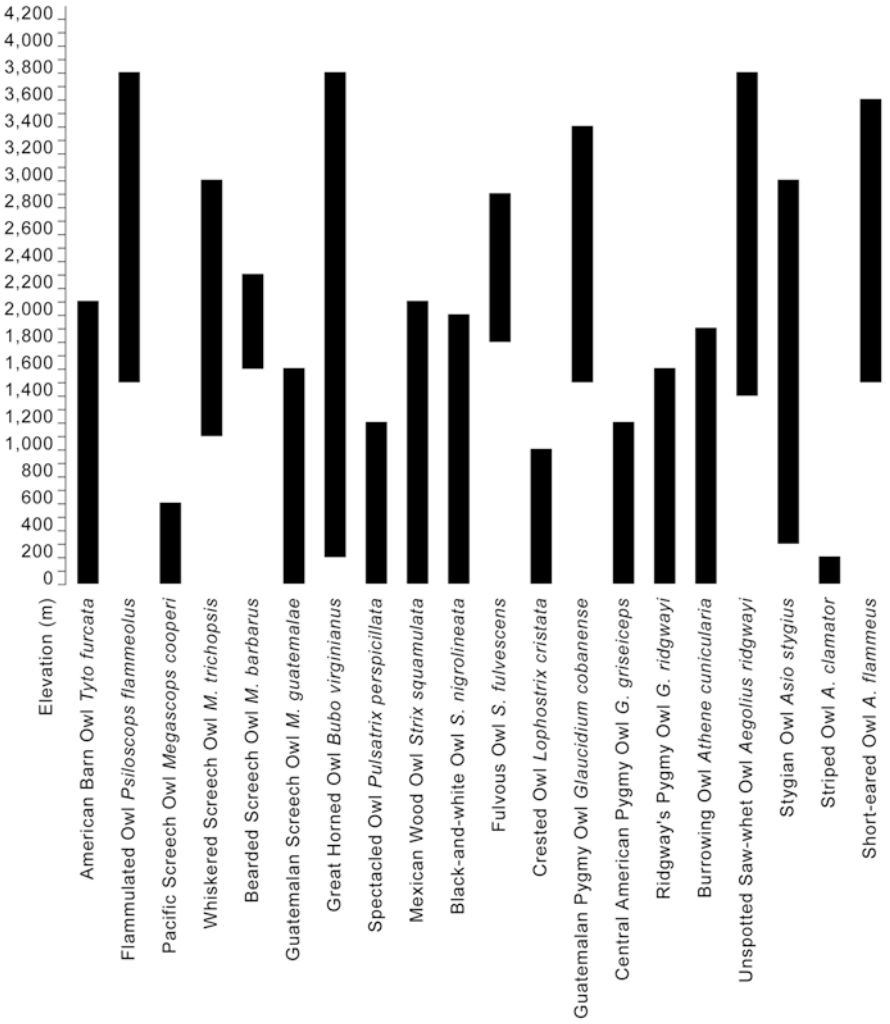


Fig. 13.3 Elevational range of owl records in Guatemala

relative abundance index for most species is below 1.5, indicating they are rare, which is not surprising for carnivore species. This index provides a comparison of the set of most common species among the three regions. It may, however, be biased because the information is based on data which does not consider detection probability. Currently, no higher-quality data are available.

Species with the highest relative abundance index in the Atlantic slope lowlands were (in descending order of abundance): Mexican wood owl, Guatemalan screech owl, Ridgway's pygmy owl, black-and-white owl (*Strix nigrolineata*), Central American pygmy owl, American barn owl (*Tyto furcata*), crested owl (*Lophostrix cristata*), and spectacled owl (*Pulsatrix perspicillata*). In the Pacific slope lowlands,

Table 13.2 Index of relative abundance (A) of owl species and number of sites with records (B) among a total of 105 sites in three ornithogeographic regions of Guatemala, according to data from 1989 to 2016

	Atlantic slope lowlands $n = 40$ sites		Highlands (>1,000 m) $n = 55$ sites		Pacific slope lowlands $n = 10$ sites	
Species	A[a]	B	A[a]	B	A[a]	B
American barn owl *Tyto furcata*	0.28	9	0.18	10	0.30	3
Flammulated owl *Psiloscops flammeolus*	0	0	0.02	1	0	0
Pacific screech owl *Megascops cooperi*	0.03	1	0	0	0.60	3
Whiskered screech owl *Megascops trichopsis*	0	0	0.38	17	0	0
Bearded screech owl *Megascops barbarous*	0	0	0.20	5	0	0
Guatemalan screech owl *Megascops guatemalae*	1.25	23	0.20	6	0.10	1
Great horned owl *Bubo virginianus*	0.08	3	0.47	24	0.10	1
Spectacled owl *Pulsatrix perspicillata*	0.18	6	0.02	1	0.10	1
Mexican wood owl *Strix squamulata*	1.85	32	1.15	31	1.90	7
Black-and-white owl *Strix nigrolineata*	0.68	18	0.11	5	0.20	1
Fulvous owl *Strix fulvescens*	0	0	0.51	14	0	0
Crested owl *Lophostrix cristata*	0.20	7	0.02	1	0.10	1
Guatemalan pygmy owl *Glaucidium cobanense*	0	0	0.64	28	0	0
Central American pygmy owl *Glaucidium griseiceps*	0.43	9	0.02	1	0.10	1
Ridgway's pygmy owl *Glaucidium ridgwayi*	0.93	23	0.45	16	1.70	8
Burrowing owl *Athene cunicularia*	0	0	0	0	0	0
Unspotted saw-whet owl *Aegolius ridgwayi*	0	0	0.44	19	0	0
Stygian owl *Asio stygius*	0.03	1	0.13	7	0	0
Striped owl *Asio clamator*	0.08	3	0	0	0.20	2
Short-eared owl *Asio flammeus*	0	0	0	0	0	0

[a]Mean of the numeric index of relative abundance at each site: 0–not recorded, 1–rare (few records, low probability to detect the species in a week of observation, or single record for a site), 2–uncommon (high probability to detect the species in a week of observation), 3–fairly common (high probability to detect an individual or territory in a day of observation), 4–common (high probability to detect several individuals or territories in a day of observation). Data in Appendix 3.1

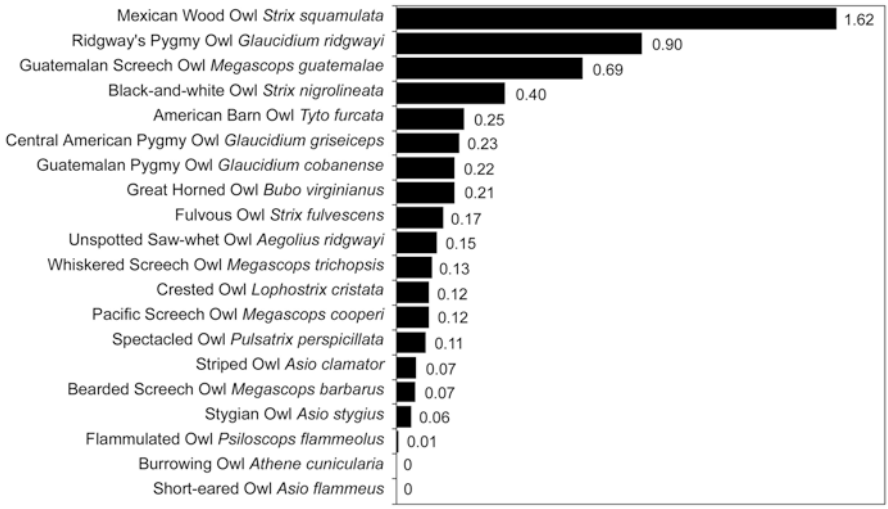


Fig. 13.4 Relative abundance index of owls in Guatemala based on data from 1989 to 2016. The index values result from weighted means across three ornithogeographic regions (Atlantic slope lowlands: 40 sites, highlands: 55 sites, Pacific slope lowlands: 10 sites). At each site, species were categorized in five abundance classes (0–4, see Methods)

most common owls were Mexican wood owl, Ridgway's pygmy owl, Pacific screech owl, American barn owl, black-and-white owl, and striped owl (*Asio clamator*). Most common owls in the highlands >1000 m were Mexican wood owl, Guatemalan pygmy owl, fulvous owl, great horned owl (*Bubo virginianus*), Ridgway's pygmy owl, unspotted saw-whet owl (*Aegolius ridgwayi*), whiskered screech owl, bearded screech owl, Guatemalan screech owl, and American barn owl (Table 13.2). According to the weighted mean value of the relative abundance index across the three ornithogeographic regions, the most common owls in the country were (abundance ranking in descending order): Mexican wood owl, Ridgway's pygmy owl, Guatemalan screech owl, black-and-white owl, American barn owl, Central American pygmy owl, Guatemalan pygmy owl, great horned owl, fulvous owl, unspotted saw-whet owl, whiskered screech owl, crested owl, and Pacific screech owl (Fig. 13.4).

It follows an annotated list of all owl species recorded in Guatemala, with information on distribution and research history in Guatemala.

13.3.6 Species Accounts

American barn owl (*Tyto furcata*) is widely distributed throughout the Americas (König et al. 2008). Two subspecies were recorded in Guatemala, *T. f. guatemalae* in the south of the country (Griscom 1932) and *T. f. pratincola* in the north of dpto. Petén (van Tyne 1935). The limit of distribution between both subspecies remains

uncertain (Marti 1992; Bruce 1999). König et al. (2008) did not recognize these subspecies. American barn owl belongs to the most widespread owls in Guatemala and has been recorded in all ornithogeographic regions (Table 13.2, Fig. 13.4, and Appendix 3.1), including urban areas.

Flammulated owl (*Psiloscops flammeolus*) ranges from western North America to northern Central America (AOU 1998). Currently no subspecies is recognized (Dickinson and Remsen 2013). Griscom (1935) described the subspecies *P. f. guatemalae* based on specimens from San Miguel Dueñas (Salvin and Godman 1897–1904), later corrected to *P. f. rarus* (Griscom 1937; Dickerman 1987). We consider flammulated owl as one of the rarest owls in Guatemala (Table 13.2, Fig. 13.4, and Appendix 13.1). The residency status of flammulated owl in Guatemala remained unknown for long. Based on presumed immature specimens from southern Mexico, Kaup (1859) assumed there was a resident population in the south of the species' range. Consequently, Land (1970) classified the species as resident in Guatemala. Phillips (1942) assumed that flammulated owl might occur only as a nonbreeding visitor in Guatemala. Linkhart and McCallum (2013) mentioned if breeding evidence would be found in Oaxaca, Mexico, it might also breed in Guatemala and probably in El Salvador (indirect record based on feathers; Marshall 1978). Because of the few historic records in Guatemala, all during the northern winter, flammulated owl was until recently classified as a migratory vagrant (Eisermann and Avendaño 2007, 2015). The nesting of flammulated owl in Guatemala was recorded for the first time in 2016 in the Sierra Los Cuchumatanes, dpto. Huehuetenango (Eisermann et al. 2017) (Fig. 13.5). The nearest known nesting site is located in the Mexican state of Veracruz, at a distance of 750 km to the northwest (Eisermann et al. 2017). Nesting has not been reported from southern Mexico and El Salvador (Marshall 1978; Enríquez-Rocha et al. 1993; Howell and Webb 1995; AOU 1998; Komar and Domínguez 2001; Pérez León et al. 2015). In addition to the recent nesting record, there are only historic specimens from three sites in Guatemala: San Miguel Dueñas, dpto. Sacatepéquez; near Parramos, dpto. Chimaltenango; and at Cerro Tecpán, dpto. Chimaltenango (Sharpe 1875c; Salvin and Godman 1897–1904; Dearborn 1907; Eisermann et al. 2017). It remains unknown if migratory flammulated owls reach Guatemala and how regular they occur as resident breeding birds in this country (Eisermann et al. 2017). The new status as breeding bird southeast of the Isthmus of Tehuantepec justifies a taxonomic reevaluation of the subspecies *P. f. rarus*.

Pacific screech owl (*Megascops cooperi*) ranges mainly along the Pacific slope lowlands from southern Mexico to Costa Rica (AOU 1998). In Guatemala, it occurs locally (Table 13.2, Fig. 13.4, and Appendix 13.1). It was recorded for the first time by Dickerman (1975) and was the last owl species added to the avifauna of the country. Nesting has been reported from La Avellana, dpto. Santa Rosa, in 1974 (Dickerman 2007). An active nest with two eggs in Manchón-Guamuchal, dpto. San Marcos, on 19 March 2015 (R. Esquivel, Personal Communication), where the female was also seen on 25 March 2015 (KE and CA, photograph), is only the second nesting record for Guatemala. In Manchón-Guamuchal, dptos. San Marcos and Retalhuleu, Pacific screech owl was regularly seen during several visits

Fig. 13.5 Female flammulated owl (*Psiloscops flammeolus*) shortly before leaving the nest hole at dusk. Sierra Los Cuchumatanes, dpto. Huehuetenango, 29 April 2016 (Photograph © Knut Eisermann)

from 2000 to 2002 (J. Berry in Eisermann and Avendaño 2015). It was recently also recorded in Monterrico, dpto. Santa Rosa, in May 2009 (O. Barden in Eisermann and Avendaño 2015), on 25 November 2014 (KE and CA, photograph), and on 14 January 2015 (KE and CA, pers. obs.), on the Salvadoran side of Lake Güija (Herrera 2005), and in Reserva Heloderma, dpto. Zacapa, in the Motagua Valley (J. Berry, J. P. Cahill in Jones and Komar 2013; site therein erroneously reported as Niño Dormido Regional Municipal Park). Reserva Heloderma is located in a transition zone between the arid lowlands of the Pacific slope and the Atlantic slope. This site is located approximately 60 km north of Lake Güija. Only Guatemalan screech owl has been recorded at other sites in the dry scrub of Motagua Valley (Eisermann and Avendaño 2015), suggesting that Pacific screech owl may have colonized this valley until recently or that it occurs only very locally, probably due to competition with Guatemalan screech owl. Pacific screech owl occurs also in Costa Rica locally in the Caribbean slope lowlands (Camacho-Varela 2014). Records of Pacific screech owl in Guatemala range from sea level to 600 m.

Whiskered screech owl (*Megascops trichopsis*) ranges from the southwestern United States to northern Central America (AOU 1998; Fig. 13.6). In Guatemala, it occurs mainly in the highlands at 1000–3000 m (Table 13.2, Fig. 13.4, and Appendix 13.1) but rarely also below 1000 m (San Bernardo, dpto. Guatemala; Griscom 1935). Eisermann and Avendaño (2015) listed recent records at Reserva Pachuj, dpto. Sololá, in November 2007 and December 2008; at Cerro Tecpán, dpto. Chimaltenango, 2009–2011; in Finca El Pilar, dpto. Sacatepéquez, in December 2009; in Finca Filadelfia, dpto. Sacatepéquez, in December 2010; at Volcán de Agua, dpto. Sacatepéquez, in December 2010 and December 2012; in Laguna

Fig. 13.6 Whiskered screech owl (*Megascops trichopsis*), rufous morph, Volcán de Agua, dpto. Sacatepéquez, 19 December 2012 (Photograph © Knut Eisermann)

Lodge Eco-Resort and Nature Reserve, Santa Cruz La Laguna, dpto. Sololá, in August 2008; in Novillero (Parque Corazón del Bosque), dpto. Sololá, in December 2012; at Montaña Sacranix, dpto. Alta Verapaz, in October 2001; at Finca San Joaquín, dpto. Alta Verapaz, in July 2007; in Guatemala City, dpto. Guatemala, in July 2010; in Parque Regional Municipal Los Altos de San Miguel Totonicapán, dpto. Totonicapán, in 2008 (K. Cleary in Eisermann and Avendaño 2015); at Volcán Candelaria, dpto. Quetzaltenango, 2001–2003 (J. Berry in Eisermann and Avendaño 2015); and at Volcán San Pedro, dpto. Sololá, in November 2008 (J. Duerr in Eisermann and Avendaño 2015). It was also recorded at Finca Chaculá, dpto. Huehuetenango (an individual on 14 April 2012, KE, pers. obs.), 6 km southeast of Huehuetenango (road kill, 20 November 2016, KE and CA, pers. obs.), and at Volcán Suchitán, dpto. Jutiapa (MVZ 188302, Museum of Vertebrate Zoology Berkeley 2015). Whiskered screech owl lives in Guatemala in pine-oak and coniferous forests and woodlands. Two juveniles collected near San Pedro Sacatepéquez, dpto. Guatemala, on 19 April 1973 (AMNH 813288–813,289; American Museum of Natural History 2013a, b) confirm breeding in Guatemala.

Bearded screech owl (*Megascops barbarus*) is distributed in a small area of approximately 9800 km^2 (KE, unpub. data; Fig. 13.7a) in the Atlantic slope highlands of southeastern Chiapas, Mexico, and Guatemala (AOU 1998) (Fig. 13.7b).

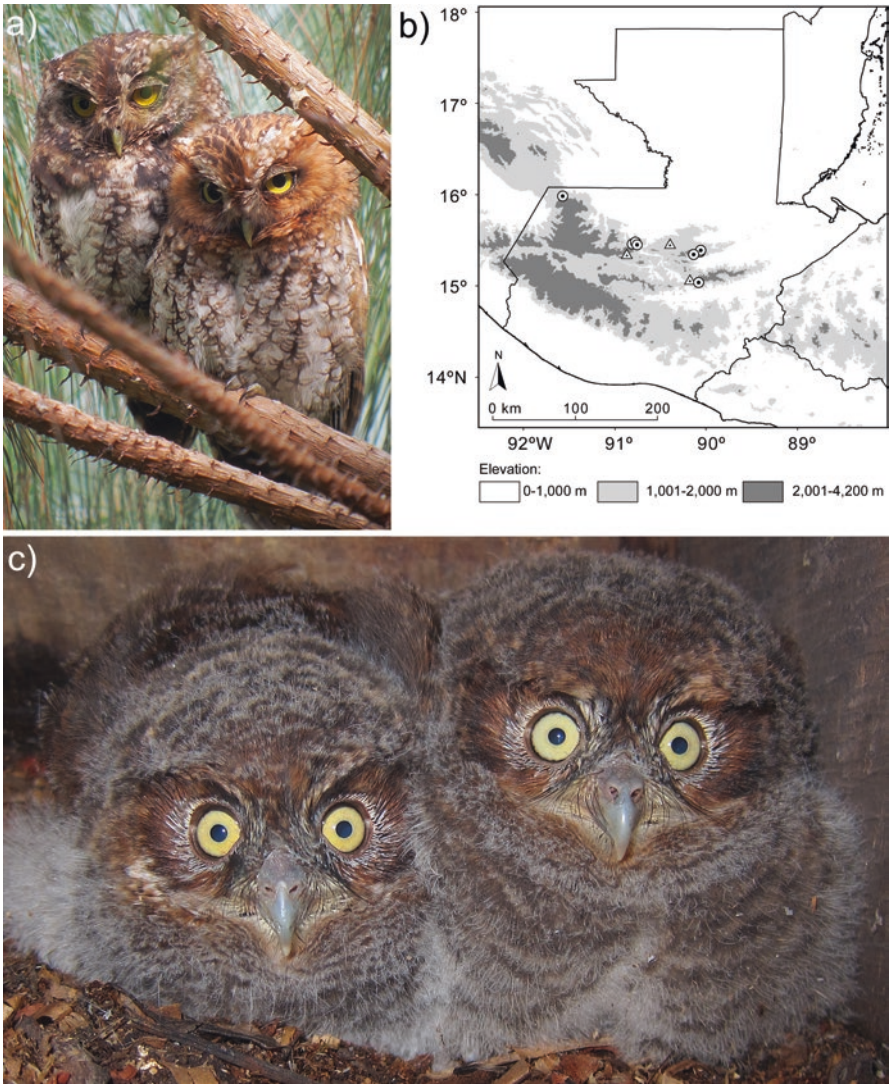


Fig. 13.7 Bearded screech owl (*Megascops barbarus*). (**a**) Pair of a rufous morph male and brown morph female at Montaña Yalijux, dpto. Alta Verapaz, 29 May 2012. (**b**) Distribution in Guatemala. Historic records are marked with *triangles*, recent records with *circles*. (**c**) Two rufous morph nestlings at Montaña Yalijux, dpto. Alta Verapaz, 21 May 2014 (Photographs © Knut Eisermann)

The holotype was collected near Santa Bárbara, dpto. Baja Verapaz (Sclater and Salvin 1868). Later it was recorded near Cobán, dpto. Alta Verapaz (Ridgway 1914), near Uspantán, dpto. Quiché (Griscom 1932). Recently it has been recorded at Montaña Guaxac, dpto. Alta Verapaz (Eisermann and Avendaño 2007); in Reserva Chelemhá, dpto. Alta Verapaz (Eisermann and Avendaño 2015); at Cerro El Amay, dpto. Quiché (Eisermann et al. 2013; Eisermann and Avendaño 2015);

and in the western part of Sierra de las Minas, dpto. El Progreso, in December 2011 (Eisermann and Avendaño 2015; KE, voice recording). A specimen of a male collected 2 km south of Yalambojoch, dpto. Huehuetenango, on 8 January 2009 (Museum of Vertebrate Zoology, Berkeley, MVZ 184214; R. A. Jiménez, photographs) is the first record for the Sierra Los Cuchumatanes mountain range. A nest at Cerro El Amay, dpto. Quiché, in April 2010 (M. V. Hernández in Eisermann and Avendaño 2015), and several broods at Montaña Yalijux 2012–2016 (Eisermann and Avendaño 2015; KE and CA, pers. obs.) (Fig. 13.7c) are the first nesting records for Guatemala. Undocumented reports from Santa Rosa, Cuilco, dpto. Huehuetenango (Pérez 2006), and from Volcán Atitlán, dpto. Suchitepéquez (Nájera 2010), require verification. Although the bearded screech owl is locally common in Guatemala, we consider it one of the less common owls in the country because of its small range and local distribution (Table 13.2, Fig. 13.4, and Appendix 13.1). The elevational range of all recent and exactly localized records is 1700–2300 m. The bearded screech owl lives in Guatemala along the edge of humid broadleaf forest, pine-oak forest, and pine plantations.

Guatemalan screech owl (*Megascops guatemalae*) occurs on the Atlantic and Pacific slope of Mexico, the Atlantic slope of Guatemala, Honduras, and Nicaragua (AOU 1998; Marks et al. 1999). Reports from northern Costa Rica (König et al. 2008; Mikkola 2014) are apparently erroneous, because records south of the Lake of Nicaragua are attributed to the closely related vermiculated screech owl (*Megascops vermiculatus*) (Marks et al. 1999). The holotype of Guatemalan screech owl was collected in Guatemala (Sharpe 1875c, Dickerman 1987). In this country, it is mainly restricted to the Atlantic slope lowlands and foothills, where it occurs in different types of habitats from sea level to 1600 m, including lowland rainforest, cloud forest, pine-oak forest, and arid scrub (KE and CA, pers. obs.). Once it was recorded in the Guatemalan Pacific slope foothills, where a probably strolling bird was heard at Finca Patrocinio, dpto. Quetzaltenango in 2002 (J. Berry in Eisermann and Avendaño 2006). Guatemalan screech owl belongs to the most common owls in Guatemala (Table 13.2, Fig. 13.4, and Appendix 13.1).

Great horned owl (*Bubo virginianus*) is widespread in North, Middle, and South America (AOU 1998). Dickinson and Remsen (2013) recognized the subspecies *B. v. mesembrinus* for Guatemala, described by Oberholser (1904), and *B. v. mayensis* (Nelson) 1901 restricted to the Yucatán peninsula. Griscom (1935) proposed to use the name *B. v. mayensis* for populations in Middle America, applied by Johnsgard (2002), Weick (2006), and König et al. (2008). In Guatemala, the great horned owl is widely distributed in the semiarid Pacific slope highlands (pine-oak forest, coniferous forest) and arid interior valleys (thorn scrub) (Table 13.2, Fig. 13.4, and Appendix 13.1). It is rare in the humid Atlantic slope highlands, where it has been recorded in Cobán, dpto. Alta Verapaz, in 2010 (J. P. Cahill in Eisermann and Avendaño 2015), and later in each year until 2014 (KE, pers. obs.). Breeding was confirmed in Cobán by observation of a pair with a fledgling in February 2014 (KE, pers. obs., voice recording). It was also recorded in urban area of Guatemala City, dpto. Guatemala, in September 2005 (Eisermann and Avendaño 2015). In the Atlantic slope lowlands, it has been reported from the arid Motagua

Fig. 13.8 Pair of great horned owl (*Bubo virginianus*) at the day roost on thorn scrub in Motagua Valley, Parque Regional Municipal Lo de China, El Jícaro, dpto. El Progreso, 7 September 2010 (Photograph © Knut Eisermann)

Valley near Usumatlán, dpto. Zacapa (Land 1962a); in Parque Regional Municipal Lo de China, El Jícaro, dpto. El Progreso, in September 2010 (Eisermann and Avendaño 2015; Fig. 13.8); in Sabana Grande, dpto. Chiquimula, in September 2010 (Eisermann and Avendaño 2015); and in Reserva Heloderma, El Arenal, dpto. Zacapa, in January 2014 (J. P. Cahill, eBird, S16366246). The great horned owl has not been documented from dpto. Petén. The species can be expected at all elevations in Guatemala, where all records range from 200 to 3730 m. The highest record is from Parque Regional Municipal Todos Santos Cuchumatán, dpto. Huehuetenango, where an individual was seen at 3730 m on 27 August 2016 (KE and CA, photo).

Spectacled owl (*Pulsatrix perspicillata*) ranges from southern Mexico to northern Argentina (AOU 1998). We consider it one of Guatemala's less common owls (Table 13.2, Fig. 13.4, and Appendix 13.1), where it has been recorded in lowland and foothill rainforests on both slopes, from sea level to 1200 m. On the Atlantic slope, it has been recorded 50 km east of Tikal, dpto. Petén (van Tyne 1935), in Parque Nacional Tikal (Beavers 1992); Parque Nacional Sierra del Lacandón, dpto. Petén (near La Pasadita archaeological site in February 2002; R. B. McNab in Eisermann and Avendaño 2015); Parque Nacional Laguna del Tigre, dpto. Petén (near Buena Vista in 2006; M. Córdova in Eisermann and Avendaño 2015); Parque Nacional El Rosario, dpto. Petén (11 October 2013, J. P. Cahill, pers. comm.); Parque Nacional Laguna Lachuá, dpto. Alta Verapaz (Avendaño 2001); Cerro San Gil, dpto. Izabal (Cerezo et al. 2005); and Refugio de Vida Silvestre Punta de Manabique, dpto. Izabal (17 October 2013, J. P. Cahill, Personal Communication). Historically, spectacled owl has been reported from several sites on the Guatemalan Pacific slope: near Escuintla, dpto. Escuintla (Salvin and Godman 1897–1904); near Antigua Guatemala,

dpto. Sacatepéquez (Ridgway 1914); at Hacienda California near Ocós, dpto. San Marcos (Griscom 1932); and in El Cacahuito near Taxisco, dpto. Santa Rosa (Tashian 1953). A specimen was collected in 1864 in Costa Cuca (ZMB 18081, Zoological Museum Berlin, Germany; Eisermann and Avendaño 2015). The exact locality is unknown, because Costa Cuca was in the nineteenth century a region covering the southern part of the modern dpto. Quetzaltenango (Eisermann 2011b). Four individuals of spectacled owl were liberated at Finca El Faro, dpto. Quetzaltenango, southeast of Volcán Santa María in 1989 (Vannini and Morales Cajas 1989). The only recent records from the Pacific slope of Guatemala are from Volcán Atitlán and were in Reserva Los Tarrales, dpto. Suchitepéquez; an individual was seen on 1 April 2009 (A. A. Anzueto in Eisermann and Avendaño 2015), two on 21 July 2009 (J. de León Lux in Eisermann and Avendaño 2015), one on 16 December 2009 (Eisermann 2010b), and one on 14 December 2015 (L. de León Lux, photograph; Eisermann 2016). In El Salvador, the spectacled owl has been recorded near the Guatemalan border at Cerro Montecristo, dpto. Santa Ana (Komar 2000), and in Parque Nacional El Imposible, dpto. Ahuachapán (Komar 2003).

Mexican wood owl (*Strix squamulata*) ranges from Mexico to northwestern South America (König et al. 2008, Fig. 13.9). This is the most common owl species in Guatemala, from sea level to 1800 m, locally to 2100 m (Table 13.2, Fig. 13.4, and Appendix 13.1). It is rare above this elevation. It lives mainly in broadleaf for-

Fig. 13.9 Mexican wood owl (*Strix squamulata*) is the most common owl in Guatemala. Reserva Los Tarrales, dpto. Suchitepéquez, 15 December 2012 (Photograph © Knut Eisermann)

ests but occurs also in mixed broadleaf and coniferous forests, plantations and adjacent open habitats, and small forest fragments in urban areas.

Black-and-white owl (*Strix nigrolineata*) ranges from southern Mexico to northeastern South America (AOU 1998). On the Guatemalan Atlantic slope, it has been recorded in dpto. Petén at the following sites: Parque Nacional Tikal (Smithe and Paynter 1963; Gerhardt et al. 1994a, 2012); Biotopo Naachtún-Dos Lagunas and Biotopo San Miguel La Palotada-El Zotz (Whitacre et al. 1991; Jones and Sutter 1992); Reserva Biológica San Román, Monumento Cultural Aguateca, and Monumento Cultural Ceibal (AHT 2000); Parque Nacional El Rosario (11 October 2013, J. P. Cahill, eBird S15381975); Parque Nacional Sierra del Lacandón (Tenez 2007); Parque Nacional Laguna del Tigre (Baumgarten 1998; Ordóñez 1998; Castillo Villeda 2001); Parque Nacional Mirador-Río Azul (Radachowsky et al. 2004; Budney et al. 2008); and archaeological site El Tintal (Budney et al. 2008). In dpto. Alta Verapaz, it has been recorded in Cahabón (Salvin and Godman 1897–1904), Panzós (Land 1963), and Parque Nacional Laguna Lachuá (Avendaño 2001; Eisermann 2001b) and in dpto. Izabal in the foothills of Sierra de las Minas in Selempín (Seglund and Conner 1997), Cerro San Gil (Cerezo et al. 2005), Refugio de Vida Silvestre Punta de Manabique (Eisermann 2001a), Área de Uso Múltiple Río Sarstún (Jones and Komar 2010a), and Sierra del Merendón (9 July 2012, J. P. Cahill, eBird S11305278). On the Pacific slope of Guatemala, it has been recorded historically in dpto. Suchitepéquez near Mazatenango (Salvin and Godman 1897–1904). Recent records on the Pacific slope are located in Reserva Los Tarrales, dpto. Suchitepéquez (Eisermann and Avendaño 2015), including a juvenile (Fig. 13.10); at Finca Las Nubes on Volcán Santo Tomás, dpto. Suchitepéquez (22 March 2011,

Fig. 13.10 Juvenile black-and-white owl (*Strix nigrolineata*) in Reserva Los Tarrales, dpto. Suchitepéquez, 26 June 2008 (Photograph © Susanne Arbeiter)

Fig. 13.11 (**a**) Fulvous owl (*Strix fulvescens*), here an adult, is in Guatemala the most obvious owl species in humid broadleaf forests above 2000 m. Reserva Chelemhá, dpto. Alta Verapaz, 16 April 2016. (**b**) This fledgling is the first documented breeding record for fulvous owl in Guatemala, Reserva Chelemhá, 6 May 2013 (Photographs © Knut Eisermann)

M. Retter, eBird S31493329); in Loma Linda, dpto. Quetzaltenango (Eisermann and Avendaño 2015); on the southern slope of Volcán de Agua (one individual at Finca El Zur, dpto. Escuintla, on 15 November 2015; D. Aldana, eBird S25925893); and at Finca El Pilar, dpto. Suchitepéquez (one individual on 23 January 2016, KE, voice recording; two individuals on 7 May 2016, KE and CA, pers. obs.). This owl has been reported from Parque Nacional El Imposible, dpto. Ahuachapán, El Salvador (Komar 2003), 15 km from the Guatemalan border. The black-and-white owl has been reported in Guatemala in the elevational range from sea level to 2000 m. We consider it one of the most common owls of Guatemala (Table 13.2, Fig.13.4, and Appendix 13.1).

Fulvous owl (*Strix fulvescens*) is restricted to the highlands of the Mexican state of Chiapas and the Central American countries Guatemala, Honduras, and El Salvador (AOU 1998; Fig. 13.11a) and has recently also been recorded in the highlands of the Mexican state of Oaxaca, west of the Isthmus of Tehuantepec (Gómez de Silva 2010; Ramírez-Julián et al. 2011). The species was described based on syntypes from Guatemala (Sclater and Salvin 1868; Dickerman 1987). In Guatemala, fulvous owl replaces Mexican wood owl in humid broadleaf forests above 2000 m, where it is the most obvious owl species (Table 13.2, Fig. 13.4, and Appendix 13.1). Guatemalan records range in elevations from 1800 to 2900 m. It has recently been reported at the following sites in dpto. Alta Verapaz, Montaña Caquipec (Eisermann and Schulz 2005) and Montaña Yalijux (Renner et al. 2006; Eisermann and Avendaño 2015); dpto. Quiché, Cerro El Amay (Eisermann et al. 2013; Eisermann and Avendaño 2015); dpto. El Progreso, Sierra de las Minas (Eisermann 1999; Eisermann and Avendaño

2015); dpto. Chiquimula, Cerro Montecristo (Eisermann 2006); dpto. Sacatepéquez, Finca El Pilar (Eisermann and Avendaño 2015), Finca Filadelfia (J. Fagan in Jones and Komar 2010a), and Volcán Agua (Eisermann and Avendaño 2015); dpto. Sololá, Volcán Atitlán (Eisermann and Avendaño 2015), Volcán San Pedro (J. Rivas in Eisermann and Avendaño 2015), and Volcán Tolimán (24 February 2001, P. Kaestner, pers. comm.); dpto. Quetzaltenango, Volcán Santa María (Vannini 1989) and Volcán Santo Tomás-Zunil (Brooks and Gee 2006, J. Berry in Eisermann and Avendaño 2015); and dpto. San Marcos, Refugio del Quetzal, San Rafael Pie de la Cuesta (Eisermann and Avendaño 2015), and Vega del Volcán (two individuals on 31 March 2015; KE, voice recording). A fledgling in Reserva Chelemhá, dpto. Alta Verapaz, in May 2013 (Fig. 13.11b), is the first documented breeding record for Guatemala. Previously, an immature, killed by local people in Chicacnab, Montaña Caquipec, dpto. Alta Verapaz, was seen in August 1998 (Eisermann and Avendaño 2015).

Crested owl (*Lophostrix cristata*) ranges from southern Mexico to Brazil (AOU 1998). The subspecies *L. c. stricklandi* was described based on syntypes from dpto. Alta Verapaz (Sclater and Salvin 1859; Dickerman 1987). In Guatemala, this owl has been reported from humid broadleaf forests from sea level to mainly below 1000 m. We consider it one of the less common owls in Guatemala (Table 13.2, Fig.13.4, and Appendix 13.1). On the Guatemalan Atlantic slope, it has been reported at the following sites in dpto. Petén, Parque Nacional Sierra del Lacandón (Tenez 2007), an individual on a day roost near Temple IV in Parque Nacional Tikal in 2004 (A. E. Hernández in Eisermann and Avendaño 2015), and Parque Nacional Laguna del Tigre, where listed without documentation by Pérez and Castillo Villeda (2000) and documented for the first time with a photograph of an injured individual near the archaeological site El Perú in February 2010 (M. Rivera Mejía in Eisermann and Avendaño 2015) (Fig. 13.12); dpto. Alta Verapaz, Parque Nacional Laguna Lachuá (Eisermann and Avendaño 2015), an undocumented record of a bird at Montaña Yalijux (Renner et al. 2006) at over 2000 m that was presumably a strolling individual; dpto. Izabal, Sierra Santa Cruz (Pérez 1998), Cerro San Gil where recorded for the first time in September 2010 (Eisermann and Avendaño 2015), and Sierra del Merendón (one individual on 14 May 2016, M. Ramírez, eBird S29676182); and dpto. El Progreso, a female collected near Tulumaje in 1932 (LACM 17710, Natural History Museum of Los Angeles County 2016). On the Guatemalan Pacific slope, crested owl has been reported historically from near Escuintla, dpto. Escuintla (Salvin 1874), near San Pedro Mártir (6 km northeast of Escuintla), and near San Diego, dpto. Escuintla, on Volcán de Agua (Salvin and Godman 1897–1904), which probably corresponds to Finca San Diego, 10 km north of Escuintla. The only recent record from the Pacific slope is from Finca Cataluña, dpto. Retalhuleu, 18 km east of Ocós, in December 2010 (J. Berry in Eisermann and Avendaño 2015), and on Cerro Montecristo on the Salvadoran-Guatemalan border (Herrera et al. 1998).

Guatemalan pygmy owl (*Glaucidium cobanense*) is restricted to the highlands of southern Mexico and northern Central America (Chiapas in Mexico, Guatemala, and Honduras). The description of the species is based on syntypes collected in dpto. Alta Verapaz (Sharpe 1875b; Dickerman 1987). The recent descrip-

Fig. 13.12 This photograph represents the first documented record of crested owl (*Lophostrix cristata*) in Parque Nacional Laguna del Tigre, dpto. Petén. Archaeological site El Perú, 10 February 2010 (Photograph © Melvin Rivera Mejía)

tion of vocalizations (Eisermann and Howell 2011; Howell and Eisermann 2011) supports the specific separation of Guatemalan pygmy owl from mountain pygmy owl (*Glaucidium gnoma*) in the Mexican highlands northwest of the Isthmus of Tehuantepec. In Guatemala, Guatemalan pygmy owl is widespread in the highlands at 1500–3400 m (mainly above 1800 m) (Table 13.2, Fig. 13.4, and Appendix 13.1). Nesting records at Montaña Yalijux, dpto. Alta Verapaz, in March 2010, March 2012, May 2013, and May 2014 (Eisermann and Avendaño 2015) (Fig. 13.13), as well as April 2015 and April 2016 (J. Mez, pers. comm., R. Rax, pers. comm., KE, pers. obs.), are the first nest records for Guatemala.

Central American pygmy owl (*Glaucidium griseiceps*) ranges from southern Mexico to northwestern South America (AOU 1998). The subspecies *G. g. griseiceps* has been described based on syntypes from Guatemala (Sharpe 1875a, Dickerman 1987). In Guatemala, this owl lives mainly in humid broadleaf forest in the Atlantic slope lowlands at 0–600 m, locally up to 1200 m (Table 13.2, Fig. 13.4, and Appendix 13.1). It is rare in the north of dpto. Petén (Beavers 1992), where it has recently been recorded in El Remate in May 2009 (O. Barden in Eisermann and Avendaño 2015), and in Parque Nacional Tikal in February 2013 (L. Oliveros in Eisermann and Avendaño 2015). Two records from the Guatemalan Pacific slope, in the western part of this zone (Howell and Webb 1995; voice recording by B. Whitney, S. Howell, Personal Communication) and in Reserva Los Tarrales, dpto. Suchitepéquez (Eisermann and Avendaño 2006) are presumably of strolling birds. No resident population is known from the Guatemalan Pacific slope. The Central American pygmy owl presumably breeds in Guatemala, but nesting has not been reported yet.

Ridgway's pygmy owl (*Glaucidium ridgwayi*) ranges from the southern United States throughout Middle America to the northwest of Colombia (König et al. 2008). In Guatemala, this owl is widespread and locally common (Table 13.2, Fig. 13.4, and Appendix 13.1) in scrub, dry forests, woodlands, plantations, and open habitats including urban areas from sea level to 1600 m.

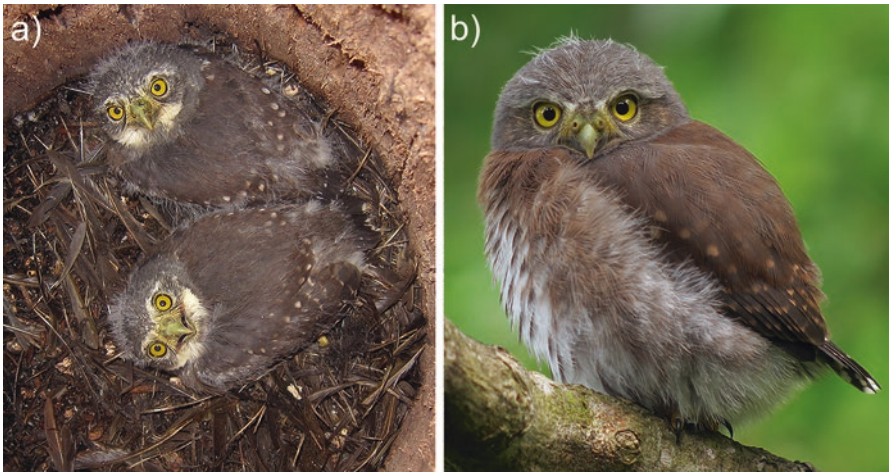


Fig. 13.13 Guatemalan pygmy owl (*Glaucidium cobanense*). (**a**) Nestlings few hours before fledging. Montaña Yalijux, dpto. Alta Verapaz, 24 May 2014. (**b**) Juvenile 2 days after fledging, Montaña Yalijux, 27 May 2012 (Photographs © Knut Eisermann)

Burrowing owl (*Athene cunicularia*) lives in breeding, partially migratory populations from southwestern Canada to northern Mexico and in resident populations in South America. Records in southern Mexico and Central America are associated with migratory birds (König et al. 2008). In Guatemala, the burrowing owl has been reported historically on the Pacific coast near Champerico, dpto. Retalhuleu; near Puerto San José, dpto. Escuintla (Salvin and Godman 1897–1904); in the highlands in San Miguel Dueñas, dpto. Sacatepéquez (Salvin and Godman 1897–1904); in San Lucas Tolimán, dpto. Sololá, and Huehuetenango, dpto. Huehuetenango (Griscom 1932); in Alotenango, dpto. Sacatepéquez (Wetmore 1941); in interior valleys near San Jerónimo, dpto. Baja Verapaz (Salvin and Godman 1897–1904); in Gualán, dpto. Zacapa (Dearborn 1907); and also in the Atlantic slope lowlands in Lanquín, dpto. Alta Verapaz (Salvin and Sclater 1860; Salvin and Godman 1897–1904). Griscom (1932) reported this owl as locally common; subsequently it was reported as such by Land (1970), although he did not report this species in his collections (Land and Wolf 1961; Land 1962a, b, 1963). The burrowing owl has not been reported recently in Guatemala; it was recorded for the last time more than 80 years ago. Thus, we consider this owl a migratory vagrant in Guatemala, similar to the status in Honduras (Bonta and Anderson 2002; Gallardo 2014) and El Salvador (Dickey and van Rossem 1938; Komar 1998).

Unspotted saw-whet owl (*Aegolius ridgwayi*) ranges from southern Mexico to western Panama (AOU 1998; Fig. 13.14a). Until recently, the distribution of this owl in Guatemala was little known. Few historic records have been published for Guatemala. Salvin and Godman (1897–1904) reported it from Quetzaltenango, dpto. Quetzaltenango; Griscom (1930) from Sacapulas, dpto. Quiché; and Baepler (1962) from Soloma, dpto. Huehuetenango. Based on recent observations from 1989 to

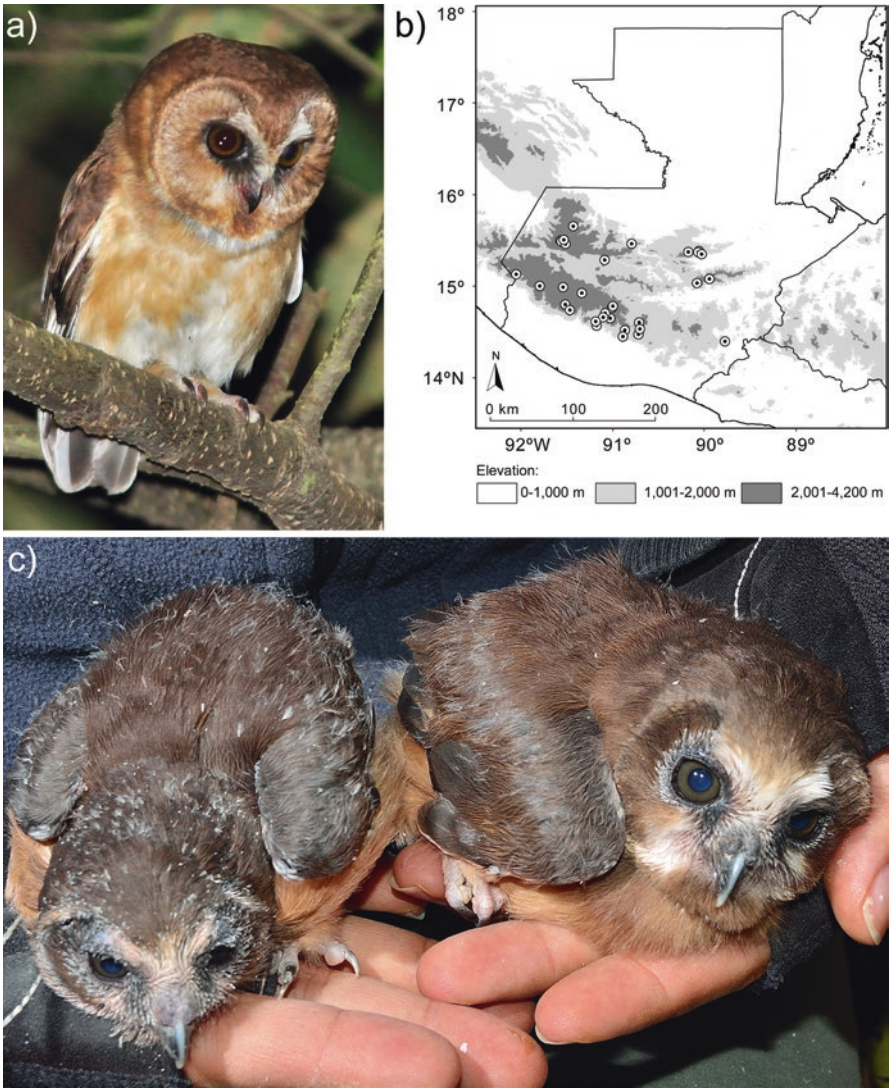


Fig. 13.14 Unspotted saw-whet owl (*Aegolius ridgwayi*). (**a**) Adult at Volcán de Agua, dpto. Sacatepéquez, December 2010. (**b**) Distribution in Guatemala. *Circles* mark the localization of all records; most of them are recent observations 2000–2016. (**c**) Nestlings at Montaña Yalijux, dpto. Alta Verapaz, February 2013 (Photographs © Knut Eisermann)

2016, we consider this owl widespread throughout the Guatemalan highlands (Fig. 13.14b, Table 13.2, Fig. 13.4, and Appendix 13.1), where it is now known from 22 topographic units. It was recorded at the following sites in dpto. Alta Verapaz, Montaña Caquipec (Eisermann and Schulz 2005), Montaña Yalijux including Reserva Chelemhá (Eisermann and Avendaño 2015), and Tzalamilá (one individual at 1400 m on 17 November 2012, KE and CA, voice recording); dpto. Quiché, Cerro

El Amay (Eisermann et al. 2013; Eisermann and Avendaño 2015); dpto. El Progreso, western Sierra de las Minas (Eisermann and Avendaño 2015), Los Albores, and western Sierra de las Minas (J. P. Cahill, eBird, S11536505); dpto. Jutiapa, Volcán Suchitán (Valdez et al. 1999); dpto. Huehuetenango, two territories 5 km southeast of Todos Santos Cuchumatán on 4 December 2014 (KE and CA, voice recording), one in Chiabal on 27 January 2016 (KE, pers. obs.), and a pair in the Parque Regional Municipal Todos Santos Cuchumatán at 3720 m on 18 November 2016 (KE and CA, photo); dpto. San Marcos, Parque Regional Municipal Canjulá, Sibinal (Eisermann and Avendaño 2015), and Parque Regional Municipal San Pedro Sacatepéquez (Eisermann and Avendaño 2015); dpto. Quetzaltenango, Volcán Candelaria (J. Berry in Eisermann and Avendaño 2007), Volcán Santo Tomás-Zunil (J. Berry in Eisermann and Avendaño 2015), and San Carlos Sija (Eisermann and Avendaño 2015); dpto. Totonicapán, Parque Regional Municipal Los Altos de San Miguel Totonicapán (J. P. Cahill, eBird, S11242340; two individuals on 10 September 2014, KE and CA, pers. obs.); dpto. Sololá, Volcán Atitlán (one individual on 15 December 2010 and on 14 December 2015, two individuals on 18 December 2016; KE, photo, voice recording), Volcán Tolimán (one on 24 February 2001, P. Kaestner, pers. comm.), Los Robles (one heard several times 2013–2015) (E. Buchán, pers. comm.), near Agua Escondida (one heard in December 2015) (G. López, pers.comm.); dpto. Chimaltenango, Cerro Tecpán (Eisermann and Avendaño 2015) and Finca Patoquer (Eisermann and Avendaño 2015); and dpto. Sacatepéquez, Volcán Agua (Eisermann 2013; Eisermann and Avendaño 2015), Finca Filadelfia (Eisermann and Avendaño 2015), Volcán Acatenango (Eisermann and Avendaño 2015), Finca El Pilar (one individual on 2 January 2016, KE, pers. obs.), and probably Volcán Fuego (Tenez 2005a; D. Tenez, pers. comm.). A fledgling in dpto. Chimaltenango, in February 2006, and a fledgling in dpto. San Marcos, in January 2011, and a successful brood with fledged juveniles in March 2013 (Fig. 13.14c) (Eisermann and Avendaño 2015), as well as a clutch in October 2015 in Montaña Yalijux, dpto. Alta Verapaz (KE, pers. obs.), are the first nesting records for Guatemala. According to these observations, the nesting season in Guatemala seems to range from September to March. Records of the unspotted saw-whet owl in Guatemala range in elevation from 1400 to 3730 m (suitable habitat available up to 3800 m), with most records above 1900 m. There are only two records at 1400 m. The unspotted saw-whet owl inhabits in Guatemala coniferous forest and woodlands, coniferous plantations, edges of pine-oak and montane humid broadleaf forest, and montane scrub with scattered trees. Two subspecies have been described in Guatemala, *A. r. rostrata* from Sacapulas (Griscom 1932) and *A. r. tacanensis* in Soloma (Baepler 1962). Validity of subspecies has been doubted (Marks et al. 1999), and König et al. (2008) did not recognize any subspecies. Eisermann (2013) described vocalizations of the unspotted saw-whet owl and compared it to vocalizations of the Guatemalan pygmy owl, which can be a field identification challenge especially during dusk and dawn.

Stygian owl (*Asio stygius*) ranges from northern Mexico to northern Argentina and the Caribbean (AOU 1998). In Guatemala, we consider it one of the rarest owls, with only few records from 11 sites on 9 topographic units, mainly from the highlands (Fig. 13.15a, Table 13.2, Fig. 13.4, and Appendix 13.1), ranging in elevation from 300 to 3000 m. Stygian owl has been recorded in a variety of habitats in

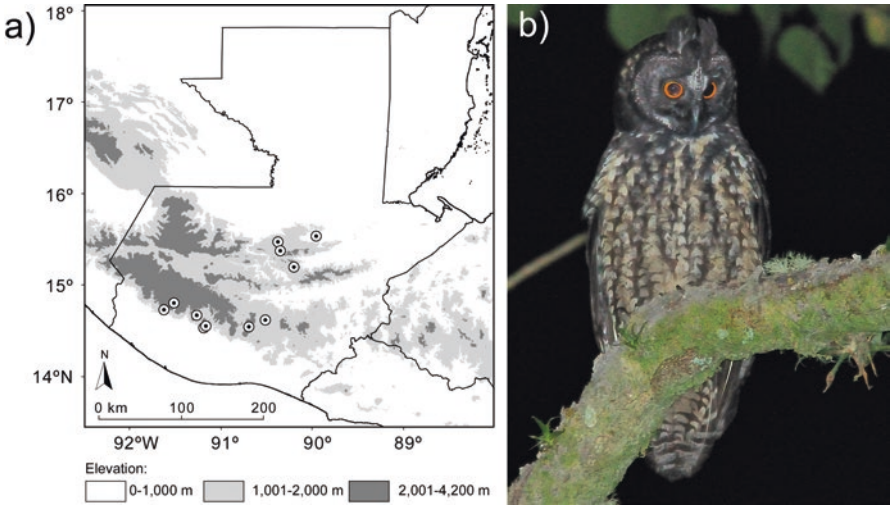


Fig. 13.15 Stygian owl (*Asio stygius*). (**a**) Distribution in Guatemala. *Circles* mark the localization of all records. (**b**) Adult in Loma Linda, dpto. Quetzaltenango, 12 January 2011 (Photograph © Knut Eisermann)

Guatemala, including pine-oak forest, humid broadleaf forest at low and mid elevations, coniferous forest, and coffee plantations. A historic record was reported from Cobán, dpto. Alta Verapaz (Ridgway 1914). Recently it was recorded in Reserva Posada Montaña del Quetzal near Biotopo Mario Dary, dpto. Baja Verapaz (P. Hubbell in Eisermann and Avendaño 2007); at Volcán Candelaria, dpto. Quetzaltenango (J. Berry in Eisermann and Avendaño 2007); Reserva Los Andes, dpto. Suchitepéquez (KE and CA in Jones and Komar 2009, J. L. Yuxón in Eisermann and Avendaño 2015); Volcán San Pedro, dpto. Sololá (J. Duerr in Eisermann and Avendaño 2015); Semuc Champey, dpto. Alta Verapaz (A. Monroy Ojeda in Jones and Komar 2010b); Loma Linda, dpto. Quetzaltenango (Eisermann and Avendaño 2015) (Fig. 15b); Reserva Los Tarrales, dpto. Suchitepéquez (one individual on 13 December 2014 and on 14 December 2015, G. López, pers. comm.); and Finca El Pilar, dpto. Sacatepéquez (one individual on 16 December 2014, KE, pers. obs.; one individual on 3 January 2016, KE, voice recording). Single injured birds were encountered in Guatemala City (O. Ericastilla in Eisermann and Avendaño 2015) and in Finca Rubelchaim, dpto. Alta Verapaz (10 April 2015, J. P. Cahill, eBird, S22820198). A fledged juvenile was seen in Reserva Los Andes, dpto. Suchitepéquez, in February 2011 (Holt et al. 2014), representing the first breeding record for Guatemala.

Striped owl (*Asio clamator*) ranges in open, savannah-like habitats and forest edges from southern Mexico to northern Argentina (AOU 1998; Marks et al. 1999). This owl has been rarely reported in Guatemala (Table 13.2, Fig. 13.4, and Appendix 13.1). Boucard (1878) first reported it for Guatemala without locality. Salvin and Godman (1897–1904) ignored this publication because of several inaccuracies

Fig. 13.16 This juvenile striped owl (*Asio clamator*) in Hacienda Tijax, dpto. Izabal, represents the first breeding record for Guatemala, 18 April 1998 (Photograph © Eugenio Gobbato)

(Griscom 1932). This owl was documented for the first time in Guatemala with several specimens near La Avellana, dpto. Santa Rosa in 1973–1976 (Dickerman 2007). Recently it was also recorded near Cebollito, dpto. Santa Rosa, in 2013 (A. Chávez, pers. comm.). At another site near the Pacific coast, in Manchón-Guamuchal, dpto. San Marcos, it was recorded on 26 October 2014 (J. P. Cahill and J. de León Lux, eBird S20373838). Based on observations in Belize (Howell et al. 1992), Howell and Webb (1995) presumed occurrence in the Guatemalan Atlantic slope lowlands. The first record for this area, and the first breeding record for the country, was a nest with two juveniles in a cattle ranch near Río Dulce Fronteras, dpto. Izabal, in March 1998 (E. Gobbato in Eisermann and Avendaño 2015; Fig. 13.16). Later an adult was photographed near Puerto Barrios, dpto. Izabal, in 2006 (J.-L. Betoulle and N. Komar in Eisermann and Avendaño 2015). Advancing deforestation in Guatemala augments available habitat for striped owl. It has recently been reported from northwestern dpto. Petén, where a bird was heard in the southeastern part of Parque Nacional Laguna del Tigre (J. P. Cahill in Jones and Komar 2015), and repeated records were photo documented in the surroundings of San Benito since October 2015 (C. Echeverría, eBird, S25372846, S27173179). Two birds were recorded at Las Guacamayas, Chiapas, Mexico (Gómez de Silva 2012), 20 km from the Guatemalan border of dpto. Quiché. These records indicate that the known range from the Mexican states of Tabasco and northern Chiapas (Howell and Webb 1995) extends more than 200 km to the southeast. Because of large-scale deforestation, this owl may be expected throughout the southern dpto. Petén and northern part of the dptos. Quiché, Alta Verapaz, and Izabal.

Short-eared owl (*Asio flammeus*) is a nearly cosmopolitan species. It breeds in northern North America, northeastern Europe, northern Asia, as well as in the Caribbean, northern and southern South America. This owl occurs as a nonbreeding visitor in southern Mexico and Central America (AOU 1998). In Guatemala, this species has been reported only once through the collection of two specimens on the slopes of Volcán de Agua, dpto. Sacatepéquez (Salvin 1866), more than 140 years ago. We consider that owl a migratory vagrant in Guatemala.

13.4 Vulnerability on a National Level

13.4.1 Classification of Vulnerability

Eisermann and Avendaño (2006) evaluated the vulnerability of all bird species of Guatemala applying IUCN Red List criteria on a national level. Criteria are quantitative, considering population size and area of distribution. We updated this information for the 20 owl species in Guatemala based on IUCN criteria (2003, 2012a, b). We classified one species as Critically Endangered (CR), one as Endangered (EN), nine as Vulnerable (VU), five as Near Threatened (NT), two as Least Concern (LC) on a national level, and two as not applicable (NA) (Table 13.1). Flammulated owl is classified as Critically Endangered, because it was recently found as a resident breeding bird in Guatemala, with a breeding population probably less than 50 mature birds. We classified stygian owl as Endangered, because the total population in Guatemala is presumed to be less than 250 mature individuals. We classified other species specialized in forest habitats as Vulnerable, considering that populations are at risk to decrease 30% or more within 10 years or three generations because of a decline of the area of occupancy due to deforestation. Annual deforestation rate in Guatemala was an estimated 1.4% or 550 km^2 from 1990 to 2000 (FAO 2011), equaling a forest loss of 5500 km^2 in 10 years. A more recent evaluation estimated an annual deforestation rate of 1% from 2000 to 2006 (Regalado et al. 2012). Both deforestation rates did not discriminate between primary forest and secondary forests or plantations. Thus, we expect the loss of primary forest to be higher. Extensive forest fires, invasions in protected areas, and management deficiencies cause deforestation even within protected areas (ParksWatch 2005). It appears unlikely that the situation will improve in the midterm, because the human population is growing rapidly in Guatemala. It increased 35% from 1994 to 2002 (INE 2002), and from 2010 to 2050 it is estimated to double to 27.9 million (CEPAL 2010). It follows a discussion of the main threats to owl populations in Guatemala.

13.4.2 Habitat Alteration

The alteration of habitat caused by human activity is the principal threat to most owl species in Guatemala. One of the most drastic habitat alterations is the conversion from forest to open agricultural land. Because of the ongoing deforestation in

Guatemala, we classified all breeding species specialized in forest habitats as Vulnerable, Endangered, or Critically Endangered on a national level. Considering that Guatemala has a primarily agricultural economy, the growing population implies an increasing demand for agricultural land. Agriculture is a main cause of deforestation. Population growth causes migrations into forested areas, converting them into agricultural land (Loening and Markussen 2003; Carr 2004, 2005, 2008a, b; Carr et al. 2006). According to a land use mapping in 2003, a total of 29,979.6 km^2 (27.5% of Guatemala) were used for agriculture (Ministerio de Agricultura, Ganadería y Alimentación 2006). Scrub covered 23,925 km^2, of which the majority is part of agricultural crop rotation systems. Consequently, more than 40% of the country is used for agriculture. Annual crops (mainly corn *Zea mays*) covered 13,579.7 km^2 (12.5% of the country); perennial and semi-perennial crops (mainly coffee *Coffea arabica*, sugarcane *Saccharum officinarum*, cardamom *Elettaria cardamomum*, banana *Musa* spp., rubber tree *Hevea brasiliensis*, African oil palm *Elaeis guineensis*, cacao *Theobroma cacao*, and fruit trees) covered 11,454.9 km^2 (10.5% of the country), pasture 4381.7 km^2 (4% of the country), and gardens, nurseries, and vegetable crops 563.3 km^2 (0.5% of the country) (Ministerio de Agricultura, Ganadería y Alimentación 2006). Areas for fuel crops such as African oil palm and Jatropha (*Jatropha curcas*) have been expanded recently (Ribeiro Gallo 2007), causing additional loss of primary forest, because especially Jatropha can be grown on poor soils not adequate for traditional crops.

Increasing fragmentation of forest areas by agricultural plots augments the spread of pesticides used in crops (herbicides, fungicides, insecticides, rodenticides), which can affect owls directly by poisoning or indirectly through alterations in food availability (Blus 1996; Marks et al. 1999). Little information about pesticide impact on owls is available on a worldwide scale (Marks et al. 1999), and no data is available for Guatemala.

Habitat alteration caused by petrol and opencast mineral exploitation is another threat for owl populations in Guatemala, because it is planned in extensive areas. A total of 36,785 km^2 (34% of the country) is used or planned for mineral and petrol exploration and exploitation (Ministerio de Energía y Minas 2011a, b). This area includes 6960 km^2 of forest (20% of the remnant forest area in the country), which is principal habitat for owls (Fig. 13.17).

Guatemala's road density has been increasing from 14.51 km/100 km^2 in 2008 to 15.36 km/100 km^2 in 2013 (CEPAL 2015). Road construction causes direct loss of natural habitat because of the area covered by roads, and in addition, it facilitates the transport of illegally harvested timber and the foundation of new settlements. Consequently, the agricultural border advances. In the Maya Biosphere Reserve (IBA Maya-Lacandón), which is part of the largest Neotropical forest north of the Amazon basin, several new roads are planned. In case all of these are constructed, a loss of 183,000 ha of forest can be expected (Ramos et al. 2007), which equals to 10% of the area of this biosphere reserve. An increasingly denser road network may also elevate the number of road kills among owls because of collision with vehicles.

Other communication infrastructures alter owl habitat in less obvious ways. Communication towers, power lines, fence lines, and wind turbines harbor potential hazards for owls because of risk of collision, displacement, and indirect effects on

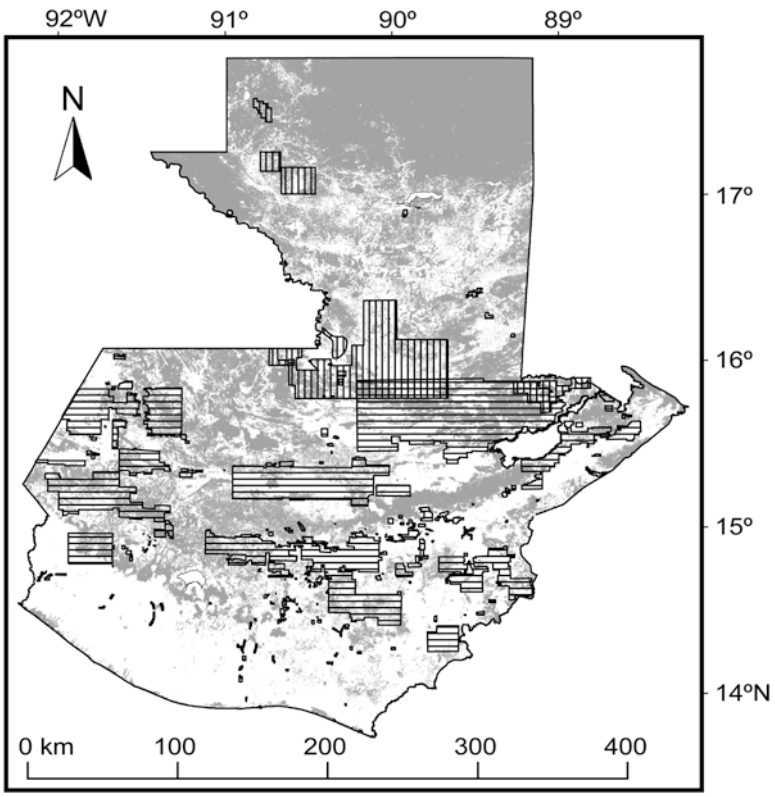


Fig. 13.17 Distribution of remaining forest (*gray shade*) in Guatemala based on a mapping by Ministerio de Agricultura, Ganadería y Alimentación (2006), and areas of mineral exploitations and exploration (*horizontal hatching*) and petrol drilling (*vertical hatching*) according to Ministerio de Energía y Minas (2011a, b)

prey availability (Gove et al. 2013). Cellular telephone networks have been developed rapidly in Guatemala in the past two decades through the installation of communication towers throughout the country. Initial studies in Europe suggest that electromagnetic contamination through the antennas has negative impact on wildlife (Balmori 2005, 2006; Balmori and Hallberg 2007). The impact on owls has not been studied. In Europe and North America, several owl species have been reported being killed by collision or electrocution on power lines, communication towers, and wind turbines (Fitzner 1975; Sergio et al. 2004; Smallwood et al. 2007). The overall impact on populations is difficult to assess but can be locally significant for rare and sensitive species (Horch and Keller 2005; Gove et al. 2013; Loss et al. 2014; Marques et al. 2014). In Guatemala, the impact of these infrastructures on owls has not been studied.

Global atmospheric contaminations cause climate changes, which alter the water cycle regime (Wigley et al. 1997; Karl and Trenberth 2003). An increasing temperature of ocean surfaces may enhance the occurrence of tropical storms (Trenberth

2005; Solomon et al. 2007; Parry et al. 2007), which can impact bird populations in tropical forests (Tejeda-Cruz and Sutherland 2005). Christensen et al. (2007) predict higher temperatures and less precipitation in Guatemala at the end of the twenty-first century. More pronounced dry seasons increase the risk of forest fires. Possible effects on tropical forests caused by climatic changes are still little studied (Clark 2007; Fischlin et al. 2007), but it appears possible that humid broadleaf forests convert gradually into coniferous and mixed forests, challenging habitat specialists of broadleaf forests. Climate changes will alter the distribution pattern of species. Peterson et al. (2001) modeled distribution changes for cracids in Mexico caused by climate changes, resulting in an increased area of distribution for some species and a decreased area of distribution for other species, with a high risk of extinction. Thomas et al. (2004) estimated the extinction of 15–37% of species with restricted range of distribution until 2050, using data for mammals, birds, amphibians, reptiles, butterflies, and plants in 20% of Earth's surface.

Part of the habitat destruction in Guatemala is caused by ignorance and violation of legal frames of nature conservation, including the destruction of protected areas, documented exemplarily for the Parque Nacional Laguna del Tigre (ParksWatch 2005).

Volcanism is a natural cause of habitat alteration. Eruptions cause local destruction of vegetation. Guatemala has currently three active volcanoes: Volcán Pacaya, dptos. Escuintla and Guatemala; Volcán de Fuego, dptos. Escuintla, Sacatepéquez, and Chimaltenango; and Volcán Santiaguito, dpto. Quetzaltenango.

13.4.3 Direct Persecution and Disturbance on Roost and Nest Sites

Direct persecution and disturbances on roost and nest sites are threats to owls, although the impact on populations has not been quantified. It is a common belief among the rural population of Guatemala, that owls attract death and illness (Eisermann and Avendaño 2015). This belief is common in many cultures (Enríquez and Mikkola 1997; Marks et al. 1999), including the Mayan culture, where owls are symbols of death and destruction (Tozzer and Allen 1910; Sharer 1994). Common names for American barn owl and for owls (involving all species) exist in all Mayan languages and in Garífuna (Appendix 13.2). It occurs that people kill owls when encountered and try to avoid that they vocalize near houses. For instance, in a village at Montaña Yalijux, dpto. Alta Verapaz, people cut an avocado tree because an owl was calling from it (Eisermann and Avendaño 2015). Villagers of Chicacnab (Montaña Caquipec) killed a young fulvous owl encountered along a forest trail (Eisermann and Avendaño 2015).

Owls are especially vulnerable on diurnal roost sites and on nest sites. Disturbances on these sites occur in part based on bad intentions, probably driven by superstitions, and in part based on ignorance. At Montaña Yalijux, Maya Q'eqchi' farmers destroyed intentionally broods of Guatemalan pygmy owl, bearded screech owl, and unspotted saw-whet owl (KE, pers. obs.; R. Rax, pers. comm.). Birdwatching is a rapidly developing pastime activity (La Rouche 2003), and Guatemala

is being promoted as a destination for traveling bird-watchers (Bland 2007; Eisermann 2007a, b, 2011a, Cocker 2008). Watching birds can cause negative impact upon populations (Sekercioglu 2002). Repeated broadcast of recorded vocalizations or vocalization imitations to attract owls, use of strong flashlights for seeing owls at night, flash photography, and knocking nest trees causing brooding birds to appear at the nest entrance may cause behavioral alterations and decreasing nesting success (Gehlbach and Gehlbach 2000). Negative impacts by bird-watchers in Guatemala have not been quantified.

Illegal trade is another cause of direct persecution. Vannini and Morales Cajas (1989) mentioned the capture of spectacled owl, Mexican wood owl, and pygmy owl (*Glaucidium* spp.). Local state authorities confiscated owls repeatedly in Guatemala. Rescue stations of the association ARCAS received a total of 63 owls from 2002 to 2015: 24 Mexican wood owls, 18 pygmy owls (*Glaucidium* spp.), 6 American barn owls, 5 striped owls, 5 great horned owls, 3 Guatemalan screech owls,1 black-and-white owl, and 1 unspotted saw-whet owl (ARCAS 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015). This equals 2.2% of the 2813 birds received, with parrots and parakeets (Psittacidae) being the most common.

The general lack of environmental awareness among the Guatemalan society, caused by low education level, lack of political will, social injustice, and poverty, is a major obstacle in reducing threats to owls in this country. Education deficiencies allow that superstitions of owls persist. According to an estimate by the Economic Commission for Latin America and the Caribbean, illiteracy rate was 25% of the Guatemalan population aged 15 years and older in 2010, and 55% lived in poverty in 2002, having an income below the basic food basket (CEPAL 2010). This indicates that improving education should be a key factor in a conservation strategy.

13.5 Conservation Strategies

The legal conditions in Guatemala are favorable for nature conservation. The country has an extensive network of protected areas based on a national law on protected areas. Guatemala has signed several international treaties. A network of Important Bird Areas has been identified, and Guatemala is part of the group of megadiverse countries since 2010. Conservation implementation, however, is still inefficient in Guatemala.

13.5.1 Protected Areas

The network of protected areas in Guatemala covers 32% of the country (CONAP 2011), based on a national law on protected areas (Ley de Áreas Protegidas, Decreto 4-89 and reforms Decretos 18-89, 110-96, 117-97 del Congreso de la República de

Guatemala). The National Council for Protected Areas (CONAP) is the government authority responsible for the management of protected areas, of which many are co-managed by other government agencies (e.g., National Forest Institute INAB and Institute for Archaeology and History IDAEH) and nongovernment organizations or private entities. Of the 192 protected areas declared from 2001 to 2010, 141 are private reserves (CONAP 2011).

13.5.2 Important Bird Areas

BirdLife International developed the Important Bird Area program as a prioritization tool to protect the world's birds as umbrella species for biodiversity conservation. These sites are identified based on populations of globally threatened species, species with restricted areas of distribution, biome-restricted species, and large bird aggregations (Devenish et al. 2009). The list of triggered species for the identification of IBAs in Guatemala included four owls: Pacific screech owl, whiskered screech owl, bearded screech owl, and fulvous owl (Eisermann and Avendaño 2009a, b). According to modern taxonomy, it should also include Guatemalan pygmy owl. The network of IBAs includes populations of all owl species of Guatemala. Three species (Ridgway's pygmy owl, Mexican wood owl, and great horned owl) have been recorded in at least 10 IBAs, 12 species in 5–9 IBAs, 4 species in 2–4 IBAs, and 1 species in a single IBA (Table 13.1).

The IBAs of Guatemala cover an area of 51,884 km^2 (48% of the country), and the size of the IBAs ranges from 43.6 to 20,950.9 km^2 (Fig. 13.1). Of the total area within IBAs, 61.2% (31,770 km^2) are covered with unaltered habitat (mainly primary forest, natural scrub, and wetlands). Habitat altered through human activity (mainly agricultural area and secondary growth scrub) covers 38.3% (19,885 km^2) of the IBA, and urban area covers 0.5% (229 km^2). Of the total area within IBAs in Guatemala, 60% (31,000 km^2) are located within protected areas, and 40% (20,884 km^2) lack legal protection. Seven of the 21 IBAs are legally protected in 0–5% of the area, five IBAs in 6–20% of the area, three IBAs in 21–50%, two IBAs in 51–90%, and four IBAs in 91–100% of the area (Eisermann and Avendaño 2009a).

13.5.3 International Conventions

The government of Guatemala signed several international conventions for the conservation of biodiversity, including the (1) Ramsar Convention for the conservation of wetlands, (2) Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), (3) United Nations Convention on Biological Diversity, (4) Convention on Climate Change, and (5) Convention for the Conservation of the Biodiversity and the Protection of Wilderness Areas in Central America.

13.5.4 Education

International conventions, declaration of protected areas, and the designation of Important Bird Areas are tools for defining the legal frame and priorities for conservation. Conservation, however, happens with and through the local people. Improving the education level is key factor for successful conservation in situ. Raising the basic education level would lead to a lower growth rate of the population and consequently reduce the pressure toward natural areas. Coverage of schools, also in remote villages, has improved considerably after signing the peace accords in 1996, which ended a 36-year civil war. Statistical indicators on school participation, however, reveal deficiencies of the Guatemalan education system. Only 46% of the population aged 13–15 years were attending high school in 2015 (Ministerio de Educación 2016). This number reflects the reality in many rural communities in Guatemala, where parents do not consider the education of their children a priority. Raising the education level and standard of living is a complex task, to be completed through local efforts by families, communities, national and international nongovernment organizations, and government agencies.

To reduce direct persecution of owls, it is necessary to improve the image of how Guatemalans perceive these birds. We recommend reinforcing environmental education in schools with dedicated information about the natural history and ecological role of owls. Involving public media, especially radio, which is still the most common media used in remote villages in Guatemala, but also TV, press, and social Internet media, may help to reach the adult population.

13.5.5 Alternative Land Use

Tourism is one of the main sectors of the Guatemalan economy, and nature tourism, especially bird-watching, is developing in the country. The income from visitors to state, community, or private protected areas can be considerable (Naidoo and Adamowicz 2005). In order to keep negative impacts by bird-watchers on owl populations as low as possible, we recommend following ethical principles of bird-watching (American Birding Association 2016).

13.6 Conclusions and Priorities for Future Research

Owls belong to the least studied birds in Guatemala (Eisermann and Avendaño 2006; Enríquez et al. 2012), for one resident species nesting has not even been reported (Table 13.1). In this chapter, we update information on distribution, habitat use, and relative abundance of previous compilations (Salvin and Godman 1897–1904; Ridgway 1914; Griscom 1932; Land 1970; Howell and Webb 1995; Enríquez et al. 2006; Eisermann and Avendaño 2007, 2015). Areas in Guatemala with few or

no data on the distribution of owls are located principally in the south of the country (dptos. Jalapa, Jutiapa, Chiquimula, and Santa Rosa; southern part of dptos. Escuintla, Suchitepéquez, and Retalhuleu) and in the semiarid highlands in the interior (southern part of dpto. Quiché, northern part of dptos. Totonicapán and Chimaltenango, western part of dpto. Baja Verapaz, dpto. Guatemala) (Fig. 13.2).

The majority of bird studies in Guatemala involving some species of owls are limited to data on presence. The quality of Neotropical bird studies has been criticized (Winker 1998; Vuilleumier 2004). Eisermann and Avendaño (2006) criticized that many of the ornithological studies in Guatemala remain unpublished; reports and digital data often become lost after some years if not deposited in public archives. To improve this situation, (1) we recommended to improve the study design, especially of rapid assessments carried out by nongovernment organizations, government agencies, and universities. Rapid assessments should include adequate methodologies to detect nocturnal species and determine their abundance. Fast technological development has made digital photography and digital voice recording widely accessible, which facilitate the documentation of field records. (2) We recommended including publication costs in study budgets. Many studies remain unpublished because of lack of funding. (3) If studies are not published formally, we recommended providing access to the data using public databases, such as eBird (Sullivan et al. 2009). Vocalizations can be deposited online via eBird or at xeno-canto (Planqué and Vellinga 2005).

The natural history of owls in Guatemala remains widely unstudied. No species has been studied thoroughly, including relatively common and widespread species such as Guatemalan screech owl and Ridgway's pygmy owl. The only owls with some natural history data published from Guatemala are Mexican wood owl, black-and-white owl, Guatemalan pygmy owl, bearded screech owl, unspotted saw-whet owl, stygian owl, and flammulated owl. During Peregrine Fund's Maya Project in northern dpto. Petén, Whitacre et al. (1991), Jones, and Sutter (1992) provided abundance data for Mexican wood owl, black-and-white owl, and Guatemalan screech owl. Census methodology was described by Whitacre et al. (1992). Gerhardt (1991) examined the reaction of Mexican wood owl to broadcasted vocalizations. Gerhardt et al. (1994a, b), Gerhardt and Gerhardt (2012), and Gerhardt et al. (2012) described breeding biology, home range, and food of Mexican wood owl and black-and-white owl in the Parque Nacional Tikal, and Gerhardt and Gerhardt (1997) published biometric data for both species. Eisermann and Howell (2011) described four different vocalizations of Guatemalan pygmy owl from the Guatemalan highlands, and Eisermann (2013) described vocalizations of unspotted saw-whet owl. Eisermann et al. (2017) described first nesting and habitat of flammulated owl in Guatemala. Holt et al. (2014) published the first evidence of breeding of stygian owl in Guatemala and Eisermann and Avendaño (2015) the first breeding records for Guatemalan pygmy owl, unspotted saw-whet owl, bearded screech owl, fulvous owl, and striped owl. The first nest site, roost sites, and biometric data for bearded screech owl were provided by Enríquez and Cheng (2008) and Enríquez et al. (2010) from Chiapas, Mexico. Because the area of distribution of this owl is small, including only the highlands of southeastern Chiapas and the Atlantic slope highlands of Guatemala, the ecology is presumably similar throughout the range. The ecology of other spe-

cies with more extensive distribution patterns may vary between regions. The knowledge on the natural history from other regions should be considered a starting point for studies in Guatemala. Current data on Neotropical owls were published in 18 country chapters by Enríquez (2015). The biology and ecology of species which occur also in North America and Europe, have been compiled elsewhere. The series *Birds of North America* covers the following owls also occurring in Guatemala: American barn owl (Marti 1992), flammulated owl (Linkhart and McCallum 2013), whiskered screech owl (Gehlbach and Gehlbach 2000), great horned owl (Houston et al. 1998), Ridgway's pygmy owl (Proudfoot and Johnson 2000), burrowing owl (Haug et al. 1993), and short-eared owl (Holt and Leasure 1993). Johnsgard (2002) and Weidensaul (2015) complied information for North American owls. One species, short-eared owl, occurs also in Europe, whose biology and ecology in this area has been described by Mikkola (1983) and Glutz von Blotzheim and Bauer (1994).

The phylogeny of owls is not yet fully resolved (Wink et al. 2004, 2008). Of the owls in Guatemala, the taxonomic status of the following taxa remains uncertain (Enríquez et al. 2015): American barn owl (relation between *Tyto furcata* in the New World and *T. alba* in the Old World), status of subspecies *Psiloscops flammeolus rarus* of flammulated owl, Pacific screech owl (relation between *M. cooperi* from southern Mexico to Costa Rica and *M. lambi* in Oaxaca, Mexico), Guatemalan screech owl (relation between *Megascops guatemalae* in Mexico and northern Central America and *M. vermiculatus* in southern Central America and northern South America), great horned owl (relation between the widespread *Bubo virginianus* and *B. magellanicus*, restricted to the Andes and southern South America) (Enríquez et al. 2015), Mexican wood owl (relation between *Strix squamulata* in Mexico, Central America, and northern South America and *S. virgata* in South America), genus *Ciccaba* (relation between genera *Ciccaba* and *Strix*), fulvous owl (relation between *Strix fulvescens* of northern Central America and southern Mexico and *Strix varia* in North America and northern Mexico), Guatemalan pygmy owl (relation between *Glaucidium cobanense* in southern Mexico and northern Central America, *G. gnoma* of northern Mexico, and *G. californicum* in western North America), Central American pygmy owl (relation between *Glaucidium griseiceps* and *G. minutissimum* s.l. in South America), unspotted saw-whet owl (relation between *Aegolius ridgwayi* and *A. acadicus*), and striped owl (status of the genus *Pseudoscops*). Further molecular and vocal analyses could provide new insight into the taxonomic status of owls in Guatemala.

The human population of Guatemala is growing rapidly, causing an increasing pressure on natural areas and owl habitat. Most owls of Guatemala live primarily in forests. Hence, the populations of most species are threatened. The conservation of Important Bird Areas (IBAs) in Guatemala could help to protect populations in the long term. Guatemalan IBAs support populations of all owl species recorded in the country. The key to efficient conservation in Guatemala is an improvement of the education.

We hope this compilation encourages (1) more studies on owls in Guatemala to fill gaps in our knowledge on abundance, habitat use, breeding biology, demography, and sensitivity toward human impacts and (2) more efforts to educate the Guatemalan society about owls. Guatemala carries a key responsibility for the conservation of some of Middle America's owl species.

Acknowledgments This compilation of the current knowledge on owls of Guatemala is based on a thorough ornithological bibliography for the country, which was supported by a multitude of persons and institutions (see acknowledgments in Eisermann and Avendaño 2006). We thank the following communities, institutions, and people, who have supported our field research on owls in Guatemala under the roof of PROEVAL RAXMU Bird Monitoring Program: communities of Rocjá Pomtilá, Sanimtacá, Xalabé, Samac, Loma Linda, Santa María Tzejá, Vega del Volcán, Unión Reforma, Sibinal, and Chiabal; Markus Reinhard, Vera Hurschler de Reinhard, and Armin Schumacher of Reserva Chelemhá; Andy Burge, Mónica Barrios, and staff of the Reserva Los Tarrales; Olga Hazard, Jim Hazard, Jaime Freire, and staff of Reserva Los Andes; Francisco Falla of Finca San Sebastián; Mario Aguilar, Lorena de Aguilar, Paulino Chuvac, and staff of Finca Patrocinio; Mayah and Jeffro of Reserva Laguna Lodge Atitlán; Carlos Mazariegos, Jamie Staples, Marcelino Orozco, and Saúl Sandoval (San Rafael Pie de la Cuesta); Misael Baltazar (Parque Regional Municipal San Pedro Sacatepéquez, dpto. San Marcos), Elías Barrera López (CONAP, Uspantán), Kyle Richard (Peace Corps, Sibinal), David Unger (PROEVAL RAXMU), Esteban Matías (Chiabal); Vinicio Bravo, Otilio Bravo, and Román Bartolón (Asociación de Desarrollo Agroforestal Integral Sostenible – ADAFIS); and Rafael Esquivel and José Roberto Jarquín. The National Council of Protected Areas (CONAP) provided research permits.

We thank the following persons for contributing unpublished data: Rogelio Rax Xo, Ernesto Chalib Rax, Juan Mez Saquí, Ernesto Col, Efraín Pop Chub, Efraín Caal, and Roberto Caal (PROEVAL RAXMU Bird Monitoring Program); Susanne Arbeiter (PROEVAL RAXMU Bird Monitoring Program and Fachhochschule Eberswalde, Germany), Roan B. McNab, and Marcial Córdova (Wildlife Conservation Society, Guatemala); Andy Burge, Josué de León Lux, and Gerardo López (Lalo); Everilda Buchán, Léster de León Lux, and Aaron de León Lux (Reserva Los Tarrales); Jesús Lucas Yuxón (Reserva Los Andes); Colum Muccio, Oda Ericastilla, and Luisa María Ortiz Samayoa (ARCAS); Steve Howell (Point Reyes Bird Observatory); Kurt Duchez, Franklin Herrera, and Julio Romero (CONAP Central); Eugenio Gobbato (Hacienda Tijax); and Rafael Esquivel, Jason Berry, Kate Cleary, Jean-Luc Betoulle, Nicholas Komar, Aquiles Estuardo Hernández, Javier Rivas, Robin Schiele, Claudia Múnera, Roger Wilson, Daniel Tenez, Jorge Antonio Jarquín, Abel Alejandro Anzueto, Janet S. Duerr, Olivier Barden, María Vicente Hernández, Carol Anderson, John Paul Cahill, Melvin Rivera Mejía, Luis Oliveros, Alfonso Chávez, and participants of the Christmas Bird Counts in Tikal, Antigua Guatemala, and at Volcán Atitlán organized by CAYAYA BIRDING. Thanks to Eugenio Gobbato, Susanne Arbeiter, and Melvin Rivera Mejía for the contribution of photographs. We thank Sylke Frahnert and Pascal Eckhoff for access and assistance during reviewing specimens in Zoological Museum Berlin (ZMB), Germany; Mayra Maldonado (Zoological collection of the Universidad Del Valle de Guatemala) and Brenda Chávez (Natural History Museum of Universidad de San Carlos de Guatemala) for facilitating access to the collection under their responsibility; and Claudia Múnera for reviewing specimens. Betsy Sánchez of Garífuna Cultural Center, Livingston, and Tomás Sánchez translated common names into Garífuna.

We appreciate comments on an earlier version of the manuscript by three anonymous reviewers, improvements on the English usage provided by an anonymous reviewer, and editorial efforts by Paula L. Enríquez. This contribution of the PROEVAL RAXMU Bird Monitoring Program includes data collected during projects supported by US Fish and Wildlife Service, Stiftung Artenschutz, Germany; Verein Sächsischer Ornithologen, Germany; Unión para Proteger el Bosque Nuboso (UPROBON), Guatemala; Reserva Los Tarrales, Heifer International Guatemala, Austrian Development Agency, Asociación de Desarrollo Agroforestal Integral Sostenible (ADAFIS), and CAYAYA BIRDING, Guatemala.

Appendix 13.1

Geographic coordinates of all sites mentioned in the text and relative abundance of owls at 105 sites

Site	Geographic coordinates	References[a]	Region[b]	Relative abundance index for each species[c]																			
				TYT FUR	PSI FLA	MEG COO	MEG TRI	MEG BAR	MEG GUA	BUB VIR	PUL PER	STR SQU	CIC NIG	STR FUL	LOP CRI	GLA COB	GLA GRI	GLA RID	ATH CUN	AEG RID	ASI STY	ASI CLA	ASI FLA
Agua Escondida, dpto. Sololá	14.6641°N 91.1072°W																						
Alotenango, dpto. Sacatepéquez	14.4869°N 90.8050°W																						
Antigua Guatemala, dpto. Sacatepéquez	14.5586°N 90.7331°W	R. Wilson, Eisermann and Avendaño (2015)	H	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Área de Uso Múltiple Monterrico, dpto. Santa Rosa	13.8986°N 90.4703°W	Dickerman and Brash (1980), Robbins and Dowell (1992), Dickerman (2007); O. Barden in Eisermann and Avendaño (2015); KE and CA, pers. obs.; A. Chávez, Personal Communication	P	1	0	2	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	1	0
Área de Uso Múltiple Río Sarstún, dpto. Izabal	15.9029°N 88.9986°W	Arrivillaga et al. (1992), J. Fagan and L. Andino in Jones and Komar (2010a)	A	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Archaeological site El Mirador, dpto. Petén	17.7531°N 89.9174°W	Budney et al. 2008	A	0	0	0	0	0	3	0	0	4	0	0	0	0	0	0	0	0	0	0	0
Archaeological site El Perú, dpto. Petén	17.2717°N 90.3656°W		See data for Parque Nacional Laguna del Tigre																				
Archaeological site El Tintal, dpto. Petén	17.5761°N 89.9991°W	Budney et al. (2008)	A	2	0	0	0	0	3	0	0	4	3	0	0	0	0	0	0	0	0	0	0

Biotopo Chocón Machacas, dpto. Izabal	15.7628°N 88.9048°W	Pérez Consuegra et al. (2001)	A	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Biotopo Mario Dary, dpto. Baja Verapaz	15.2134°N 90.2203°W	Bardolf and Bauer (1992), Eisermann and Avendaño (2006, 2015)	H	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	1	0	0
Biotopo Naachtún - Dos Lagunas, dpto. Petén	17.7384°N 89.5566°W	Whitacre et al. (1991), Jones and Sutter (1992)	A	0	0	0	0	0	4	0	0	4	2	0	0	0	0	0	0	0	0	0	0
Biotopo San Miguel La Palotada - El Zotz, dpto. Petén	17.2340°N 89.8069°W	Whitacre et al. (1991), Jones and Sutter (1992)	A	0	0	0	0	0	4	0	0	4	2	0	0	0	0	0	0	0	0	0	0
Buena Vista, Parque Nacional Laguna del Tigre, dpto. Petén	17.2961°N 90.1267°W		See data for Parque Nacional Laguna del Tigre																				
Cahabón, dpto. Alta Verapaz	15.6059°N 89.8123°W																						
Carmelita, dpto. Petén	17.4618°N 90.0556°W	Molina (1998)	A	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Cebollito, dpto. Santa Rosa	13.8748°N 90.4281°W		See data for Área de Uso Múltiple Monterrico																				
Cerro Cruz Maltín, dpto. Huehuetenango	15.6803°N 91.2402°W	Garcia Barrientos and Gaitán González (2003)	H	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Cerro El Amay, dpto. Quiché	15.4945°N 90.7989°W	Eisermann et al. (2013), Eisermann and Avendaño (2015)	H	0	0	0	0	4	3	0	0	4	0	3	0	2	1	0	0	1	0	0	0

(continued)

Site	Geographic coordinates	References[a]	Region[b]	Relative abundance index for each species[c]																			
				TYT FUR	PSI FLA	MEG COO	MEG TRI	MEG BAR	MEG GUA	BUB VIR	PUL PER	STR SQU	CIC NIG	STR FUL	LOP CRI	GLA COB	GLA GRI	GLA RID	ATH CUN	AEG RID	ASI STY	ASI CLA	ASI FLA
Cerro Montecristo, dpto. Chiquimula	14.4167°N 89.3500°W	Herrera et al. (1998), Komar (2000), Eisermann (2006)	H	0	0	0	1	0	0	1	1	1	0	1	0	0	0	1	0	0	0	0	0
Cerro San Gil, dpto. Izabal	15.6667°N 88.7833°W	Robbins and Dowell (1992, 1993, 1995); Dowell et al. (1994), Robbins (1996), Cerezo (2001), Cerezo et al. (2005), Eisermann and Avendaño (2015)	A	0	0	0	0	0	4	0	2	4	2	0	1	0	3	1	0	0	0	0	0
Cerro Tecpán, dpto. Chimaltenango	14.7828°N 91.0268°W	Eisermann and Avendaño (2015)	H	0	0	0	2	0	0	2	0	0	0	0	0	1	0	0	0	2	0	0	0
Cobán, dpto. Alta Verapaz	15.4705°N 90.3701°W	Eisermann and Avendaño (2015)	H	1	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0
Champerico, dpto. Retalhuleu	14.2954°N 91.9107°W																						
El Cacahuito, dpto. Santa Rosa	14.0904°N 90.4469°W																						
El Estor, dpto. Izabal	15.5249°N 89.3354°W	Dowell et al. (1994)	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
El Jobal, dpto. Huehuetenango	15.6167°N 91.9333°W	Sandoval (2000)	P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
El Rancho, dpto. El Progreso	14.9158°N 90.0074°W																						
El Remate, dpto. Petén	16.9943°N 89.6922°W	KE, O. Barden, J. P. Cahill in Eisermann and Avendaño (2015)	A	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0

Escuintla, dpto. Escuintla	14.3057°N 90.7840°W																						
Finca Cataluña, dpto. Retalhuleu	14.4727°N 92.0241°W	J. Berry in Eisermann and Avendaño (2015)	P	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Finca Chaculá and Yalambojoch, dpto. Huehuetenango	15.9754°N 91.6517°W	KE and CA, pers. obs., R. A. Jiménez, Personal Communication	H	0	0	0	1	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Finca Dos Marias, dpto. San Marcos	14.8174°N 91.8054°W	D.S. Cooper in Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Finca El Carmen, dpto. Huehuetenango	15.9167°N 91.7167°W	Sandoval (2000)	H	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Finca El Faro Volcán Santa María (<1000 m), dpto. Quetzaltenango	14.6755°N 91.5819°W	Vannini (1989), Morales Cajas (1991)	P	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Finca El Faro, Volcán Santa María (>1000 m), dpto. Quetzaltenango	14.6755°N 91.5819°W	Vannini (1989), Morales Cajas (1991)	H	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0
Finca El Pilar, dpto. Sacatepéquez	14.5333°N 90.7000°W	Eisermann (2010a); Eisermann and Avendaño (2015); KE, pers. obs.	H	0	0	0	1	0	0	1	0	2	1	3	0	2	0	0	0	1	1	0	0
Finca El Zur, dpto. Escuintla	14.4072°N 90.7564°W		See data for Volcán Agua																				
Finca Filadelfia, dpto. Sacatepéquez	14.6016°N 90.7196°W	Eisermann (2010a), J. Fagan in Jones and Komar 2010a, Eisermann and Avendaño (2015)	H	0	0	0	3	0	0	2	0	3	0	2	0	0	0	2	0	1	0	0	0

(continued)

Site	Geographic coordinates	References[a]	Region[b]	Relative abundance index for each species[c]																			
				TYT FUR	PSI FLA	MEG COO	MEG TRI	MEG BAR	MEG GUA	BUB VIR	PUL PER	STR SQU	CIC NIG	STR FUL	LOP CRI	GLA COB	GLA GRI	GLA RID	ATH CUN	AEG RID	ASI STY	ASI CLA	ASI FLA
Finca Las Nubes, dpto. Suchitepéquez	14.6668°N 91.4914°W																						
Finca Los Cimientos, dpto. Huehuetenango	15.8833°N 91.8167°W	Sandoval (2000)	P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Finca Patoquer, dpto. Chimaltenango	14.6505°N 91.0297°W	C. Prahl in Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Finca Patrocinio, dpto. Quetzaltenango	14.6600°N 91.6000°W	J. Berry in Eisermann and Avendaño (2015), Eisermann and Avendaño (2015)	P	0	0	0	0	0	1	0	0	4	0	0	0	0	0	2	0	0	0	0	0
Finca San Diego, dpto. Escuintla	14.4142°N 90.7867°W																						
Finca San Francisco, dpto. Huehuetenango	15.9833°N 91.5500°W	Sandoval (2000)	H	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Finca Santa Victoria, dpto. Sololá	14.7692°N 91.1340°W	Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Gualán, dpto. Zacapa	15.1136°N 89.3588°W																						
Guatemala City, dpto. Guatemala	14.6190°N 90.5246°W	Eisermann and Avendaño (2015), C. Múnera in Eisermann and Avendaño (2015), ARCAS, CONAP, MUSHNAT	H	0	0	0	1	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0

Hacienda California, dpto. San Marcos	14.5592°N 92.1753°W																						
Huehuetenango, dpto. Huehuetenango	15.3201°N 91.4702°W																						
La Avellana, dpto. Santa Rosa	13.9212°N 90.4675°W			See data for Área de Uso Múltiple Monterrico																			
La Cumbre, El Paraíso, Cuilco, dpto. Huehuetenango	15.5500°N 91.9833°W	Sandoval (2000)	H	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
La Pasadita (archaeological site), dpto. Petén	17.0095°N 91.0621°W																						
Laguna Lodge Eco-Resort and Nature Reserve, dpto. Sololá	14.7433°N 91.1972°W	Eisermann and Avendaño (2015)	H	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Laguna Yolnabaj, dpto. Huehuetenango	16.0333°N 91.5833°W	Sandoval (2000)	H	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Lake Güija, dpto. Jutiapa	14.2667°N 89.5500°W	Herrera (2005)	P	1	0	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0
Lanquín, dpto. Alta Verapaz	15.5761°N 89.9803°W																						
Loma Linda, dpto. Quetzaltenango	14.7287°N 91.6270°W	Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	1	0	0
Los Robles, dpto. Sololá	14.7048°N 91.0853°W																						

(continued)

Site	Geographic coordinates	References[a]	Region[b]	Relative abundance index for each species[c]																			
				TYT FUR	PSI FLA	MEG COO	MEG TRI	MEG BAR	MEG GUA	BUB VIR	PUL PER	STR SQU	CIC NIG	STR FUL	LOP CRI	GLA COB	GLA GRI	GLA RID	ATH CUN	AEG RID	ASI STY	ASI CLA	ASI FLA
Manchón-Guamuchal, dptos. Retalhuleu and San Marcos	14.4368°N 92.0914°W	J. Berry in Eisermann and Avendaño (2015), K. Eisermann and C. Avendaño, pers. obs., J. de León Lux, eBird, S20373838	P	0	0	3	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	1	0
Mazatenango, dpto. Suchitepéquez	14.5339°N 91.5042°W																						
Momostenango, dpto. Totonicapán, 7 km south of town	14.9825°N 91.4370°W	Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Montaña Caquipec, dpto. Alta Verapaz	15.3667°N 90.1833°W	Eisermann and Schulz (2005)	H	0	0	0	0	0	0	0	0	1	0	4	0	2	0	0	0	1	0	0	0
Montaña Guaxac (<1000 m), dpto. Alta Verapaz	15.3333°N 90.1333°W	Eisermann (2001b)	A	0	0	0	0	0	1	0	0	4	0	0	0	0	0	3	0	0	0	0	0
Montaña Guaxac (>1000 m), dpto. Alta Verapaz	15.3333°N 90.1333°W	Eisermann (2001b)	H	0	0	0	0	1	2	0	0	4	0	0	0	0	0	3	0	0	0	0	0
Montaña Sacranix (<1000 m), Alta Verapaz	15.5203°N 90.4658°W	Eisermann (2001b)	A	1	0	0	0	0	4	0	0	4	0	0	0	0	2	3	0	0	0	0	0
Montaña Sacranix (>1000 m), dpto. Alta Verapaz	15.5203°N 90.4658°W	Eisermann (2001b)	H	1	0	0	1	0	4	0	0	4	0	0	0	2	0	3	0	0	0	0	0

Montaña Yalijux (>1000 m), dpto. Alta Verapaz	15.3971°N 90.0496°W	Renner et al. (2006), Eisermann and Avendaño (2015); KE, pers. obs.	H	1	0	0	0	4	0	0	0	1	0	4	1	2	0	1	0	2	0	0	0
Monterrico, dpto. Santa Rosa	13.8926°N 90.4800°W		See data for Área de Uso Múltiple Monterrico																				
Monumento Cultural Aguateca, dpto. Petén	16.3914°N 90.2284°W	AHT International (2000)	A	0	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0
Monumento Cultural Ceibal, dpto. Petén	16.5067°N 90.0739°W	AHT International (2000)	A	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Morazán, dpto. El Progreso	14.9335°N 90.1423°W	Eisermann and Avendaño (2015)	A	0	0	0	0	0	2	0	0	0	0	0	0	0	0	4	0	0	0	0	0
Novillero (Parque Corazón del Bosque), dpto. Sololá	14.7941°N 91.2678°W	Eisermann and Avendaño (2015)	H	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Ocós, dpto. San Marcos	14.5080°N 92.1946°W																						
Panajachel, dpto. Sololá	14.7396°N 91.1595°W																						
Panzós, dpto. Alta Verapaz	15.3996°N 89.6407°W																						
Parque Nacional El Rosario, dpto. Petén	16.5198°N 90.1584°W																						

(continued)

Site	Geographic coordinates	References[a]	Region[b]	Relative abundance index for each species[c]																			
				TYT FUR	PSI FLA	MEG COO	MEG TRI	MEG BAR	MEG GUA	BUB VIR	PUL PER	STR SQU	CIC NIG	STR FUL	LOP CRI	GLA COB	GLA GRI	GLA RID	ATH CUN	AEG RID	ASI STY	ASI CLA	ASI FLA
Parque Nacional Laguna del Tigre, dpto. Petén	17.5045°N 90.6780°W	Baumgarten (1998), Ordoñez (1998), Castillo Villeda (2001); M. Córdova, M. Rivera Mejía in Eisermann and Avendaño (2015), J. P. Cahill in Jones and Komar (2015)	A	1	0	0	0	0	1	0	1	4	2	0	1	0	0	1	0	0	0	1	0
Parque Nacional Laguna Lachuá, dpto. Alta Verapaz	15.9167°N 90.6667°W	Avendaño (2001), Eisermann (2001b), Eisermann and Avendaño (2015)	A	1	0	0	0	0	3	0	1	4	2	0	2	0	2	1	0	0	0	0	0
Parque Nacional Mirador-Río Azul, dpto. Petén	17.7500°N 89.3333°W	Radachowsky et al. (2004)	A	0	0	0	0	0	3	0	0	4	1	0	0	0	0	0	0	0	0	0	0
Parque Nacional Sierra del Lacandón, dpto. Petén	17.0298°N 90.9571°W	Morales (2001), Puebla-Olivares et al. (2002), Tenez (2007), R.B. McNab in Eisermann and Avendaño (2015)	A	1	0	0	0	0	1	0	1	3	1	0	1	0	1	1	0	0	0	0	0
Parque Nacional Tikal, dpto. Petén	17.2333°N 89.6167°W	Beavers et al. (1991), Beavers (1992), Gerhardt et al. (1994a), Eisermann (2007c, 2008b, 2009b, 2010c), L. Oliveros in Eisermann and Avendaño (2015)	A	0	0	0	0	0	2	0	1	3	2	0	1	0	1	1	0	0	0	0	0
Parque Nacional Yaxhá-Nakum-Naranjo, dpto. Petén	17.1327°N 89.4124°W	Seavy et al. (1995), J. P. Cahill (eBird)	A	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0

Parque Regional Municipal Canjulá, Sibinal, dpto. San Marcos	15.1295°N 92.0619°W	Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Parque Regional Municipal Lo de China, El Jícaro, dpto. El Progreso	14.8959°N 89.8860°W	Eisermann and Avendaño (2015)	A	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0
Parque Regional Municipal Los Altos de San Miguel Totonicapán, dpto. Totonicapán	14.9223°N 91.3323°W	Eisermann and Avendaño (2015), J. Berry, K. Cleary, J. P. Cahill in Eisermann and Avendaño (2015)	H	1	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0
Parque Regional Municipal Niño Dormido, Cabañas, dpto. Zacapa	14.9099°N 89.8109°W	Eisermann and Avendaño (2015)	A	0	0	1	0	0	2	0	0	0	0	0	0	0	0	3	0	0	0	0	0
Parque Regional Municipal San Pedro Sacatepéquez, dpto. San Marcos	15.0085°N 91.7939°W	Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0
Parque Regional Municipal Todos Santos Cuchumatán, dpto. Huehuetenango	15.5313°N 91.5823°W	García Barrientos and Gaitán González (2003), Eisermann et al. (2017), KE and CA, pers. obs.	H	0	1	0	0	0	0	1	0	0	0	0	0	2	0	0	0	2	0	0	0
Parramos, dpto. Chimaltenango	14.6095°N 90.8030°W																						
Patzún, dpto. Chimaltenango	14.6834°N 91.0148°W																						

(continued)

Site	Geographic coordinates	References[a]	Region[b]	Relative abundance index for each species[c]																		
				TYT FUR	PSI FLA	MEG COO	MEG TRI	MEG BAR	MEG GUA	BUB VIR	PUL PER	STR SQU	CIC NIG	STR FUL	LOP CRI	GLA COB	GLA GRI	GLA RID	ATH CUN	AEG RID	ASI STY	ASI CLA	ASI FLA
Pepajau, dpto. Huehuetenango	15.5373°N 91.4279°W	Garcia Barrientos and Gaitán González (2003)	H	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Puerto Barrios, dpto. Izabal	15.7351°N 88.5980°W	J.-L. Betoulle in Eisermann and Avendaño (2015)	A	2	0	0	0	0	0	0	0	2	0	0	0	0	0	3	0	0	0	1	0
Puerto San José, dpto. Escuintla	13.9246°N 90.8210°W																						
Quetzaltenango, dpto. Quetzaltenango	14.8333°N 91.5167°W																						
Refugio de Vida Silvestre El Pucté, dpto. Petén	16.6277°N 90.3749°W	AHT International (2000)	A	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Refugio de Vida Silvestre Petexbatún, dpto. Petén	16.4507°N 90.1814°W	AHT International (2000)	A	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Refugio de Vida Silvestre Punta de Manabique, dpto. Izabal	15.8000°N 88.4167°W	Eisermann (2001a), J. P. Cahill, eBird, S15494859	A	0	0	0	0	0	0	0	1	4	1	0	0	0	0	2	0	0	0	0	0
Refugio de Vida Silvestre Xutilhá, dpto. Petén	16.3460°N 89.7714°W	AHT International (2000)	A	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Refugio del Quetzal (municipal reserve of San Rafael Pie de la Cuesta), dpto. San Marcos	14.9398°N 91.8748°W	Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0

Reserva Atitlán, dpto. Sololá	14.7524°N 91.1673°W	Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Reserva Biológica San Román, dpto. Petén	16.2826°N 90.2950°W	AHT International (2000)	A	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Reserva Chelemhá, dpto. Alta Verapaz	15.3833°N 90.0667°W			See data for Montaña Yalijux																			
Reserva de Biosfera Montañas Mayas Chiquibul, dpto. Petén	16.4477°N 89.2910°W	AHT International (2000)	A	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
Reserva Heloderma, El Arenal, Cabañas, dpto. Zacapa	14.8625°N 89.7898°W	J. Berry, J. P. Cahill in Jones and Komar (2013); J. P. Cahill and K. V. Vusse, eBird (S21596821)	A	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Reserva Los Andes, dpto. Suchitepéquez	14.5333°N 91.1833°W			See data for Volcán Atitlán																			
Reserva Los Tarrales, dpto. Suchitepéquez	14.5333°N 91.1667°W			See data for Volcán Atitlán																			
Reserva Pachuj and Cerro Iquitiú, dpto. Sololá	14.61188°N 91.1259°W	Valdez et al. (1999), Eisermann (2009a), Eisermann and Avendaño (2015)	H	0	0	0	1	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0
Rincón Grande, dpto. Baja Verapaz	15.0352°N 90.3430°W	Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0

(continued)

Site	Geographic coordinates	References[a]	Region[b]	Relative abundance index for each species[c]																		
				TYT FUR	PSI FLA	MEG COO	MEG TRI	MEG BAR	MEG GUA	BUB VIR	PUL PER	STR SQU	CIC NIG	STR FUL	LOP CRI	GLA COB	GLA GRI	GLA RID	ATH CUN	AEG RID	ASI STY	ASI CLA	ASI FLA
Río Dulce (Fronteras), dpto. Izabal	15.6608°N 89.0070°W	Rotenberg (2007); E. Gobbato in Eisermann and Avendaño (2015), Eisermann and Avendaño (2015)	A	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0
Sabana Grande, dpto. Chiquimula	14.7373°N 89.5566°W	Eisermann and Avendaño (2015)	A	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Sacapulas, dpto. Quiché	15.2879°N 91.0902°W																						
San Benito, dpto. Petén	16.9237°N 89.9180°W																						
San Bernardo, dpto. Guatemala	14.8777°N 90.4387°W																						
San Carlos Sija, dpto. Quetzaltenango	14.9858°N 91.5426°W	Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
San Gerónimo, dpto. Baja Verapaz	15.0605°N 90.2386°W																						
San Joaquín, dpto. Alta Verapaz	15.3349°N 90.4774°W	Eisermann and Avendaño (2015)	H	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
San Lucas Tolimán, dpto. Sololá	14.6335°N 91.1456°W																						
San Miguel Dueñas, dpto. Sacatepéquez	14.5238°N 90.7971°W	Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
San Pedro Mártir, dpto. Escuintla	14.3442°N 90.7477°W																						

Santa Bárbara, dpto. Baja Verapaz	15.0715°N 90.1805°W																						
Santa María de Jesús, dpto. Quetzaltenango	14.7236°N 91.5254°W	J. Berry in Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
Santa María Tzejá, dpto. Quiché	15.8662°N 90.8901°W	Eisermann (2011c)	A	1	0	0	0	0	2	0	0	2	1	0	0	0	2	0	0	0	0	0	0
Santa Rosa, Cuilco, dpto. Huehuetenango	15.4518°N 92.0089°W																						
Selempín, dpto. Izabal	15.3190°N 89.4071°W	Seglund and Conner (1997)	A	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Semuc Champey, dpto. Alta Verapaz	15.5340°N 89.9587°W	A. Monroy Ojeda in Jones and Komar (2010b), Eisermann and Avendaño (2015)	A	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0
Sierra Chinajá, dpto. Alta Verapaz	15.9896°N 90.2198°W	APROBA SANK (2006)	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Sierra de las Minas (>1000 m), dptos. El Progreso and Zacapa	15.1426°N 89.8314°W	Land (1962b), Robbins and Dowell (1992), Eisermann (1999), Eisermann and Avendaño (2015)	H	0	0	0	0	1	0	0	0	1	0	1	0	1	0	0	0	1	0	0	0
Sierra del Merendón, incl. Sierra Caral and Sierra del Espíritu Santo, dpto. Izabal	15.4500°N 88.5667°W	Arrivillaga et al. (1992), Cerezo and Ramírez (2003), J. P. Cahill (eBird, S11305278)	A	0	0	0	0	0	1	0	0	1	1	0	1	0	2	1	0	0	0	0	0

(continued)

Site	Geographic coordinates	References[a]	Region[b]	Relative abundance index for each species[c]																			
				TYT FUR	PSI FLA	MEG COO	MEG TRI	MEG BAR	MEG GUA	BUB VIR	PUL PER	STR SQU	CIC NIG	STR FUL	LOP CRI	GLA COB	GLA GRI	GLA RID	ATH CUN	AEG RID	ASI STY	ASI CLA	ASI FLA
Sierra Santa Cruz, dpto. Izabal	15.6333°N 89.4167°W	Arrivillaga et al. (1992), Pérez (1998), Cerezo and Ramírez (2002)	A	0	0	0	0	0	3	0	0	3	0	0	1	0	3	1	0	0	0	0	0
Soloma, dpto. Huehuetenango	15.6575°N 91.4322°W																						
Sumpango, dpto. Chimaltenango	14.6471°N 90.7358°W	MUSHNAT	H	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Takalik Abaj, dpto. Retalhuleu	14.6466°N 91.7362°W	J. Berry, C. Múnera, R. Schiele in Eisermann and Avendaño (2015), Eisermann and Avendaño (2015)	P	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0
Tontem, dpto. Alta Verapaz	15.4153°N 90.4032°W	Eisermann and Avendaño (2015); KE, pers. obs.	H	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Tulumaje, dpto. El Progreso	14.9276°N 90.0326°W																						
Unicornio Azul, Chiantla, dpto. Huehuetenango	15.3923°N 91.3809°W	Eisermann and Avendaño (2015), KE, pers. obs.	H	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Unión Reforma, Sibinal, dpto. San Marcos	15.1633°N 92.0199°W	Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Uspantán, dpto. Quiché	15.3480°N 90.8698°W																						
Usumatlán, dpto. Zacapa	14.9469°N 89.7767°W																						
Polochic valley near Tucurú, dpto. Alta Verapaz	15.2744°N 90.0932°W	Sigüenza (1997)	A	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0

Vega del Volcán, Sibinal, dpto. San Marcos	15.1523°N 92.0830°W	KE and CA, pers. obs.	H	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0
Volcán Acatenango, dpto. Sacatepéquez	14.5068°N 90.8741°W	Tenez (2005a), Eisermann and Avendaño (2015)	H	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	0	0
Volcán de Agua (>1000 m), dpto. Sacatepéquez	14.4673°N 90.7407°W	Eisermann and Avendaño (2015); D. Aldana, eBird (S25925893, S17510117, S30623549)	H	0	0	0	1	0	0	0	0	2	1	1	0	1	0	2	0	1	0	0	0
Volcán Atitlán (<1000 m), dpto. Suchitepéquez	14.5821°N 91.1876°W	Eisermann (2008a, 2009a, 2010b), A.A. Anzueto, J. de León Lux in Eisermann and Avendaño (2015), Eisermann and Avendaño (2015); J. de León Lux, Personal Communication	P	1	0	0	0	0	0	0	1	4	2	0	0	0	1	3	0	0	0	0	0
Volcán Atitlán (>1000 m) dptos. Suchitepéquez and Sololá	14.5821°N 91.1876°W	Eisermann (2008a), Eisermann and Avendaño (2015), C. Múnera in Eisermann and Avendaño (2015)	H	1	0	0	0	0	0	1	0	4	2	3	0	2	0	2	0	1	1	0	0
Volcán Candelaria, dpto. Quetzaltenango	14.8000°N 91.5167°W	J. Berry in Eisermann and Avendaño (2015)	H	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	0

(continued)

Site	Geographic coordinates	References[a]	Region[b]	Relative abundance index for each species[c]																		
				TYT FUR	PSI FLA	MEG COO	MEG TRI	MEG BAR	MEG GUA	BUB VIR	PUL PER	STR SQU	CIC NIG	STR FUL	LOP CRI	GLA COB	GLA GRI	GLA RID	ATH CUN	AEG RID	ASI STY	ASI CLA	ASI FLA
Volcán Fuego, dptos. Sacatepéquez, Escuintla, and Chimaltenango	14.4750°N 90.8808°W	Tenez (2005a), C. Múnera in Eisermann and Avendaño (2015)	H	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
Volcán Lacandón, dpto. Quetzaltenango	14.8164°N 91.7170°W	Tenez (2005b)	H	0	0	0	0	0	0	0	0	4	0	0	0	0	0	3	0	0	0	0	0
Volcán San Pedro, dpto. Sololá	14.6594°N 91.2658°W	J. Rivas, J.S. Duerr, Carol Anderson in Eisermann and Avendaño (2015)	H	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0
Volcán Santa María, dpto. Quetzaltenango	14.7569°N 91.5520°W																						
Volcán Santiaguito, dpto. Quetzaltenango	14.7426°N 91.5709°W																						
Volcán Santo Tomás-Zunil, dptos. Quetzaltenango and Suchitepéquez	14.7331°N 91.4694°W	Brooks and Gee (2006), J. Berry in Eisermann and Avendaño (2015), Eisermann and Avendaño (2015), M. Retter, eBird (S31493329); J. P. Cahill, eBird (S17051774); A. P. Oxom, eBird (S17399804)	H	0	0	0	2	0	0	0	0	3	1	3	0	1	0	1	0	2	0	0	0

Volcán Suchitán, dpto. Jutiapa	14.4000°N 89.7833°W	Valdez et al. (1999), Museum of Vertebrate Zoology-UC Berkeley- MVZ Bird Collection (2015)	H	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
Volcán Tolimán, dpto. Sololá	14.6230°N 91.1861°W																						

[a]Abbreviations used in references: *ARCAS* Asociación de Rescate y Conservación de Vida Silvestre, *CONAP* Consejo Nacional de Áreas Protegidas, *MUSHNAT* Museo de Historia Natural de la Universidad de San Carlos de Guatemala

[b]Ornithogeographic region: *A* Atlantic slope lowlands, *H* highlands, *P* pacific slope lowlands

[c]Index of relative abundance (based on data from 1989 to 2016): 0, not recorded; 1, rare (few records, low probability to detect the species in a week of observation, or single record for a site); 2, uncommon (high probability to detect the species in a week of observation); 3, fairly common (high probability to detect an individual/territory in a day of observation); 4, common (high probability to detect several individuals/territories in a day of observation). Species codes: TYTFUR, American barn owl; PSIFLA, flammulated owl; MEGCOO, Pacific screech owl; MEGTRI, whiskered screech owl; MEGBAR, bearded screech owl; MEGGUA, Guatemalan screech owl; BUBVIR, great horned owl; PULPER, spectacled owl; STRSQU, Mexican wood owl; CICNIG, black-and-white owl; STRFUL, fulvous owl; LOPCRI, crested owl; GLACOB, Guatemalan pygmy owl; GLAGRI, Central American pygmy owl; GLARID, Ridgway's pygmy owl; ATHCUN, burrowing owl; AEGRID, unspotted saw-whet owl; ASISTY, stygian owl; ASICLA, striped owl; ASIFLA, short-eared owl

Appendix 13.2

Common names for American barn owl (*Tyto furcata*) and owls (Strigidae) in the majority of languages in Guatemala

Language	Common name for American barn owl *Tyto furcata*	Common name for owl (*Strigidae*)[a]
Spanish	Lechuza	Tecolote, búho
Achí	Xooch'	Tukur
Kaqchikel	Xoch'	Tukre
K'iche'	Xooch'	Tukur
Poqomam	Kuxkux	Tuhkur
Poqomchii'	Xooch'	Tuhkur
Q'eqchi'	Hoob'aq	Warom
Sakapulteko	Xoch'	Tukur
Sipakapense	Sootz'	Tukr
Tz'utujiil	Xo'uuch'	Xken
Uspanteko	Wupup	Tukur
Akateko	Tonton	Tukulin
Chuj	Tzulpop	Tukul
Popti'	No'huh	No'ku'
Q'anjob'al	Chulpop	Tukur, tonton
Ch'orti'	Xo'ch	Tijkirin
Itzaj	Xooch	B'uj
Mopan	Ch'aaw	Buj
Ixhil	Xotx'	Tuuqul
Mam	Xitx'	Tukru
Awakateko	Tukuru	Tukuru
Garífuna	Duguyu	Duguyu

According to Cú Cab et al. (2003), B. Sánchez y T. Sánchez (Personal Communication)

[a]The common name *tecolote* derives from Nahuatl *tecolotl*, origin of the name of the town Teculután, dpto. Zacapa. In several Mayan languages, it translates to "tucur" (Cú Cab et al. 2003), an onomatopoeic word related to owl vocalizations. The name of the town Tucurú, dpto. Alta Verapaz, is based on this word (Sandoval 1942)

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