Chapter 12
Birds

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Abstract In this chapter, we present the current situation faced by 30 species of the Yucatán Peninsula which conservation status is currently at stake. We focus primarily on endemic species as well as resident and migrant species of conservation concern. Understanding how these species respond to their changing environment is vital to foreseeing their future in the Yucatán Peninsula. The information available for each species is highly variable, and we report many unpublished data and rely on personal observations to provide species accounts as complete as possible to assess the situation. In general coastal birds are at great risk due to rampant development threatening many coastal ecosystems, especially to the North and East of the peninsula, and because the Caribbean coast is regularly beaten by strong hurricane winds which frequency tends to increase with climate change. Small forest birds so far do not appear vulnerable, but large birds have declined due to hunting pressure or to the pet trade. Natural protected areas cover large tracts of the peninsula and represent most ecosystems, thus ensuring the protection of some species, but many species or populations are found outside these areas and require other strategies.

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12.1 Introduction

Birds are among the most conspicuous and attractive wildlife species, and as such one of the best known taxa. This explains the long history of ornithological research in the Yucatán Peninsula relative to other taxonomic groups. The first scientific expeditions included scientists dedicated exclusively to the discovery of bird diversity, with reports in scientific outlets starting in the mid-1800 (e.g. Cabot 1845; Lawrence 1869; Ridgway 1873). The number of publications on birds of the peninsula peaked in the 1980s (Fig. 12.1), after the opening of the last forest frontiers (permitted by road construction) and its concomitant surge of deforestation started in the late 1960s (Turner et al. 2001). Later, and despite the presence of a large number of protected areas and several new research centers, the number of ornithological publications decreased. In this regard, the region lags well behind other Neotropical areas despite its 555 bird species (MacKinnon 2013).

It is only by the second half of the last century that ornithology moved from the discovery of species to formal surveys on their ecology in the Yucatán Peninsula. The turn started in the 1950s, when bird research was still oriented towards discovery and natural history as illustrated by Paynter's notes from 1950 to 1957, and his famous "Ornithogeography of the Yucatán Peninsula" (Paynter 1955), but some ecological or behavioral research on migrant birds started to emerge (e.g., Eisenmann 1955). Understanding the ecology of species is particularly relevant in the Yucatán Peninsula as it is an important wintering area and migration corridor

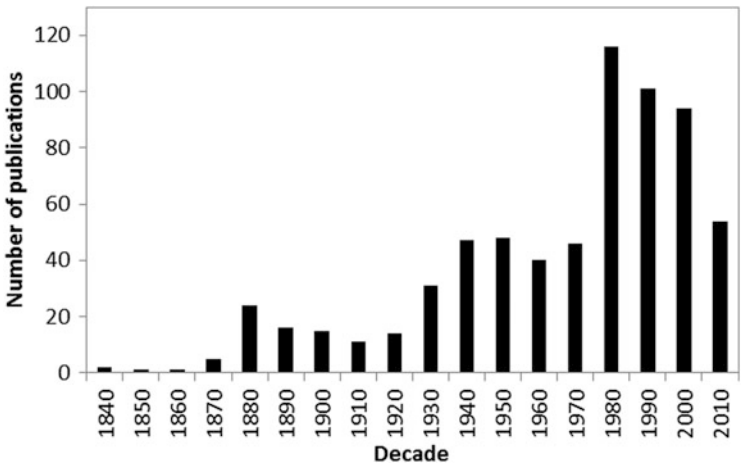

Fig. 12.1 Number of publications related to birds of the Yucatán Peninsula published per decade between 1840 and 2014

for many Nearctic-Neotropic bird species. More than 200 migratory bird species use the peninsula, 106 of which overwinter there, with another 26 species that have both resident and migrant populations, 12 species that are mainly transient of which some individuals overwinter in the peninsula, one species that is both transient and resident, 35 transient species, and 47 vagrant species (<5 records). The Yucatán Peninsula also hosts a large number of resident species, 17 of which are endemics or near-endemics, even when land cover has been changing considerably and climate change is presenting further challenges for species.

The status of the Yucatán Peninsula as bird habitat has changed dramatically over recent time. For the one part, population growth—along with urbanization—has increased pressure on land, while for the other part, new activities (e.g. cattle ranching) have promoted land use change. The peninsula remained scarcely populated as late as the 1960s, but both the government-promoted colonization of Quintana Roo and Southern Campeche, and natural demographic growth due to tourism development that began with the island of Cancún in 1969 have contributed to increased population (Fondo Nacional de Fomento al Turismo 1980). Between 1930 and 2010, the population of the Yucatán Peninsula has increased by more than 752 %, with the present population slightly above four million (Fig. 12.2). Currently three quarters of the peninsula land cover has been transformed or disturbed (see Chaps. 8 and 15), leading to changes in the composition and abundance of bird communities. Even if no long-term data exist, reviewing the localities from which earlier ornithologists reported their findings provides a clear idea of how great that change has been. For instance, of the 15 localities with known coordinates from which Ocellated Turkeys (*Meleagris ocellata*) were collected prior to 1960, only less than half hosted the species in 2000 (Calmé and Sanvicente 2000).

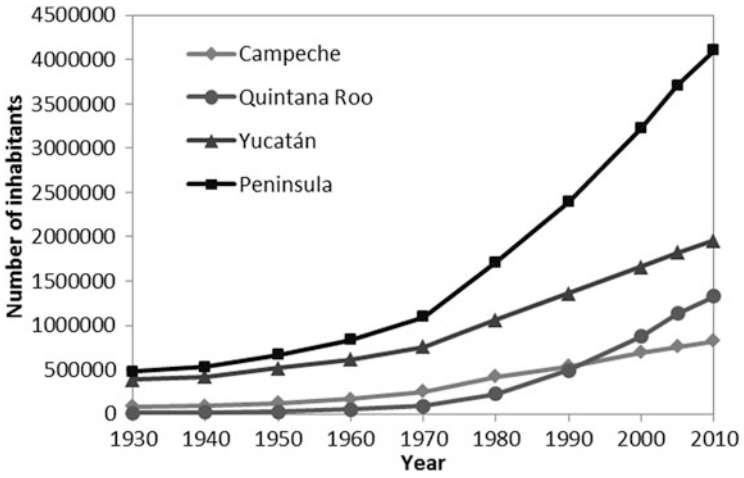

Fig. 12.2 Human Population change in the Yucatán Peninsula between 1930 and 2010. Data from Instituto Nacional de Estadistica y Geografia

In this chapter, we aim to present the current situation on the risks faced by a select number of species which conservation status is currently at stake. For detailed accounts on species we refer the reader to reference books such as The Handbook of the Birds of the World (del Hoyo et al. 1992–2013). We focus primarily on endemic species as well as resident and migrant species of conservation concern according to BirdLife International and the International Union for the Conservation of Nature (Table 12.1). Understanding how these species respond to their changing environment is vital to foreseeing their future in the Yucatán Peninsula. For this reason, we organize the chapter around the main physical features of the peninsula: the coastal areas, Cozumel Island, and the forested interior. We conclude tentatively by looking at the environmental history of the Yucatán Peninsula and reflecting on how it has shaped its avifauna.

12.2 Coastal Birds

Because of its peninsular nature, the Yucatán has a large proportion of coastal areas, some of which go far inland due to its landform (Chap. 2). The coast also borders two seas, the Gulf of Mexico to the west and north, and the Caribbean to the east. Coastal habitat as we define it in this chapter includes shallow salt waters, mudflats, beaches, dunes, mangroves, and scrublands found within the first kilometers inland. Following that definition, we include eight species in this section: Reddish Egret, Snowy Plover, Piping Plover, White-crowned Pigeon, Mexican Sheartail, Yucatán Vireo, Yucatán Wren, and Black Catbird. Seven are considered near-threatened by the International Union for the Conservation of Nature (IUCN); two overwinter in the peninsula (both plovers), one is endemic to Mexico (Mexican Sheartail), two others are endemic to the peninsula (Yucatán Wren and Black Catbird), and one is near-endemic (Yucatán Vireo).

Reddish Egret In the peninsula this medium-sized heron (Fig. 12.3a) is rather rare, and information about it is sparse. However, recent surveys have allowed recording the largest known colony. This colony of 670 pairs is located close to Sisal, Yucatán (Palacios et al. 2013). A total of 897 pairs living in ten colonies are estimated to reside in the whole peninsula (Palacios et al. 2013); however, three quarters of that number live in the largest colony mentioned above, while half of the other colonies have less than 25 pairs. While the Reddish Egret is confirmed to breed in numbers on the northern and eastern coasts, as well as in small colonies in Ría Celestún estuary and on a mangrove island at Isla Aguada, future research may confirm the presence of more colonies on the west coast of the peninsula (MacKinnon pers. obs.). Colonies are sometimes found among those of other birds such as herons and spoonbills (Kushlan and Hancock 2005). The species nests on all kinds of substrate, usually mangrove trees (Wilson et al. 2014), while it feeds on mudflats, preying mainly upon small minnows (Ramo and Busto 1993).

Table 12.1 Bird species included in the chapter, with their distribution and conservation status

English name	Scientific name	Distribution status	Conservation status
Coastal birds			
Reddish Egret	*Egretta rufescens*	R/M	NT
Snowy Plover	*Charadrius nivosus*	R/M	NT
Piping Plover	*Charadrius melodus*	M	NT
White-crowned Pigeon	*Patagioenas leucocephala*	R	NT
Mexican Sheartail	*Doricha eliza*	NE	NT
Yucatan Vireo	*Vireo magister*	NE	LC
Yucatan Wren	*Campylorhynchus yucatanicus*	E	NT
Black Catbird	*Melanoptila glabrirostris*	E	NT
Cozumel birds			
Cozumel Emerald	*Chlorostilbon forficatus*	E	LC
Cozumel Vireo	*Vireo bairdi*	E	LC
Cozumel Thrasher	*Toxostoma guttatum*	E	CR
Forested interior birds			
Great Tinamou	*Tinamus major*	R	NT
Great Curassow	*Crax rubra*	R	VU
Black-throated Bobwhite	*Colinus negrogularis persiccus*	NE	LC
Ocellated Turkey	*Meleagris ocellata*	E	NT
Agami Heron	*Agamia agami*	R	VU
Ornate Hawk-Eagle	*Spizaetus ornatus*	R	NT
Yucatan Poorwill	*Nyctiphrynus yucatanicus*	E	LC
Yucatan Nightjar	*Antrostomus badius*	E	LC
Yucatan Woodpecker	*Melanerpes pygmaeus*	E	LC
Orange-breasted Falcon	*Falco deiroleucus*	R	NT
Yellow-headed Parrot	*Amazona oratrix*	R	EN
Yellow-lored Parrot	*Amazona xantholora*	E	LC
Northern Mealy Parrot	*Amazona guatemalae*	R	NT
Yucatan Flycatcher	*Myiarchis yucatanensis*	E	LC
Yucatan Jay	*Cyanocorax yucatanicus*	E	LC
Wood Thrush	*Hylocichla mustelina*	M	NT
Rose-throated Tanager	*Piranga roseogularis*	E	LC
Painted Bunting	*Passerina ciris*	M	NT
Orange Oriole	*Icterus auratus*	E	LC

Distribution status is defined according to residence status and endemism with *R* resident; *M* migrant; *E* endemic; and *NE* near-endemic. Endemism to the Yucatán Peninsula here corresponds to a distribution encompassing the three Mexican states of the Yucatán Peninsula (Yucatan, Campeche and Quintana Roo), Northern Belize and Northern Guatemala, i.e., the peninsula in its geographical rather than geopolitical definition. Conservation status follows up-to-date Birdlife International Red List. *LC* Least Concern; *NT* Near Threatened; *VU* Vulnerable; *EN* Endangered; *CR* Critically Endangered

Fig. 12.3 (**a**–**g**) Some of the remarkable species of birds present in the Yucatán Peninsula. (**a**) Reddish Egret, which largest known colony (>600 pairs) is located in Sisal, Yucatán. Photo by Alexander Dzib Chay; (**b**) Cozumel Emerald, an endemic of Cozumel Island, on a rare sighting of

Despite no data existing for the Yucatán Peninsula, a recent genetic analysis of populations from Baja California, Northwestern Gulf coast, and Bahamas showed a strong differentiation among these regions, suggesting that dispersal is limited (Hill et al. 2012). These authors also suggest that given the scattered distribution and rather small size of its habitat, colonies tend to be small, increasing the risks of extinction caused by stochastic events, demographic or environmental.

The main environmental stochastic events on the coast of the peninsula are hurricanes, especially on its Caribbean coast (see also Chap. 7). In fact, the Yucatán Peninsula is the region of the Eastern American continent with the highest records of hurricane strikes. Some argue that hurricane probability or strength will further rise with climate change. If so, this could be of great concern for Reddish Egrets of the peninsula. Although there was no detected effect on breeding, colonies of the species were more clustered after Hurricane Ike (2008) swept the Great Inagua in the Bahamas on its path, leaving mangrove islands severely damaged (Green et al. 2011). Another study looking at the effect of hurricanes Katrina (2005) and Rita (2005) found that wind speed was associated with waterbird colony abandonment or with the reduction of the number of breeding pairs following these events (Leberg et al. 2007). The authors suggested these effects were caused by the heavy damages suffered by the vegetation serving as breeding support, although they could not demonstrate it.

Because feeding habitat (mudflats) is located in areas improper for tourist development, we believe that the sprawling urban development on the Yucatán and Quintana Roo coasts should not affect the Reddish Egret in the short term. In fact, the mudflats around known colonies are Ramsar sites protected both in Yucatán (El Palmar State Reserve) and in Quintana Roo (Sian Ka'an Biosphere Reserve). However, recreational activities (e.g. kayaking) in the lagoons where the species is nesting have the potential to disturb the birds if not undertaken with care. The access to feeding grounds might also be disturbed. The majority of the large colony of Sisal, for instance, flies over areas that will be subject to development to reach feeding grounds (B. MacKinnon pers. obs.). Development will also surely include the filling (at least partial) of the lagoon behind Sisal, leading to the loss of feeding habitat and to potential contamination. We should note, moreover, that drought may reduce the availability of mudflats or increase their salinity, leading to a higher mortality of organisms living in them. However, no information currently exists on the effect of drought on the Reddish Egret or its feeding habitat.

Fig. 12.3 (continued) an adult feeding nestlings. Photo by Rafael Chacón; (**c**) Yucatan Woodpecker, a little known endemic of the peninsula. Photo by José Antonio Linage. (**d**) Yucatan Wren, an endemic of the dry scrub of northern Yucatán. Photo by José Antonio Linage; (**e**) Orange Oriole, an endemic of the peninsula. Photo by Alejandro Pacheco Moreno; (**f**) Black Catbird, an endemic mainly nesting on the Caribbean coast. Photo by Jorge Machado Castro; (**g**) Ocellated Turkey, an endemic, emblematic and heavily hunted bird. Photo by Alexander Dzib Chay

Snowy Plover This shorebird was recently recognized as a New World species when it was officially split from the Kentish Plover (*C. alexandrinus*) by the American Ornithologists' Union (Chesser et al. 2011), after it was found to be genetically distinct (Küpper et al. 2009). It is a relatively uncommon bird that can be found in small flocks on sandy beaches, salt ponds and salt flats of the Yucatán Peninsula (Howell and Webb 1995; Thomas et al. 2012). However, year-long residents and breeders are found on the northern coast of the peninsula; the birds encountered along the Western Gulf coast and Eastern Caribbean coast are rather considered winter migrants. The breeding population is probably quite small given the number of birds (180 in 11 locations) counted during the North American-wide sampling realized by Thomas et al. (2012).

The Snowy Plover is very vulnerable to coastal tourist development, which in turn causes both habitat destruction and creates a lot of disturbance to feeding and nesting birds. On the one hand, dune vegetation is usually removed by beach-front property owners (pers. obs.), while the species nests at the limit of the beach and the front dune (Lafferty et al. 2006). Increasing tourist development of the peninsula northern coast is thus likely to destroy a significant part of Snowy Plover's nesting habitat in that region, even if development remains mostly concentrated along a 120-km stretch between Sisal and Dzilam de Bravo, in Yucatán State, and around Holbox, in Yum Balam Biosphere Reserve, in Quintana Roo. This latter area is of particular concern since the development of Holbox Island has literally exploded over the past few years. Tourists are also a main source of disturbance to birds feeding or nesting on beaches (Lafferty et al. 2006). Snowy Plover are greatly disturbed by people at distances of 10 m (>50 % of the events cause disturbance; Lafferty 2001). This latter study also found that dogs contributed more to disturbance than people, especially when unleashed. In Mexico, lots of stray dogs wander around towns and villages in search for food and may therefore cause further disturbance and mortality (to eggs and chicks) than reported in the USA by Lafferty et al. (2006), where dogs were accompanying their owners.

Salt flats and ponds, important feeding grounds where Snowy Plovers prey on small invertebrates, are common features in several parts of the peninsula northern coast. They remain generally little disturbed. However, there exists locally salt-works and saltpans built for the production of brine shrimp (*Artemisia* sp.) cysts. Those artificial basins are located in areas not suitable for tourism. In consequence, overall habitat modification tends to expand over most of the peninsula northern coast, at the exception of the protected areas of Ría Lagartos Special Biosphere Reserve, and Dzilam de Bravo State Reserve. In these protected areas, development is limited and better controlled than elsewhere, in the latter one because the coast can only be reached by boat. One other important reserve, Ría Celestún Special Biosphere Reserve, is failing to provide long-term protection on its Yucatán side, as it is being slowly developed.

Piping Plover This relatively rare migrant species uses beaches and sandflats in the same area on the peninsula Northern coast as resident Snowy Plovers in addition to Isla Blanca north of Cancún. Like this latter species, it also feeds on small invertebrates (Wiersma et al. 2014). It is therefore subject to the same kind of disturbance on the beaches it frequents, i.e., people and dogs. Burger (1994) found that the time Piping Plovers spent foraging in dunes was halved in the presence of people within 100 m, while vigilance increased. Because overwintering migrants need to acquire enough energy to be able to fly back to their breeding grounds, the cost of vigilance is potentially high. Furthermore, the kind of short flights initiated to flee a source of disturbance are also very costly to birds (Nudds and Bryant 2000), and may decrease their probability of survival during spring migration.

White-Crowned Pigeon This is a relatively common Caribbean bird that is therefore present only on the Caribbean coast of the Yucatán Peninsula (Howell and Webb 1995), except when individuals get blown off course and reach the Río Lagartos area. With the exception of small winter populations on Cozumel Island and Cayo Centro and Cayo Norte on Banco Chinchorro, the species arrives in late spring and leaves in the fall (MacKinnon and Acosta Aburto 2003). Along the coast, the White-crowned Pigeon uses two distinct vegetation types for feeding and breeding. The species breeds on mangrove islets, cays and large islands off the coast, but feeds in seasonal tropical forest on the coast (Howell and Webb 1995). Although no study on the diet of the White-crowned Pigeon has been conducted in the Yucatán Peninsula, the bird appears to be almost strictly frugivorous elsewhere, most probably feeding on trees present in Quintana Roo forests such as *Metopium* and *Ficus* (Bancroft and Bowman 1994), and *Brosimum alicastrum* (Baptista et al. 2014). In Florida, nesting phenology, in terms of timing and number of nests initiated, seems strongly associated with the fruiting phenology (timing and abundance of fruits) of *Metopium* (Bancroft et al. 2000).

Even when habitat destruction is the main threat to White-crowned Pigeon in other parts of its distribution (Baptista et al. 2014), we do not believe it to strongly affect the species in the Yucatán Peninsula. The Northern Caribbean coast has been subject to intensive tourist development leading to deforestation over the past 40 years, and to the South a similar development is looming, despite being aimed to be less intensive. However, White-crowned Pigeon has the ability to fly over distances in the tens of kilometers. For instance, MacKinnon and Acosta Aburto (2003) observed 18 individuals leave Banco Chinchorro prior to sunset in direction of the mainland, located 31 km from the cay; and five individuals later coming from the mainland. This flight ability should allow the species to reach feeding habitat in the less developed forested interior, as development remains usually limited to a relatively narrow strip along the coast. Also, the Yum Balam, Sian Ka'an, and Banco Chinchorro Biosphere Reserves, as well as the Isla Contoy National Park protect more than 150 km of coast and offshore islands with suitable White-crowned Pigeon feeding and breeding habitat. The species is sensitive, however, to human disturbance, and is known to abandon nesting sites when disturbed (e.g. in Sian Ka'an; B. MacKinnon pers. obs.)

As noted before, hurricanes are common events on the Caribbean coast of the Yucatán Peninsula, and cause extensive damage to forests (Whigham et al. 2003) and mangroves. Trees in the region are adapted to this type of disturbance by sprouting on stems after having been snapped or uprooted, allowing post-hurricane forest composition to remain stable (Vandermeer et al. 1997; Whigham et al. 2003). The trees on which the White-crowned Pigeon feeds are mainly fast-growing species that recover after hurricane damage but also after burning (e.g. *Metopium*, *Bursera*). This is an important characteristic since hurricanes are often followed by wildfires due to the large accumulation of dead organic material (see Chap. 7). Even if trees have the ability to recover from hurricane disturbance, fruiting is reduced or even suppressed immediately after, and many trees change their fruiting cycle for a few years (Wunderle 1999). Since nesting in White-crowned Pigeon is synchronized with fruit-peaking, and varies quantitatively with fruit availability (Bancroft et al. 2000), hurricane damages have obvious consequences on its population dynamics within the area.

We believe the combined effect of habitat destruction (via land use change) and habitat disturbance (via hurricanes and humans) to be the most serious threat to the White-crowned Pigeon on the Yucatán Peninsula. Birds might have a hard time finding a new feeding ground following a hurricane if too much forest has been cleared for tourism. This could be especially worrying if the area affected by the climatic event is a Biosphere Reserve. Given the current rate of development in coastal Quintana Roo and the possible increase in the frequency or strength of hurricanes in the face of climate change, this threat might materialize sooner than later.

Black Catbird The distribution of this endemic (Fig. 12.3f) encompasses the Yucatán Peninsula; however it is locally common only on the Eastern Yucatán Peninsula and Cozumel Island, including Northern Belize (Morgenthaler 2003). The density of nests found in some areas on the Caribbean coast (up to 3.9 per ha; Roldán-Clarà et al. 2013), as well as territory clustering (Morgenthaler 2003; Roldán-Clarà 2009), suggest that the Black Catbird could be colonial. Inland Yucatán, B. MacKinnon (pers. obs.) found the species completely colonial when nesting. To that point the reasons for such aggregation remain unknown (see Danchin and Wagner 1997 for a review of hypotheses). The species uses a variety of vegetation types for breeding that are typical of Caribbean coastal vegetation: scrubby vegetation, sometimes dominated by mangrove, littoral forest and mangrove (Morgenthaler 2003; Roldán-Clarà et al. 2013). Inland the species has been observed nesting in chukum trees, *Havardia albicaus*, but is also frequently found in thick scrub, and almost always near a water source (B. MacKinnon pers. obs.). According to Morgenthaler (2003) Black Catbirds forage on arthropods, especially during the breeding season, and a variety of fruits from trees (e.g. *Manilkara zapota*, *Metopium brownei*), palm (*Thrinax radiata*), coastal scrub (*Coccoloba uvifera*) and bush. It also feeds on the fruit of the Black Mangrove (*Avicennia germinans*) and Black Sage (*Lantana involucrata*) (MacKinnon 2005).

Like plovers and White-Crowned Pigeons, Black Catbirds are at risk of sprawling tourist development along the Caribbean coast. Even in Sian Ka'an Biosphere Reserve, a small amount (<3 %) of the reserve is private property but it is mostly located along the coast (Roldán-Clarà et al. 2013). Small properties usually result in the almost complete loss of native vegetation on the dune and behind the dune (S. Calmé pers. obs.). We are also concerned by the fact that the species appears to require a matrix of different vegetation types as shown by Morgenthaler (2003), when tourist development favors homogenization of the habitat (Gunn 1997).

Nest predation is another potential threat to the species. Roldán-Clarà et al. (2013) observed several events of predation or intents of it by the Great-tailed Grackle (*Quiscalus mexicanus*), and they believed that this species was responsible for a large fraction of depredation in Sian Ka'an Biosphere Reserve. Contrary to the Black Catbird, this species thrives in areas subjected to development (Fraga 2011), with the risk of increasing predation pressure on Black Catbird in an unsustainable way.

Mexican Sheartail It is an endemic species in Mexico with two allopatric populations, one in central Veracruz and the other one on the northern extreme of the Yucatán Peninsula. This species is listed as near-threatened by the IUCN (Birdlife International 2014) and as in danger of extinction by the Mexican government (SEMARNAT 2010). Both populations have a small geographical range and are locally threatened by habitat loss and degradation (Ortiz-Pulido et al. 2002). In the Yucatán Peninsula, the Mexican Sheartail hummingbird occurs mainly in the coastal dune and the edge of the mangrove, with at least a geographic range of 4 km from the coastline (Santamaría-Rivero et al. 2013). However, a few observations have been reported in the dry tropical deciduous forest within a distance of 5 km from the coastline (Leyequién unpubl. data) and in gardens in Mérida City during the summer months, 36 km inland (MacKinnon unpubl. data). López-Ornat and Lynch (1990) reported an isolated observation on Isla Cancun, which represents its most northeastern range. This species forages and constructs nests on native vegetation found in its habitat. It feeds on at least 23 plant species, i.e., *Malvaviscus arboreus*, *Agave angustifolia*, *Ernodea littoralis*, *Opuntia stricta*, *Tillandsia dasyliriifolia*, *Caesalpinia vesicaria*, *Cannavalia rosea*, *Cordia sebestena*, *Dicliptera sexangularis*, *Sophora tomentosa*, *Gossypium hirsutum*, *Ipomoea pes-caprae*, *Lycium carolinianum*, *Passiflora foetida*, *Suriana marítima*, *Tournefortia gnaphalodes*, *Scaevola plumieri*, *Myrmecophila cristinae*, *Euphorbia personata*, *E. heterophylla*, *Turnera diffusa*, *Bougainvillea spectabilis*, and *Cocos nucifera*. For nesting, Mexican Sheartails use Black Mangrove (*Avicenia germinans*), Button Mangrove (*Conocarpus erectus*), Bay Cedar (*Suriana maritima*), and White Mangrove (*Laguncularia racemosa*), among others (Leyequién unpubl. data). This species presents two breeding peaks during the year: the first from January to April, and the second from June to November (Leyequién unpubl. data).

Current threats to the Mexican Sheartail include potentially low recruitment rates and loss of feeding habitat. The probability of nest survival, i.e. probability

that a nest fledges at least one young with a nesting period of 48 days, is as low as 16.5 % (based on Mayfield, 1975 from Leyequién unpubl. data). Causes of recorded failure are predation by ants, praying mantis, strong winds, parasites, and infertility (Leyequién unpubl. data). We believe that habitat loss and degradation is another important risk factor for the population, as native vegetation is replaced by homogenous and/or non-native plants in the gardens of hotels and summer houses (an important breeding ground has been found in Telchac Puerto surrounded by summer houses, hotels, and roads; E. Leyequién pers. obs.). Also the potential construction of wind farms in ecologically vulnerable areas such as in Dzilam de Bravo, Yucatán State, could severely threaten the nest success and population dynamics of this species through collision risk, displacement due to disturbance, barrier effect acting upon local flight paths, and habitat change and loss (Drewitt and Langston 2006). A number of studies recommend the precautionary avoidance of construction of wind turbines close to any important bird breeding colony and within the most frequent foraging flight paths (Everaert and Stienen 2007).

Yucatán Vireo This near endemic species is distributed for the most part along the east coast of the Yucatán Peninsula, Belize and adjacent islands, including Honduras islands of Guanaja—abundant, Utila and Roatán—not abundant (Howell 1991), and Grand Cayman. There are at least three records of individuals photographed or netted in the northeastern corner of Yucatán (San Felipe, Ría Lagartos and El Cuyo) between 2004 and 2013 that can be considered vagrants (Gómez de Silva 2004, 2005, 2014), and one vagrant was documented in Texas in 1984 (Morgan et al. 1985). Although found principally in coastal zones, it has been recorded in the past 45 km inland at the archeological zone of Cobá (MacKinnon pers. obs.). Its habitat consists of humid to semi-humid scrubby woodland and edge and mangroves (Howell and Webb 1995).

Vireo magister magister probably forms a super-species with *V. olivaceus*, *V. gracilirostris*, *V. flavoviridis* and *V. altiloquus*. Four subspecies are recognized, including: *V. m. magister* (S. F. Baird, 1871)—SE Mexico (Quintana Roo, including islands of Mujeres and Cozumel) and mainland Belize; *V. m. decoloratus* (A. R. Phillips, 1991)—islands off Belize (Ambergris Cay S to Turneffe Is); *V. m. stilesi* (A. R. Phillips, 1991)—Glover's Reef (off C Belize) and Bay Is (off N Honduras); and *V. m. caymanensis* Cory, 1887—Grand Cayman I (Brewer 2010). Although it may have a small range, it is not believed to approach the thresholds for "Vulnerable" under the range size criterion of the IUCN and consequently is listed as a species of Least Concern. Partners in Flight estimated the population to figures fewer than 50,000 individuals (BirdLife International 2015).

The species nests between April and July on the peninsula in a nest similar to others of its family, a cup suspended from a forked, horizontal branch at medium height. It feeds on insects and fruits, including those of the chaká (*Bursera simaruba*), as do all vireos, and abounds in the very dense dune vegetation that provides both food and refuge (MacKinnon 2013).

Unfortunately, no in-depth study has been made on the ecology of this species, which should be a priority due to the rapid development of tourism infrastructure

and expanding urbanization along the majority of the east coast of the peninsula, affecting the species major distributional habitat. As seen with the Black Catbird, even within the Sian Ka'an Biosphere Reserve, private coastal properties are cleared of native dune vegetation upon which the species depends.

Yucatán Wren Campylorhynchus yucatanicus is an endemic species of the Yucatán Peninsula, whose distribution is highly restricted to the waterfront in the northwestern portion of the Peninsula, in the states of Campeche and Yucatán. It lives exclusively in coastal scrub (Fig. 12.3d) and adjacent black mangrove forest, with the first one regarded as rare and restricted to the shoreline of the above mentioned area (Flores and Espejel 1994). Sixty five percent of the Yucatán Wren nests found by Vargas-Soriano et al. (2010) were in coastal scrub, while the remaining 35 % were in flooded lowland forest (between the coastal scrub and mangrove forest). Only three species, Button Mangrove (*Conocarpus erectus*), Peccary Tree (*Sideroxylon americanum*), and Blackbead (*Pithecellobium pallens*), supported 75 % of all nests, suggesting that the Yucatán Wren is highly dependent on these tree species (Vargas-Soriano et al. 2010). According to their observations, nest construction began in early April and finalized in mid-September; nest building ranged from 4 to 12 days. Despite early nest construction in April, the first egg was not laid until June; the reason why egg laying was delayed by 67 days (the time span between the first nest built and the first egg laid) is unknown. The last nest was recorded at the end of July, covering a nesting period of 48 days from the first brood. Second attempts after failure or success of the nests were recorded. Clutch size varied from 1 to 5 eggs that were incubated for 15–17 days. Brood hatching was synchronous. Parental care was provided by two adult individuals, presumably the parents, which fed the chicks in turn. In 4 % of the population, three adults participated, hinting at a cooperative breeding system in this species (Vargas-Soriano et al. 2010).

Predation is the main natural cause of failure of Yucatán Wren nests. However, the Yucatán Wren and its habitat, the coastal scrub and the black mangrove are being threatened primarily by the development of hotel infrastructure, and to a lesser extent by charcoal production and logging. Given the extremely restricted range of the species, an assessment of its population should be performed, and strict protection measures should be enforced.

12.3 Cozumel Birds

Cozumel avifauna is unique in that the island is not all that distant from the mainland (17.5 km), separated by a channel approximately 400 m deep, but has three endemic species and 16 resident endemic subspecies (Clements 2014). However, rich as it is in endemics it is limited in extension (478 km^2) and habitats, being a coral based ocean island with a maximum height of 10 m and with no ground level water source (Cuarón 2009). In this section we present the cases of the three

Cozumel endemics: Cozumel Emerald, Cozumel Vireo, and Cozumel Thrasher. The first two are not considered of conservation concern, while the Cozumel Thrasher is listed as Critically Endangered. Threats to the endemic species and subspecies include the annual reduction and fragmentation of habitat due to increased tourism infrastructure and urbanization, as well as introduction of invasive species (both competitors and predators) that include *Boa constrictor*, feral dogs (*Canis lupus familiaris*) and cats (*Felis catus*), rats (*Rattus rattus*) and mice (*Mus musculus*), and more recently feral bovine cattle (*Bos* sp.) (Cuarón et al. 2004; Cuarón 2009; McFadden et al. 2010). In addition, hurricane impacts on habitat have taken their toll over the past few decades. Of concern for all bird species on Cozumel, but even more so for endemics, is that population trends and natural history have not been studied in depth or are completely unknown. Of recent creation, the Cozumel Birding Club, in collaboration with the Commission for Natural Protected Areas (CONANP) are carrying out monitoring of bird species on the island, which over the long term will help assess the population trends for all endemics on Cozumel.

Cozumel Emerald Formally considered a subspecies of *Chlorostilbon canivetii* it was recognized as a separate species in the early 1990s (Howell 1993). Its distribution is limited to the island of Cozumel, with an individual found on nearby Isla Mujeres being considered a vagrant. It is fairly common on the island where it is found in "scrub and low deciduous insular forest" (Paynter 1955) and in vegetation described as "brushy woodland and scrub, second growth, etc." (Howell and Webb 1995). In more recent times it has been commonly found feeding and nesting in the yards of private homes and even restaurants in the town of San Miguel (MacKinnon pers. obs.). The species has been documented by local biologist Rafael Chacón reproducing from January through May, building nests mostly at low to mid-level in tree branches near food sources as well as in man-made objects such as broken lamp fixtures and even cables. Although hummingbirds are known for laying just two white eggs, there are some examples of three offspring in a nest, albeit not necessarily from the same female. A picture was taken of two eggs in a nest built atop a frond of a potted xiat palm (*Chamaedorea* sp.), but at a later date, a picture was taken of three featherless chicks in this nest (Fig. 12.3b); however, only two survived. Casual observations of five nests between January and April of 2015 produced estimates of between 4 and 5 weeks for incubation and 17 days between hatching and when fledglings left the nest. Nest destruction observed was a result of inclement weather in which strong winds caused nests to plummet from their location. In one case, the female stayed out all night, returning to the nest the next morning, without any harm caused to the chicks (R. Chacón pers. com).

The IUCN Red List has assessed the Cozumel Emerald of Least Concern (BirdLife International 2012d) as even though the species has a very small range, it is not believed to approach the thresholds for vulnerable under the range size criterion; nor is the species considered threatened under Mexican law. However, its population trend is not known. There was concern for the species after the passing of Hurricane Wilma (4 on Saffir-Simpson scale when it made landfall) in October

of 2005 as the species was not visible to observers the following January, but appeared normal again in March. The species therefore seems quite resilient to hurricanes, even as their frequency or intensity is expected to increase with current climate change.

Cozumel Vireo Considered common just 20 years ago (Macouzet 1997), this endemic bird to the island of Cozumel currently is reported fairly common as evidenced by a recent monitoring project initiated by CONANP and the Cozumel Birding Club. However, since its population trend has not been scientifically studied, it is currently considered a species of Least Concern (BirdLife International 2012c) and is not considered threatened under Mexican law.

The Cozumel Vireo belongs to the 'eye-ring' group of vireos that includes eight species endemic to the West Indies or the adjacent Caribbean Coast of Mexico and Central America, of which few studies exist. The most range-restricted species among these is the Cozumel Vireo (LaPergola et al. 2012). The species inhabits "scrubby woodland and edge, and second growth" (Howell and Webb 1995), which would seem to protect it, but not if considering the increasing threats due to the growth of the island's human population, both resident and visitor, as well as the damage created to habitat as a result of category five hurricanes passing over the island (Gilbert in 1988; Wilma in 2005). Only recently a description of the nest and eggs of this species was provided (LaPergola et al. 2012), leaving much of its breeding biology completely unknown. In 2012 a wind farm project was proposed for the island which would have impacted negatively on the habitat of this species as well as other endemics, but it eventually was turned down by authorities.

Cozumel Thrasher Once known as a fairly common to common bird species endemic to Cozumel Island (AOU 1998), the Cozumel Thrasher seemed to almost disappear from view after Hurricane Gilbert pounded the island in September 1988, followed by Roxanne in 1995. Howell (pers. com.) only saw one individual during 2 days in July 1988 vs. 3–4 a day in early to mid-1980s, and saw none in February 1989 or thereafter. It would seem then that the species was already beginning to wane before Hurricane Gilbert hit the island. Prior to Roxanne, there were only four records of the species obtained during monthly visits to the island spanning August 1994–August 1995. The last definitive scientific record was in June 1995, when a single bird was captured in a mist net (Macouzet and Escalante Pliego 2001). Since then, intensive searches have been very disappointing with only four observations of what may well have been the same individual during 2004, with another report from a different area the same year. There have been other possible sightings in 2004 and 2006, but none have been positively confirmed (BirdLife 2015). During 2013 and 2014, a program of intensive search was performed without a single sighting being reported (Martinez-Morales 2013, 2014). Although it is listed as Critically Endangered by the IUCN Red List and in danger of extinction under Mexican law (it is considered the bird most at risk of extinction in Mexico, and perhaps globally), the species may in fact already be extinct. Sadly, no systematic studies were previously made to estimate population parameters or learn its natural history.

At one time the Cozumel Thrasher was considered a subspecies of the Long-billed Thrasher by some authorities (Paynter 1955; Mayr and Short 1970). However, the Cozumel Thrasher is currently listed as a distinct species in the AOU Checklist, 7th edition (1998); this assessment is based on Zink et al. (1999), who found *T. guttatum* to be about 5 % genetically different from both *T. longirostre* and *T. rufum*. According to R. L. Curry (www.homepage.villanova.edu/robert.curry/Cozumel), (the genetic uniqueness of the Cozumel Thrasher raises the question of its origin based on different theories. One is that it is a relic species that once inhabited the Yucatán Peninsula. Another refutes this saying that relatively rapid divergence in morphology and plumage is common in mimids which have colonized even more remote islands, such as the Galápagos Islands and Socorro Island in the Revillagigedo Archipelago. Others speculate that the species may have originated from stray migrants from much further away than the mainland peninsula.

The Cozumel Thrasher has been described as a shy and secretive bird found in dense vegetation, preferring to run rather than fly when disturbed. It is a brown and white bird with black streaking on chest and sides; a long, slightly decurved black bill with amber eyes; juveniles have never been described (Howell and Webb 1995). Due to it being an endemic species it has always been of interest to visiting birdwatchers, but was not noticed by resident islanders, whose interest in birdwatching is of recent development National and international researchers, with few exceptions, only began to pay serious attention to the conservation of the avifauna of the island in the late 1980's. In any case, the story of the Cozumel Thrasher is truly a tragic one. . .a species on the verge of extinction and its life history described very little.

12.4 Birds of the Forested Interior

The interior of the Yucatán Peninsula is characterized by two landforms, flat lowlands to the North and East, and low rolling hills to the South and West (see Chap. 2). Even if there is a strong rainfall gradient and edaphic factors that allow heterogeneity, the dominant ecosystem is tropical forest. Forests vary from dry (and low) to humid (and tall), and also include the very particular low seasonally flooded forests (Chap. 3). In this forest matrix, a number of wetlands are found, and the ecotone between forest and these wetlands are also important areas for many birds. Anthropogenic land use change increased the quantity of edge habitat between forest and open habitat, even if their nature is obviously different. The 19 bird species we document in this section occupy these different types of forest and wetlands found inland. More than half of them are endemic or near-endemic to the Yucatán Peninsula (nine endemics, one near-endemic): Black-throated Bobwhite, Ocellated Turkey, Yucatán Poorwill, Yucatán Nightjar, Yucatán Woodpecker, Yellow-lored Parrot, Yucatán Flycatcher, Yucatán Jay, Rose-throated Tanager, and Orange Oriole. The same number of species is listed in some category of threat

in the IUCN Red List (seven as Near-Threatened, NT, two as Vulnerable, VU, and one as Endangered, EN): Great Tinamou (NT), Great Curassow (VU), Ocellated Turkey (NT), Agami Heron (VU), Ornate Hawk-Eagle (NT), Orange-breasted Falcon (NT), Yellow-headed Parrot (EN), Northern Mealy Parrot (NT), Wood Thrush (NT), and Painted Bunting (NT). It is noteworthy that none of the Yucatán Peninsula endemics or near-endemics but one (Ocellated Turkey) are of conservation concern, providing some insight on the degree of conservation of their original habitat.

Great Tinamou This species reaches its northernmost distribution in the Yucatán Peninsula, where it is found only in the South. It is a forest-dweller that prefers undisturbed forests (Cabot et al. 2014). Contrary to what Howell and Webb (1995) report, it does not use only evergreen tropical forest, but also mature seasonal tropical forest (Calmé et al. unpubl. data). The Great Tinamou is rather uncommon in the peninsula. Over one complete year of sampling (372 km of line-transect walked) in three large (>20,000 ha) community forests, the species was detected only in two of these forests, once in one, and 10 times in another (Calmé et al. unpubl. data). Because some of the records belonged to the same transects, they likely corresponded to the same individuals. In a same 3-km transect, individuals detected on a same day were separated by at least 450 m. Most individuals were detected while vocalizing between mid-May and mid-July. All individuals were found at more than 12 km from human settlements, reflecting the fact than farther from villages forests are less disturbed, and hunting pressure is lower (Manzón Che 2010). In fact, only one Great Tinamou was hunted of a total of 647 harvested animals in the same villages and over the same period (Calmé et al. unpubl. data).

The low abundance of the Great Tinamou in the Yucatán Peninsula is probably linked to several factors, namely its position within its distribution range and habitat quality, and subsistence hunting. As mentioned in Chap. 3, evergreen forest, the common habitat of the Great Tinamou, is rare in the peninsula. Evergreen forest has also been subject to land use change disproportionately to its abundance (Vester et al. 2007). As a consequence, the best habitat for the species is extremely reduced. Even without accounting for global climate change effects, increased deforestation in the area already induces reduced rainfall during the dry season (roughly by 15 %; Ray et al. 2006). This is enough to alter forest species composition toward drier forests as suggested by Ray et al. (2006), as well as increase the frequency of fires (Cochrane 2003), likely reducing Great Tinamou habitat. A further threat comes from hunting. The species is considered a treat (del Hoyo et al. 1992) and hunted whenever possible (S. Calmé pers. obs.). However, few locals have hunted Great Tinamou over the past 10 years in the Southern Yucatán, both because it is uncommon and because it occupies areas difficult to access. Hunting in the region is done mainly for self-consumption of the meat, and is carried out along with other activities, especially agriculture (see Chap. 13). Therefore, hunters do not travel to remote parts of the forest other than for large prey, typically during timber harvest, which is very limited spatially and temporally, and chicle gum tapping (González-Abraham et al. 2007), an activity that has sharply declined.

Great Curassow This cracid is found in almost all the forest types of the Yucatán Peninsula, including *peten* (tree island hammocks) of Los Petenes and Ría Celestun Biosphere Reserves in Campeche and Yucatán (Calmé unpubl. data; MacKinnon pers. obs.). It is only absent from the dry low forests found both in Yucatán and Campeche states (Calmé unpubl. data). The Great Curassow distribution in the peninsula is therefore different from what is reported elsewhere (e.g., del Hoyo and Kirwan 2013). An endangered, small population of an endemic subspecies, *C. r. griscomi*, is also found in the forests of Cozumel Island at low densities of approximately 1.0 ind./km^2 (Martínez-Morales et al. 2009). On the mainland the species is rare to common, with documented densities varying from 1.2 ind./km^2 in the Eastern Yucatán Peninsula (Ramírez-Barajas et al. 2006; Ramírez-Barajas and Naranjo 2007) to 14.5 ind./km^2 in the Southern Yucatán Peninsula (Calmé unpubl. data). It uses well preserved forests dominated by late successional species (Martínez-Morales 1999, all co-authors pers. obs.) such as *Manilkara zapota* and *Brosimum alicastrum*, which fruits it consumes. Almost 80 % of the Great Curassow diet (expressed in dry weight) consists of fruits or seeds (del Hoyo and Kirwan 2013). The species is also positively associated with water bodies within the forest, with an influence of water bodies on its abundance up to 2 km (Martínez-Morales 1999). That importance is also well illustrated by the observation of a party of 40 Great Curassows, all males, at one *aguada* in Calakmul Biosphere Reserve during the dry season of 2002 (S. Calmé pers. obs.).

The Great Curassow presents large variations in density in the Yucatán Peninsula, linked to habitat suitability, but also to subsistence hunting pressure. As a result, the species is much rarer in areas with fragmented, secondary forests, which dominate much of Yucatán and Northern Campeche (Calmé unpubl. data). Elsewhere, it can still be relatively abundant even when it is one of the two most hunted large bird species along with the Ocellated Turkey. The Great Curassow represented up to 24 % of all the annual kills in one Mayan community of the Southern Yucatán Peninsula (Calmé et al. 2008). More importantly, the Great Curassow was actively selected by hunters in three of five communities studied in the Southern and Eastern Yucatán Peninsula (Calmé et al. 2006, 2008), portending a bleak future.

On Cozumel Island, the situation of the Great Curassow is likely to become critical. Martínez-Morales et al. (2009) estimated the population at 282 birds in 1994–1995, and 372 birds in 2005, which may appear to indicate a stable population. However, these estimates were made previous to the passing of, respectively, hurricane Roxanne (3 on Saffir-Simpson Hurricane Wind Scale) in 1995, and hurricanes Emily and Wilma (both 4 on Saffir-Simpson Scale) in 2005. Martínez-Morales et al. (2009) thus consider that the population had been recovering over the 10 years between the two estimates. The last two hurricanes also strongly damaged the forest vegetation (preventing these authors to continue fieldwork), which has an impact on fruit production as seen earlier in this chapter (Wunderle 1999). On the mainland, Ramírez-Barajas et al. (2012) showed that the Great Curassow abundance had sharply declined (−46 %) 8–14 months after Hurricane Dean (4 on Saffir-Simpson scale) struck in 2007. Two years and a half after the impact, the

species still showed no sign of recovery (Ramírez-Barajas et al. 2012), even if in this instance the area impacted by the hurricane was well connected to other parts of the landscape so that recolonization was possible. On Cozumel, recolonization is very unlikely if not assisted, and population models show that the subspecies could become extinct by the mid-century or even faster if hurricane frequency increases (Martínez-Morales et al. 2009).

Ocellated Turkey This gregarious, endemic species of the Yucatán Peninsula, including northern Guatemala and Belize down to the Maya Mountains (Howell and Webb 1995; Fig. 12.3g), has declined substantially or been extirpated from many areas of its range over the past 35 years (Calmé and Sanvicente 2000). The species is a habitat generalist, using a wide range of vegetation types ranging from seasonally flooded savannas (during the dry season) to tall humid forests, including secondary vegetation (Calmé and Sanvicente 2000); however it depends on forest for the reproductive season, and specifically for nesting (González et al. 1998). The Ocellated Turkey is also quite generalist in its diet, and feeds opportunistically (McRoberts 2014). It is mainly granivore (almost 80 %, expressed in dry weight) without regards for the habitat (Baur 2008: forest, McRoberts 2014: agricultural landscape). Its adaptability is such that in an agricultural landscape McRoberts (2014) found that more than 92 % of the diet was composed of cultivated plants (mainly sorghum *Sorghum bicolor* and maize *Zea mays*). The only study presenting annual demographic data indicates a low annual survival rate of 0.5 (McRoberts 2014). This author also estimated a high juvenile:adult ratio of 2.89, and a male: female ratio of 0.44; these data correspond to an area where the population has been stable and even increasing for years (Calmé et al. 2010). However, Kampichler et al. (2010) found that the species was likely engaged in an extinction vortex, suggesting that the population is highly fragmented with low dispersal rates among sub-populations. Dispersal did not appear strongly limited in McRoberts' study (2014), with distances travelled by Ocellated Turkeys of approximately 20 km between non-breeding and breeding habitat; but since turkeys' movements were not analyzed, we are still limited in our understanding of how the species moves across the landscape.

Kampichler et al. (2010) showed that the decline of Ocellated Turkey between 1980 and 2000 was associated with decreasing forest cover and increasing human populations. In fact the species did not persist when forest cover was below 50 %, and abundance remained stable only when forest cover was over 80 % (Kampichler et al. 2010). Increasing human population is linked to declines in forest cover through land use change, but also to hunting pressure, as the species is prized by subsistence hunters. Ocellated Turkey represented up to 28 % of all the animals bagged annually by hunters in a community of the Southern Yucatán Peninsula (Calmé et al. 2006). It is the bird most commonly hunted along with the Great Curassow in the forests of the Yucatán Peninsula (see Chap. 13). The Ocellated Turkey tends to be an easy prey, particularly males during the breeding season. Their vocalizations are heard at several hundreds of meters and when fighting they do not pay attention to potential predators (Calmé pers. obs.). When individuals of

all sexes and ages gather during the fall, they also often move to agricultural areas to feed on crops, increasing the probability of encounters with hunters. Predation other than by humans is also high. González et al. (1998) estimated that only 15 % of the chicks made it to the juvenile stage in Tikal National Park, and in Yucatán where the species has become rare interviewees mentioned that they do not see females with chicks anymore (Calmé and Sanvicente 2000). It comes to no surprise as smaller predators like foxes, known to predate on nests, flourish in anthropogenic landscapes after large predators' numbers are reduced.

Despite the grim figures provided by Kampichler et al. (2010), the recent study by McRoberts (2014) in an area already considered a model for conservation in agricultural settings (Calmé et al. 2010) brings the prospect of a better future than anticipated. In that area some huge flocks of >100 individuals gather at field edges (photo provided by J. Guerrero) even when it was very rare a decade earlier. The case of Calakmul Biosphere Reserve also provides another example where the ending of subsistence hunting was enough to increase flock size (Calmé et al. 2010). The Ocellated Turkey adaptability to a large array of vegetation types and food plants weights in its favor. The species even appears to be resilient to huge disturbances such as hurricanes. Ramírez-Barajas et al. (2012) found that despite abundance was reduced by 55 % in the 8–14 months after the passing of hurricane Dean in 2007, the species quickly recovered two years and a half after: its abundance increased by 66 % and habitat occupancy by 28 %. Should hunting pressure on the Ocellated Turkey decrease significantly, there are good reasons to be optimistic regarding the fate of the species; otherwise, a steady decline linked to local extinctions will continue.

Black-Throated Bobwhite The species, *Colinus nigrogularis*, which possibly is conspecific with *C. virginianus*, is composed of four recognized subspecies distributed in the following manner: *C. n. persiccus* Van Tyne and Trautman, 1941—Progreso area of Yucatán; *C. n. caboti* Van Tyne and Trautman, 1941—N Campeche, Yucatán (except Progreso area) and N Quintana Roo; *C. n. nigrogularis* (Gould, 1843)—Belize and N Guatemala; and *C. n. segoviensis* Ridgway, 1888—E Honduras and NE Nicaragua. *C. n. persiccus* is distinctive in that it is paler than the other three subspecies and its limited distribution may merit further investigation (Carroll and Boesman 1994). This subspecies "has its center of distribution at Progreso and extends to Celestún on the west, Mina de Oro (Dzilam de Bravo) on the east, and inland about 20 km from Progreso, tapering to less than 10 km at the eastern extremity and confined to the narrow projection of land at Celestún on the west" (Paynter 1955).

The species as a whole is not globally threatened by any means, in spite of being a ground nester; to the contrary, its distribution has expanded considerably since the 1950s (Paynter 1955; Leopold 1959) with the most increase taking place during the past 20 years due to the expansion of cattle ranching in the southern portion of the peninsula (B. MacKinnon pers. obs.). Paynter (1955) found the species only as far south in Quintana Roo as Laguna Chichancanab and in Campeche to Pixoyal (between Champotón and Laguna de Términos), along a longitude comparable to

slightly north of Noh Bec, Quintana Roo. Leopold (1959), on the other hand, described the species as being from the arid northwestern part of the Yucatán Peninsula, with disjunct populations in Guatemala and British Honduras (Belize), being separated by uninhabitable humid forest. Today, the species is found in appropriate habitat almost continuously to Caobas in Southern Quintana Roo. If one is to consider the impact of the ancient Maya civilization on the ecosystems of what is today Central America prior to its collapse in the ninth century (Schele and Freidel 1990), it is not difficult to imagine that at one time the species may have been distributed continuously throughout its range.

The endemic subspecies of *C. n. persiccus* may well be at risk in the future due to the elimination of native vegetation surrounding coastal properties and increased urbanization of coastal villages which may impact dramatically on the Northern Coast of the peninsula. However, for the time being the species is presently benefiting from the replanting of sisal fields which have found new markets for its products.

Ornate Hawk-Eagle This species inhabits humid forest from central Mexico to Northern Argentina with three main distributional regions. The first includes mostly Southeastern Mexico, the Caribbean coast of Central America and the northern part of Colombia and Ecuador; the second region encloses Southern Venezuela, Colombia and Ecuador, Eastern Peru, Guyana, Suriname, French Guiana, Bolivia, and Northern Brazil; while the third region includes Southeastern Brazil, Paraguay and a reduced area in Argentina. However, in Mexico its broad distribution has been fragmented and restricted to large clumps of forest such as the Chimalapas and the south of the Yucatán Peninsula, with at least one record up to Laguna Ocom to the south of Felipe Carrillo Puerto, Quintana Roo (MacKinnon pers. obs.). The Ornate Hawk-Eagle usually inhabits the most extensive primary forests compared to Black Hawk-Eagle that sometimes is found in open areas (Escalona et al. 2006). Territory size is modest for such a large bird, at almost 7 km^2 (in French Guiana; Thiollay 1989). It is a powerful predator that primarily hunts large prey such as birds including macaws, parrots, toucans, doves, great curassow, guans, tinamous, herons, and even backyard chickens. It also feeds on several mammals like tayras, agoutis, rats, bats, and squirrels. Occasionally it will eat Black Vultures (*Coragyps atriceps*) and remains of monkeys, iguanas, and snakes (Brown and Amadon 1968; Lyon and Kuhnigk 1985).

In the peninsula, the incubation period lasts from January to May, which coincides with the dry season. The species has a long period of courtship prior to egg laying (Klein et al. 1988). Nests were previously reported to range between 100 and 125 cm wide and 45 cm high, but Balán Medina (2009) recorded larger dimensions, with nests varying between 109 and 160 cm in diameter and on average 93 cm high ($n = 6$). Nests are often built on long branches far from the main trunk in Central and South America; however, in the peninsula the nests are built on the principal axis of the shaft, which confers easy access to these raptors, but makes it difficult for potential terrestrial predators to reach the egg or chick. Ornate Hawk-Eagles nest high, close to the top of large trees, but not necessarily in tall forest

(Balán Medina 2009; MacKinnon pers. obs.); many of these nests were also on the edge of small, not much frequented roads. Although the incubation is mostly done by the female, the male does share incubation and bring prey to the female (Lyon and Kuhnigk 1985). Incubation time in Brazil was estimated to last 40 days (Brown 1977), and the nestling period 80–90 days. Once fledged, parental dependency is long (Klein et al. 1988). The species has a low productivity, with only one young per year if successful (Klein et al. 1988).

As Ornate Hawk-Eagles rely on big emergent trees for nesting, large extensions of well-preserved humid forests are required to sustain a viable population. Some of the tree species most used as support for the nest in the peninsula, for instance *Bucida buceras* (Balán Medina 2009; Calmé pers. obs.), are subject to logging outside protected areas. For the time being, it does not appear to be a big threat, as protected areas in the Southern peninsula cover a huge territorial extension. Outside reserves, however, the species requirements make it vulnerable to habitat loss, which is one of the most prominent threats.

Yucatán Nightjar This species is a year-round resident of the Yucatán Peninsula, including Cozumel Island and the northern half of Campeche (BirdLife International 2015). Mostly sedentary, it is a winter visitor in Belize, northern Honduras (near Tela), and Half Moon Cay in the Bahamas during December to February (Cleere and Nurney 2010). This species is insectivorous, solitary and inhabits mostly open, lowland forests, and forest edge (Cleere 1999). A recent study carried out in the northeast of Yucatán state, close to the city of Mérida, found much greater abundance of this species in earlier successional forests (i.e., between 4 and 15 years old), than in older secondary forest (i.e., between 30 and 40 years old) (Avilés-Peraza 2014). Aside from this latter information, which indicates the tolerance of the Yucatán Nightjar to anthropogenic landscapes, knowledge about this species remains scarce.

Yucatán Poorwill This species is endemic to the Yucatán Peninsula ranging from the Mexican states to northern Guatemala and Belize (Cleere and Nurney 2010). Although the northernmost limit of its distribution has been reported in the city of Mérida, Yucatán (BirdLife International 2015), Avilés-Peraza (2014) recently reported systematic observations of the Yucatán Poorwill in the municipality of Hunucmá. These observations extend the geographical range of this species to the north for nearly 10 km. It is a poorly known species that inhabits low deciduous forest and open woodland in the Yucatán peninsula; also found in secondary forests and farmland. In the Hunucmá municipality, the Yucatán Poorwill has been found in early secondary forests (i.e., between 4 and 15 years) but not in older secondary forest (i.e., between 30 and 40 years). However, the landscape surrounding the sample sites in Hunucmá corresponds to the older successional age, which contrasts with the dominance of early succession and semi-rural areas surrounding the samples of Temozón Norte where there are no records. The latter raises the question of whether the Yucatán Poorwill requires older forest for refuge and breeding, whereas it prefers early successional forest for foraging. The breeding season is

from April to June in Guatemala (Cleere and Nurney 2010) but there is no systematic study regarding the breeding period in the Yucatán Peninsula.

Yucatán Woodpecker This endemic species to the Yucatán Peninsula (except the Southwest) and central Belize has three subspecies, *Melanerpes p. pygmaeus* which resides on the island of Cozumel, *M. p. tysoni* found on the island of Guanaja off the northern coast of Honduras, and *M. p. rubricomus* resident on the mainland (Clements et al. 2014). The Yucatán Woodpecker inhabits deciduous forest, forest edges, clearings, secondary forests and coastal scrub (Winkler et al. 2013; Fig. 12.3c). The species forages solitary "usually lower than other Centurus" (= Melanerpes) (Howell and Webb 1995), feeding, for instance, on dead coconut palm trunks (B. MacKinnon pers. obs.). However, Philips (2007) reported Yucatán Woodpecker foraging high on tall trees with big diameters, in closed-canopy forests, with a preference for branches rather than trunks. The breeding season includes April to June (Clements et al. 2014; B. MacKinnon pers. obs.), and there are reliable observations of adults bringing food to the nest (years 1975 and 1977), and an adult in a nest (year 1978) on Isla Cancún (B. MacKinnon pers. obs.). In the years 1977 and 1979, this species had been observed on numerous occasions nesting in live or dead narrow trunks of the Chit palm (*Thrinax radiata*) in the dune vegetation on Isla Cancún.

The ecology of this species is poorly known, and its population trend and breeding ecology have not been systematically studied. In the Yucatán Peninsula this species appears not to be as near as common as it was 35 years ago, whereas on Cozumel Island, the opposite is true in that the species is more common there than the Golden-fronted Woodpecker (*Melanerpes auratus*) (B. MacKinnon pers. obs.). Land use change from forest to pasture and urban development might pose a threat, as well as logging since they frequently use big tall trees for foraging. However, its use of a wide array of vegetation types and substrate for foraging and nesting suggest adaptability to varying habitat conditions.

Orange-Breasted Falcon This species reaches its northernmost geographical limit in the south of Mexico, including the base of the Yucatán Peninsula (del Hoyo et al. 1994). The remaining sparse distribution is throughout Central America, and outstretches to South America, but the occurrence of Orange-breasted Falcon is rare everywhere. At the present time, this species appears to be virtually extirpated from most of its distribution area in southern Mexico and Central America, and there are indications that its range in South America is contracting (Berry et al. 2010). The first reported observation of the Orange-breasted Falcon in the Yucatán Peninsula was in 1973, approximately 15 km north of Xpujil, Campeche (Hardy et al. 1975), in what is now called the Calakmul region. Since then there has been a number of isolated observations of the species in the Calakmul region (e.g., in the 1990s by J. Salgado pers. com.), the last reported by Balán Medina (2009).

The Orange-breasted Falcon is ecologically highly specialized, with low reproductive rate, which, added to its rarity and sparse distribution, make it of high risk for population decline and local extirpation (Kruger and Radford 2008; Berry et al. 2010). The habitat of this species is mature humid tropical forest (Baker

et al. 2000). It is not known to nest apart from mature forest, where it tends to use cliffs to build its nest, but it can traverse a diverse landscape matrix with different types of habitat such as farmed fields, orchards, pasture lands (Berry et al. 2010). This species preys on small and medium-sized birds, and specializes on primarily hunting above the canopy (Baker et al. 2000). In the Yucatán Peninsula there are no systematic studies about the biology or ecology of the Orange-breasted Falcon, but in the near region of Belize, Berry et al. (2010) found a steep decline in occupancy and the mean number of fledged young per territorial pair, with a high proportion of nest failure (i.e., 55 %). The imminent threat for this species is the expansion of rural and urban development which causes habitat loss; there are clear examples of the loss of territories in Belize with the construction of hydroelectric dams along the Macal River, or in Ecuador with logging activities (Berry et al. 2010). These authors also report the expansion of the Black Vulture as a threat as that species tends to compete for the same nesting sites as the Orange-breasted Falcon.

Yellow-Headed Parrot Amazona oratrix was formerly distributed in both coastal slopes of Mexico from the Tres Marías Islands in Nayarit to Oaxaca and from Nuevo León to northern Chiapas and southern Tabasco and southwestern Campeche. Also there are disjunct populations in Belize, Guatemala, and Honduras. According to Monterrubio-Rico et al. (2010) its distribution in the Mexican Pacific coast has shrunk by 79 %. This is one reason for which the Yellow-headed Parrot is the second most endangered species in the region after the Cozumel Thrasher, and the situation is critical because of habitat loss and the high value of the species in the illegal pet trade, given its ability to mimic sounds and words (Cantú et al. 2007). In the Yucatán Peninsula, the occurrence of *Amazona oratrix* is related to areas where small forest fragments are interspersed in a matrix of open habitat (Plasencia-Vázquez et al. 2014). Plasencia-Vázquez and Escalona-Segura (2014) also confirmed that the Yellow-headed Parrot still maintains a high abundance in Palizada, Campeche, despite the loss of much of its vegetation cover and high fragmentation of forests. It is interesting that the species, which is characterized by a low reproductive rate and a preference for high and medium tropical forests, is present in large numbers within an area of significant human activity, making it highly vulnerable to illegal trafficking and deforestation (Enkerlin-Hoeflich 2000). The historical component has not been taken into account but may be a determining factor in explaining the observed patterns. Very little is known about this species in the Yucatán Peninsula and no data are available on its abundance prior to the deforestation of most of the forests that dominated the distribution area of this species in the southwest of the peninsula.

The area encompassing the Palizada population of Yellow-headed Parrot has been identified as a priority for conservation in Mexico (Macías-Caballero et al. 2000; Macías-Caballero and Iñigo-Elías 2003). In fact, parrots have high longevity (Munshi-South and Wilkinson 2006), thus many of the individuals observed in this region of the Yucatán Peninsula are adults that have managed to survive in a suboptimal environment. Furthermore, adult parrots normally remain in the forest canopy, making them difficult to capture, while parrot chicks suffer the

highest capture rates by poachers as they are more easily found and removed from the nest. Therefore, despite low reproduction rates and high predation, large numbers of Yellow-headed Parrots continue to be observed in that portion of their habitat in the Yucatán Peninsula (Plasencia-Vázquez and Escalona-Segura 2014). If recruitment is too low, however, in the near future the population will be composed of mainly old individuals with very low productivity and on the verge of a potentially catastrophic population crash. Unfortunately, illegal pet trade remains important in the area as reported by local people, a large number of which kept Yellow-headed Parrots as pets. Because of this situation, we recommend that surveillance be strengthened and sites with high parrot abundance be better controlled during nesting, particularly outside the boundaries of the Laguna de Términos protected area.

Yellow-Lored Parrot Amazona xantholora is endemic to the Yucatán Peninsula biotic province including Northeastern Belize, very much similar to the range of the Yucatán Woodpecker. It inhabits deciduous to evergreen forest (Collar and Boesman 2014), and mangroves in *petenes*, as well as forest edges near agricultural crops (Plasencia-Vázquez and Escalona-Segura 2014). The Yellow-lored Parrot is present in landscapes characterized by large fragments of tropical semi-evergreen medium-height forest, and its distribution probability decreases with increasing fragment irregularity and the isolation of forest fragments (Plasencia-Vázquez et al. 2014). Hence, in forested areas their relative abundance can be as high as 37 individuals in Sian Ka'an, compared to deforested areas such as Palizada with 0 out of 100 parrots in each area (Plasencia-Vázquez and Escalona-Segura 2014). In Southwestern Campeche, Gómez-Garduño (2006) found that this species nests more frequently in areas with less human activity. According to this author, it is selective in its choice of nesting cavities, and nests are usually distant 450 m to 1 km from each other.

Although considered stable by Birdlife International (2015), the Yellow-lored Parrot population is perceived to have declined by local ornithologists (B. MacKinnon pers. obs.). It may well have to do with its need for large extensions of forest. White-fronted Parrots (*Amazona albifrons*) on the other hand have increased with forest fragmentation. Historically (1970s) the White fronted Parrot moved into the coastal coconut groves on Cancún and along the east coast to nest, showing their resilience to coastal habitats, something the Yellow-lored did not seem to do. Actually, these species present a contrary controversy.

Northern Mealy Parrot Amazona guatemalae has two subspecies, *A. g. guatemalae* and *A .g. virenticeps*. This Mesoamerican parrot reaches its northernmost range in the south of the Yucatán Peninsula, where it has been observed only near the border with Guatemala and Belize, mainly in Calakmul and Escárcega municipalities. Bjork (2004) suggested that this parrot makes use of these areas during the non-reproductive stage, when performing migrations from the Petén in Guatemala to certain areas of Belize, Campeche and Chiapas. However, in 2006 O. Gómez-Garduño (pers. comm.) recorded a nest in southeast Calakmul. No other study has shown movements in other areas of its distribution. However, movements

can be linked to food availability, because the Mealy Parrot only feeds in primary evergreen forest, mainly in the canopy, and has disappeared from certain parts of its range, probably because the conditions in disturbed areas do not meet its ecological requirements (Ridgely 1981). Indeed, the habitat of this species is mostly closed-canopy humid lowland forest, but it can be found near edges or clearings (del Hoyo et al. 2014). There are no studies in Mexico about the reproduction of the Northern Mealy Parrot that we are aware of, but in nearby Guatemala the breeding season encloses April to May (Harrison and Holyoak 1970). The two biggest threats to this species is its capture for the pet trade, national and international, and the loss and fragmentation of its habitat.

Yucatán Flycatcher There are three subspecies of this endemic flycatcher, *Myiarchus yucatanensis yucatanensis* found in eastern Mexico from extreme eastern Tabasco to northern and central Yucatán Peninsula; *M. y. lanyoni* restricted to Cozumel Island, where it is a year-round resident; and *M. y. navai* resident in southern Quintana Roo to northern Belize and Guatemala. Due to its large range, and despite the fact that the population trend appears to be decreasing, the IUCN does not believe that the decline is sufficiently rapid to approach the thresholds for Vulnerable under the population trend criterion.

Unlike the other two *Myarchus* species in the region, the Yucatán Flycatcher is not migratory and is found year-round on Cozumel and throughout its range (Parks 1982), but in very low numbers. It tends to stay in the "shadows" of medium height tropical forest and edge, along with the Dusky-capped Flycatcher (*M. tuberculifer*), making its presence more difficult to ascertain than that of the Brown-crested Flycatcher (*M. tyrannulus*), which prefers more open perches. However, it is very much in the open when feeding on the fruit of the chaká (*Bursera simaruba*), or when declaring its territory during its reproductive period in March–April. It nests in natural tree holes as do the other two resident species of its genus, and although its nest hole has not been described it may be assumed that its height is similar to those of the Dusky-capped and Brown-crested Flycatchers, varying from 1.5 to 3 m from the ground and may even substitute a tree for a former wooden fence post (B. MacKinnon pers. obs.). There are no published accounts of this endemic bird's reproductive biology, which in light of the fact that its population appears to be declining, makes it all the more urgent that the species be studied in order to ascertain its habitat needs, and hence the risk of decline caused by habitat loss.

Yucatán Jay The distribution of this species is throughout the Yucatán Peninsula, the adjacent Mexican state of Tabasco, the north of Belize, and in the Petén district of Guatemala (BirdLife International 2015). In the Yucatán Peninsula it is a common bird in the edges and clearings of tropical deciduous forest and dense scrubby woodland (dos Anjos 2009). The Yucatán Jay has a sedentary character that most likely favours the kinship of breeding flock members, and is characterised by delayed maturity, low reproductive rate, low dispersal, and nonmigratory habits (Raitt and Hardy 1976). The diet of this species is omnivorous, consisting of seeds, e.g., from *Bursera simaruba*, *Ehretia tinifolia*, and maize (Scott and Martin 1984), and arthropods such as beetles (Coleoptera), Lepidoptera larvae, Orthoptera,

spiders, ants, dipterans, and also mollusks (Raitt and Hardy 1976). The mating system of this species is cooperative, and the nest success in the Yucatán Peninsula has been estimated at 42 %, where predation by snakes and small mammals is an important cause of nest losses (Raitt and Hardy 1976). The species thrives in relatively disturbed habitats, however due to its low reproductive rate and low dispersal, the population dynamics could be disturbed by rapid land use change, especially the fragmentation of its habitat.

Wood Thrush Although the Wood Thrush is still common throughout the forests of eastern North America, populations suffered a cumulative decline of 55 % between 1966 and 2010, according to the North American Breeding Bird Survey. The species is a prime example of what is happening to forest songbirds in North America. The species is presently listed as Near Threatened on the IUCN Red List, but not listed as threatened in Mexico. The major reason for concern over the species internationally is the impact of habitat loss and fragmentation in both breeding and wintering grounds. On migration to Mexico and Central America each winter, the Wood Thrush will settle into undisturbed to moderately disturbed wet primary tropical forests. Its preferred habitat includes interior understory of tropical primary, closed-canopy, semi-evergreen, broad-leaved, and mixed palm forests at 50–1000 m elevation from humid lowland to arid or humid mountain forest, as well as scrub and thickets (Rappole et al. 1989; Winker et al. 1990; Blake and Loiselle 1992; Petit et al. 1992).

Researchers tracking these birds to their wintering grounds have discovered that they stay in the same area, even though it has been destroyed, and usually die within a short period from starvation or predation. The Wood Thrush is one of the songbird species selected by researchers from the Universities of Illinois and Alabama, as well as from Canada to attach automated radio telemetry transmitters on south-bound migrants in order to learn about their migration routes. The result is that some will go down the east coast to Florida, across to Cuba and over water to Central America whereas others will fly over the Gulf of Mexico, entering land along the north coast of the Yucatán Peninsula before heading further south where they will spend the winter. Some will remain in the humid forests of Quintana Roo and southern Campeche, but most will move further south into Central America. Because of the large cover of mature tropical forest still remaining in this region, we consider that the situation in the peninsula does not pose any threat to the species.

Rose-Throated Tanager This endemic tanager has three subspecies: *Piranga roseogularis roseogularis* found in the more arid regions of the northern portion of the peninsula; *P. r. tincta* that inhabits the central-southern portion of the peninsula; and *P.r. cozumelae* endemic to Cozumel. This latter subspecies is much darker and less colorful than its mainland relatives. The species was removed from the family of Thraupidae and placed in that of Cardinalidae in recent years (Chesser et al. 2009). It is considered a species of least concern by the IUCN (BirdLife International 2012a, b) and is not of special concern under Mexican law as there is no indication that its population is diminishing.

With the advent of more trained observers and ability to enter more areas, this species has been recorded further west in Northern Yucatán than shown in Howell and Webb (1995), including Chichén Itza where Paynter collected a specimen in 1949 (MacKinnon 2013). However, distribution in the dryer semi-deciduous forests of Yucatán near Espita and Tizimín appears to be very local and of very low density (MacKinnon pers. obs.). Contrary to its distribution in Yucatán State, the species is quite common in humid forest in the states of Quintana Roo and Campeche. It is found in forests at medium to high levels but rarely on an exposed limb. Although it is known to nest from March to July, there is no published account that describes its nest and eggs, and nothing is known of its ecology, thus putting it at risk in the future due to a lack of information.

Painted Bunting The breeding distribution of the Painted Bunting is comprised of two allopatric populations separated by a distance of 550 km in southeastern US. It is unknown if the Atlantic Coast and interior birds are also isolated during migration and on wintering grounds. Two subspecies are recognized, *Passerina ciris pallidor*, distributed in the southwest US and northern Mexico, migrating to western Panama, and *P. ciris ciris* occupying the coastal area of southeastern US and migrating to Bahamas, Cuba, Jamaica and Yucatán (Herr et al. 2011), where it is present between September and beginning of May (MacKinnon 2013). Although there is no conclusive proof that the eastern population of the Painted Bunting winters in the Yucatán Peninsula, it is supposed based on the fact that the species is very common in Cuba during spring and fall migrations but not during winter. To confirm scientifically the distribution of the Atlantic Coast population in the Yucatán would require that birds be examined genetically or by stable isotope analysis (Sykes et al. 2007). The species is listed as Near Threatened by the IUCN (BirdLife International 2012a, b) and is ranked a "species at risk" and a species of Continental Importance by Partners in Flight (Rich et al. 2004), but at present is not listed as threatened under Mexican law. On the peninsula, the species is more apt to be found feeding on grasses of the genus *Cenchrus* and *Eragrostis* situated in open areas within forests than in open fields where most seedeaters are prominent.

The concern over the species has to do with its long-term decline of 1.6 % per year, with the eastern population declining 3.5 % annually between 1966 and 1996. The major factors contributing to the overall decline of the species include loss of habitat and the cage bird trade (Herr et al. 2011). In the peninsula, loss of habitat is not nearly as much of a threat as is the illegal capture and commercialization of the colorful male of the Painted Bunting. In the past, the species could be captured legally in the region as it was assumed incorrectly that all the birds found on the peninsula were from the population that breeds in the north of Mexico. It is estimated that at least 100,000 Painted Buntings were trapped in Mexico between 1984 and 2000. The present law does not allow for their legal capture but illegally, it is only second in demand after the Cardinal in the illegal trade market.

A great deal of emphasis is presently being put on environmental education in general, and bird conservation specifically, in the region, in which the Painted

Bunting is more often than not the popular figurehead for attracting attention to the need to conserve habitat for migratory birds.

Orange Oriole This is an endemic species (Fig. 12.3e) whose distribution is restricted to the three states of the Yucatán Peninsula with only a small population that winters in northeastern Belize and Ambergris Cay from October to April (Jones 2003). The species is resident in Campeche south to the community of Las Carolinas, 5 km southwest of Zoh Laguna. IUCN lists it as a species of Least Concern as it has a large range and appears to have a stable population; nor is it considered threatened under Mexican law. Partners in Flight estimated the population to number fewer than 50,000 individuals (BirdLife international 2015).

The little that is known of the breeding biology of the Orange Oriole points to it rarely breeding individually, but rather in colonies that will vary from just two or three nests in close proximity in the same tree, camouflaged by leaves in the upper canopy which are usually located near a water source, or low down in seasonally inundated scrub vegetation in colonies with as many as 35 nests (Howell et al. 1991). The species of trees apparently is not as important as the location near water, which may have to do with the availability of a very strong, black fiber of a basidiomycete fungus (Ortega Jiménez 2002) that grows on the bark of trees (MacKinnon pers. obs.). Under different circumstances the nest may be constructed of Silver Saw Palm (*Acoellorraphe wrightii*) or something similar (Ortega Jiménez 2002). Colonial nesting sites are located in seasonally inundated depressions as well as in open savannas, containing islands of scrub vegetation, surrounding a spring fed pond, all within a larger forest habitat. It has been reported laying 4–6 eggs in its pouch-like nest (Ortega Jiménez 2002), although for other *Icterus* species the norm is 2–3 or 3–4 eggs. The nest is a bit deeper than that of the Hooded Oriole (*I. cucullatus*) and it reproduces for the most part between April and August; nesting is not synchronous.

The Orange Oriole falls into the same category as other endemic and near-endemic species of the region, including the Yucatán Woodpecker, Rose-throated Tanager, and Yucatán Vireo, in that very little has been studied of its selection of habitat both for food and reproduction.

12.5 Conservation Perspective

The Yucatán Peninsula harbors a very rich avifauna that includes several endemic and near-endemic species, a very special fact given that the peninsula does not present any geographical barrier. This richness and uniqueness are threatened to different degrees and for different reasons that the species accounts in this chapter showcase almost completely. Broadly, threats can be divided into those related to anthropogenic activities and those linked to climate change.

Anthropogenic activities are by far the most important threats to birds in the Yucatán Peninsula. These activities foster land use change, be it for agriculture or

for urban or tourist development. The ecosystems most at risk currently in the peninsula are those with very limited distribution found on or near the coasts, namely the dunes, the dry forest of Yucatán State and, close to urban areas, mangroves (Chap. 3). The vegetation of these ecosystems is being removed, and it the case of wetlands, landfills allow for urban spreading. These ecosystems are the habitat of a number of bird species for which the peninsula is key to ensure their conservation, either because they are endemic (e.g., Yucatán Wren) or because the peninsula sustains important and probably distinct populations (e.g., Reddish Egret). Given the rate of urban growth along the coast or around main cities, especially in Yucatán and Quintana Roo, we are let but with a dismal prospective for some of the species depending of these rare ecosystems.

Deforestation for agriculture has greatly increased over the past decades, but most forest types remain well represented in the Yucatán Peninsula, both within and outside reserves. Cavity nesters or large raptors, however, are most at risk as small scale logging for domestic purposes usually targets the largest trees, those that are or would become most adequate for nesting. This problem is acute outside reserves, and even in large natural protected areas where ranging patrols are rare (e.g., Balamku, Campeche).

Several bird species are also directly affected by human activities leading to their extraction from their habitat, e.g., hunting or trapping. Hunting is a pervasive activity reaching almost the farthest reaches of the forests of the Yucatán Peninsula, even if activities such as gum-tapping that required working within the forest have severely declined. This threat concerns mainly large, terrestrial game birds (e.g., Great Curassow and Ocellated Turkey), but their decline will certainly affect smaller birds currently considered common (e.g., Plain Chachalaca *Ortalis vetula*). Trapping for the pet trade has already greatly impacted the populations of the largest psittacids of the peninsula (i.e., Yellow-headed and Northern Mealy Parrots), and of the colored Painted Bunting. Even if these species are now legally protected, and some awareness exists among the population, trading remains important due to demand and to weak law enforcement.

A last concern regards the current ongoing climate change, which has the potential to grossly change the face of the peninsula's ecosystems. The vegetation distributional changes are too speculative to be discussed in terms of their impact on the avifauna, but the expected change in the intensity or frequency of the hurricanes striking the peninsula is a far more concrete fact. The birds of Cozumel Island have experienced several strong hurricanes over the past 25 years that have led to the presumed extinction of the endemic Cozumel Thrasher and to a strong decline of the endemic subspecies of Great Curassow. Other species have recovered, both on the island (e.g. Yucatán Emerald) and on the mainland (e.g. Ocellated Turkey). In fact, one would expect many bird species of the Yucatán Peninsula, especially those more common on the Caribbean coast, to be resilient to hurricane impacts. However, these impacts may become not only stronger or more frequent, but synergetic effects with habitat fragmentation may well emerge (Brook et al. 2008) with dire consequences for those species with limited dispersal ability or too specialized in their habitat or feeding habits.

Even if natural protected areas remain a tool of choice for conservation (see Chaps. 14 and 15), our ability to protect effectively any species depends largely on how well their natural history and ecology are known. In face of all the recent changes in the landscapes of the peninsula, more studies are badly needed for some species without regards for their conservation status. The state of Yucatán has encouraged birdwatching tourism, which may have the double benefit of providing information and raising awareness among the population benefited from the activity. Some NGOs have also been very active in that regard, by encouraging the conservation of the resident American Flamingo (*Phoenicopterus ruber*) in Ría Lagartos area. Due to the large number and size of the protected areas in the Yucatán Peninsula, we believe that the National Commission of Natural Protected Areas (CONANP) has a major role to play that it has yet to assume.

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