

Evaluation of Waterbird Populations and their Conservation in Guatemala

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Abstract

This evaluation is based on a recent compilation on the birds of Guatemala and on workshops with institutions involved in waterbird conservation. Guatemala has ~250 km of Pacific coast and ~150 km of Atlantic coast, ~2,780 km² of interior water bodies, and 6,270 km² of other wetlands as waterbird habitats, equaling 8.3% of the country. In the country 149 species of waterbirds have been reliably reported, 29 of them with hypothetical records, without documentation by specimen or photograph. Three of the 149 species are considered extinct or extirpated: Atitlan Grebe (*Podilymbus gigas*), Black Rail (*Laterallus jamaicensis*), and Eskimo Curlew (*Numenius borealis*). Reproduction has been reported for 32 species and is assumed for additional nine species; 103 species are considered non-reproductive in Guatemala, and the status of five species is uncertain. The Guatemalan region most species rich in waterbirds is the Pacific Coast, where 123 species have been recorded, followed by the Pacific Slope (102 species), the Atlantic Coast (88 species), the Atlantic Slope (87 species), and the Highlands with 47 species. Of the 149 species, 38 are restricted to the Pacific Slope and Coast, but only 9 species are restricted to the Atlantic Slope and Coast. Based on relative abundance data from few sites and data on the distribution of wetlands, total populations in Guatemala are estimated for 91 species. Based on present knowledge, sites on the Pacific coast and slope support the highest abundances especially of wintering waterbirds. Based on previous evaluations of conservation priorities on global, regional, and national scales, 54 waterbird species of special concern were identified. An account of 17 important sites is presented, including status, threats and recommendations for their conservation.

Introduction

Water is one of the most essential natural resources for mankind. The overall human population on earth is growing rapidly. Therefore public interest has focused early on the conservation of wetlands. An international convention on wetlands was signed in 1971 in Ramsar, Iran, providing a framework for wetland protection. In Guatemala, five sites are designated as Ramsar sites (Valencia Rodríguez 2004; <http://www.wetlands.org>) and four more are proposed. However, unsustainable land use practices threaten wetland habitats seriously (e.g. ParksWatch 2005). Mangrove forests have been evaluated as threatened in all Central America (Dinerstein *et al.* 1995). Expansion of cattle ranching is a major threat to fresh water marshes and swamp forests in Guatemala. Introduction of exotic fish species and overharvest of fish affect the biological balance of water ecosystems. The use of water as transport medium for waste endangers whole watersheds.

Birds have been identified as adequate organisms for biological monitoring in different kinds of habitat. While almost all bird species use water at least for drinking and bathing, some are specialized on habitats near water. In Guatemala approximately 20% of all bird species are waterbirds. Some of them are specialists of the open sea, others of shaded rainforest rivers, of coastal lagoons and beaches or freshwater marshes. Knowledge of waterbirds in Guatemala is poor and there is no national waterbird monitoring as an indicator for habitat quality (Ellison 2004, Eisermann & Avendaño 2006). Habitats are disappearing without the possibility to quantify the loss of biodiversity. This report is an attempt to quantify waterbird populations in Guatemala and to identify important sites with the objectives addressed on a global scale by Delany & Scott (2002). Main deficiencies for the conservation of waterbirds in Guatemala are discussed with the goal to find strategies and solutions on a regional scale (Kushlan *et al.* 2002).

Background

The history of documentation of bird species in the area today known as Guatemala reaches back to the Maya era (2000 BC - 1500 AD); Tozzer & Allen (1910) identified 14 species of birds in Maya codex figures, including several waterbirds like herons and cormorants. Inventorying waterbird species with scientific standards began in Guatemala in the 19th century, when major collections of bird specimens were made. Distributional data from this period were compiled by Salvin & Godman (1879-1904). Later compilations on species distribution in Guatemala and adjacent areas were published by Griscom (1932), Dickey & van Rossem (1938), Friedmann *et al.* (1950), Miller *et al.* (1957), Russell (1994), Monroe (1968), Land (1970), Blake (1977), Álvarez del Toro (1980), Thurber *et al.* (1987), Miller & Miller (1992), Howell & Webb (1995), Komar (1998), Jones & Valley (2001), Komar & Domínguez (2001), Bonta & Anderson (2002), Jones (2003), and Eisermann & Avendaño (2006). Compilations for North American species, wintering or transient in Guatemala, were published by Poole & Gill (1992-2003). The compilations are based on the following original works about waterbirds. The ecology and extinction of the Atitlan Grebe (*Podilymbus gigas*) has been documented by Bowes (1964), LaBastille (1969, 1974, 1978, 1983a,b, 1984, 1990a,b, 1992, 1994, 1996), Polunin (1969), LaBastille & Bowes (1962), Hamilton (1970), LaBastille *et al.* (1973), Hunter (1988), Prytherch & Everett (1988), and Wahlstedt (1988). Off-shore birds are the least studied in Guatemala (Eisermann & Avendaño 2006), with only a few papers focused on them (Salvin 1864, 1865, Jehl 1974, Pitman 1986, Pitman & Jehl 1998, Spear *et al.* 1995, Huyvaert & Anderson 2004). Band recoveries of waterbirds in Guatemala have been published for several species (Cooke 1938a,b, 1940, 1946a,b, 1950, Bergstrom 1951, Austin 1953, Chapman 1969, Hopkins 1972, Thurber & Villeda 1972, Gill & Mewaldt 1983, Anonym 1986, Dunning 1987, Botero & Rusch 1988, Schreiber & Mock 1988, Belant & Dolbeer 1993, Houston 2000, King & Greve 2001). The distribution of Cattle Egret (*Bubulcus ibis*) in Guatemala, a species of African origin, has been documented by Smithy & Land (1960) and Crosby (1972). Distributional and natural history data for waterbirds were published by Salvin (1861, 1864, 1865), Oberholser (1918), Dickey (1929), Deignan (1933), Wetmore (1941, 1945), Conover (1945), Saunders (1950), Tashian, (1953), Smithe & Paynter (1963), Coues (1964), Weller (1964), Smithe (1966), Dickerman (1968, 1972, 1973, 1977), Biderman & Dickerman (1978), Jehl (1979), Zedekar *et al.* (1980), Wendelken & Martin (1986, 1989), Myers *et al.* (1990), Beavers *et al.* (1991), Beavers (1992), Howell & Webb (1992), Weber & Bucklin (1995), Palacios & Mellink (1996), Baker *et al.* (1999), Pérez & Castillo (2000), Eisermann (2003a), Komar (2003), Eisermann & Avendaño (2004), Herrera (2005), and Herrera & Ibarra (2005). Recent distributional data are published in quarterly reports on bird records in Central America compiled by Jones (since 2000).

Rapid assessments with information about waterbirds were carried out in the Punta de Manabique Wildlife Refuge (CECON-CDC 1992, Pérez 1999), in the Laguna del Tigre National Park (Pérez & Castillo 2000), and Bocas del Polochic Wildlife Refuge (Arrivillaga *et al.* 1992, Dowell *et al.* 1994, Holtropp 1995). University studies ("licenciatura" thesis research, university practice) including waterbirds were carried out at lake Atitlán (Cazali 1984), Bocas del Polochic Wildlife Refuge (Cardona 1994), Manchón-Guamuchal (Sigüenza 1995), Laguna del Tigre National Park (Baumgarten 1998, Ordoñez 1998, Castillo 1999), Punta de Manabique Wildlife Refuge (Tenez 2001), Laguna Lachuá National Park (Avendaño 1999, 2001) and Lake Amatitlán (Chávez 1997, 2001). More detailed studies were carried out in the Bocas del Polochic Wildlife Refuge (Seglund & Conner 1997), in the Punta de Manabique Wildlife Refuge (Eisermann 2001a, 2003a), and on Lake Güija (Herrera & Ibarra 2005). Continued monitoring efforts have been made in the Bocas del Polochic Wildlife Refuge (Valle 2002, Pérez *et al.* 2003, García 2004, García de la Vega 2005). Dix & Fernández (2001) published an inventory of 191 Guatemalan wetlands with scarce information on the biological diversity of each site.

Methodology

Definition of terms: This report treats as waterbirds all species of the following bird families with species distributed in the Neotropics: Spheniscidae, Gaviidae, Podicipedidae, Diomedidae, Procellariidae, Hydrobatidae, Pelecanoididae, Phaethontidae, Pelecanidae, Sulidae, Phalacrocoracidae, Anhingidae, Fregatidae, Ardeidae, Chionididae, Threskiornithidae, Phoenicopteridae, Anhimidae, Anatidae, Gruidae, Aramidae, Rallidae, Heliornithidae, Eurypygidae, Jacanidae, Rostratulidae, Haematopodidae, Recurvirostridae, Burhinidae, Charadriidae, Scolopacidae, Thinocoridae, Ciconiidae, Laridae, Rhynchopidae, and Alcidae.

The term "wetland" is used for all kinds of waterbird habitats: off-shore, beaches, estuaries and river mouths, salt and fresh water marshes, swamp forests, mangroves, lakes, and rivers.

Sources of information: I reviewed relevant literature including gray literature, recently compiled in a bibliographic list by Eisermann & Avendaño (2006). Unwritten information was gathered during two workshops with relevant institutions. One workshop was held on 7 September 2005 in Flores, Petén, with institutions active in northern Guatemala (Petén) and a second workshop was held on 12 September 2005 in Guatemala City with institutions active in southern Guatemala. See section "13. References/experts consulted" for the names of participating institutions and personnel.

Spatial analysis are based on GIS layers which have been prepared with Landsat satellite images and topographic maps 1:250,000 (MAGA 2002).

For some of the key sites a satellite image (Landsat SWIR bands, provided online by NASA at <https://zulu.ssc.nasa.gov/mrsid>) is presented, which illustrates the distributions of forest and water bodies. Images are from the year 2000.

Distribution: A division of geographical units is used for the description of species distribution (Fig. 1): Atlantic Slope and Pacific Slope (<900 masl), Highlands (>900 masl), Atlantic Coast and Pacific Coast (coastal waters, beaches, estuaries and mangrove).

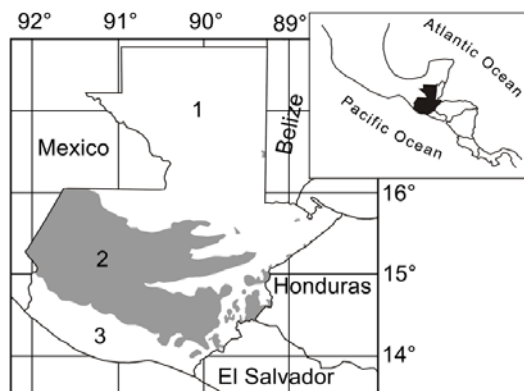


Fig. 1. Geographic units in Guatemala. 1-Atlantic Slope, 2-Highlands (>900 m, in gray), 3-Pacific Slope. The inset map shows the location of Guatemala in Mesoamerica.

Population estimates and status: No population census data were available for Guatemalan wetlands. Data on relative abundance were available for some sites. From these I estimated population sizes for the sites. For the whole area of suitable habitat (derived from MAGA 2002), I applied the mean population size per km² of wetland from sites with relative abundance data. The median was taken of a range of values of abundance from expert opinions for further estimates. Similar to classes applied by Delany & Scott (2002) for the size of world populations, I present estimates for the populations in Guatemala as best-guess information in the following classes: A <50 individuals; B 51-250; C 251-1,000; D 1,001-10,000; E 10,000-50,000; F >50,000. The estimated percentage of the total population of the subspecies or regional population was calculated

based on the most recent numbers given by Delany & Scott (2002). I assume that all individuals of populations entirely breeding in North America and entirely wintering in South America, pass through Guatemala. The percentage of the regional population is therefore marked with "100%".

In-country population trends are based on expert opinions collected during workshops, however no long-term monitoring data were available. I used categories proposed by Delany & Scott (2002): Stable, Decreasing, Increasing, Fluctuating, Extinct, and I added Data Deficient as an additional category.

Identification of important sites and species of special concern: I define an important site as a land unit which can be managed for conservation (usually a protected area, a part of a river, a lake or small scale watershed, or other naturally defined wetland) with relatively high species richness and/or high abundances, or with records of species of special concern. Species of special concern are globally threatened species (BirdLife International 2004), species listed in Parker *et al.* (1996) with conservation priority in the Neotropics, species with populations at risk or at potential risk in North and Central America (Kushlan *et al.* 2002), or species listed as threatened in Guatemala (Eisermann & Avendaño 2006).

Species nomenclature follows AOU (1998) and supplements; names of species treated in this report are influenced by Banks *et al.* (2000, 2002). Common local names are given for some regions of Guatemala. Local Spanish names were provided by Eisermann (2001a) for the Punta de Manabique Wildlife Refuge, Izabal, and for Petén, names were compiled during the workshop. Names in the Q'eqchi' language for some species or groups of species were provided by the bird census takers from the community Rocjá Pomtilá, Cobán, Alta Verapaz (PROEVAL RAXMU Bird Monitoring Program, Eisermann 2003b). However, the account of local names remains incomplete, considering that 24 languages are spoken in Guatemala (Secaira 2000).

Results

Species occurring within the country

In Guatemala 149 waterbird species of 24 families (Fig. 2) have been reliably reported (Appendix I, see Appendix II for common names), 29 species of them with hypothetical records lacking a documentation by specimen or photograph (Eisermann & Avendaño 2006). Table 1 summarizes status of residency of waterbird species, see Appendix I for the category of each species. An additional 19 species may occur in Guatemala; they have been recorded near Guatemala in neighbouring countries (Appendix III).

Of the 149 species of waterbirds, most species occur in Guatemala exclusively as visitors (Fig. 2). Reproduction is documented for 32 species, an additional 9 species are assumed to nest in Guatemala, 103 species are considered non-reproductive in Guatemala, and the status of five species is uncertain.

Table 1. Status of waterbirds reported in Guatemala.

	Number of documented species*	Number of species with hypothetical record	Total number of species
Reproductive residents, without migratory populations	14 (1)	0	14 (1)
Reproductive residents, in part migratory	18	0	18
Residents assumed to be reproductive	9 (1)	0	9 (1)
Subtotal reproductive species	41 (2)	0	41 (2)
Non-reproductive visitor	51	8	59
Transient	10	3	13
Migratory vagrant	15 (1)	16	31 (1)
Subtotal non-reproductive species	76 (1)	27	103 (1)
Status uncertain	3	2	5
Total	120 (3)	29	149 (3)

* The number of species includes the number of extinct or extirpated species, indicated in parentheses.

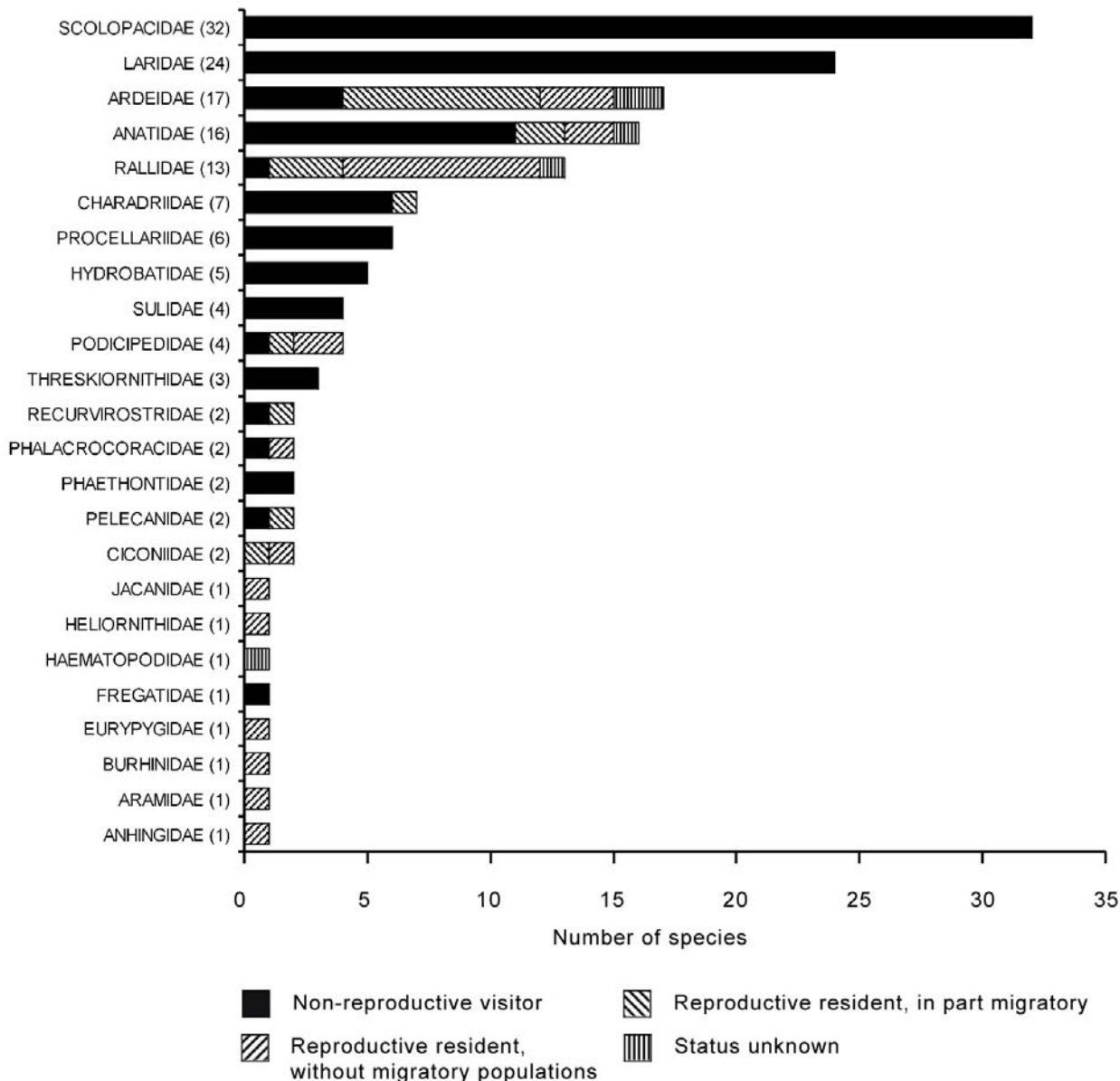


Fig. 2. Number of species of each family of waterbirds recorded in Guatemala. The number in parentheses indicates the number of species recorded. Non-reproductive visitors include vagrants and transients.

One species, the Atitlan Grebe (*Podilymbus gigas*), was restricted to the Atitlán Lake and is now considered extinct (Wege & Long 1995, O'Donnel & Fjeldsá 1997, Hilton-Taylor 2000, BirdLife International 2004). There exist apparently no recent record of Black Rail (*Laterallus jamaicensis*) (Howell & Webb 1995), and the Eskimo Curlew (*Numenius borealis*) was recorded reliably only once in Guatemala (Salvin 1861). Both species are considered locally extirpated (Eisermann & Avendaño 2006).

Distribution and habitat needs information

Guatemala covers an area of ~108,900 km², with ~250 km Pacific coast line and ~150 km Atlantic coast line. All types of wetlands (without coastal waters) cover a total of 9,043 km², which is 8.3% of Guatemala (Fig. 3). Of this total wetland area, the interior water bodies including major rivers cover ~2,779 km², equaling ~2.5% of the country. Forested wetlands including mangroves and other wetlands cover ~6,264 km², equaling ~5.8% of the country. Guatemala has no oceanic islands, which are important nesting sites for seabirds in other Central American countries (e.g. Angehr 2003).

Guatemala's region with the highest species richness in waterbirds is the Pacific Coast, where 123 species have been recorded, followed by the Pacific Slope (102 species), the Atlantic Coast (88 species), the Atlantic Slope (87 species), and the Highlands with 47 species (Appendix I). Of the 149 species, 38 are restricted to the Pacific Slope and Coast, but only 9 species are restricted to the Atlantic Slope and Coast.

A total of 33 species are restricted to one of the five regions (Appendix I). Nineteen species occur exclusively on the Pacific Coast: Parkinson's Petrel (*Procellaria parkinsoni*), Pink-footed Shearwater (*Puffinus creatopus*), Wedge-tailed Shearwater (*Puffinus pacificus*), Sooty Shearwater (*Puffinus griseus*), Christmas Shearwater (*Puffinus nativitatis*), Audubon's Shearwater (*Puffinus lherminieri*), Wilson's Storm-Petrel (*Oceanites oceanicus*), Leach's Storm-Petrel (*Oceanodroma leucorhoa*), Wedge-rumped Storm-Petrel (*Oceanodroma tethys*), Black Storm-Petrel (*Oceanodroma melania*), Least Storm-Petrel (*Oceanodroma microsoma*), Red-billed Tropicbird (*Phaethon aethereus*), Nazca Booby (*Sula granti*), South Polar Skua (*Stercorarius maccormicki*), Long-tailed Jaeger (*Stercorarius*

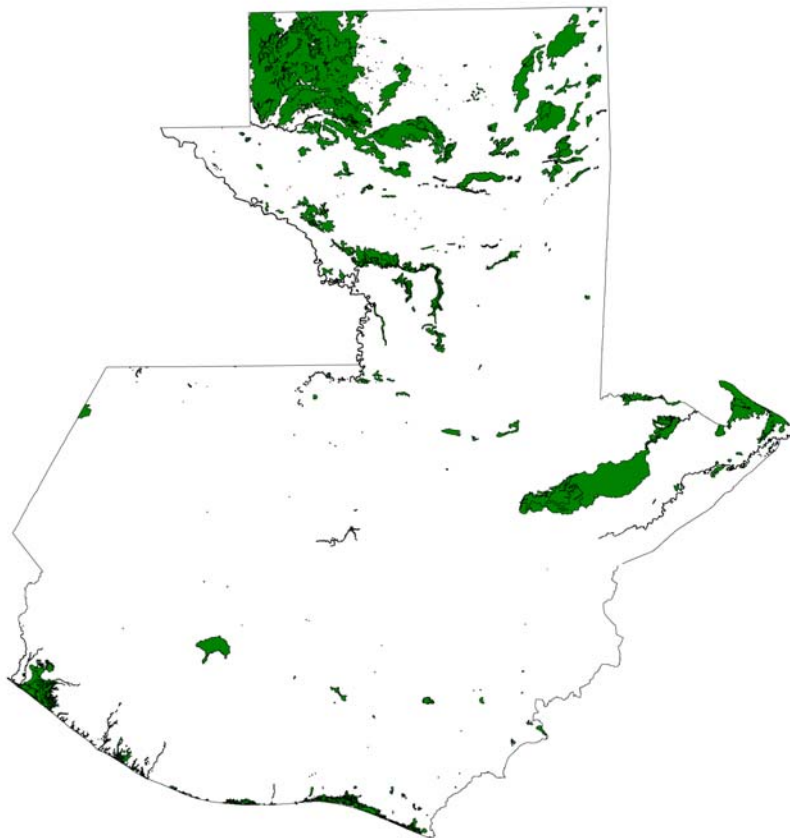


Fig. 3. Distribution of major wetlands in Guatemala, based on GIS layers (MAGA 2002) prepared with Landsat images and topographic maps 1:250,000.

longicaudus), Heermann's Gull (*Larus heermanni*), Sabine's Gull (*Xema sabini*), Elegant Tern (*Sterna elegans*), and Arctic Tern (*Sterna paradisaea*). Four species occur exclusively on the Atlantic Coast: White-tailed Tropicbird (*Phaethon lepturus*), Double-crested Cormorant (*Phalacrocorax auritus*), Roseate Tern (*Sterna dougallii*), and Bridled Tern (*Sterna anaethetus*); two exclusively on the Atlantic Slope: Pinnated Bittern (*Botaurus pinnatus*) and Sunbittern (*Eurypyga helias*); one on the Pacific slope (Mallard *Anas platyrhynchos*), and seven species have been recorded exclusively in the Highlands: Canvasback (*Aythya valisineria*), Eared Grebe (*Podiceps nigricollis*), Virginia Rail (*Rallus limicola*), Wilson's Phalarope (*Phalaropus tricolor*), the extinct Atitlan Grebe (*Podilymbus gigas*), the extirpated Black Rail (*Laterallus jamaicensis*), and Eskimo Curlew (*Numenius borealis*). Distribution maps of

some species which are not widespread in Guatemala are shown in Fig. 4 (for species not shown consult distribution maps in Howell & Webb 1995), and the Guatemalan regions where each species have been recorded are listed in Appendix 1.

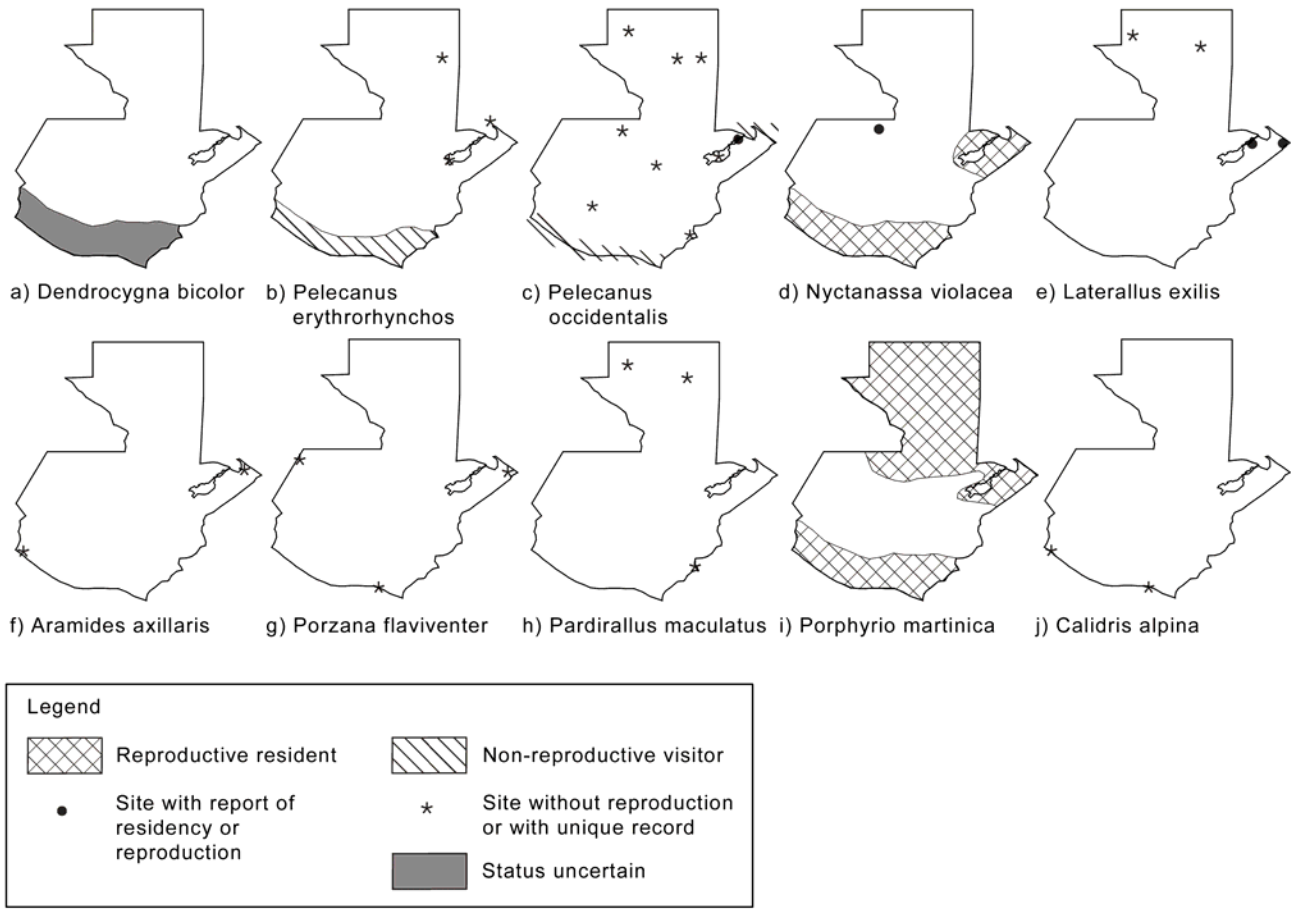


Fig. 4. Distribution maps of some species with updated information (Eisermann & Avendaño 2006).

Population estimates, percent of global population, and in-country trends (status)

The estimation is based on relative abundance data from four sites on the Atlantic slope, four sites on the Pacific slope, and two sites in the Highlands (Table 2). Details for the derivation of population estimates are given in Appendix V. The following species are breeding in North America and wintering in South America (Howell & Webb 1995); I assume that all individuals pass through Guatemala: American Golden-Plover (*Pluvialis dominica*), Upland Sandpiper (*Bartramia longicauda*), Hudsonian Godwit (*Limosa haemastica*), Buff-breasted Sandpiper (*Tryngites subruficollis*), and Franklin's Gull (*Larus pipixcan*). With exception of Franklin's Gull, there are only few records of all of these species in Guatemala. Migration happens probably mainly at night, as a report of 30 hunted Upland Sandpipers in one night in a village in Huehuetanago suggests (Baepler 1962). The overall waterbird population in Guatemala is estimated to be ~1.8 million individuals.

Noteworthy is the population estimate of 1960 individuals of the Bare-throated Tiger-Heron (*Tigrisoma mexicanum*), which represents almost 20% of the estimated world population (Delany & Scott 2002, Kushlan *et al.* 2002). Eleven more species are supposed to have >1% of the regional population in Guatemala: Fulvous Whistling-Duck (*Dendrocygna bicolor*), Blue-winged Teal (*Anas discors*), Least Grebe (*Tachybaptus dominicus*), American White Pelican (*Pelecanus erythrorhynchos*), Little Blue Heron (*Egretta caerulea*), Cattle Egret (*Bubulcus ibis*), Jabiru (*Jabiru mycteria*), Wood Stork (*Mycteria americana*), American Coot (*Fulica americana*), Collared Plover (*Charadrius collaris*), Spotted Sandpiper (*Actitis macularius*). However, all estimates are preliminary due to the lack of useful field data. None of the key sites in Guatemala supports 1% of the regional population.

Table 2. Wetland sites with relative abundance data as base for national population estimates.

Region	Site	Source
Pacific slope	Manchón-Guamuchal	Sigüenza (1995); R. Sigüenza, pers. comm.
	Sipacate-Naranjo	pers. comm. by: R. Sigüenza and F. Valenzuela
	Monterrico-Hawaii	pers. obs.; C. Avendaño, pers. comm.
	Lake Güija	Herrera & Ibarra (2005)
Highlands	Lake Atitlán	pers. obs.
	Lake Amatitlán	Chávez (2001)
Atlantic slope	Punta de Manabique	Eisermann (2001a)
	Yaxhá	Seavy <i>et al.</i> (1995), pers. obs.
	Laguna del Tigre National Park	Castillo (2001); pers. comm. by R. Balas McNab, J. M. Castillo Rivera, E. González Ordoñez, T. Dubon Ortiz, G. Gámez Díaz, V. E. Cuoj.
	Bocas del Polochic	Seglund & Conner (1997), pers. obs.

For 56 of the 149 waterbird species in Guatemala, data were deficient and I was unable to estimate the population. National population estimates, percentage of global populations, and overall in-country trend are listed in Appendix I. For the lack of data trends could be estimated for only 31 species. I assume a population decrease for all species which prefer wooded wetlands due to habitat alteration (Fig. 22), like Boat-billed (*Cochlearius cochlearius*) or Agami Heron (*Agamia agami*).

Species of Special Concern

A total of 54 species of special concern have been identified (Table 3). Four species are included in the Red List of globally threatened bird species (BirdLife International 2004, IUCN <http://www.redlist.org>), nine species have been evaluated with medium to urgent conservation priority in the Neotropics (Parker *et al.* 1996), and 19 species have been evaluated at risk or potential risk in North and Central America (Kushlan *et al.* 2002). In the official national Red List (CONAP 2001) many waterbird families were ignored, but 37 species have been evaluated as threatened or data deficient on a national scale by Eisermann & Avendaño (2006).

Globally threatened species: Three of the waterbird species recorded in Guatemala are listed in the Red List of globally threatened species (BirdLife International 2004). Eskimo Curlew (*Numenius borealis*) is listed as Critically Endangered, in Guatemala it has been recorded reliably only once (Salvin 1861). Vulnerable are Parkinson's Petrel (*Procellaria parkinsoni*) and Pink-footed Shearwater (*Puffinus creatopus*). Seabirds have been identified as the least investigated group of birds in Guatemala (Eisermann & Avendaño 2006). *P. parkinsoni* breeds on two islands in New Zealand. During migration to the Pacific waters off Mesoamerica and South America the species is threatened by fisheries (BirdLife International 2004). *P. creatopus* breeds exclusively on islands off Chile (Collar *et al.* 1992). The species has been reported entangled in fishing gear (BirdLife International 2004). Abundances and the impact of fisheries on both species in Guatemala is unknown. Regular monitoring of populations off Central America should be undertaken, including quantifying the impact of fisheries.

Locations and descriptions of key sites used by aquatic species

A total of 17 important waterbird sites were identified in Guatemala (Fig. 5, Table 4), based on publications, gray literature, and expert opinions. These include 13 wetlands within protected areas (including all Guatemalan Ramsar sites) and four wetlands which are not declared as protected areas. The regional distribution is as follows: four of the key sites are located on the Pacific Coast, one on the Pacific Slope, two on the Atlantic Coast, eight on the Atlantic Slope and two in the Highlands (Fig. 5).

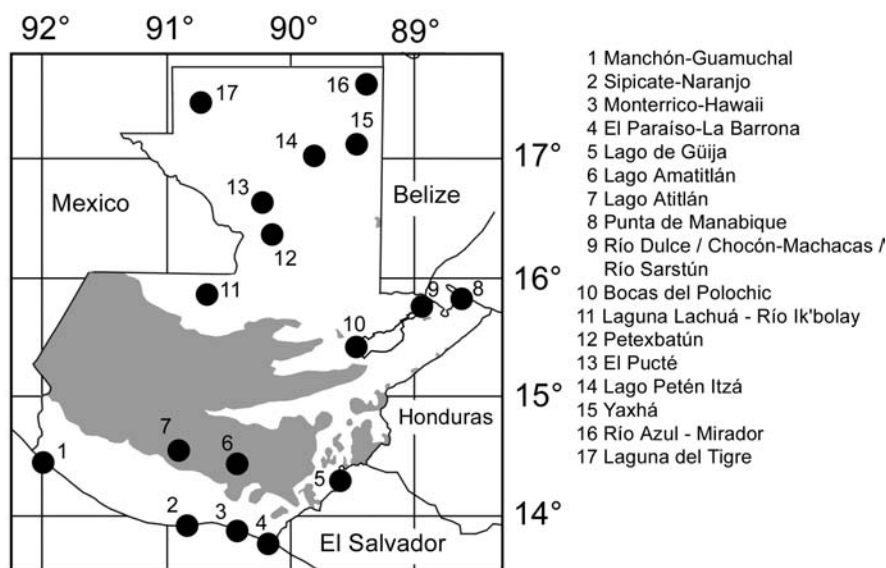


Fig. 5. Important waterbird sites in Guatemala.

Based on present knowledge, the sites on the Pacific coast (Manchón-Guamuchal, Sipacate-Naranjo, Monterrico-Hawaii, and El Paraíso-La Barrona) and Lake Güija support the highest abundances of waterbirds in Guatemala, especially migratory populations. Sites on the Atlantic coast and slope are important for their high species richness of waterbirds and for supporting species of special concern.

An account follows of all key sites including information on location, size, habitats, conservation status, importance, threats, recommendations for conservation improvements, and involved institutions. Information on the size of protected areas is based on CONAP (2005). See section "Organizations relevant to waterbird and/or wetland conservation" for full names of abbreviations of institutions.

Table 3. Waterbird species of special concern on global, regional, and national scale in Guatemala.

Species	Common name	World (Birdlife International 2004 and IUCN) ¹	Neotropics (Parker <i>et al.</i> 1996) ²	North and Central America (Kushlan <i>et al.</i> 2002) ³	Guatemala (Eisermann & Avendaño 2006) ⁴
<i>Dendrocygna autumnalis</i>	Black-bellied Whistling-Duck	-	-	-	VU A3c,d / -
<i>Dendrocygna bicolor</i>	Fulvous Whistling-Duck	-	-	-	DD / -
<i>Cairina moschata</i>	Muscovy Duck	-	-	-	VU A3c,d / -
<i>Nomonyx dominicus</i>	Masked Duck	-	-	-	CR D / -
<i>Oxyura jamaicensis</i>	Ruddy Duck	-	-	-	CR D / -
<i>Podilymbus podiceps</i>	Pied-billed Grebe	-	-	-	VU B2a,b(iii) / -
<i>Podilymbus gigas</i>	Atitlan Grebe	EX	1	-	EX / -
<i>Podiceps nigricollis</i>	Eared Grebe	-	-	4	-
<i>Procellaria parkinsoni</i>	Parkinson's Petrel	VU D2	-	-	- / DD
<i>Puffinus creatopus</i>	Pink-footed Shearwater	VU D2	-	-	- / DD
<i>Puffinus nativitatis</i>	Christmas Shearwater	-	-	4	-
<i>Puffinus ilherminieri</i>	Audubon's Shearwater	-	-	4	-
<i>Oceanodroma tethys</i>	Wedge-rumped Storm-Petrel	-	3	-	-
<i>Sula sula</i>	Red-footed Booby	-	-	4	-
<i>Pelecanus occidentalis</i>	Brown Pelican	-	-	-	VU B2a,c(iii) / -
<i>Botaurus pinnatus</i>	Pinnated Bittern	-	-	-	VU B2a,b(iii) D1 / -
<i>Botaurus lentiginosus</i>	American Bittern	-	3	-	-
<i>Ixobrychus exilis</i>	Least Bittern	-	-	-	VU B2a(iii) / -
<i>Tigrisoma mexicanum</i>	Bare-throated Tiger-Heron	-	-	-	VU A3c / -
<i>Ardea alba</i>	Great Egret	-	-	-	VU A3c / -
<i>Egretta thula</i>	Snowy Egret	-	-	-	VU A3c / -
<i>Egretta caerulea</i>	Little Blue Heron	-	-	4	-
<i>Egretta tricolor</i>	Tricolored Heron	-	-	-	VU A3c / -
<i>Egretta rufescens</i>	Reddish Egret	-	3	-	-
<i>Butorides virescens</i>	Green Heron	-	-	-	VU A3c / -
<i>Agamia agami</i>	Agami Heron	-	-	-	EN D / -
<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	-	-	-	VU A3c / -
<i>Nyctanassa violacea</i>	Yellow-crowned Night-Heron	-	-	-	VU A3c / -
<i>Cochlearius cochlearius</i>	Boat-billed Heron	-	-	-	VU A3c / -
<i>Platalea ajaja</i>	Roseate Spoonbill	-	-	5	-
<i>Jabiru mycteria</i>	Jabiru	-	-	-	CR D / -
<i>Mycteria americana</i>	Wood Stork	-	-	-	VU A3c / -
<i>Laterallus exilis</i>	Gray-breasted Crake	-	-	-	VU D1,2 / -
<i>Laterallus jamaicensis</i>	Black Rail	-	2	-	RE / -
<i>Rallus limicola</i>	Virginia Rail	-	3	-	DD / -
<i>Aramides axillaris</i>	Rufous-necked Wood-Rail	-	-	-	EN B2a,b(iii) / -
<i>Amaurolimnas concolor</i>	Uniform Crake	-	-	-	EN D / -
<i>Porzana flaviventer</i>	Yellow-breasted Crake	-	-	-	VU Ba,b(iii) / -
<i>Pardirallus maculatus</i>	Spotted Rail	-	-	-	CR D / -
<i>Heliornis fulica</i>	Sungrebe	-	-	-	VU A3c / -
<i>Eurypyga helias</i>	Sunbittern	-	-	-	CR B2a,b(iii) / -
<i>Aramus guarana</i>	Limpkin	-	-	-	VU A3c / -
<i>Burhinus bistriatus</i>	Double-striped Thick-knee	-	-	-	VU D1 / -
<i>Charadrius collaris</i>	Collared Plover	-	-	-	VU D1 / -
<i>Himantopus mexicanus</i>	Black-necked Stilt	-	-	-	VU D1 / -
<i>Catoptrophorus semipalmatus</i>	Willet	-	3	-	-
<i>Numenius borealis</i>	Eskimo Curlew	CR D	-	-	- / RE
<i>Larus heermanni</i>	Heermann's Gull	-	-	5	-
<i>Xema sabini</i>	Sabine's Gull	-	-	4	-
<i>Sterna elegans</i>	Elegant Tern	-	-	4	-
<i>Sterna dougallii</i>	Roseate Tern	-	-	5	-
<i>Sterna hirundo</i>	Common Tern	-	-	4	-
<i>Sterna antillarum</i>	Least Tern	-	3	-	-
<i>Chlidonias niger</i>	Black Tern	-	3	-	-

¹ Evaluated by Birdlife International (2004) and IUCN (<http://www.redlist.org>) with IUCN categories (IUCN 2001, 2003): EX-Extinct; CR-Critically Endangered; VU-Vulnerable. Lower categories are not listed here.

² Conservation priorities according to Parker *et al.* (1996): 1-Urgent; 2-High; 3-Medium (lower categories not listed here).

³ Threat to breeding and/or visiting populations (Kushlan *et al.* 2002): 4-potential risk; 5-risk (lower categories not listed here).

⁴ IUCN categories (IUCN 2001, 2003) applied on national scale. Reproducing populations are indicated first, and after the slash follows the status of visiting non-reproductive populations. EX-Extinct, RE-Regionally Extinct, CR-Critically Endangered, EN-Endangered, VU-Vulnerable, DD-Data Deficient. Lower categories are not listed here.

Table 4. Key sites for waterbirds in Guatemala*.

Site	Reserve category	UTM coordinates
Manchón-Guamuchal	Private Protected Area (partially)	Zone 15, 599800 / 1597000
Sipacate-Naranjo	National Park	Zone 15, 711000 / 1541000
Monterrico-Hawaii	Area of Multiple Use	Zone 15, 777000 / 1537000
El Paraíso-La Barrona	not declared	Zone 15, 803000 / 1525000
Lake Güija	not declared	Zone 16, 224000 / 1579000
Lake Amatitlán	not declared	Zone 15, 762000 / 1600000
Lake Atitlán	Area of Multiple Use	Zone 15, 693000 / 1626000
Punta de Manabique	Wildlife Refuge	Zone 16, 344000 / 1752000
Río Dulce / Chocón-Machacas / Río Sarstún	National Park / Biotope / Area of Multiple Use	Zone 16, 301000 / 1744000
Bocas del Polochic	Wildlife Refuge	Zone 16, 242000 / 1709000
Laguna Lachuá / Río Ik'bolay	National Park (partially)	Zone 15, 755000 / 1752000
Petexbatún	Wildlife Refuge	Zone 15, 799000 / 1820000
El Pucté	Wildlife Refuge	Zone 15, 780000 / 1838000
Lake Petén Itzá	not declared	Zone 16, 200000 / 1881000
Yaxhá-Nukum-Naranjo	National Park	Zone 16, 245000 / 1888000
Mirador-Río Azul	National Park	Zone 16, 250000 / 1960000
Laguna del Tigre	National Park / Biotope	Zone 15, 750000 / 1940000

*Sites are listed in geographic order from south to north.

Manchón-Guamuchal

- Location: departments Retalhuleu and San Marcos, UTM Zone 15 599800/1597000.
- Size: ~14,900 ha, the Private Protected Area "La Chorrera-Manchón-Guamuchal" covers 1,243 ha of it (CONAP 2005).
- Habitats: mangrove, reed swamp, beach.
- Conservation status: Private Protected Area; Ramsar site (designated 1995).
- Importance: The site supports large breeding colonies of several heron species (R. Sigüenza) and large numbers (possibly thousands) of wintering and staging populations of migratory species. No detailed abundance data are available. At least 23 species of special concern have been recorded (Appendix IV).
- Threats: Estimated waterbird habitat is ~14,900 ha, most of it designated as Ramsar site (López *et al.* 1993; Fig. 6), but 92% of the Ramsar site is unprotected. The area lacks management due to scarce interaction with private landowners. Hunting seems to be intensive; massive kills of White Ibis (*Eudocimus albus*) have been observed (R. Sigüenza, pers. comm.). Sport hunters enter the area. Deforestation of mangrove and water pollution by agrochemicals were reported by López *et al.* (1993) and Schaeffer Novelli (2003). There is insufficient surveillance in the area.
- Recommendations for conservation improvement: Promote communication with all landowners within the Ramsar site and apply a management plan for the Ramsar site.
- Involved Institutions: INAB, CONAP, OCRET.

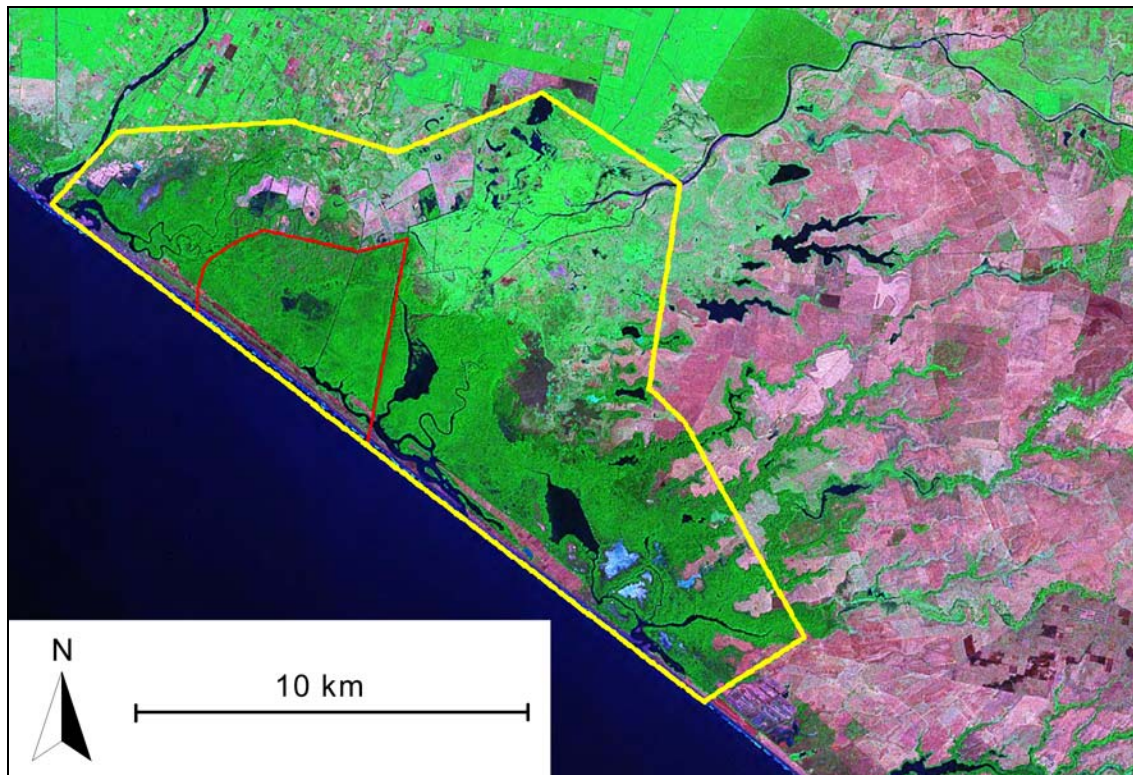


Fig. 6. Area of Manchón-Guamuchal; approximate border of Ramsar site is marked by the yellow line, the approximate border of the Private Reserve is marked by the red line. The dark green area along the coast line is mangrove, which is bordered by reed swamps and agricultural land (light green areas, areas with shades of magenta, lavender and pink). Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

Sipacate-Naranjo

- Location: department Escuintla, UTM Zone 15 711000 / 1541000.
- Size: ~3,300 ha, the National Park covers 2,000 ha of it.
- Habitats: mangrove, reed swamp, beach.
- Conservation status: National Park.
- Importance: Large nesting colony of herons (apparently *Ardea alba*, according to description by F. Valenzuela). At least 13 species of special concern have been recorded (Appendix IV).
- Threats: Estimated waterbird habitat is ~3,300 ha, therefore ~1,300 ha are unprotected (Fig. 7). Massive harvest of heron chicks in the nesting colonies; the meat is sold at markets in Guatemala City (R. Sigüenza, pers. comm.). Sewage from the sugar industry is causing yearly dying of fish between May and November (F. Valenzuela, pers. comm.). The area is used by sport hunters and there is insufficient institutional control. Mangrove is deforested by local people.
- Recommendations for conservation improvement: The first management master plan has been elaborated for the period 2002-2006 (CONAP 2002). To prevent harvest on nesting sites, surveillance needs to be improved, which requires additional personnel.
- Involved Institutions: CONAP, OCRET.

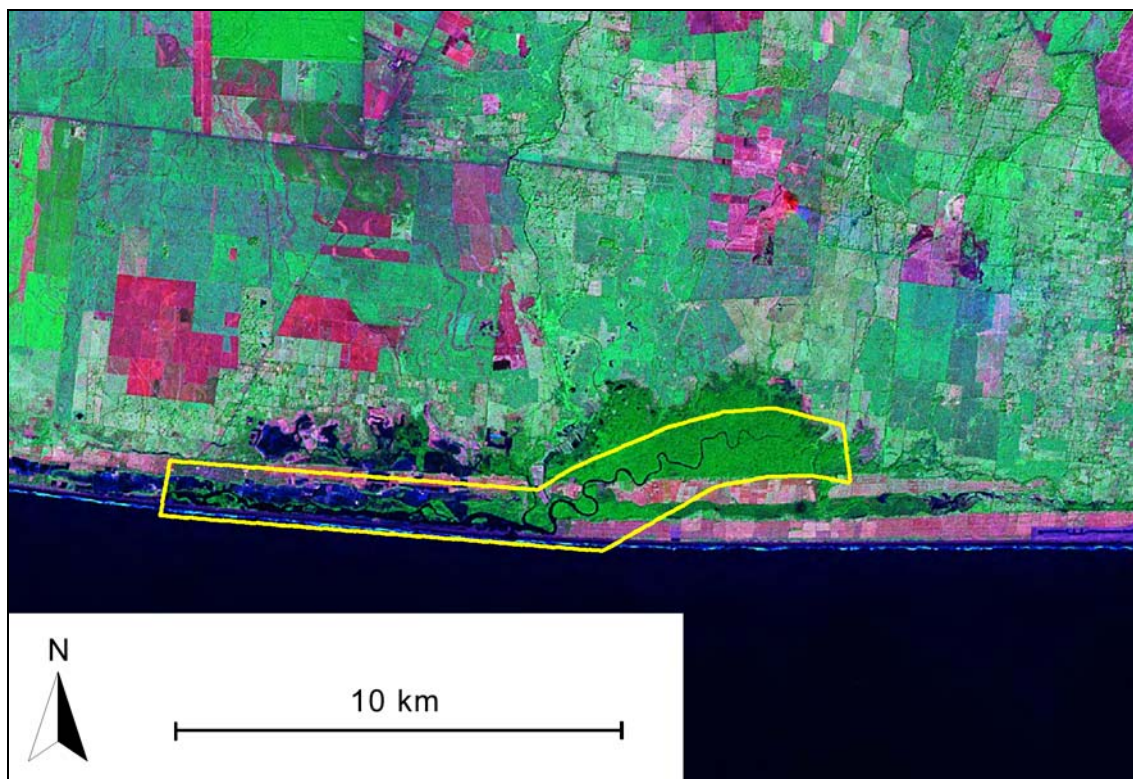


Fig. 7. Area of Sipacate-Naranjo; approximate border of the National Park is marked by the yellow line. The dark green area along the coast line is mangrove, which is bordered by agricultural land (light green areas, areas with shades of magenta, lavender and pink). Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

Monterrico - Hawaii

- Location: department Santa Rosa, UTM Zone 15 777000 / 1537000
- Size: Monterrico 2,800 ha; Hawaii 3,657 ha (ARCAS 2004)
- Habitats: reed swamp, mangrove, beach.
- Conservation status: Monterrico is an Area of Multiple Use, Hawaii is an proposed Area of Multiple Use (Fig. 8). The largest lagoons north of Monterrico have not been included in the protected area.
- Importance: Monterrico-Hawaii is the second-largest mangrove area in Guatemala, after Manchón-Guamuchal. A high abundance of wintering waterbirds has been found, especially in shallow lagoons within reed swamp: 500 *Pelecanus erythrorhynchos* (Eisermann in Jones 2005b), >1,000 *Ardea alba*, >200 *Egretta thula*, >100 *Butorides virescens*, >50 *Mycteria americana*, >300 *Anas discors* (pers. obs.). At least 21 species of special concern have been recorded (Appendix IV).
- Threats: Subsistence fisheries and shrimp larva harvest (Sigüenza de Micheo & Ruiz Ordoñez 2000), burning reed for the harvest of a snail, mangrove deforestation as fuel for salt production and firewood.
- Recommendations for conservation improvement: A declaration as Ramsar site might be considered. Monterrico and neighbouring beaches are popular national and international tourist destinations. Approximately 9,000 people live within the protected areas of Monterrico-Hawaii (Sigüenza de Micheo & Ruiz Ordoñez 2000, ARCAS 2004), further development of tourism services may provide more people with alternative income.
- Involved Institutions: CECON (administration in Monterrico), ARCAS (administration in Hawaii), OCRET.

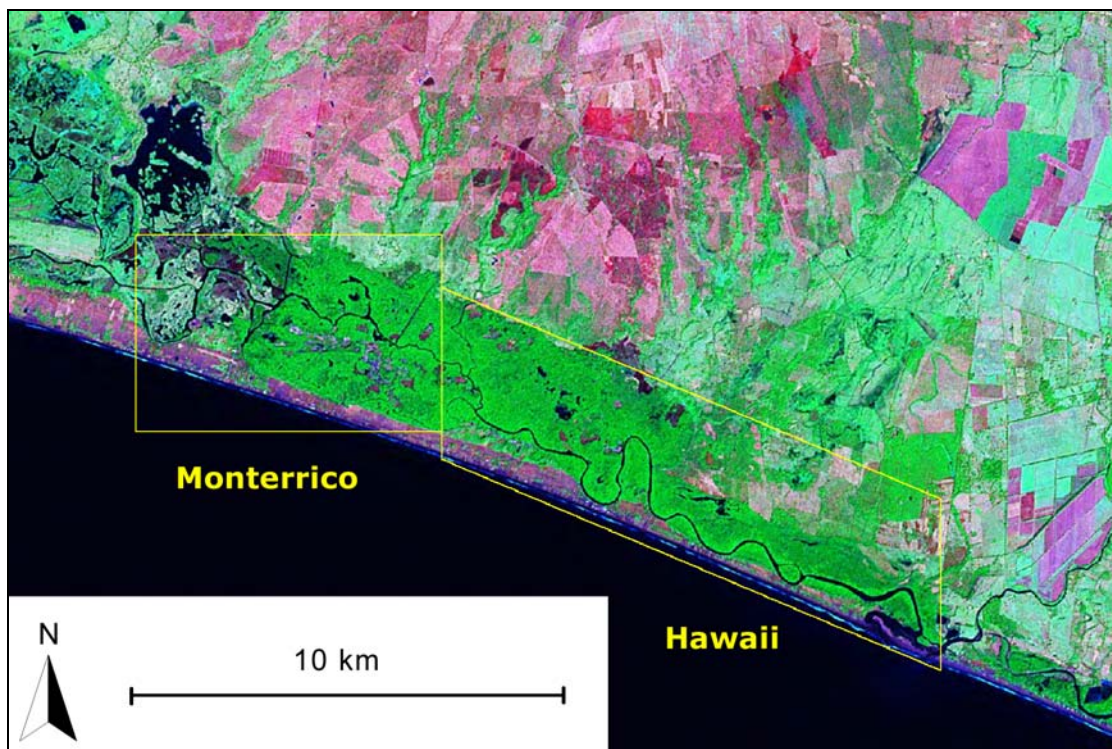


Fig. 8. Satellite image with the approximated limits (yellow frames) of the Area of Multiple Use Monterrico and the proposed Area of Multiple Use Hawaii. Dark green areas within the reserves are mangroves. Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

El Paraíso - La Barrona

- Location: department Jutiapa, UTM Zone 15 803000 / 1525000.
- Size: ~2,700 ha.
- Habitats: mangrove, beach.
- Conservation status: The area has been proposed as protected area and also as Ramsar site (F. Castro, pers. comm.).
- Importance: Congregations of waterbirds have been observed (R. Sigüenza, pers. comm.) but no data or report is available. I assume similarities of the bird community with Monterrico- Hawaii due to the proximity and similar habitat.
- Threats: Deforestation of mangrove for firewood. American White Pelicans (*Pelecanus erythrorhynchos*) are killed on shrimp farms (R. Sigüenza, pers. comm.)
- Recommendations for conservation improvement: Apply a management plan.
- Involved Institutions: OCRET, CONAP, INAB.

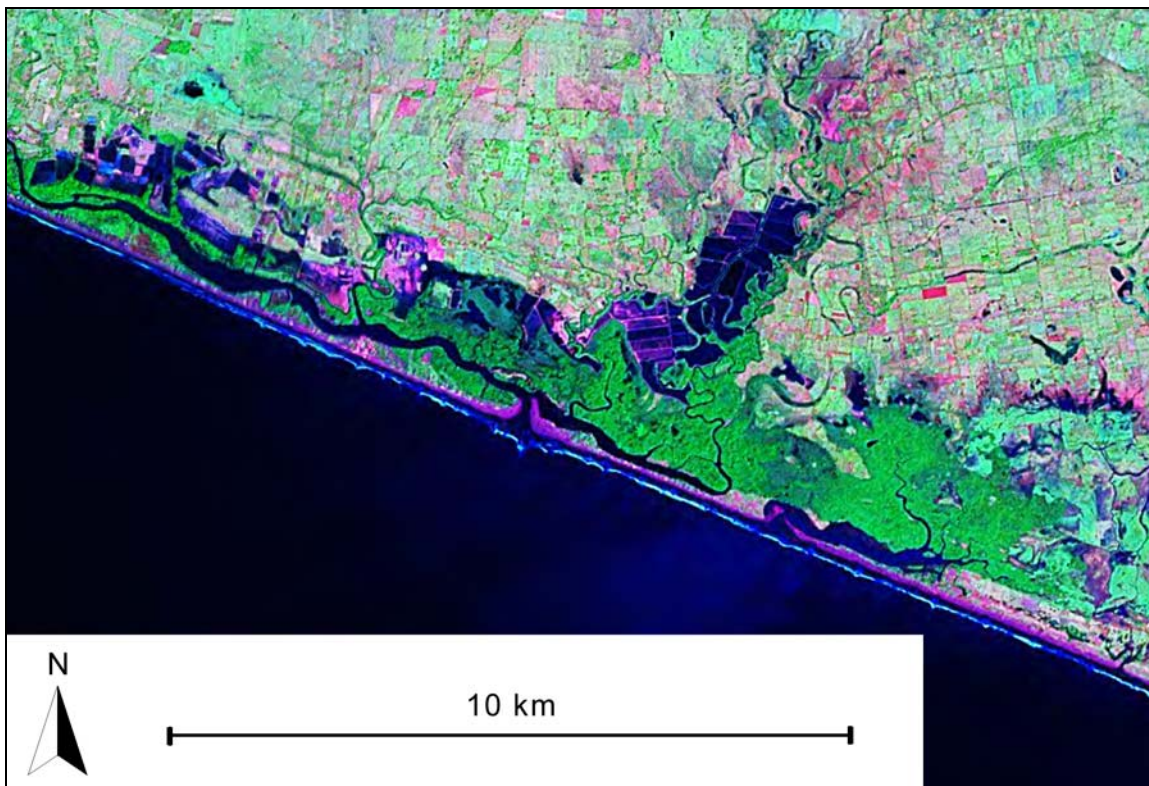


Fig. 9. Satellite image of the area El Paraíso-La Barrona. Dark green areas within the reserves are mangroves. Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

Lake Güija

- Location: department Jutiapa, UTM Zone 16 224000 / 1579000, and Santa Ana, El Salvador.
- Size: 4,200 ha, of which 1,010 ha are on Guatemalan territory.
- Habitats: Lake, reeds.
- Conservation status: The area has been proposed as protected area and also as Ramsar site (MARN 2001, F. Castro, pers. comm.).
- Importance: Wintering site for several thousands of Nearctic-Neotropical migratory waterbirds (Herrera & Ibarra 2005, Herrera, pers. comm.), e.g. 11,150 *Fulica americana*; 10,000 *Anas discors*; 5,100 *Dendrocygna bicolor*; 3,500 *Aythya affinis*; 2,000 *Dendrocygna autumnalis*; 1,200 *Anas clypeata*; 630 *Sterna caspia*; and 300 *Mycteria americana*. At least 19 species of special concern have been recorded (Appendix IV).
- Threats: Eutrophication by surrounding agricultural activities and settlements. Fisheries seem to be intensive (MARN 2001), but I am unable to assess the impact on waterbird populations due to a lack of data.
- Recommendations for conservation improvement: Apply a management plan.
- Involved Institutions: CONAP, A3K.



Fig. 10. Satellite image of the area of Lake Güija. The yellow line marks the border between Guatemala and El Salvador. Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

Lake Amatitlán

- Location: department Guatemala, UTM Zone 15 762000 / 1600000.
- Size: 1,520 ha.
- Habitat: Lake.
- Conservation status: not declared as protected area.
- Importance: Wintering and stopover site for Nearctic-Neotropical migratory waterbirds: 100 *Anas acuta*, 40 *Anas discors*, 20 *Anas clypeata*, 20 *Aythya affinis*, 1,500 *Fulica americana* (Chávez 2001). At least 10 species of special concern have been recorded (Appendix IV).
- Threats: A dense human population and industrial and domestic sewage input from Guatemala City (via Villalobos River) causes water pollution and lake degradation by major sedimentation (Fig. 11). The watershed of Lake Amatitlán has been identified as the most polluted Guatemalan region (AMSA 1998, CEPAL 2002). High degree of deforestation around the lake. Eutrophication causes expansion of water hyacinth *Eichhornia crassipes*.
- Recommendations for conservation improvement: A governmental project including a waste water purification plant is on the way. According to Martínez (2005) the first plant is working since 2005. Water quality should be continuously monitored.
- Involved Institutions: FUNDALAGO, Comité del Lago de Amatitlán, AMSA.

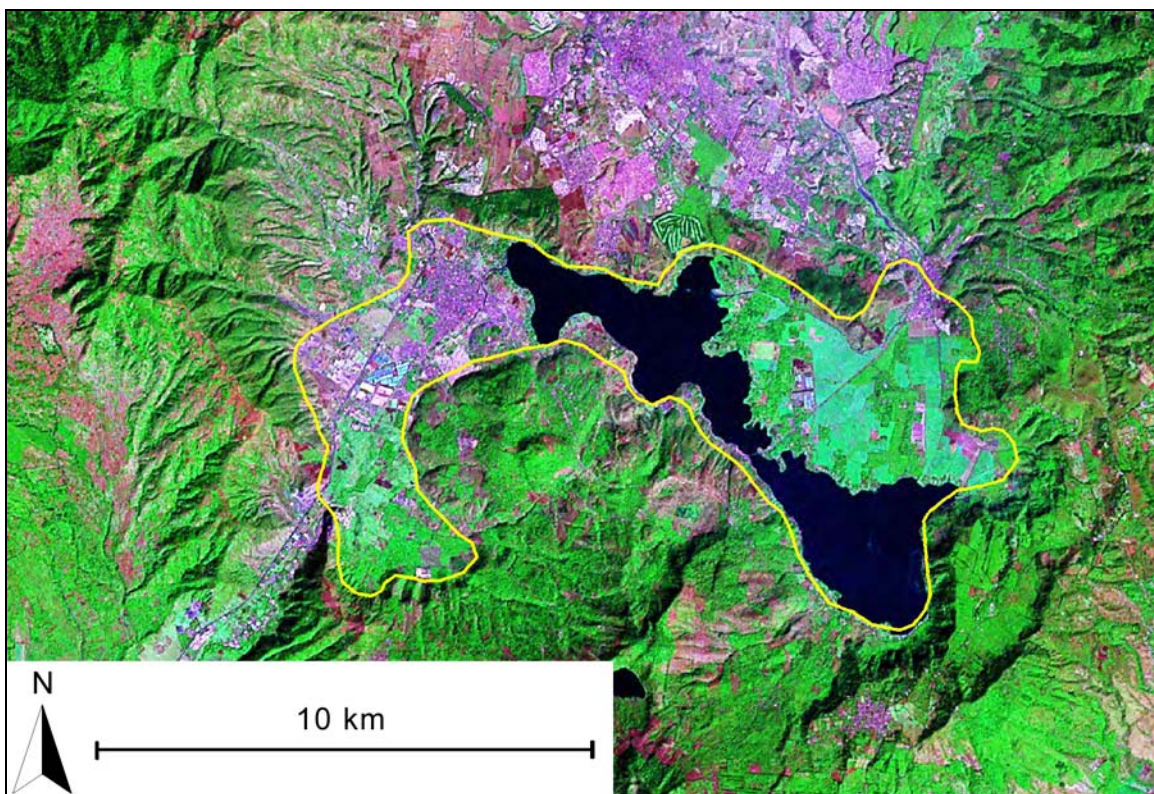


Fig. 11. This satellite image shows the status of deforestation and settlements around the lake Amatitlán, and the approximate limit of the former shoreline ~20,000 years ago (yellow line; according to Castañeda Salguero 1995). Urban areas appear in shades of magenta, lavender and pink. Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

Lake Atitlán

- Location: department Sololá, UTM Zone 15 693000 / 1626000
- Size: 12,700 ha
- Habitat: Lake.
- Conservation status: Area of Multiple Use
- Importance: Former site of the endemic Atitlan Grebe (*Podilymbus gigas*), which is considered extinct (BirdLife International 2004). Presumed nesting site of Ruddy Duck (*Oxyura jamaicensis*). Wintering and stopover site for water fowl. At least 5 species of special concern have been recorded recently (Appendix IV).
- Threats: Loss of reed habitat along the shore due to a continuously dropping water level has been observed since a major earthquake in 1976 and has been evaluated as one of the reasons for the extinction of the Atitlan Grebe (Hunter 1988, LaBastille 1992). Introduction of exotic fish species, mainly *Micropterus salmoides*, caused reduction of food resources for waterbirds (LaBastille 1974, 1984). Eutrophication through input of sewage from communities along the shore has increased in the last decades (Castellanos *et al.* 2002, Dix *et al.* 2003). Reed (*Typha domingensis*, *Scirpus californicus*) is overharvested for handicrafts, which reduces nesting sites.
- Recommendations for conservation improvement: The installation of sewage treatment in all communities and enterprises (mainly hotels) around the lake should be fulfilled in the short term. Harvest of reed should be managed, during breeding season it should be avoided.
- Involved Institutions: CONAP, TNC, AMSCLAE, Asociación Patronato Vivamos Mejor.

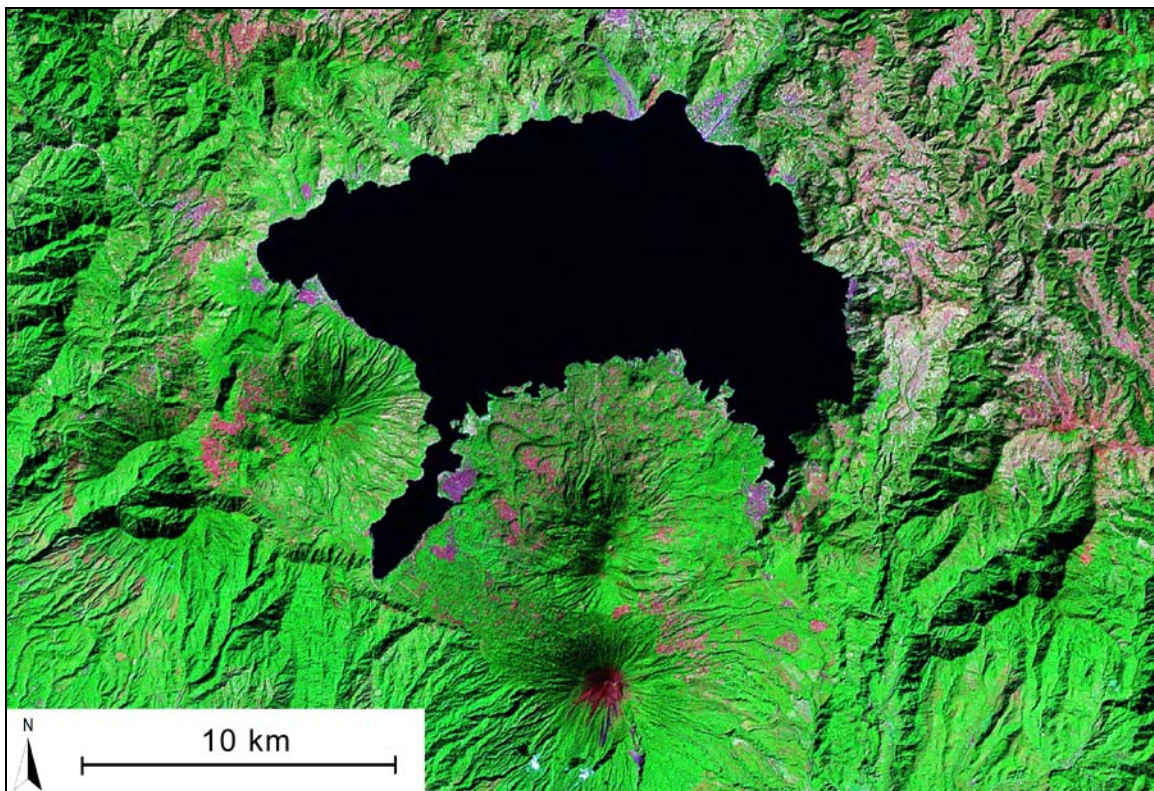


Fig. 12. Satellite image of Lake Atitlán. Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

Punta de Manabique

- Location: department Izabal, UTM Zone 16 344000 / 1752000.
- Size: 66,900 ha terrestrial; 66,000 ha coastal waters (Fig. 14).
- Habitats: Swamp forest, mangrove, salt marshes, beach, coastal waters.
- Conservation status: Wildlife Refuge; Ramsar site (designated 2000).
- Importance: High species richness of waterbirds, although no species has been found in high abundances; 25 species of shorebirds; nesting colony of 40 pairs of *Ardea alba*; 29 species of special concern have been recorded (Appendix IV).
- Threats: Habitat alteration (deforestation for cattle farming) mainly in the southern part of the reserve (Fig. 13; Sigüenza 1999) cause an increase of water pollution with agrochemicals. The Motagua river, crossing Guatemala from the western highlands to the Gulf of Honduras, has impact over coastal waters with a high load of industrial sewage and agrochemicals. Occasional dying of fish has been observed on the lower Motagua river (Grupo Seguridad y Justicia 2003). Unsustainable subsistence fishery methods cause reduction of food resources: anchovies (*Anchoa sp.*) are harvested along the coast with small-mesh nets, and mouths of estuaries and rivers are crossed with nets in order to harvest fish populations moving between the sea and the inland water bodies. Institutional control in the area is weakened by lawlessness (Eisermann 2003c,d; CALAS 2005a).
- Recommendations for conservation improvement: Surveillance in the areas needs to be reinforced to prevent overharvest of natural resources, coupled with the development of alternative income.
- Involved Institutions: CONAP, FUNDARY.

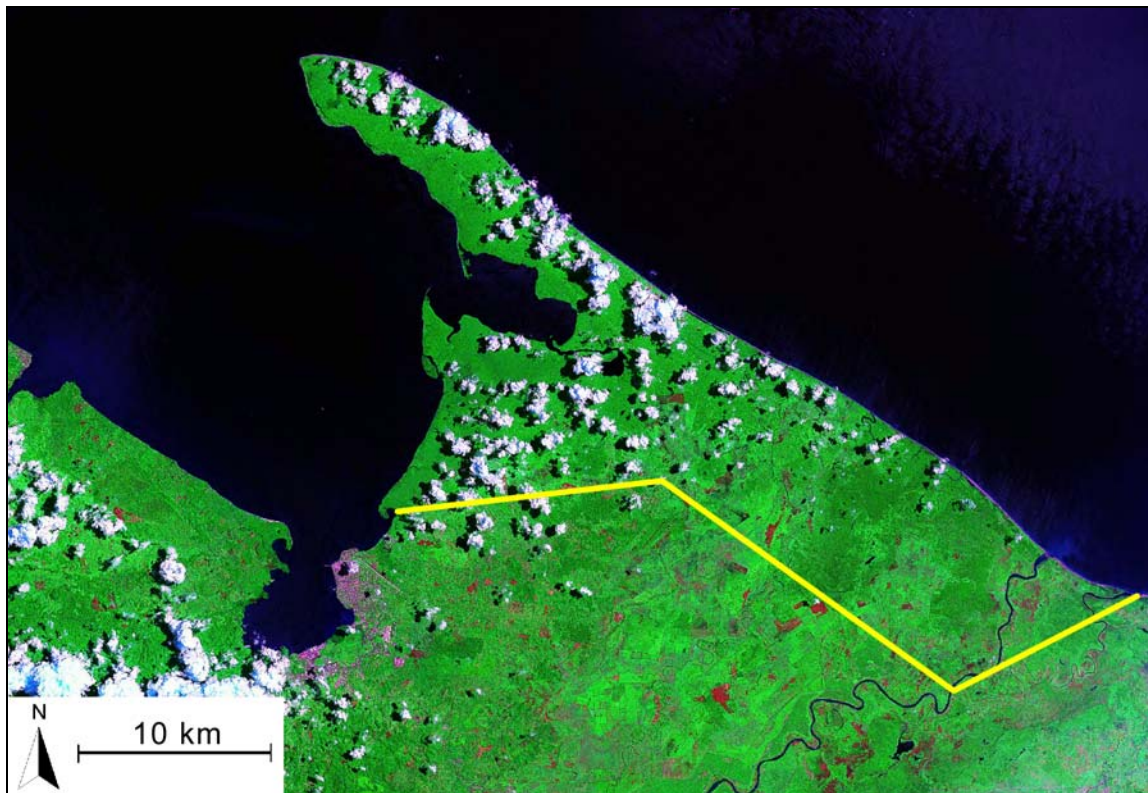


Fig. 13. Satellite image of the Punta de Manabique Wildlife Refuge. Brightest shades of green in the southern part of the reserve (limited by yellow line) are deforested areas. Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

Río Dulce / Chocón Machacas / Río Sarstún

- Location: department Izabal, UTM Zone 16, 301000 / 1744000 (Fig. 14)
- Size: total 54,457 ha (Río Dulce 13,000 ha; Chocón-Machacas 6,265 ha; Río Sarstún 35,202 ha).
- Habitats: river, lake, mangrove (Yañez-Arancibia *et al.* 1994).
- Conservation Status: Río Dulce (National Park); Chocón Machacas (Biotope); Río Sarstún (Area of Multiple Use).
- Importance: In the area 16 species of special concern have been recorded (Appendix IV).
- Threats: Deforestation for agriculture (cattle farming) causes habitat loss and water pollution. Several settlements are located within the area, the use of natural resources is unsustainable. The Biotope Chocón-Machacas has been evaluated as critically threatened (ParksWatch 2003a).
- Recommendations for conservation improvement: Surveillance should be reinforced and management plans applied.
- Involved Institutions: CONAP, FUNDAECO, CECON.

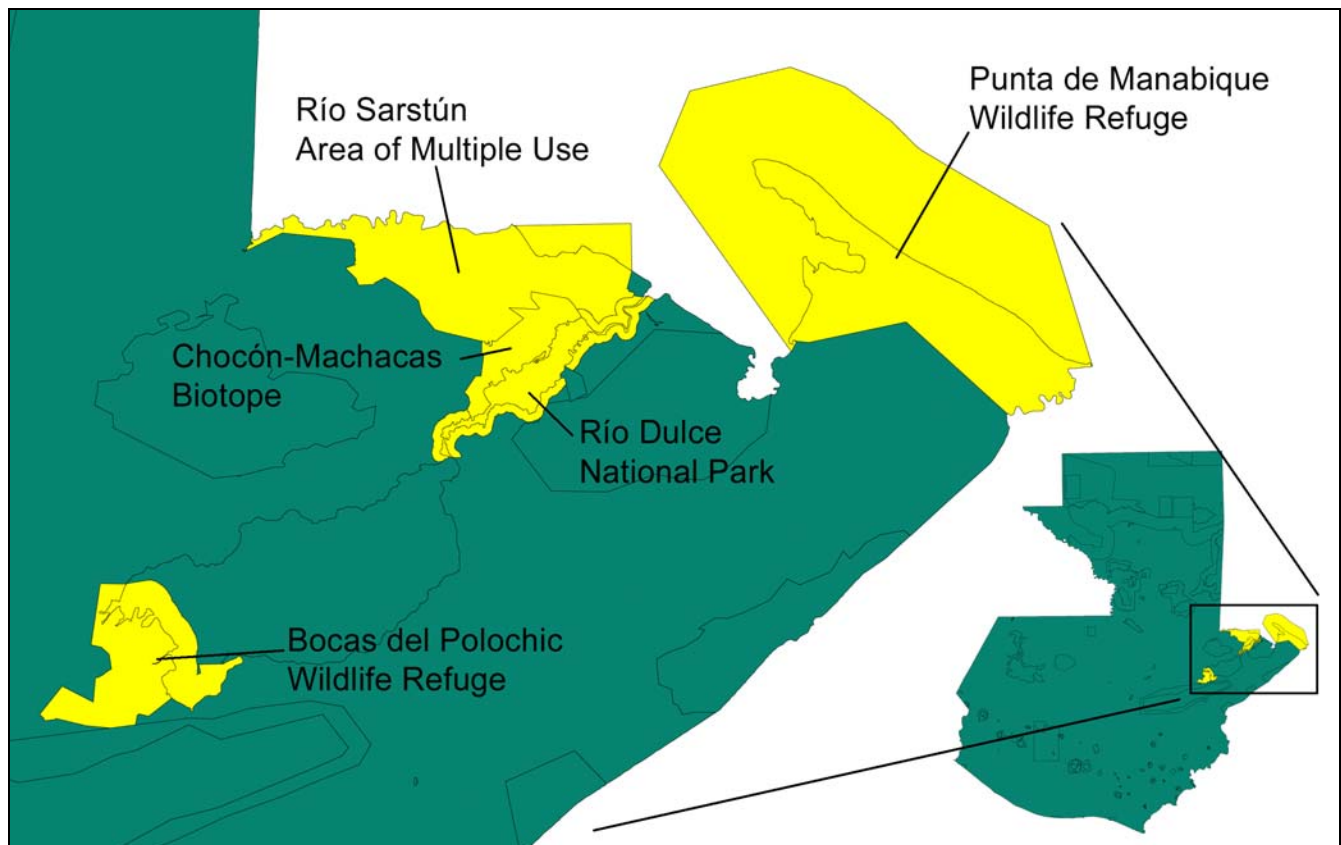


Fig. 14. Location of important sites for waterbirds on the Atlantic coast (from GIS data by MAGA 2002.)

Bocas del Polochic

- Location: department Izabal, UTM Zone 16, 242000 / 1709000 (Fig. 14).
- Size: 20,760 ha.
- Habitats: freshwater swamp (wooded and reed), river.
- Conservation status: Wildlife Refuge; Ramsar site (designated 1996).
- Importance: High species richness, 20 species of special concern have been recorded (Appendix IV).
- Threats: The reserve is surrounded by private farm land (rice and cattle farming). Pollution with agrochemical is presumed. Fish is overharvested by local people, causing reduction of food resources. Nickel mining north of the reserve is proposed and may in future cause pollution with heavy metals. Sport hunting has been observed (G. Martínez, pers. comm.), but not quantified.
- Recommendations for conservation improvement: Monitoring of heavy metal pollution should be installed. Reinforcement of surveillance of use of natural resources.
- Involved Institutions: CONAP, FDN, AMAZURLY.

Laguna Lachuá and Floodplain of the Ik'bolay river

- Location: department Alta Verapaz, UTM Zone 15, 755000 / 1752000.
- Size: ~19,550 ha.
- Habitats: Lake, wooded rivers, yearly flooded woodlands.
- Conservation status: National Park (partially), see Fig. 15.
- Importance: High species richness, 13 species of special concern have been recorded (Appendix IV).
- Threats: Local people around the National Park live mainly from growing corn for subsistence and cardamom as cash crops. Large farms for cattle ranching have been founded in the last years which cause considerable landscape pauperization, which is a major threat especially for the floodplain, which is unprotected.
- Recommendations for conservation improvement: Extend the technical assistance to develop alternative crops like cacao and vanilla with the local population.
- Involved Institutions: INAB, IUCN, Sank', PROEVAL RAXMU, USAC.

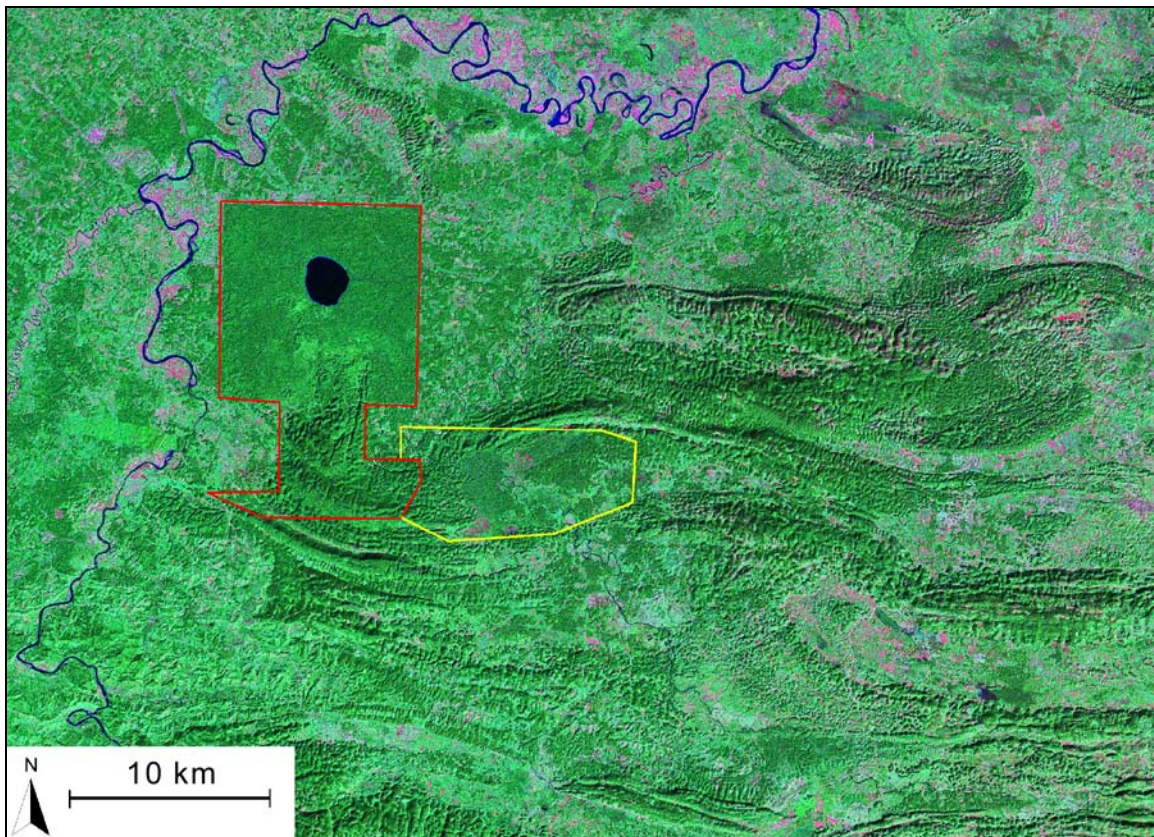


Fig. 15. Satellite image with the approximated limits of the Laguna Lachuá National park (red frame) and the floodplain of the Ik'bolay river (yellow frame). Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

Petexbatún

- Location: department Petén, UTM Zone 15, 799000 / 1820000.
- Size: 4,044 ha.
- Habitats: Lake.
- Conservation status: Wildlife Refuge.
- Importance: Few data available, but eight species of special concern have been recorded (Appendix IV).
- Threats: The southern Petén lacks management and surveillance in the protected areas. Surrounding areas are intensively used for agriculture (Fig. 16). Control over fishing activity is poor (G. Ortiz, pers. comm.).
- Recommendations for conservation improvement: Apply management plans and reinforce surveillance.
- Involved Institutions: CONAP.

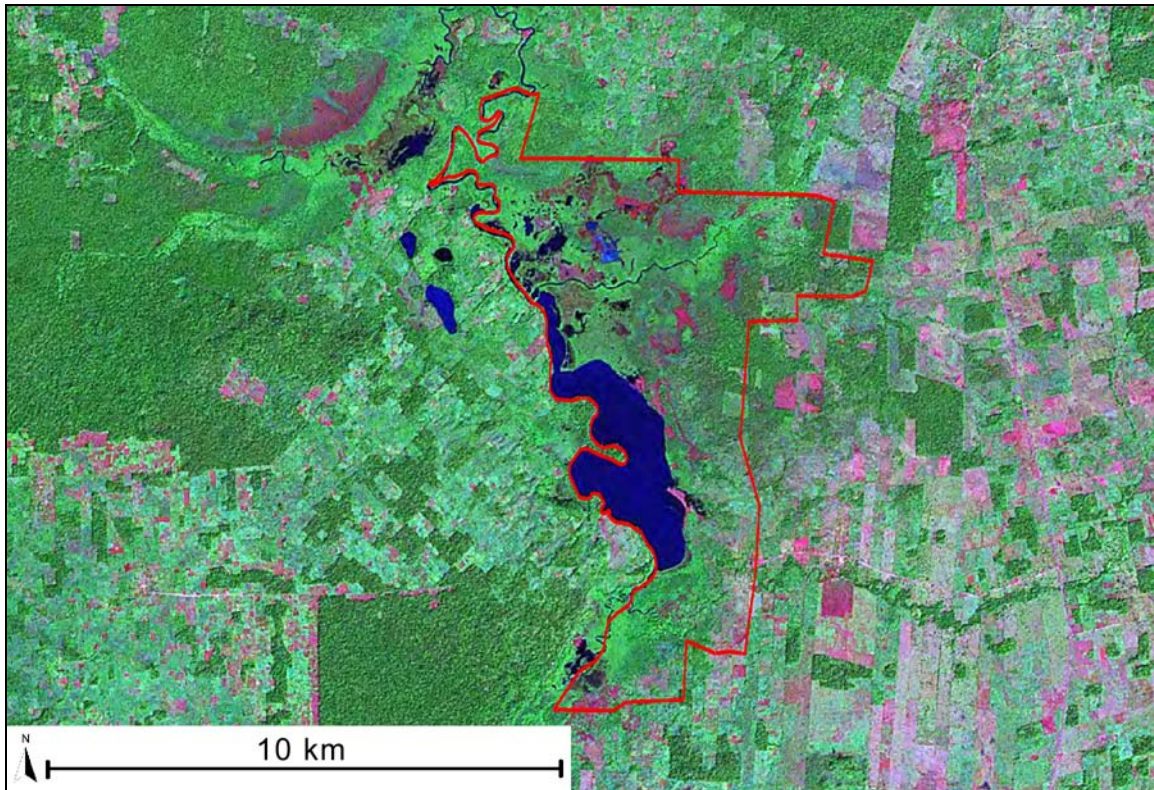


Fig. 16. Satellite image with the approximated limits of the Petexbatún Wildlife Refuge (red frame). Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

El Pucté

- Location: department Petén, UTM Zone 15, 780000 / 1838000.
- Size: 16,695 ha.
- Habitats: Rivers, swamp forest.
- Conservation status: Wildlife Refuge.
- Importance: At least 10 species of special concern have been recorded (Appendix IV).
- Threats: The southern Petén lacks management and surveillance in the protected areas. The area is threatened by an advancing agricultural border (Fig. 17). Control over fishing activity is poor (G. Ortíz, pers. comm.).
- Recommendations for conservation improvement: Apply management plans and reinforce surveillance.
- Involved Institutions: CONAP.

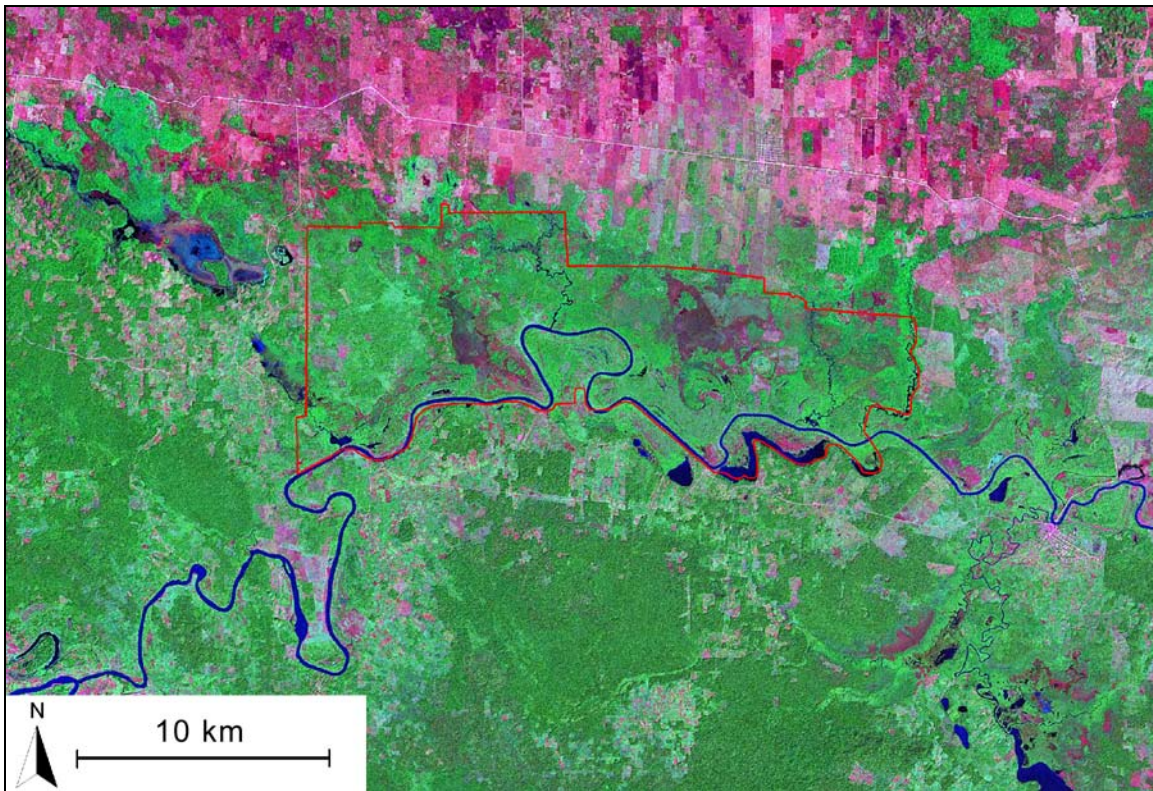


Fig. 17. Satellite image with the approximated limits of the Pucté Wildlife Refuge (red frame). Note the intensive agricultural land use north of the reserve (shades of magenta, lavender and pink). Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

Lake Petén Itzá

- Location: department Petén, UTM Zone 16, 200000 / 1881000.
- Size: 10,490 ha.
- Habitat: Lake.
- Conservation status: not declared as protected area. The northern shoreline is part of the Buffer Zone of the Maya Biosphere Reserve, at the north-eastern shore the Biotopo Cerro Cahui is located adjacent to the lake.
- Importance: At least 10 species of special concern have been recorded recently (Appendix IV).
- Threats: Pollution by domestic sewage from communities around the lake.
- Recommendations for conservation improvement: Installation of sewage treatment plants in all communities.
- Involved Institutions: AMPI, Municipalities, CECON, CONAP.

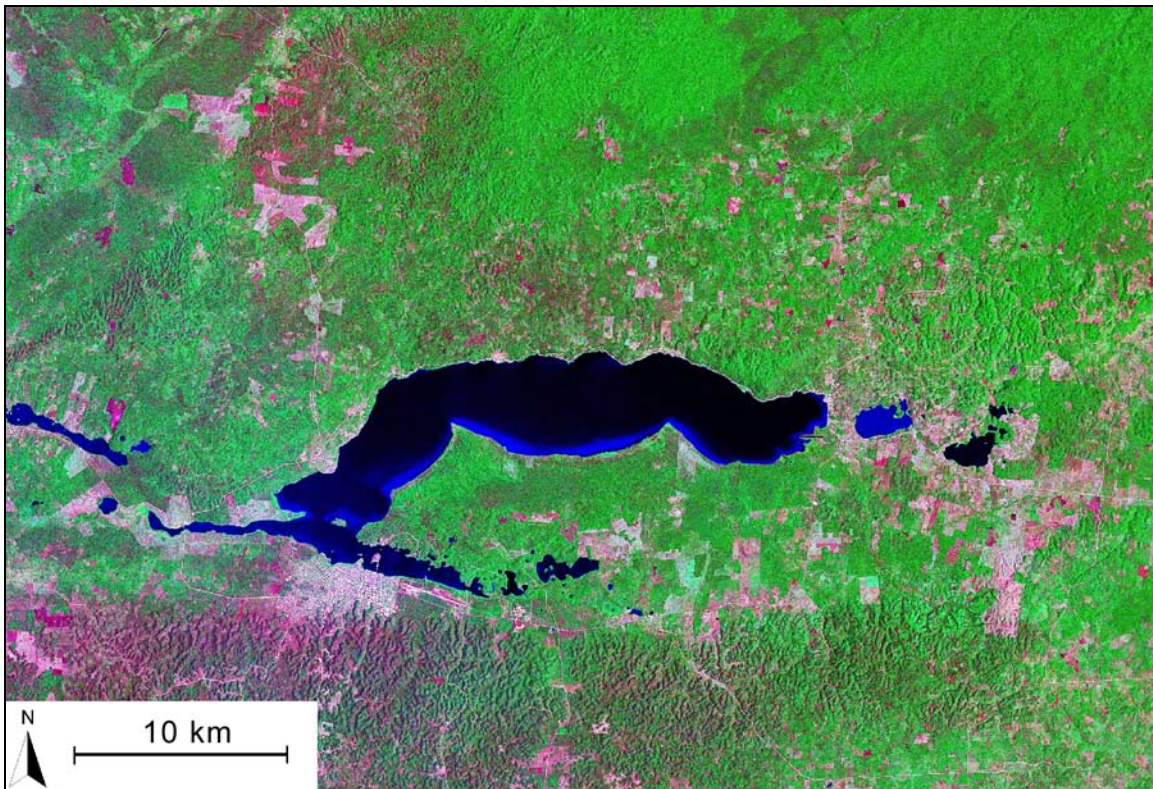


Fig. 18. Satellite image of Lake Petén Itzá. Note intensive agricultural land use around the lake (shades of magenta, lavender and pink). Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

Yaxhá-Nakum-Naranjo

- Location: department Petén, UTM Zone 16, 245000 / 1888000.
- Size: 37,160 ha.
- Habitats: Lake, swamp forest.
- Conservation status: National Park and Ramsar site (designated 2006), part of the Maya Biosphere Reserve (Fig. 19, 20); part of Yaxhá is a private protected area, where a biological station is under construction.
- Importance: At least 14 species of special concern have been recorded recently (Appendix IV). Nesting of *Himantopus mexicanus* has been observed on lake Yaxhá (J. Madrid, pers. comm.) and in May 2004 an adult and an immature Jabiru (*Jabiru mycteria*) were observed (Photo 15 in Appendix VI).
- Threats: The agricultural border is advancing (Fig. 22), human-caused forest fires are a major threat in the whole Maya Biosphere Reserve (ParksWatch 2002a).
- Recommendations for conservation improvement: Urgent need of more personnel for surveillance in the Maya Biosphere Reserve.
- Involved Institutions: CONAP, IDAEH.

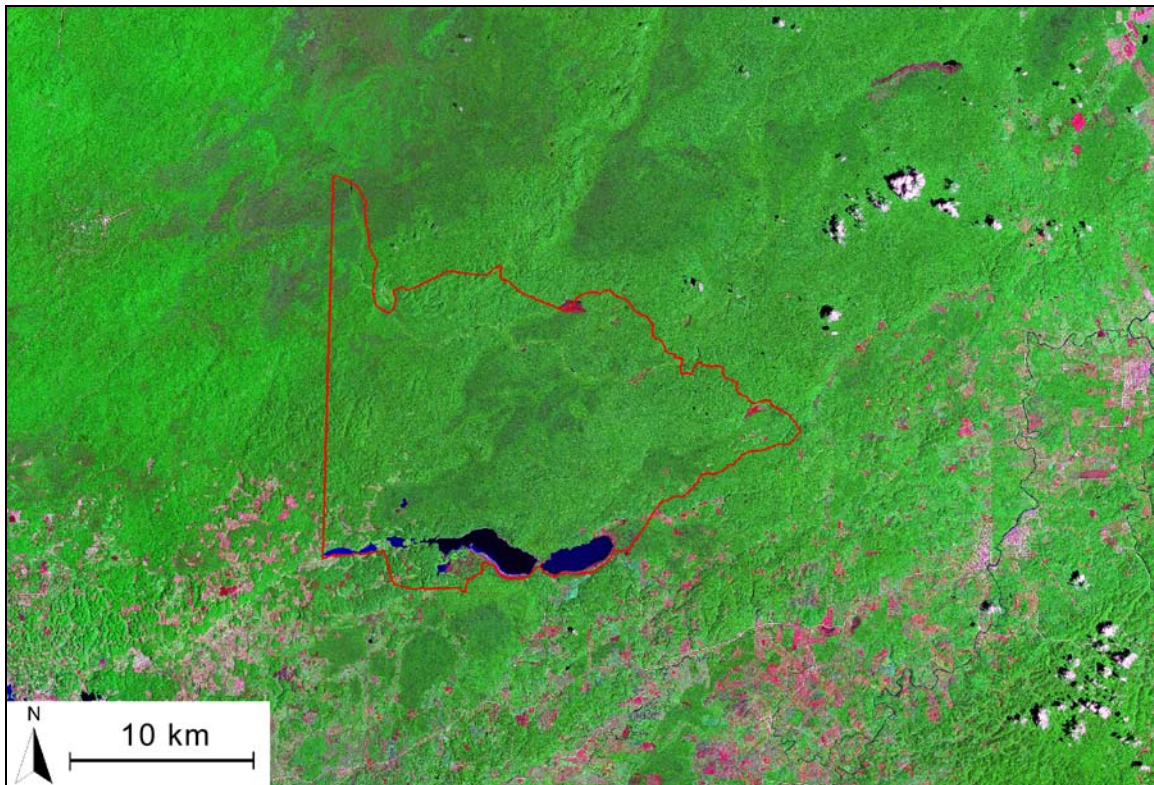


Fig. 19. Satellite image with the approximated limits of the Yaxhá-Nakum-Naranjo National Park (red frame). Intensive agricultural land use is indicated by shades of magenta, lavender and pink. Landsat image provided by NASA (<https://zulu.ssc.nasa.gov/mrsid>).

Mirador-Río Azul

- Location: department Petén, UTM Zone 16, 250000 / 1960000 (Fig. 20).
- Size: 116,991ha.
- Habitats: Swamp forest and freshwater marshes, rivers.
- Conservation status: National Park, part of the Maya Biosphere Reserve.
- Importance: Extensive swamps within the largest continuous tropical forest in Central America. At least 12 species of special concern have been recorded (Appendix IV).
- Threats: Habitat alteration is an issue in the whole Maya Biosphere Reserve. Although the Mirador-Río Azul National Park belongs currently to the most pristine areas, near future threats may be caused by proposed road constructions between Petén and México and the development of tourism infrastructure in these areas (ParksWatch 2002b).
- Recommendations for conservation improvement: Monitoring impact of human activities on waterbird populations.
- Involved Institutions: CONAP, IDAEH, WCS.

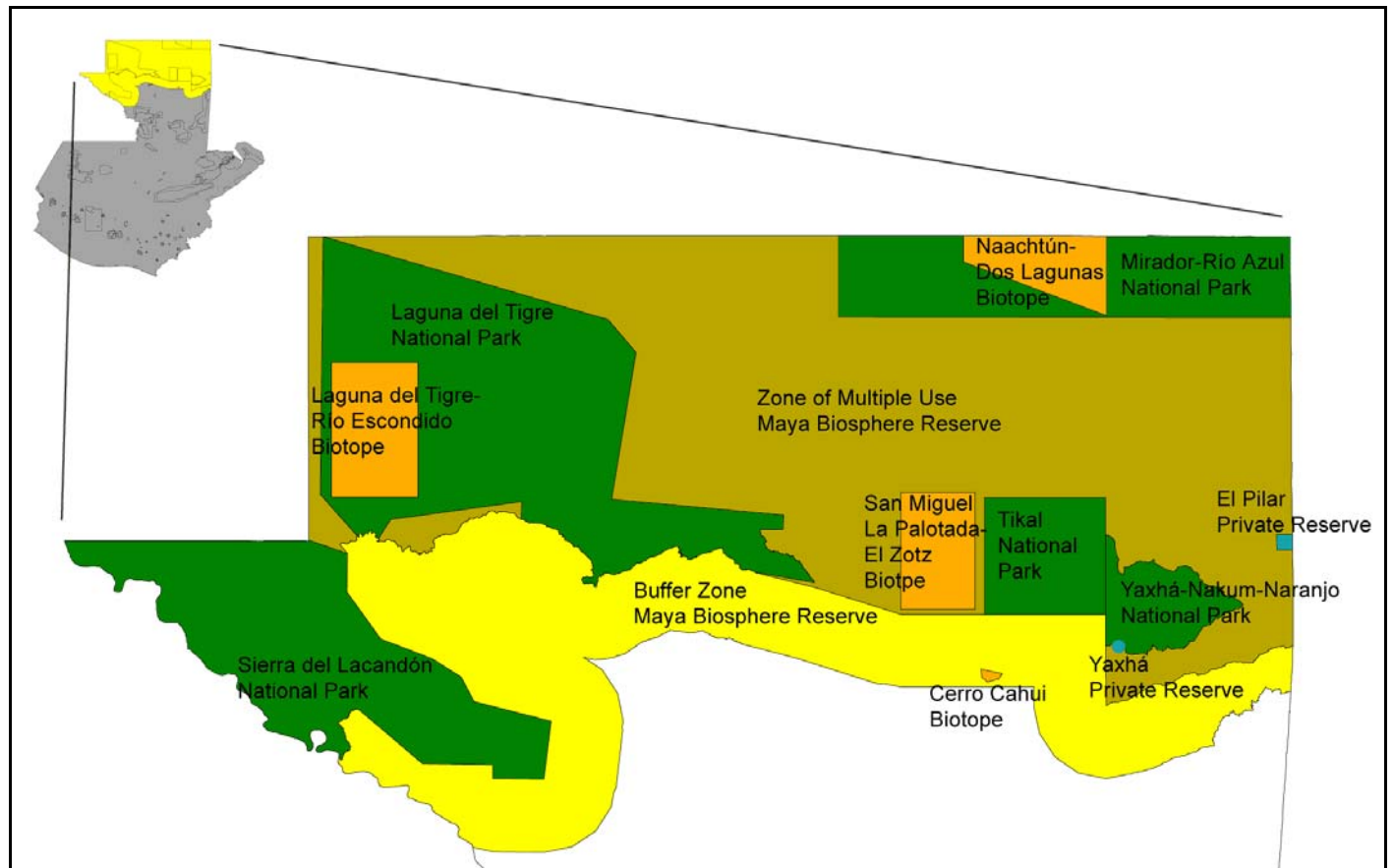


Fig. 20. Maya Biosphere Reserve.

Laguna del Tigre

- Location: department Petén, UTM Zone 15, 750000 / 1940000.
- Size: 335,080 ha.
- Habitats: Rivers, lagoons, freshwater marshes, swamp forest.
- Conservation status: National Park, Biotope; both reserves are part of the Maya Biosphere Reserve (Fig. 20); Ramsar site (designated 1990).
- Importance: The northwestern part of Petén is the largest wetland area in Guatemala. At least 22 species of special concern have been recorded (Appendix IV) and reproduction has been confirmed for *Himantopus mexicanus* (R. Balas McNab, pers. comm.).
- Threats: Laguna del Tigre has been evaluated as critically threatened (ParksWatch 2003b,c). Both documents summarize the threats which include forest fires, illegal settlements, agriculture (mainly cattle farming), oil exploitation, and illegal extraction of natural resources. The issues are worsened by lack of institutional control and general lawlessness. Reports are available online at www.parkswatch.org. To date all threats have continued and worsened; in fact ~50% of this protected area is damaged (ParksWatch 2005).
- Recommendations for conservation improvement: A special law has been created in 2004 for the rescue of this National Park (Decreto 16-04, see section "Legislation"). Urgent action is required to save at least 50% of the area (ParksWatch 2005).
- Involved Institutions: CONAP, CECON, IDAEH, WCS, ProPetén, SEPRONA, Ejército Nacional de Guatemala, ProPetén.

Potential sites

An account follows of potential important sites for waterbirds. Very few or no data were available, but for the size or location they are presumed to have certain importance; field studies are necessary.

- **Laguna Perdida** (Area of Special Protection), Petén: 1,095 ha; UTM Zone 15 797000 / 1889000.
- **Río Mopán, La Polvora** (Buffer Zone of the Maya Biosphere Reserve), Petén: River. Congregations of herons have been observed and nesting is assumed (R. Balas McNab, pers. comm.). UTM Zone 16 253000 / 1882000.
- **Río Machaquilá / Laguneta Guacamayas** (Buffer Zone Complex IV of the Protected Areas of southern Petén), Petén: ~40 km of the Río Machaquila and adjacent lagoons, UTM Zone 16 196500 / 1810500.
- **San Román** (Biological Reserve), Petén: 18,646 ha; >30 km of rivers, UTM Zone 15 785000 / 1800000.
- **Lagoons La Perdida, Roto Viejo, El Lineco, Roto Nuevo** (Buffer Zone Complex I of the Protected Areas of southern Petén), Petén: lagoons which were part of the river bed of the Río Salinas; 1,400 ha, UTM Zone 15 776000 / 1800000.
- **Río Usumacinta** (partially Sierra del Lacandón National Park, Buffer Zone of the Maya Biosphere Reserve, partially outside of declared protected areas). Border between Petén and Chiapas, México: river and adjacent lagoons (former river bed), ~160 km of river, southern point UTM Zone 15 762000 / 1823000, northern point UTM Zone 15 665500 / 1908000.
- **Río Chixoy / Rubelsanto** (unprotected area, oil exploitation): freshwater marsh and river. Several species restricted to water habitats and evaluated as threatened in Guatemala (Eisermann & Avendaño 2006) have been recorded during short visits, including Black-bellied Whistling-Duck (*Dendrocygna autumnalis*), Snail Kite (*Rostrhamus sociabilis*), Black-collared Hawk (*Busarellus nigricollis*); ~2,500 ha; UTM Zone 15 775000 / 1771000.

- **Lake Izabal** (unprotected area), Izabal: Largest lake in Guatemala, except for the Bocas del Polochic Wildlife Refuge, no data exist about the use by waterbirds. ~68,000 ha; UTM Zone 16 270000 / 1716000.
- Castañeda Salguero (1995) compiled an inventory of **1,139 lagoons** at sizes <1,000 ha in Guatemala (Fig. 21). Many of them are included in important sites for waterbirds, e.g. Laguna del Tigre, Punta de Manabique, Bocas del Polochic and Manchón-Guamuchal, but the status and importance of many other lagoons is uncertain.

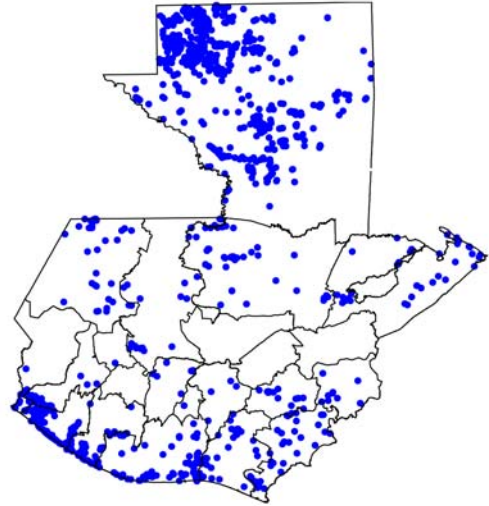


Fig. 21. Lagoons mapped in the division of Guatemalan departments (MAGA 2002), according to an inventory by Castañeda Salguero (1995).

Issues and threats to waterbirds and their habitats

The human population in Guatemala is growing rapidly, an increase of 35% has been documented from 1994-2002 (INE 2002). The national economy depends basically on small and medium scale agriculture and a major part of the human population are subsistence farmers. Increasing land requirements for agriculture cause pressure also on waterbird habitats.

Main threats to waterbird populations in Guatemala include the following:

- Lack of knowledge about waterbird populations
- Habitat alteration
- Reduction of food resources
- Hunting and fisheries
- Introduced species
- Water pollution
- Disturbance on roosting and foraging sites
- Management deficiencies
- General lack of environmental consciousness in the Guatemalan society

Lack of knowledge of waterbird populations

There is a lack of published data on the recent distribution of waterbirds in Guatemala (Ellison 2004, Eisermann & Avendaño 2006); this report is based almost exclusively on unpublished reports and expert opinions. Unpublished information was very limited, due to the lack of monitoring programs or the inappropriate performance of waterbird monitoring. The least studied group are off shore seabirds.

Habitat alteration

The annual deforestation rate in Guatemala from 1990-2000 was 1.7%, equaling 485 km² (FAO 2003). Today the lowlands on the Guatemalan Pacific slope are almost entirely deforested (Fig. 22). Especially waterbirds requiring wooded habitats, like Agami Heron (*Agamia agami*), Boat-billed Heron (*Cochlearius cochlearius*), Yellow-crowned Night-Heron (*Nyctanassa violacea*), and Sungrebe (*Heliornis fulica*) are threatened by the deforestation of mangroves and swamp forests. All of these species are resident. Deforestation is a threat in all parts of Guatemala. A secondary effect of deforestation is the alteration of water quality.

Another type of habitat alteration is the harvest of emergent water plants like *Scirpus* spp., *Typhus* spp. (Lake Atitlán, Monterrico), which affects nesting and foraging habitats of herons and rails.

Eutrophication through water pollution may alter habitat by massive growth of floating plants, like *Eichhornia crassipes*, which can cover small water bodies completely.

Water bodies were directly altered through the construction of dams for electric power production, the largest one across the Chixoy river. Human modification of river beds and banks has not been an issue in Guatemala, but after a recent storm disaster along the Pacific Slope in October 2005 (Hurricane STAN), a national fund was created for constructing artificial river beds (González Arrecis 2005).

Reduction of food resources

Waterbirds feed mainly on fish, arthropods and their larvae, small vertebrates, plankton, and plants (Poole & Gill 1992-2003). Fish and crustaceans are reduced directly by human competition. Fish is harvested in all water bodies near human settlements. Comments by local people explaining that quantity and quality (size) decreased drastically are indicators of overharvest. This is a major problem in regions where local people live mainly from fisheries (coastal regions, e.g. Punta de Manabique, Monterrico-Hawaii). Indirect reduction of food resources (major fish dyings) through water pollution has been reported in Sipacate-Naranjo and on the Motagua river (Punta de Manabique).

Hunting and fisheries

Subsistence hunting is common in rural communities in Guatemala, but waterbirds are not the main target, with exception of Muscovy Duck (*Cairina moschata*) and migratory ducks. In Sipacate-Naranjo heron chicks (*Ardea alba*) have been harvested at a nesting colony and in Manchón-Guamuchal hunting of White Ibis (*Eudocimus albus*) has been observed. In the department Huehuetenango migratory birds are hunted at night using fires, the method is locally known as "chitbal" (Monzón 1976). Baepler (1962) reported that in one night 30 Upland Sandpipers (*Batramia longicauda*) were taken by the local people.

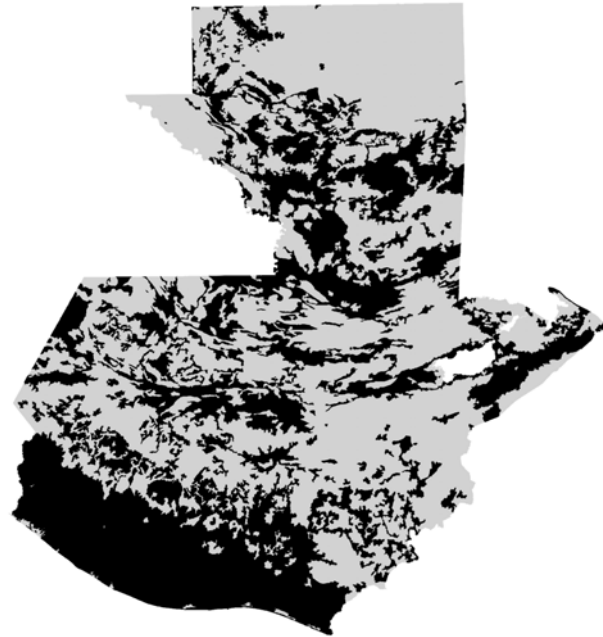


Fig. 22. Areas without forest cover (drawn in black) indicate the high impact of habitat alteration in Guatemala (based on GIS data, MAGA 2002).

Sport hunting has been observed in Bocas del Polochic, Sipacate-Naranjo, Manchón-Guamuchal, but the impact on waterbird populations can not be assessed due to the lack of quantifying data. On agricultural cultivations (rice fields) or fish and shrimp farms, where certain waterbirds are thought to cause economic loss, shooting these birds is common (e.g. Black-bellied Whistling Duck *Dendrocygna autumnalis*, Muscovy Duck *Cairina moschata*, American White Pelican *Pelecanus erythrorhynchos*, Neotropic Cormorant *Phalacrocorax brasilianus*), which has been observed in Bocas del Polochic, Punta de Manabique and El Paraíso-La Barrona.

Hunting is forbidden in protected areas, but management deficiencies prevent effective controls and sufficient surveillance in the areas.

Commercial and sport ocean fisheries are serious threats for seabirds, which are subjects of bycatches. An account of critical fishery methods in the Pacific region was published by U.S. Fish and Wildlife Service (2005). Estimates suggest that hundredthousands of seabird are killed annually in the Pacific (U.S. Fish and Wildlife Service 2005). To my knowledge, the impact of fisheries on seabirds foraging in Guatemalan waters has not been studied. An international action plan to reduce the incidental catch of seabirds was published by FAO (1999).

Introduced species

Worldwide most cases of extinction of bird species since 1800 were caused by introduced species (BirdLife International 2000). In Guatemala, the extinction of the Atitlan Grebe has been attributed partially to the introduction of largemouth bass (*Micropterus salmoides*), which reduced the grebe's food resources (LaBastille 1974, 1984). Cattle is non-native in Guatemala and large-scale cattle farming of half-wild herds is a major cause of deforestation in Guatemala, threatening especially waterbirds which are specialized in wooded wetlands.

Water pollution

Human population in Guatemala is growing, which consequently increases the production of waste and sewage. Sewage treatment is underdeveloped nationwide (Spillman *et al.* 2000). Major dying of fish has been observed in the Río Motagua (Grupo Seguridad y Justicia 2003) and the watershed of the Amatitlán Lake has been labeled as the most polluted in Guatemala (CEPAL 2002). Additional to urban sewage, habitats are contaminated by agricultural runoffs with pesticides and nutrients, discharges from industry and mining activities. Eutrophication can be assumed through an increased input of nitrogen due to extensive forest fires (Fig. 23) and cattle ranching. Oil exploitation has caused habitat contamination (e.g. ParksWatch 2003, 2005).

Sea pollution with petroleum products has threatened seabird populations worldwide (e.g. Page *et al.* 1990, U.S. Fish and Wildlife Service 2005). In Guatemala, oil ports are located on both the Atlantic and the Pacific coast (Santo Tomás, Champerico, Puerto San José). Additional potential threats to Guatemalan off shore waters and coasts are oil transports between the USA and southern Central and South America (U.S. Fish and Wildlife Service 2005). Robles (1999) reported the formation of a committee for disaster prevention in ports on the Guatemalan Atlantic coast. There is currently no institutional control on pollution in off shore waters by international oversea traffic.

Disturbance of roosting and foraging sites

Increased human disturbance on roosting and foraging sites of waterbirds causes the birds to flee more often, which consequently causes an increased energy consumption. Especially migratory birds can be affected considerably; energy deficiencies on the wintering and staging grounds may lower individual fitness and breeding success in the subsequent nesting period. Increased movements are assumed in all areas with high hunting activity (Sipacate-Naranjo, Manchón-Guamuchal, Bocas del Polochic). Aggregations of hundreds of Great Egrets (*Ardea alba*) and American White Pelicans



Fig. 23. Smoke and heat points (forest fires) in northern Central America on 20 April 2003. Satellite image: NASA, with kind permission from NASA.

(*Pelecanus erythrorhynchos*) in shallow lagoons in Monterrico have been observed fleeing due to local fishermen and boats with tourists (pers. obs.), a kind of traffic which occurs daily. The Guatemalan Pacific coast is a popular destination for national tourists. Weekend houses have been built along the coastline between Monterrico and Hawaii in the last decade. Leisure time activities include riding four-wheel motorcycles along the beaches, riding water-motorcycles, and the use of ultra-light aircrafts along the beach; negative effects on shorebirds are assumed.

Management deficiencies

Guatemala has a large system of protected areas which covers 30% (3,356,341 ha) of the country (CONAP 2005). Some of the reserves are in fact unprotected due to management deficiencies; the worse case is symbolized by Laguna del Tigre National Park and Biotope (ParksWatch 2003b, 2005). Guatemala's national budget for protected areas was in 2005 ~USD 4.2 million (Pellecer 2005), which equals one US Dollar and 30 Cents per ha of protected area. Costa Rica has 1,195,740 ha of protected areas (EarthTrends 2003) and the 2005 budget for them was at USD 26 millions (Pellecer 2005), which equals USD 21.7 per ha. The low budget in Guatemala does not allow sufficient surveillance in the reserves; one park guard covers on average 9,282 ha (Pellecer 2005).

General lack of environmental consciousness in the Guatemalan society

People throwing trash wherever they move, farmer families living in crude oil contaminated areas, fish dying caused by water pollution from major factories, and people invading protected areas are indicators of a lack of environmental consciousness in Guatemala, caused by lack of education, lack of political will, social injustice, and poverty. The rate of analphabetism in Guatemala among the population aged 15 years and over was 28.2% in 2004, which is the second highest value in Latin America and the Caribbean after Haiti (CEPAL 2005). In 2002, 60.2% of the Guatemalan population lived in poverty, having incomes amounting to less than the cost of a basic food basket (CEPAL 2005). Habitat destruction in Guatemala happens because of basic need of subsistence food production within many rural communities. On the other hand, it happens through ignorance and violation of legal frame works, in order to perform major business (e.g. cattle farming, mining and oil exploitation), supported by the lack of institutional control and political will. Many environmental punishable acts in Guatemala remain exempt from legal judgment and punishment (Boueke 2004, CALAS 2005b, E. Cifuentes en Calito 2006).

Infectious diseases

Infectious diseases can be serious threats to bird populations, e.g. avian botulism (Adams *et al.* 2003), West Nile Virus (Peterson *et al.* 2004), or avian influenza. In 2003 the first cases of an atypical avian influenza (H5N1) have been documented in poultry in several Asian countries (CDC 2005) and its transmission from bird to human has been reported (Apisarnthanarak *et al.* 2005). However, the risk of transmission from bird to human is very low, but future mutation of the virus may cause transmission between humans (CDC 2005, Mott 2005). Waterbird populations are facing a twofold threat by the H5N1 virus: 1. The influenza may cause epidemic death among bird populations. 2. Incorrect interpretation of scientific results on the different forms of avian influenza, virus distribution and wrong information in medias (e.g. TV, radio, press, internet) may cause direct persecutions and mass killings of migratory waterbirds as supposed dangers for human health and life. Persecution of animals based on beliefs have occurred, and are occurring in owls, bats, snakes, and other groups. Direct persecution of certain species may cause their local extirpation or extinction (Primack 1993).

Climate change

Climate changes are likely to become a major issue also for waterbirds. Human-induced global warming is altering the global water regime (Wigley *et al.* 1997, Karl & Trenberth 2003). The increase of sea surface temperature and atmospheric water vapor may enhance tropical storms and rainfall (Trenberth 2005), which may cause decrease in breeding success of waterbirds, especially of species which nest near the coast. Further changes in microclimate due to deforestation may cause drying out of wetlands, and rising sea levels (Meehl *et al.* 2005, Wigley 2005) will alter the coastal landscapes. Changes in migratory behavior due to climatic changes have been reported in some European bird species (Stock 2005). Primary ecosystem productivity was reported to be reduced during unusual hot weather situations in Europe (Ciais *et al.* 2005), which affects waterbird habitat and food resources.

Ongoing aquatic bird conservation programs and participants

It follows an account of legal frameworks and institutions relevant for waterbird conservation in Guatemala. Current and proposed application of these frameworks to conservation action considering species of special concern is layed out in the next section "Conclusions and recommended conservation action for species of special concern".

Legislation

It follows a list of principal national laws and regulations affecting waterbird conservation in Guatemala. Laws ratifying international conventions and declaring protected areas are mentioned in the section "Formal and informal international instruments for aquatic bird conservation". Lists of all applying laws, including laws declaring protected areas, laws creating authorities etc. and electronic copies are available online at www.calas.org.gt and www.congreso.gob.gt

- Environmental law (1986) - Ley de protección y mejoramiento del medio ambiente (Decreto 68-86, reformado por los Decretos Legislativos 75-91, 1-93 y 90-2000, Congreso de la República de Guatemala).
- Regulation of evaluation, control and environmental pursuit (2003) - Reglamento de Evaluación, Control y Seguimiento Ambiental (Acuerdo Gubernativo 23-2003, Congreso de la República de Guatemala).
- Law of protected areas (1989) - Ley de áreas protegidas (Decreto 4-89 y sus Reformas Decretos 18-89, 110-96 y 117-97 del Congreso de la República de Guatemala. Reglamento de la ley de áreas protegidas Acuerdo Gubernativo 759-90 y su reforma Acuerdo Gubernativo 263-92, Congreso de la República de Guatemala).
- Forestry law (1996) - Ley forestal (Decreto 101-96, Congreso de la República de Guatemala).
- Regulation for the profitable use of mangrove (1998) - Reglamento para el aprovechamiento del mangle (Resolución de la Junta Directiva del INAB 01.25.98).
- Law for fishery and aquaculture (2002) - Ley general de pesca y acuicultura (Decreto 80-2002, Congreso de la República de Guatemala).
- Hunting law (2004) - Ley general de caza (Decreto 36-04, Congreso de la República de Guatemala).
- Red List Fauna (2001) - Listado de especies de fauna silvestre amenazadas de extinción (Lista Roja de fauna) (Resolución de la Secretaría Ejecutiva del CONAP ALC 032/2001).
- Regulation for the discharge of residual water into main drainage (2005) - Reglamento de Descargas de aguas residuales a cuerpos receptores (Acuerdo Gubernativo 66-2005, Congreso de la República de Guatemala).
- Law for the regulation of territorial reserves (1997) - Ley reguladora de las reservas territoriales del estado de Guatemala (Decreto 126-97, Congreso de la República de Guatemala).
- Law for the fomentation and divulgation of environmental consciousness (1996) - Ley de fomento a la difusión de la conciencia ambiental (Decreto 116-96, Congreso de la República de Guatemala).
- Mining law (1997) - Ley de minería (Decreto 48-97, Congreso de la República de Guatemala).
- Emergency law for the defense, restauration, and conservation of the Laguna del Tigre National Park (2004) - Ley de emergencia para la defensa, la restauración y la conservación del Parque Nacional Laguna del Tigre (Decreto 16-04, Congreso de la República de Guatemala).
- Electricity law (1996) - Ley general de electricidad (Decreto 93-96, Congreso de la República de Guatemala).

Formal and informal international instruments for aquatic bird conservation

A multitude of international conventions have been created, which may somehow affect waterbird conservation. To list every treaty is not the focus of this report. For instance, all conventions treating nuclear power and its by-products may have impact on water, but only some are mentioned here. The following list is not a reference list for all conventions signed or ratified by Guatemala. Conventions not mentioned here are not necessarily not signed or ratified by Guatemala.

Global

- Ramsar convention on wetlands of international importance especially as waterfowl habitat. Ratified by Guatemala in 1988 (Decreto 4-88, Congreso de la República de Guatemala) Five sites are designated in Guatemala (Laguna del Tigre National Park, Yaxhá-Nakum-Naranjo National Park, Punta de Manabique Wildlife Refuge, Bocas del Polochic Wildlife Refuge, Manchón-Guamuchal), and four more sites are proposed (or proposal in preparation): Laguna Lachuá National Park, Lake Güija, Paraíso-La Barrona, Río Sarstún Area of Multiple Use.
- CITES (Convention on international trade in endangered species of wild flora and fauna). Ratified by Guatemala in 1980 (Decreto 0063-1979, Congreso de la República de Guatemala). Three species of Guatemalan waterbirds are included in Appendix I, the extinct/extirpated Atitlan Grebe (*Podilymbus gigas*) and Eskimo Curlew (*Numenius borealis*), and the Jabiru (*Jabiru mycteria*). One species, the Double-striped Thick-knee (*Burhinus bistriatus*) is listed in Appendix III.
- United Nations convention on biological diversity. Ratified by Guatemala in 1995 (Decreto 05-95, Congreso de la República de Guatemala). As part of the ratification of this convention in Guatemala a national strategy was elaborated (CONAP/OTECBIO 1999).
- Convention concerning the protection of the world cultural and natural heritage, adopted by UNESCO 1972. Ratified by Guatemala in 1978 (Decreto 0047-1978, Congreso de la República de Guatemala). Three sites are designated in Guatemala, one of them as World Natural and Cultural Heritage: Tikal National Park (designated in 1979). Although Tikal was not identified as important waterbird site, the park includes swamp forests as potentially important habitat for waterbirds.
- Convention on climate change, Kyoto Protocol. Ratified by Guatemala in 1999 (Decreto 23-99, Congreso de la República de Guatemala)
- Basel convention on the control of transboundary movements of hazardous wastes and their disposal. Ratified by Guatemala in 1995 (Acuerdo Gubernativo 2504-95).
- Convention on the prevention of pollution of the sea by dumping of waste and other materials (London Dumping Convention). Ratified by Guatemala in 1975 (Decreto 0025-1975, Congreso de la República de Guatemala).
- International convention for the prevention of pollution from ships. Ratified by Guatemala in 1996 (Decreto 77-96, Congreso de la República de Guatemala).
- Convention on the high seas of 1958. Ratified by Guatemala in 1961 (Decreto 1494-1961, Congreso de la República de Guatemala).
- United Nations convention on the law of the sea of 10 December 1982 (UNCLOS 82). Ratified by Guatemala in 1996 (Decreto 56-96, Congreso de la República de Guatemala).
- International convention on civil liability for oil pollution damage, 1969 (CLC 1969). Ratified by Guatemala in 1983 (72-82, Congreso de la República de Guatemala).
- Stockholm convention on persistent organic pollutants. Signed by Guatemala in 2002.
- International convention relating to intervention on the high seas in cases of oil pollution casualties. Signed by Guatemala in 1969.
- Geneva convention on the territorial sea and the contiguous zone. Ratified by Guatemala in 1976 (Decreto 0020-1976, Congreso de la República de Guatemala).
- Vienna convention for the protection of the ozone layer. Ratified by Guatemala in 1987 (Decreto 39-87, Congreso de la República de Guatemala).
- United Nations convention to combat desertification. Ratified by Guatemala in 1999 (Decreto 0405-98, Congreso de la República de Guatemala).
- International tropical timber agreement. Ratified by Guatemala in 2001 (Acuerdo Gubernativo 1210-2000).
- Montreal protocol on substances that deplete the ozon layer. Ratified by Guatemala in 1994 (Acuerdo Gubernativo 2204-94).
- Treaty banning nuclear weapon tests in the atmosphere, in outer space and under water. Ratified by Guatemala in 1963 (Decreto 0135-1963, Congreso de la República de Guatemala).

- Treaty on the prohibition of the emplacement of nuclear weapons and other weapons of mass destruction on the sea bed and the ocean floor and in the subsoil thereof. Ratified by Guatemala in 1994 (Decreto 13-94, Congreso de la República de Guatemala).

Regional

- SAM, "Sistema Arrecifal Mesoamericano": international treaty between Guatemala, Belize, Honduras and Mexico for the conservation of reefs in the Gulf of Honduras, funded by World Bank.
- Convention for the conservation of the biodiversity and the protection of wilderness areas in Central America. Ratified by Guatemala in 1993 (Acuerdo Gubernativo 1009-1993).
- "Programa Ambiental Regional para Centroamérica" (PROARCA): Conservation of the Gulf of Honduras. Funded by TNC, WWF, CCAD (Comisión Centroamericana de Ambiente y Desarrollo), and USAID.
- "Protección ambiental y control de la contaminación originada por el transporte marítimo en el Golfo de Honduras": Environmental protection and control of the pollution caused by the maritime transportation in the Gulf of Honduras (proposed for 5 years). With funds from GEF / BID, with COCATRAM as partner. This project will work to improve the control and prevention of pollution related with sea transportation in the main ports, navigation routes and coastal and marine areas adjacent to the Gulf of Honduras.
- SICAP: "Sistema Centroamericano de Áreas Protegidas" (Central American System of Protected Areas). It works on the negotiation and support of laws and agreements on a regional scale or between countries, as a department of the Comisión Centroamericana de Ambiente y Desarrollo-CCAD – (Central American Commission for Environment and Development) is one of the SICAP's departments and promotes development of protected areas as an effective Mesoamerican Biological Corridor.
- Convention on flora, fauna and natural scenic beauty of the American nations. Ratified by Guatemala en 1941 (Decreto 2554-1941, Congreso de la República de Guatemala)
- Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention) and Protocol Concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region. Ratified by Guatemala in 1989 (Decreto 32-89, Congreso de la República de Guatemala)
- Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region. Signed by Guatemala in 1990.
- Agreement instituting the Latin American Organization for Fisheries Development (OLDEPESCA). Ratified by Guatemala in 1986 (Decreto 58-86, Congreso de la República de Guatemala)
- Eastern Pacific Ocean Tuna Fishing Agreement. Signed by Guatemala en 1983.
- International convention for the conservation of Atlantic tunas. Ratified by Guatemala in 2004 (Decreto 27-04, Congreso de la República de Guatemala)

Bilateral

- "Programa ALIANZAS", IUCN: since 2004, bi-national program for the establishment of sustainable use of natural resources on the Pacific coast, between Monterrico, Guatemala and Barra de Santiago, El Salvador.

Important international treaties not signed by Guatemala

- Bonn convention on migratory species. More than 50 species of waterbirds recorded in Guatemala are listed in Appendices I and II of this convention. Guatemala has not yet signed this treaty.

Organizations relevant to waterbird and/or wetland conservation

It follows a list in alphabetical order:

- AMAZURLY (Authority for the management of the Lake Izabal watershed): Local development projects.
- AMPI (Authority for the management of the Lake Petén Itzá watershed).
- AMSA (Autoridad para el manejo sustentable de la cuenca y lago de Amatitlán) - Governmental authority for the sustainable management of Lake Amatitlán watershed.
- AMSCLAE Autoridad para el Manejo Sustentable de la Cuenca del Lago Atitlán y su Entorno (Governmental authority for the sustainable management of Lake Atitlán watershed).
- ARCAS: Wildlife Rescue and Conservation Association.
- Asociación Ak'Tenamit: Sustainable development of indigenous communities in Río Dulce.
- Asociación de Reservas Naturales Privadas de Guatemala: Association of Private Natural Reserves in Guatemala. They gather and coordinate activities of the administrators of the private protected areas in the country.
- Asociación Tercer Milenio (A3K): Technical study of Lake Guija.
- Asociación Patronato Vivamos Mejor.
- BID: Banco Interamericano de Desarrollo (Interamerican Bank for Development).
- BirdLife International: funding for this study.
- CALAS: Centro de Acción Legal Ambiental y Social (Center for Environmental and Social Legal Action). Environmental litigation.
- CCAD: Comisión Centroamericana de Ambiente y Desarrollo (Central American Commission for Environment and Development).
- CECON, USAC: Centro de Estudios Conservacionistas de la Universidad de San Carlos de Guatemala (Center for Conservationist Studies of the San Carlos University, Guatemala). Administration of 3 protected areas, research.
- CONAP: Consejo Nacional de Áreas Protegidas (National Council of Protected Areas). Administration of national protected areas.
- Critical Ecosystem Partnership Fund (CEPF) - Conservation International/World Bank/Global Environmental Facility/Government of Japan/ MacArthur Foundation/: Funding support in the Maya Biosphere Reserve and Guatemalan highlands.
- FDN: Fundación Defensores de la Naturaleza. Co-administration of protected areas.
- FUNDAECO: Fundación para el Ecodesarrollo. Co-administration of protected areas.
- FUNDALAGO - Fundación para la Salvación del Lago de Amatitlán.
- FUNDARY: Fundación Mario Dary. Co-administration of protected areas.
- GEF: Global Environmental Facility.
- INAB: Instituto Nacional de Bosques (National Institute for Forests). Co-administration of protected areas.
- IUCN: sustainable development of communities around the Laguna Lachuá National Park.
- Instituto de Antropología e Historia (IDAEH): Co-administration of protected areas.
- MAGA: Ministerio de Agricultura, Ganadería y Alimentación. Local development projects.
- MARN: Ministerio de Medio Ambiente y Recursos Naturales.
- PROEVAL RAXMU (Proyectos Evaluados Raxmu): sustainable development in Rocjá Pomtilá, región Lachuá-Ik'bolay.
- ProPetén: Sustainable development projects, research.
- SICA: Sistema de Integración Centroamericana (System of Central American Integration).
- Sociedad Guatemalteca de Ornitología (Ornithological Society of Guatemala): promotes research and conservation of the Guatemalan avifauna.

- TNC: The Nature Conservancy. Sustainable development projects, research.
- UNIPESCA: Unidad de Pesca y Acuicultura del MAGA (Ministerio de Agricultura, Ganadería y Alimentación). Control of fishery activities in Guatemala.
- USAID: Funding.
- USFWS: Funding.
- WCS Petén: Wildlife Conservation Society – Petén: Sustainable development projects, monitoring.
- WWF: Funding.

Research activities

Ornithological research is underdeveloped in Guatemala. Past studies have been summarized in the section "Background". FDN is establishing a waterbird monitoring in the Bocas del Polochic Wildlife Refuge, with currently inappropriate methods (García 2004, García de la Vega 2005).

Monitoring and indicators

There is no nation-wide monitoring carried out currently.

Conclusions and recommended conservation action for species of special concern

Basic conditions are favorable for waterbird conservation in Guatemala: 30% of the country territory are declared as protected areas and the legal framework is established with laws on protected areas, environment, and hunting. Guatemala has also signed international conventions on wetlands, ocean conservation, and biological diversity. Nevertheless, natural habitats including wetlands are threatened by major deficiencies in the application of existing frameworks. Urgent action is needed in order to save important sites like Laguna del Tigre National Park. This will require changes in the national political attitude in order to fulfill national and international responsibilities. Achieving a change in the short term is a difficult issue which might be possible by strengthening the non-governmental sector. Many protected areas in Guatemala are co-administrated by non-governmental organizations. In order to improve effectiveness of NGO's, rigorous evaluations by donors or independent third parties should be part of each project supported, which is currently not a usual procedure. The National Council for Protected Areas (CONAP) is currently planning to implement a conservation plan in communities adjacent to wetlands (Calito 2006).

In order to fill gaps in our knowledge on waterbirds in Guatemala, all conservation action should be accompanied by appropriate research. Most areas lack even basic data; with few exceptions, there are no data available on reproduction of waterbirds. Population sizes presented in this report are guessed, based on very few data. The performance of a basic field study across the whole country establishing baseline data for continuous monitoring is recommendable. While knowledge on waterbird populations can be generated in the short term, developing environmental consciousness is a long-term goal, which can be achieved only by environmental education.

It follows a summarizing account of proposed conservation action for species of special concern (listed in Table 3, here without extinct or probably extinct species), grouped by habitat. First and foremost, most of these species would benefit from management improvements in and around the protected areas. Although the number of park guards was recently elevated in several protected areas (F. Herrera, pers. comm.), surveillance is still underdeveloped. Sustainable land use in and outside of protected areas has much been discussed, but there is actually no conclusive large scale concept.

This account includes punctual actions in order to improve short-term conservation on some hotspots. To achieve long-term conservation and indeed address threats listed in the previous chapter "Issues and threats to waterbirds and their habitats" requires complex improvements among the Guatemalan society, which are out of scope of this report, but which must include:

- Education: an elevated educational level would rise the environmental consciousness and lower the rate of human population increase. Both are key factors of all threats.
- Management of public enterprises (government, communities) according to applying laws and frameworks (emission control, waste water and sewage treatment, etc.).
- Once public enterprises are managed appropriately, public control over private enterprises may be reforced.

When key sites are mentioned, refer also to the specific section in "Locations and descriptions of key sites used y aquatic species" for details.

Offshore seabirds (*Procellaria parkinsoni*, *Puffinus creatopus*, *Puffinus nativitatis*, *Puffinus ilherminieri*, *Oceanodroma tethys*, *Sula sula*): Visiting populations need to be monitored and a fisheries observation program should be installed, possibly in coordination with the other Central American countries.

Near shore and estuary seabirds (*Pelecanus occidentalis*, *Larus heermanni*, *Xema sabini*, *Sterna elegans*, *Sterna dougallii*, *Sterna hirundo*, *Sterna antillarum*, *Chlidonias niger*): Probable nesting sites (Brown Pelican) require documentation and special protection. Visiting populations need to be monitored and a fisheries observation program should be installed.

Birds of shores, marshes, and savannahs (*Burhinus bistriatus*, *Charadrius collaris*, *Himantopus mexicanus*, *Catoptrophorus semipalmatus*): Most shorebirds depend on mud flats as feeding grounds during migration. Repeated disturbance (flushing causes increased energy consumption) by human activities (e.g. fisheries, sport hunting, tourism) should be controlled at all sites along the Pacific coast. Half-wild cattle moving a long the beach in Punta de Manabique are threatening probably nesting Collared Sandpipers by trampling.

Waterbirds mainly of wooded wetlands, incl. mangrove (*Tigrisoma mexicanum*, *Butorides virescens*, *Agamia agami*, *Nycticorax nycticorax*, *Nyctanassa violacea*, *Cochlearius cochlearius*, *Aramides axillaris*, *Heliornis fulica*, *Eurypyga helias*): Further deforestation in Laguna del Tigre National Park and in mangroves of Sipacate Naranjo, Manchón Guamuchal, and Monterrico-Hawaii need to be prevented. First attempts to implement mangrove conservation by sustainable and alternative landuse along the Guatemalan Pacific coast have been made (Cordero Pérez *et al.* 2000) with limited success. The impact of the bilateral program "ALIANZAS" between El Salvador and Guatemala is still limited in Guatemala (C. Muccio, pers. comm.).

Non-specialized waterbirds of freshwater wetlands and salt marshes (*Cairina moschata*, *Dendrocygna autumnalis*, *Dendrocygna bicolor*, *Nomonyx dominicus*, *Oxyura jamaicensis*, *Podilymbus podiceps*, *Podiceps nigricollis*, *Botaurus pinnatus*, *Botaurus lentiginosus*, *Ixobrychus exilis*, *Ardea alba*, *Egretta thula*, *Egretta caerulea*, *Egretta tricolor*, *Egretta rufescens*, *Platalea ajaja*, *Jabiru mycteria*, *Mycteria americana*, *Laterallus exilis*, *Rallus limicola*, *Amaurolimnas concolor*, *Porzana flaviventer*, *Pardirallus maculatus*, *Aramus guarauna*): Sport hunting needs to be controlled in Manchón-Guamuchal and Bocas del Polochic. Overharvest of fish needs to be addressed in Bocas del Polochic, Monterrico-Hawaii (here also shrimps), Punta de Manabique, Petexbatún, El Pucté. Annual reed burning in Monterrico should be prevented.

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Appendix I. Status, distribution, population size, and vulnerability of waterbird species reported in Guatemala*

Family Species	Status ¹	Region ²	Population size ³	% of regional population ⁴	Regional population ⁵	Trend ⁶	Vulnerability reprod. / visitors ⁷
ANATIDAE							
<i>Dendrocygna autumnalis</i> (Linnaeus) 1758	R	P,A,Ca,Cp	D	0.8	1,000,000	dec	VU A3cd / -
<i>Dendrocygna bicolor</i> (Vieillot) 1816	?	P,Cp	E	1.4	1,000,000	inc	DD / -
<i>Cairina moschata</i> (Linnaeus) 1758	R	P,A,Ca,Cp	D	0.2	1,000,000	dec	VU A3cd / -
<i>Anas americana</i> Gmelin 1789	V	P,H,Cp	B	0	2,000,000	DD	- / NT
<i>Anas platyrhynchos</i> Linnaeus 1758	vagM	P	A	0	2,000,000	DD	- / NA
<i>Anas discors</i> Linnaeus 1766	V	all	E	1.5	2,000,000	DD	- / NT
<i>Anas cyanoptera</i> Vieillot 1816	vagM	P,Cp	A	0	260,000	DD	- / NA
<i>Anas clypeata</i> Linnaeus 1758	V	P,Cp	D	0.2	2,000,000	DD	- / NT
<i>Anas acuta</i> Linnaeus 1758	V	H,A,Cp,Ca	B	0	2,000,000	DD	- / NT
<i>Anas crecca</i> Linnaeus 1758	vagM,H	P,Cp	DD	nd	2,000,000	DD	- / NA
<i>Aythya valisineria</i> (Wilson) 1814	vagM	H	DD	nd	620,000	DD	- / NA
<i>Aythya americana</i> (Eyton) 1838	vagM,H	P,Cp	DD	nd	750,000	DD	- / NA
<i>Aythya collaris</i> (Donovan) 1809	vagM	H,A	DD	nd	1,220,000	DD	- / NA
<i>Aythya affinis</i> (Eyton) 1838	V	all	D	0.5	2,000,000	DD	- / NT
<i>Nomonyx dominicus</i> (Linnaeus) 1766	RM	P,H	A	nd	nd	DD	CR D / NA
<i>Oxyura jamaicensis</i> (Gmelin) 1789	RM	P,H,Cp	C	0	500,000	DD	CR D / NT
PODICIPEDIDAE							
<i>Tachybaptus dominicus</i> (Linnaeus) 1766	R	all	C	9.7	10,000	DD	NT / -
<i>Podilymbus podiceps</i> (Linnaeus) 1758	RM	all	C	0.7	100,000	DD	VU B2ab(iii) / NT
<i>Podilymbus gigas</i> Griscom 1929	ex (R)	H	0	nd	EX	EX	EX / -
<i>Podiceps nigricollis</i> Brehm 1831	V	H	A	0	3,700,000	DD	- / NT
PROCELLARIIDAE							
<i>Procellaria parkinsoni</i> Gray 1862	vagM	Cp	DD	nd	nd	DD	- / DD
<i>Puffinus creatopus</i> Coues 1864	vagM,H	Cp	DD	nd	nd	DD	- / DD
<i>Puffinus pacificus</i> (Gmelin) 1789	vagM	Cp	DD	nd	nd	DD	- / NA
<i>Puffinus griseus</i> (Gmelin) 1789	vagM	Cp	DD	nd	nd	DD	- / NA
<i>Puffinus nativitatis</i> Streets 1877	vagM	Cp	DD	nd	nd	DD	- / NA
<i>Puffinus lherminieri</i> Lesson 1839	vagM	Cp	DD	nd	nd	DD	- / NA
HYDROBATIDAE							
<i>Oceanites oceanicus</i> (Kuhl) 1820	vagM,H	Cp	DD	nd	nd	DD	- / NA
<i>Oceanodroma leucorhoa</i> (Vieillot) 1818	vagM	Cp	DD	nd	nd	DD	- / NA
<i>Oceanodroma tethys</i> (Bonaparte) 1852	vagM,H	Cp	DD	nd	nd	DD	- / NA
<i>Oceanodroma melania</i> (Bonaparte) 1854	vagM,H	Cp	DD	nd	nd	DD	- / NA
<i>Oceanodroma microsoma</i> (Coues) 1864	vagM,H	Cp	DD	nd	nd	DD	- / NA
PHAETHONTIDAE							
<i>Phaethon lepturus</i> Daudin 1802	vagM,H	Ca	DD	nd	nd	DD	- / NA
<i>Phaethon aethereus</i> Linnaeus 1758	vagM,H	Cp	DD	nd	nd	DD	- / NA
SULIDAE							
<i>Sula dactylatra</i> Lesson 1831	vagM,H	Cp,Ca	DD	nd	nd	DD	- / NA
<i>Sula granti</i> Rothschild 1902	vagM	Cp	DD	nd	nd	DD	- / NA
<i>Sula leucogaster</i> (Boddaert) 1783	vagM	Cp,Ca	A	nd	nd	DD	- / NA
<i>Sula sula</i> (Linnaeus) 1766	vagM,H	Cp,Ca	A	nd	nd	DD	- / NA
PELECANIDAE							
<i>Pelecanus erythrorhynchos</i> Gmelin 1789	V	P,A,Ca,Cp	D	4.9	180,000	inc	- / NT
<i>Pelecanus occidentalis</i> Linnaeus 1766	RM	all	D	0.9	290,000	DD	VU B2ac(iii) / NT

Family Species	Status ¹	Region ²	Population size ³	% of regional population ⁴	Regional population ⁵	Trend ⁶	Vulnerability reprod. / visitors ⁷
PHALACROCORACIDAE							
<i>Phalacrocorax brasilianus</i> (Gmelin) 1789	R	P,A,Cp,Ca	E	nd	nd	DD	NT / -
<i>Phalacrocorax auritus</i> (Lesson) 1831	vagM,H	Ca	DD	nd	1,400,000	DD	- / NA
ANHINGIDAE							
<i>Anhinga anhinga</i> (Linnaeus) 1766	R	P,A,Cp,Ca	D	nd	nd	dec	NT / -
FREGATIDAE							
<i>Fregata magnificens</i> Mathews 1914	V	Cp,Ca	C	nd	nd	DD	- / LC
ARDEIDAE							
<i>Botaurus pinnatus</i> (Wagler) 1829	?	A	DD	nd	nd	DD	VU B2ab(iii); D1 / -
<i>Botaurus lentiginosus</i> (Rackett) 1813	vagM	P,A	DD	nd	2,000,000	DD	- / NA
<i>Ixobrychus exilis</i> (Gmelin) 1789	RM	P,H,A,Ca	B	0	130,000	DD	VU B2a(iii) / NT
<i>Tigrisoma lineatum</i> (Boddaert) 1783	?, H	A,Ca	DD	nd	nd	DD	NA / -
<i>Tigrisoma mexicanum</i> Swainson 1834	R	P,A,Ca,Cp	D	19.6	10,000	DD	VU A3c / -
<i>Ardea herodias</i> Linnaeus 1758	V	all	D	nd	nd	DD	- / NT
<i>Ardea alba</i> (Linnaeus) 1758	RM	all	D	nd	nd	dec	VU A3c / NT
<i>Egretta thula</i> (Molina) 1782	RM	all	D	0.5	1,210,000	dec	VU A3c / NT
<i>Egretta caerulea</i> (Linnaeus) 1758	V	all	D	1.3	300,000	DD	- / LC
<i>Egretta tricolor</i> (Müller) 1776	RM	all	C	0.1	290,000	dec	VU A3c / NT
<i>Egretta rufescens</i> (Gmelin) 1789	V	P,A,Ca,Cp	B	0.5	10,000	dec	- / NT
<i>Bubulcus ibis</i> (Linnaeus) 1758	RM	all	E	1.4	1,500,000	inc	LC / LC
<i>Butorides virescens</i> (Linnaeus) 1758	RM	all	D	nd	nd	dec	VU A3c / NT
<i>Agamia agami</i> (Gmelin) 1789	r	A,Ca	B	nd	nd	dec	EN D / -
<i>Nycticorax nycticorax</i> (Linnaeus) 1758	RM	all	D	0.9	110,000	dec	VU A3c / NT
<i>Nyctanassa violacea</i> (Linnaeus) 1758	RM	P,A,Ca,Cp	C	0.8	110,000	dec	VU A3c / NT
<i>Cochlearius cochlearius</i> (Linnaeus) 1766	R	P,A,Ca,Cp	D	nd	nd	dec	VU A3c / -
THRESKIORNITHIDAE							
<i>Eudocimus albus</i> (Linnaeus) 1758	V	P,A,Ca,Cp	C	nd	nd	dec	- / NT
<i>Plegadis chihi</i> (Vieillot) 1817	vagM	P,Cp	DD	nd	150,000	DD	- / NA
<i>Platalea ajaja</i> Linnaeus 1758	V	P,A,Ca,Cp	C	0.4	180,000	DD	- / NT
CICONIIDAE							
<i>Jabiru mycteria</i> (Lichtenstein) 1819	r	P,A,Cp	A	1.7	675	DD	CR D / -
<i>Mycteria americana</i> Linnaeus 1758	RM	P,A,Ca,Cp	D	2.5	123,000	DD	VU A3c / NT
RALLIDAE							
<i>Laterallus ruber</i> (Sclater and Salvin) 1860	R	all	D	nd	nd	stab	LC / -
<i>Laterallus exilis</i> (Temminck) 1831	r	A,Ca	A	nd	nd	DD	VU D1+2 / -
<i>Laterallus jamaicensis</i> (Gmelin) 1789	ex (r)	H	0	nd	100,000	EX	RE / -
<i>Rallus limicola</i> Vieillot 1819	r	H	DD	nd	nd	DD	DD / -
<i>Aramides axillaris</i> Lawrence 1863	?,H	Cp,Ca	A	nd	nd	DD	EN B2ab(iii) / -
<i>Aramides cajanea</i> (Müller) 1776	R	P,A,Ca,Cp	D	nd	nd	dec	NT / -
<i>Amaurolimnas concolor</i> (Gosse) 1847	r	A,Ca	A	nd	nd	DD	EN D / -
<i>Porzana carolina</i> (Linnaeus) 1758	V	all	DD	nd	nd	DD	- / NT
<i>Porzana flaviventer</i> (Boddaert) 1783	r	P,A,Ca	A	nd	nd	DD	VU B2ab(iii) / -
<i>Pardirallus maculatus</i> (Boddaert) 1783	r	A,P	A	nd	nd	DD	CR D / -
<i>Porphyrio martinica</i> (Linnaeus) 1766	RM	all	C	0.1	1,000,000	stab	NT / NT
<i>Gallinula chloropus</i> (Linnaeus) 1758	RM	all	C	0.1	1,000,000	stab	NT / NT
<i>Fulica americana</i> Gmelin 1789	RM	all	E	1.6	2,000,000	stab	LC / LC
HELIORNITHIDAE							
<i>Heliornis fulica</i> (Boddaert) 1783	R	P,A,Cp,Ca	C	nd	nd	dec	VU A3c / -
EURYPYGIDAE							
<i>Eurypyga helias</i> (Pallas) 1781	r	A	DD	nd	nd	dec	CR B2a,b(iii) / -
ARAMIDAE							

Family Species	Status ¹	Region ²	Population size ³	% of regional population ⁴	Regional population ⁵	Trend ⁶	Vulnerability reprod. / visitors ⁷
<i>Aramus guarauna</i> (Linnaeus) 1766	R	P,A,Cp,Ca	D	nd	nd	stab	VU A3c / -
BURHINIDAE							
<i>Burhinus bistriatus</i> (Wagler) 1829	R	P,Vi	DD	nd	nd	dec	VU D1 / -
CHARADRIIDAE							
<i>Pluvialis squatarola</i> (Linnaeus) 1758	V	P,A,Ca,Cp	B	0.1	200,000	DD	- / LC
<i>Pluvialis dominica</i> (Müller) 1776	T	all	F	100	150,000	DD	- / LC
<i>Charadrius collaris</i> Vieillot 1818	RM	P,A,Ca,Cp	B	1.8	10,000	DD	VU D1 / NT
<i>Charadrius alexandrinus</i> Linnaeus 1758	V	P,A,Ca,Cp	A	0.2	13,000	DD	- / NT
<i>Charadrius wilsonia</i> Ord 1814	V	P,A,Ca,Cp	A	0.5	6,000	DD	- / NT
<i>Charadrius semipalmatus</i> Bonaparte 1825	V	P,A,Ca,Cp	B	0.1	150,000	DD	- / NT
<i>Charadrius vociferus</i> Linnaeus 1758	V	all	C	0.1	1,000,000	DD	- / LC
HAEMATOPODIDAE							
<i>Haematopus palliatus</i> Temminck 1820	?	P,A,Cp,Ca	A	0.3	8,500	DD	- / NT
RECURVIROSTRIDAE							
<i>Himantopus mexicanus</i> (Müller) 1776	RM	all	C	0.1	1,000,000	inc	VU D1 / NT
<i>Recurvirostra americana</i> Gmelin 1789	V	P,Cp	DD	nd	450,000	DD	- / NT
JACANIDAE							
<i>Jacana spinosa</i> (Linnaeus) 1758	R	P,A,Cp,Ca	D	nd	nd	stab	- / LC
SCOLOPACIDAE							
<i>Tringa melanoleuca</i> (Gmelin) 1789	V	all	B	0.1	100,000	DD	- / NT
<i>Tringa flavipes</i> (Gmelin) 1789	V	all	B	0	550,000	DD	- / NT
<i>Tringa solitaria</i> Wilson 1813	V	all	B	0	150,000	DD	- / NT
<i>Catoptrophorus semipalmatus</i> (Gmelin) 1789	V	P,A,Ca,Cp	A	0	250,000	DD	- / NT
<i>Heteroscelus incanus</i> (Gmelin) 1789	V	P,Cp	DD	nd	25,000	DD	- / NT
<i>Actitis macularius</i> (Linnaeus) 1766	V	all	D	1.1	250,000	DD	- / LC
<i>Bartramia longicauda</i> (Bechstein) 1812	T	all	F	100	350,000	DD	- / NT
<i>Numenius borealis</i> (Forster) 1772	ex (vagM)	H	0	nd	100	EX	- / RE
<i>Numenius phaeopus</i> (Linnaeus) 1758	V	P,A,Ca,Cp	B	0.2	57,000	DD	- / LC
<i>Numenius americanus</i> Bechstein 1812	V	P,Cp	DD	nd	14,000	DD	- / NT
<i>Limosa haemastica</i> Linnaeus 1758	T	P,Cp	E	100	50,000	DD	- / NT
<i>Limosa fedoa</i> (Linnaeus) 1758	V	P,Cp	A	0	170,000	DD	- / NT
<i>Arenaria interpres</i> (Linnaeus) 1758	V	P,A,Ca,Cp	B	0	180,000	DD	- / NT
<i>Aphriza virgata</i> (Gmelin) 1789	V	P,Cp	DD	nd	70,000	DD	- / NT
<i>Calidris canutus</i> (Linnaeus) 1758	V	P,A,Ca,Cp	A	0	80,000	DD	- / NT
<i>Calidris alba</i> (Pallas) 1764	V	P,A,Ca,Cp	C	0	300,000	DD	- / NT
<i>Calidris pusilla</i> (Linnaeus) 1766	V	P,A,Ca,Cp	A	0	3,500,000	DD	- / NT
<i>Calidris mauri</i> (Cabanis) 1857	V	P,H,A,Cp,Ca	B	0	2,000,000	DD	- / NT
<i>Calidris minutilla</i> (Vieillot) 1819	V	all	C	0.1	600,000	DD	- / NT
<i>Calidris fuscicollis</i> (Vieillot) 1819	T	A,Cp,Ca	B	0	400,000	DD	- / NT
<i>Calidris bairdii</i> (Coues) 1861	T	all	A	0	300,000	DD	- / NT
<i>Calidris melanotos</i> (Vieillot) 1819	T	all	B	0	100,000	DD	- / NT
<i>Calidris alpina</i> (Linnaeus) 1758	vagM	P,Cp	DD	nd	550,000	DD	- / NA
<i>Calidris himantopus</i> (Bonaparte) 1826	V	all	A	0	200,000	DD	- / NT
<i>Tryngites subruficollis</i> (Vieillot) 1819	T	A,Cp,Ca	E	100	15,000	DD	- / NT
<i>Philomachus pugnax</i> (Linnaeus) 1758	vagM	P,Cp	DD	nd	nd	DD	- / NA
<i>Limnodromus griseus</i> (Gmelin) 1789	V	P,A,Ca,Cp	C	0.1	320,000	DD	- / NT
<i>Limnodromus scolopaceus</i> (Say) 1823	V	P,Cp	DD	nd	500,000	DD	- / NT
<i>Gallinago delicata</i> (Ord) 1825	V	P,H,A,	DD	nd	2,000,000	DD	- / NT
<i>Phalaropus tricolor</i> (Vieillot) 1819	T	H	DD	nd	1,500,000	DD	- / NT
<i>Phalaropus lobatus</i> (Linnaeus) 1758	V	P,Cp	DD	nd	2,000,000	DD	- / NT
<i>Phalaropus fulicarius</i> (Linnaeus) 1759	V,H	P,Cp	DD	nd	1,000,000	DD	- / NT

Family Species	Status ¹	Region ²	Population size ³	% of regional population ⁴	Regional population ⁵	Trend ⁶	Vulnerability reprod. / visitors ⁷
LARIDAE							
<i>Stercorarius maccormicki</i> Saunders 1893	V,H	Cp	DD	nd	nd	DD	- / LC
<i>Stercorarius pomarinus</i> (Temminck) 1815	V,H	Cp,Ca	DD	nd	nd	DD	- / LC
<i>Stercorarius parasiticus</i> (Linnaeus) 1758	V,H	Cp,Ca	DD	nd	nd	DD	- / LC
<i>Stercorarius longicaudus</i> Vieillot 1819	V,H	Cp	DD	nd	nd	DD	- / LC
<i>Larus atricilla</i> Linnaeus 1758	V	all	D	0.2	800000	DD	- / LC
<i>Larus pipixcan</i> Wagler 1831	T	P,H,Cp	F	100	980000	DD	- / LC
<i>Larus heermanni</i> Cassin 1852	vagM,H	Cp	DD	nd	530000	DD	- / NT
<i>Larus delawarensis</i> Ord 1815	vagM,H	P,A,Cp	DD	nd	2000000	DD	- / NA
<i>Larus argentatus</i> Pontoppidan 1763	V	P,H,A,Cp,Ca	A	0	370000	DD	- / LC
<i>Xema sabini</i> (Sabine) 1819	V,H	Cp	DD	nd	550000	DD	- / NT
<i>Sterna nilotica</i> Gmelin 1789	V	P,Cp,Ca	B	0.3	25000	DD	- / NT
<i>Sterna caspia</i> Pallas 1770	V	P,A,Ca,Cp	D	2.2	100000	DD	- / NT
<i>Sterna maxima</i> Boddaert 1783	V	P,A,Ca,Cp	D	1.0	150000	DD	- / NT
<i>Sterna elegans</i> Gambel 1849	T,H	Cp	DD	nd	70000	DD	- / NT
<i>Sterna sandvicensis</i> Latham 1787	V	P,Cp,Ca	C	0.4	100000	DD	- / NT
<i>Sterna dougallii</i> Montagu 1813	V,H	Ca	DD	nd	25000	DD	- / NT
<i>Sterna hirundo</i> Linnaeus 1758	T	Cp,Ca	A	0	410000	DD	- / NT
<i>Sterna paradisaea</i> Pontoppidan 1763	T,H	Cp	DD	nd	nd	DD	- / NT
<i>Sterna forsteri</i> Nuttall 1834	V,H	P,Cp	DD	nd	120000	DD	- / NT
<i>Sterna antillarum</i> (Lesson) 1847	V	A,Cp,Ca	B	0.1	68500	DD	- / NT
<i>Sterna anaethetus</i> Scopoli 1786	V,H	Ca	DD	nd	nd	DD	- / NT
<i>Sterna fuscata</i> Linnaeus 1766	V	Cp,Ca	DD	nd	2950000	DD	- / NT
<i>Chlidonias niger</i> (Linnaeus) 1758	V	all	B	0	450000	DD	- / NT
<i>Rynchops niger</i> Linnaeus 1758	V	P,A,Ca,Cp	D	1.2	101000	DD	- / NT

* Nomenclature according to AOU (1998) and supplements (Banks *et al.* 2000, 2002).

¹ Status: R-Breeding resident; r-Resident, breeding suspected; RM- Breeding resident, partially migratory; RV-Breeding visitor; rv- Visitor, breeding suspected; V-Non-breeding visitor; T-Transient; vagM-Migratory vagrant; vagR-Non-migratory vagrant; H-Species with hypothetical record; ?-Status uncertain; ex-Extinct or extirpated, in parentheses former status.

² Region: P-Pacific slope (<900 msnm); A-Atlantic slope (<900 msnm); H-Highlands (>900 msnm); Cp-Pacific coast; Ca-Atlantic coast; all-in all regions.

³ Population estimate: A <50 individuals; B 51-250; C 251-1000; D 1,001-10,000; E 10,000-50,000; F >50,000; DD-Data deficient, 0-extinct/extirpated.

⁴ Percentage of the total population of subspecies or regional population according to Delany & Scott (2002).

⁵ Population of subspecies or regional population according to Delany & Scott (2002) in number of individuals; nd-no data.

⁶ Population trend: dec-Decreasing; inc-Increasing; stab-Stabil; EX-Extinct/Extirpated; DD-Data Deficient.

⁷ Vulnerability reprod. / visitors (Eisermann & Avendaño 2006), applying IUCN criteria (2001, 2003) on national level to evaluate reproductive populations and visiting non-breeding populations (reproductive populations are listed first, after the slash visiting non-breeding populations): NE-Not Evaluated; NA-Not Applicable; DD-Data Deficient; EX-Extinct; RE-Regionally Extinct; EW-Extinct in the Wild; CR-Critically Endangered; EN-Endangered; VU-Vulnerable; NT-Near Threatened; LC-Least Concern. Categories VU, EN and CR are indicated with sub-categories according to IUCN (2001), accessible online at <http://www.redlist.org>

Appendix II. Common names of waterbirds reported in Guatemala

Scientific name	Common English name	Q'eqchi' ¹	Common Spanish names ²
<i>Dendrocygna autumnalis</i>	Black-bellied Whistling-Duck		píjiji
<i>Dendrocygna bicolor</i>	Fulvous Whistling-Duck		píjiji
<i>Cairina moschata</i>	Muscovy Duck	patux	pato
<i>Anas americana</i>	American Wigeon		pato
<i>Anas platyrhynchos</i>	Mallard		pato
<i>Anas discors</i>	Blue-winged Teal		pato, mancornado
<i>Anas cyanoptera</i>	Cinnamon Teal		pato
<i>Anas clypeata</i>	Northern Shoveler		pato
<i>Anas acuta</i>	Northern Pintail		pato
<i>Anas crecca</i>	Green-winged Teal		pato
<i>Aythya valisineria</i>	Canvasback		pato
<i>Aythya americana</i>	Redhead		pato
<i>Aythya collaris</i>	Ring-necked Duck		pato
<i>Aythya affinis</i>	Lesser Scaup		pato
<i>Nomonyx dominicus</i>	Masked Duck		pato
<i>Oxyura jamaicensis</i>	Ruddy Duck		pato
<i>Tachybaptus dominicus</i>	Least Grebe		poc, pato poc, pato
<i>Podilymbus podiceps</i>	Pied-billed Grebe		poc, pato poc, pato
<i>Podilymbus gigas</i>	Atitlan Grebe		
<i>Podiceps nigricollis</i>	Eared Grebe		
<i>Procellaria parkinsoni</i>	Parkinson's Petrel		
<i>Puffinus creatopus</i>	Pink-footed Shearwater		
<i>Puffinus pacificus</i>	Wedge-tailed Shearwater		
<i>Puffinus griseus</i>	Sooty Shearwater		
<i>Puffinus nativitatis</i>	Christmas Shearwater		
<i>Puffinus ilherminieri</i>	Audubon's Shearwater		
<i>Oceanites oceanicus</i>	Wilson's Storm-Petrel		
<i>Oceanodroma leucorhoa</i>	Leach's Storm-Petrel		
<i>Oceanodroma tethys</i>	Wedge-rumped Storm-Petrel		
<i>Oceanodroma melania</i>	Black Storm-Petrel		
<i>Oceanodroma microsoma</i>	Least Storm-Petrel		
<i>Phaethon lepturus</i>	White-tailed Tropicbird		
<i>Phaethon aethurus</i>	Red-billed Tropicbird		
<i>Sula dactylatra</i>	Masked Booby		
<i>Sula granti</i>	Nazca Booby		
<i>Sula leucogaster</i>	Brown Booby		
<i>Sula sula</i>	Red-footed Booby		
<i>Pelecanus erythrorhynchos</i>	American White Pelican		pelicano blanco
<i>Pelecanus occidentalis</i>	Brown Pelican		alcatrás, pelicano
<i>Phalacrocorax brasilianus</i>	Neotropic Cormorant		pato coche, malach
<i>Phalacrocorax auritus</i>	Double-crested Cormorant		pato coche, malach
<i>Anhinga anhinga</i>	Anhinga	malaach	pato aguja
<i>Fregata magnificens</i>	Magnificent Frigatebird		tigeria
<i>Botaurus pinnatus</i>	Pinnated Bittern		
<i>Botaurus lentiginosus</i>	American Bittern		
<i>Ixobrychus exilis</i>	Least Bittern		
<i>Tigrisoma lineatum</i>	Rufescent Tiger-Heron		
<i>Tigrisoma mexicanum</i>	Bare-throated Tiger-Heron	cocoxjotz	garza tigre, ajuquin, jorjor
<i>Ardea herodias</i>	Great Blue Heron	jotz	garza
<i>Ardea alba</i>	Great Egret	jotz	garza, garzon blanco
<i>Egretta thula</i>	Snowy Egret	jotz	garza
<i>Egretta caerulea</i>	Little Blue Heron	jotz	garza
<i>Egretta tricolor</i>	Tricolored Heron	jotz	garza
<i>Egretta rufescens</i>	Reddish Egret	jotz	garza
<i>Bubulcus ibis</i>	Cattle Egret	sak'iquil, jotz	garza
<i>Butorides virescens</i>	Green Heron	jotz	garza, poyoyo
<i>Agamia agami</i>	Agami Heron	jotz	garza
<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron		garza, beruzana
<i>Nyctanassa vialacea</i>	Yellow-crowned Night-Heron		garza, beruzana
<i>Cochlearius cochlearius</i>	Boat-billed Heron		cucharón
<i>Eudocimus albus</i>	White Ibis		
<i>Plegadis chihi</i>	White-faced Ibis		
<i>Platalea ajaja</i>	Roseate Spoonbill		garza rosada, espátula rosada
<i>Jabiru mycteria</i>	Jabiru		jabirú, cigüeña
<i>Mycteria americana</i>	Wood Stork		cigüeña
<i>Laterallus ruber</i>	Ruddy Crake	maxtululha	
<i>Laterallus exilis</i>	Gray-breasted Crake		
<i>Laterallus jamaicensis</i>	Black Rail		
<i>Rallus limicola</i>	Virginia Rail		
<i>Aramides axillaris</i>	Rufous-necked Wood-Rail		cocolea, gallina de monte
<i>Aramides cajanea</i>	Gray-necked Wood-Rail		cocolea, gallina de monte
<i>Amaurolimnas concolor</i>	Uniform Crake		
<i>Porzana carolina</i>	Sora		
<i>Porzana flaviventer</i>	Yellow-breasted Crake		
<i>Pardirallus maculatus</i>	Spotted Rail		
<i>Porphyrio martinica</i>	Purple Gallinule		gallareta morada
<i>Gallinula chloropus</i>	Common Moorhen		

Scientific name	Common English name	Q'eqchi' ¹	Common Spanish names ²
<i>Fulica americana</i>	American Coot		pato
<i>Heliornis fulica</i>	Sungrebe		guacalito
<i>Eurypyga helias</i>	Sunbittern		
<i>Aramus guarana</i>	Limpkin		correa, margarita
<i>Burhinus bistriatus</i>	Double-striped Thick-knee		
<i>Pluvialis squatarola</i>	Black-bellied Plover		pichich
<i>Pluvialis dominica</i>	American Golden-Plover		pichich
<i>Charadrius collaris</i>	Collared Plover		pichich
<i>Charadrius alexandricus</i>	Snowy Plover		pichich
<i>Charadrius wilsonia</i>	Wilson's Plover		pichich
<i>Charadrius semipalmatus</i>	Semipalmated Plover		pichich
<i>Charadrius vociferus</i>	Killdeer		pichich
<i>Haematopus palliatus</i>	American Oystercatcher		pichich
<i>Himantopus mexicanus</i>	Black-necked Stilt		pichich, soldado
<i>Recurvirostra americana</i>	American Avocet		pichich
<i>Jacana spinosa</i>	Northern Jacana		fraile, gallito, chicharná
<i>Tringa melanoleuca</i>	Greater Yellowlegs		pichich
<i>Tringa flaviceps</i>	Lesser Yellowlegs		pichich
<i>Tringa solitaria</i>	Solitary Sandpiper		pichich
<i>Catoptrophorus semipalmatus</i>	Willet		pichich
<i>Heteroscelus incanus</i>	Wandering Tattler		pichich
<i>Actitis macularius</i>	Spotted Sandpiper	pitzun	pichich, saltaculito
<i>Bartramia longicauda</i>	Upland Sandpiper		pichich
<i>Numenius borealis</i>	Eskimo Curlew		pichich
<i>Numenius phaeopus</i>	Whimbrel		pichich
<i>Numenius americanus</i>	Long-billed Curlew		pichich
<i>Limosa haemastica</i>	Hudsonian Godwit		pichich
<i>Limosa fedoa</i>	Marbled Godwit		pichich
<i>Arenaria interpres</i>	Ruddy Turnstone		pichich
<i>Aphriza virgata</i>	Surfbird		pichich
<i>Calidris canutus</i>	Red Knot		pichich
<i>Calidris alba</i>	Sanderling		pichich
<i>Calidris pusilla</i>	Semipalmated Sandpiper		pichich
<i>Calidris mauri</i>	Western Sandpiper		pichich
<i>Calidris minutilla</i>	Least Sandpiper		pichich
<i>Calidris fuscicollis</i>	White-rumped Sandpiper		pichich
<i>Calidris bairdii</i>	Baird's Sandpiper		pichich
<i>Calidris melanotos</i>	Pectoral Sandpiper		pichich
<i>Calidris alpina</i>	Dunlin		pichich
<i>Calidris himantopus</i>	Stilt Sandpiper		pichich
<i>Tryngites subruficollis</i>	Buff-breasted Sandpiper		pichich
<i>Philomachus pugnax</i>	Ruff		pichich
<i>Limnodromus griseus</i>	Short-billed Dowitcher		pichich
<i>Limnodromus scolopaceus</i>	Long-billed Dowitcher		pichich
<i>Gallinago delicata</i>	Wilson's Snipe		pichich
<i>Phalaropus tricolor</i>	Wilson's Phalarope		pichich
<i>Phalaropus lobatus</i>	Red-necked Phalarope		pichich
<i>Phalaropus fulicarius</i>	Red Phalarope		pichich
<i>Stercorarius macormicki</i>	South Polar Skua		gaviota
<i>Stercorarius pomarinus</i>	Pomarine Jaeger		gaviota
<i>Stercorarius parasiticus</i>	Parasitic Jaeger		gaviota
<i>Stercorarius longicaudus</i>	Long-tailed Jaeger		gaviota
<i>Larus atricilla</i>	Laughing Gull		gaviota
<i>Larus pipixcan</i>	Franklin's Gull		gaviota
<i>Larus heermanni</i>	Heermann's Gull		gaviota
<i>Larus delawarensis</i>	Ring-billed Gull		gaviota
<i>Larus argentatus</i>	Herring Gull		gaviota
<i>Xema sabini</i>	Sabine's Gull		gaviota
<i>Sterna nitolica</i>	Gull-billed Tern		gaviota
<i>Sterna caspia</i>	Caspian Tern		gaviota
<i>Sterna maxima</i>	Royal Tern		gaviota
<i>Sterna elegans</i>	Elegant Tern		gaviota
<i>Sterna sandvicensis</i>	Sandwich Tern		gaviota
<i>Sterna dougallii</i>	Roseate Tern		gaviota
<i>Sterna hirundo</i>	Common Tern		gaviota
<i>Sterna paradisaea</i>	Arctic Tern		gaviota
<i>Sterna forsteri</i>	Forster's Tern		gaviota
<i>Sterna antillarum</i>	Least Tern		gaviota
<i>Sterna anaethetus</i>	Bridled Tern		gaviota
<i>Sterna fuscata</i>	Sooty Tern		gaviota
<i>Chlidonias niger</i>	Black Tern		gaviota
<i>Rynchops niger</i>	Black Skimmer		gaviota

¹ Names in the Q'eqchi' language for some species or groups of species were provided by the bird census takers from the community Rocjá Pomtilá, Cobán, Alta Verapaz (PROEVAL RAXMU Bird Monitoring Program).

² Local Spanish names from Eisermann (2001a), and personal comments by R. Balas McNab, J. M. Castillo Rivera, E. González Ordoñez, T. Dubon Ortiz, G. Gámez Díaz, V. E. Cuoj.

Appendix III. Species of waterbirds probably occurring in Guatemala

Family Species	English Name	Comments
ANATIDAE		
<i>Anser albifrons</i> Scopoli 1769	Greater White-fronted Goose	Some records in the south of Mexico and in Belize (Howell & Webb 1995, Jones & Vallely 2001, Jones 2003).
<i>Chen caerulescens</i> Linnaeus 1758	Snow Goose	
<i>Branta canadensis</i> (Linnaeus) 1758	Canada Goose	
<i>Aix sponsa</i> (Linnaeus) 1758	Wood Duck	
<i>Mergus serrator</i> Linnaeus 1758	Red-breasted Merganser	
PROCELLARIIDAE		
<i>Pterodroma neglecta</i> (Schlegel) 1863	Kermadec Petrel	
<i>Pterodroma externa</i> (Salvin) 1875	Juan Fernandez Petrel	
<i>Pterodroma phaeopygia</i> (Salvin) 1876	Galapagos Petrel	
<i>Pterodroma rostrata</i> (Peale) 1848	Tahiti Petrel	
<i>Puffinus auricularis</i> Townsend 1890	Townsend's Shearwater	An observation and identification by P. Kaestner on 11 May 2002 off Iztapa (13°56'N 90°43'O), dpto. Escuintla, was communicated by J. Berry (in Eisermann & Avendaño 2006). A confirmation with the observer was not possible.
HYDROBATIDAE		
<i>Oceanodroma homochroa</i> (Coues) 1864	Ashy Storm-Petrel	An observation and identification by P. Kaestner on 11 May 2002 off shore of Iztapa (13°56'N 90°43'O), dpto. Escuintla, was communicated by J. Berry (in Eisermann & Avendaño 2006). A confirmation with the observer was not possible.
SULIDAE		
<i>Sula nebouxii</i> Milne-Edwards 1882	Blue-footed Booby	
THRESKIORNITHIDAE		
<i>Plegadis falcinellus</i> (Linnaeus) 1766	Glossy Ibis	See map in Howell & Webb (1995). There exist 3 recent records for El Salvador (O. Komar in Eisermann & Avendaño 2006).
PHOENICOPTERIDAE		
<i>Phoenicopterus ruber</i> Linnaeus 1758	Greater Flamingo	Two individuals were seen in Aguacaliente, Toledo Distr., Belize, ~25 km from the Guatemalan border (O. Figueroa in Jones 2001).
CHARADRIIDAE		
<i>Vanellus chilensis</i> (Molina) 1782	Southern Lapwing	Resident of South America (AOU 1998); Martin (1998) reported the species in Mexico and Jones (2005) reported records in Belize and range extensions in Central America.

Family Species	English Name	Comments
LARIDAE		
<i>Larus philadelphia</i> (Ord) 1815	Bonaparte's Gull	Was recorded in El Salvador on three occasions (O. Komar in Eisermann & Avendaño 2006).
<i>Larus californicus</i> Lawrence 1854	California Gull	Recorded in El Salvador (Komar 2001)
<i>Anous stolidus</i> (Linnaeus) 1758	Brown Noddy	
ALCIDAE		
<i>Synthliboramphus craveri</i> (Salvadori) 1865	Craveri's Murrelet	A sighting of an individual of the family Alcidae was assigned probably to this species (Jehl 1974).

Appendix IV. Records of waterbird species of special concern in Guatemalan key sites

Species	MG ¹	SN ²	MH/PB ³	Güja ⁴	Am ⁵	Atit ⁶	Man ⁷	Dulce ⁸	BdP ⁹	L/Ik ¹⁰	Pet ¹¹	Puc ¹²	Itza ¹³	Yax ¹⁴	Mir ¹⁵	Tig ¹⁶	Number of sites where species is present
<i>Dendrocygna autumnalis</i>	X		X	X	X		X	X	X	X				X	X	X	11
<i>Dendrocygna bicolor</i>	X		X	X	X												4
<i>Cairina moschata</i>	X			X	X		X	X	X	X						X	7
<i>Oxyura jamaicensis</i>	X		X	X	X	X											5
<i>Podilymbus podiceps</i>	X	X	X	X	X	X	X	X	X	X			X	X	X	X	14
<i>Podilymbus gigas</i>						EX											0
<i>Podiceps nigricollis</i>				X	X												2
<i>Procellaria parkinsoni</i>																	0
<i>Puffinus creatopus</i>																	0
<i>Puffinus nativitatis</i>																	0
<i>Puffinus ilherminieri</i>																	0
<i>Oceanodroma tethys</i>																	0
<i>Sula sula</i>							X										1
<i>Pelecanus occidentalis</i>	X	X	X	X			X	X	X	X	X		X	X		X	12
<i>Botaurus pinnatus</i>	X																1
<i>Botaurus lentiginosus</i>																	0
<i>Ixobrychus exilis</i>			X						X							X	3
<i>Tigrisoma mexicanum</i>	X		X				X	X	X	X	X	X	X	X	X	X	12
<i>Ardea alba</i>	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	15
<i>Egretta thula</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	16
<i>Egretta caerulea</i>	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	15
<i>Egretta tricolor</i>	X	X	X	X			X	X	X	X	X	X	X	X	X	X	14
<i>Egretta rufescens</i>	X											X					2
<i>Butorides virescens</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	16
<i>Agamia agami</i>							X		X							X	3
<i>Nycticorax nycticorax</i>	X		X	X			X	X	X	X						X	8
<i>Nyctanassa violacea</i>	X	X	X	X			X	X	X					X	X	X	10
<i>Cochlearius cochlearius</i>	X	X	X				X	X	X					X	X	X	9
<i>Platalea ajaja</i>	X	X	X	X			X	X	X					X	X		9
<i>Jabiru mycteria</i>	X													X		X	3
<i>Mycteria americana</i>	X	X	X	X			X	X	X						X	X	9
<i>Laterallus exilis</i>							X									X?	2
<i>Laterallus jamaicensis</i>																	0
<i>Rallus limicola</i>																	0
<i>Aramides axillaris</i>	X						X										2
<i>Amaurolimnas concolor</i>							X										1
<i>Porzana flaviventer</i>							X										1
<i>Pardirallus maculatus</i>				X												X?	2
<i>Heliornis fulica</i>			X				X		X	X		X				X	6
<i>Eurypyga helias</i>																	0
<i>Aramus guarana</i>	X		X	X			X		X	X		X	X			X	9
<i>Burhinus bistriatus</i>																	0
<i>Charadrius collaris</i>				X			X										2
<i>Himantopus mexicanus</i>	X	X	X	X			X		X	X	X	X	X	X		X	12
<i>Catoptrophorus semipalmatus</i>			X				X	X									3

Species	MG ¹	SN ²	MH/PB ³	Güja ⁴	Am ⁵	Atit ⁶	Man ⁷	Dulce ⁸	BdP ⁹	L/Ik ¹⁰	Pet ¹¹	Puc ¹²	Itza ¹³	Yax ¹⁴	Mir ¹⁵	Tig ¹⁶	Number of sites where species is present
<i>Numenius borealis</i>																	0
<i>Larus heermanni</i>																	0
<i>Xema sabini</i>																	0
<i>Sterna elegans</i>																	0
<i>Sterna dougallii</i>																	0
<i>Sterna hirundo</i>							X										1
<i>Sterna antillarum</i>		X					X										2
<i>Chlidonias niger</i>							X										1

¹ Manchón-Guamuchal, source: Sigüenza (1995), pers. comm. by R. Sigüenza, J. Berry.

² Sipacate-Naranjo, source: CONAP (2002), pers. comm. by R. Sigüenza.

³ Monterrico-Hawaii, source: pers. obs. K. Eisermann & C. Avendaño. No data were available for El Paraiso-La Barrona, but the geographic proximity to Monterrico Hawaii and comments by R. Sigüenza suggest similarities.

⁴ Lake Güija, source: Herrera & Ibarra (2005).

⁵ Lake Amatitlán, source: Chávez (2001).

⁶ Lake Atitlán, source: pers. obs.

⁷ Punta de Manabique, source: Eisermann (2001a).

⁸ Río Dulce / Chocón Machacas / Río Sarstún, Source: Arrivillago *et al.* (1992), Pérez Consuegra *et al.* (2001).

⁹ Bocas del Polochic, source: Seglund & Conner (1997).

¹⁰ Laguna Lachuá / Floodplain Ik'bolay river, Source: Avendaño (2001), Eisermann (2001b).

¹¹ Petexbatún, source: AHT International (2000); J. M. Castillo Riverapers. comm; pers. obs.

¹² El Pucté, source: pers. comm. by J. Madrid.

¹³ Lake Petén Itzá, source: pers. comm by J. Madrid, pers. obs.

¹⁴ Yaxhá-Nakum-Naranjo, source: Seavy *et al.* (1995), Eisermann & Avendaño (2004), pers. comm by J. Madrid, pers. obs.

¹⁵ Mirador-Río Azul, source: pers. comm. by R. Balas McNab, J. M. Castillo Rivera, E. González Ordoñez, T. Dubon Ortiz, G. Gámez Díaz, V. E. Cuj.

¹⁶ Laguna del Tigre, source: Pérez & Castillo (2000), Castillo (2001); pers. comm. by R. Balas McNab, J. M. Castillo Rivera, E. González Ordoñez, T. Dubon Ortiz, G. Gámez Díaz, V. E. Cuj.

Appendix V. Derivation of population estimates*

Species	Atlantic slope				E SUM	F km coa. Atl.	G km ² wetl. Atl.	H Mean n/km ² Atl.	I M-H	Pacific slope				M Sum	N km coa. Pac.	O km ² wetl. Pac.	P Mean n/km ² Pac.	Highlands		S SUM	T km ² wetl. Highl.	U Mean n/km ² Highl.	Total area of wetlands in Guatemala					Z km coast Pac.	Number of individuals per region					f Total
	A Man	B PNLT	C Yax	D BdP						J Güija	K SN	L MG	Q Ama					R Attit	V km ² Atl.				W km ² Pac.	X km ² wetl. Highl.	Y km coast Atl.	a coast	b coast		c slope	d slope	e Highlands			
<i>Dendrocygna autumnalis</i>	150	300	6	300	756	3537	0.21	100	2000	100	100	2300	253	9,090	1	1	142.2	0.00703236	1	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	1744	6083	2	7828			
<i>Dendrocygna bicolor</i>	0	0	0	0	0	3537	0.00	0	0	0	10	5130	253	20,357	3	3	142.2	0.02109705	3	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	13620	5	13625				
<i>Cairina moschata</i>	75	750		100	925	3537	0.26	0	0	0	100	100	253	0,39526	2	2	142.2	0.0140647	2	142.2	669.1	216.8	8157.2	669.1	216.8	2133	264	3	2401					
<i>Anas americana</i>	0	0	0	0	0	3537	0.00	0	0	0	15	15	253	0,05929	11	11	142.2	0.07735584	11	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	40	17	56				
<i>Anas platyrhynchos</i>	0	0	0	0	0	3538	0.00	0	0	0	0	0	253	0	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	0	0	0				
<i>Anas discors</i>	15	300		100	415	3537	0.12	500	10000	200	500	11200	253	44,2688	43	43	142.2	0.302391	43	142.2	669.1	216.8	8157.2	669.1	216.8	957	29620	66	30643					
<i>Anas cyanoptera</i>	0	0	0	0	0	3537	0.00	0	0	0	1	1	253	0,00395	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	3	0	3				
<i>Anas clypeata</i>	0	0	0	0	0	3537	0.00	0	0	0	1200	1200	253	4,74308	22	22	142.2	0.15471167	22	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	3174	34	3207				
<i>Anas acuta</i>	0	0	0	0	0	3537	0.00	10	15	10	35	253	0,13834	100	100	142.2	0.70323488	100	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	93	152	245					
<i>Anas crecca</i>	0	0	0	0	0	3537	0.00	0	0	0	0	0	253	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	0	0	0	0				
<i>Aythya valisineria</i>	0	0	0	0	0	3537	0.00	0	0	0	0	0	253	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	0	0	0	0				
<i>Aythya americana</i>	0	0	0	0	0	3537	0.00	0	0	0	0	0	253	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	0	0	0	0	0			
<i>Aythya collaris</i>	0	0	0	0	0	3537	0.00	0	0	0	0	0	253	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	0	0	0	0	0			
<i>Aythya affinis</i>	0	0	0	10	10	3537	0.00	3500	3500	3500	3500	253	13,834	18	2	20	144.2	0.13869626	20	144.2	669.1	216.8	8157.2	669.1	216.8	23	9256	30	9309					
<i>Nomonyx dominicus</i>	0	0	0	0	0	3537	0.00	0	5	5	5	253	0,01976	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	13	0	13					
<i>Oxyura jamaicensis</i>	0	0	0	0	0	3537	0.00	10	75	10	95	253	0,37549	5	10	15	152.2	0.09855453	15	152.2	669.1	216.8	8157.2	669.1	216.8	0	0	251	21	273				
<i>Tachybaptus dominicus</i>	10	220		30	260	3537	0.07	50	9	20	50	129	253	0,50988	16	2	18	144.2	0.12482663	18	144.2	669.1	216.8	8157.2	669.1	216.8	600	341	27	968				
<i>Podilymbus podiceps</i>	10	75	2	50	137	3537	0.04	50	6	20	50	126	253	0,49802	7	20	27	162.2	0.16646116	27	162.2	669.1	216.8	8157.2	669.1	216.8	316	333	36	685				
<i>Podilymbus gigas</i>	0	0	0	0	0	3537	0.00	0	0	0	0	0	253	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	0	0	0	0				
<i>Podiceps nigricollis</i>	0	0	0	0	0	3537	0.00	2	2	2	2	253	0,00791	5	5	5	142.2	0.03516174	5	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	5	8	13				
<i>Procellaria parkinsoni</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Puffinus creatopus</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Puffinus pacificus</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Puffinus griseus</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Puffinus nativitatis</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Puffinus lilherminieri</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Oceanites oceanicus</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Oceanodroma leucorhoa</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Oceanodroma tethys</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Oceanodroma melania</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Oceanodroma microsoma</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Phaethon lepturus</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Phaethon aethurus</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Sula dactylatra</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Sula granti</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Sula leucogaster</i>	10	0	0	0	10	60	0.17	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	25	0	0	25				
<i>Sula sula</i>	10	0	0	0	10	60	0.17	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	25	0	0	25				
<i>Pelecanus erythrorhynchos</i>	0	25	8	0	33	3537	0.01	1000	30	300	2000	3330	253	13,1621	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	76	8807	0	8883			
<i>Pelecanus occidentalis</i>	150	10	2	1	163	3537	0.05	200	1	100	500	801	253	3,16601	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	376	2118	0	2494			
<i>Phalacrocorax brasilianus</i>	300	1000	70	100	1470	3537	0.42	100	320	200	3000	3620	253	14,3083	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	0	0	3390	9574	0	12964			
<i>Phalacrocorax auritus</i>	0	0	0	0	0	60	0.00	0	0	0	0	0	65	0	0	142.2	0	0	142.2	669.1	216.8	8157.2	669.1	216.8	150	250	0	0	0	0				
<i>Anhinga anhinga</i>	35	100	3																															

Species	Atlantic slope				E SUM	F km coa. Atl.	G km ² wetl. Atl.	H Mean n/km ² or n/km Atl.	Pacific slope				M Sum	N km coa. Pac.	O km ² wetl. Pac.	P Mean n/km ² or n/km Pac.	Highlands		S SUM	T km ² Mean n/km ² Highl.	U or n/km Highl.	Total area of wetlands in Guatemala				a Number of Att. coast	b Individuals Pac. coast	c Att. slope	d Per region Pac. slope	e Highlands	f Total				
	Man	PNLT	Yax	BdP					I M-H	J Güija	K SN	L MG					Q Ama	R Atit				V Total area Att.	W km ² Pac.	X km ² wetl.	Y km coast Atl.							Z km coast Pac.			
<i>Rallus limicola</i>					0		3537	0.00				0		253					0	142.2		0	8157.2	669.1	216.8				0	0		0	nd		
<i>Aramides axillaris</i>	10				10	60		0.17				5	65	0.07692				0	142.2		0	8157.2	669.1	216.8		150	250				0	44			
<i>Aramides cajanea</i>	75	1000		30	1105		3537	0.31	100			100		253	0.79051			0	142.2		0	8157.2	669.1	216.8				25	19	2548	529	3077			
<i>Amaurolimnas concolor</i>	10				10		3537	0.00						0	253	0			0	142.2		0	8157.2	669.1	216.8				23	0		0	23		
<i>Porzana carolina</i>					0		3537	0.00						0	253	0			0	142.2		0	8157.2	669.1	216.8				0	0		0	nd		
<i>Porzana flaviventer</i>	10				10		3537	0.00						0	253	0			0	142.2		0	8157.2	669.1	216.8				23	0		0	23		
<i>Pardirallus maculatus</i>					0		3537	0.00					1	0	253	0.00395			0	142.2		0	8157.2	669.1	216.8				0	3		0	3		
<i>Porphyrio martinica</i>	35	100			50	185		3537	0.05	10	75		50	135	253	0.5339		1	142.2		1	0.00703235	8157.2	669.1	216.8				427	357		2	785		
<i>Gallinula chloropus</i>		100			50	150		3537	0.04	20	97		20	137	253	0.5415		6	2	8	144.2	0.0554785	8157.2	669.1	216.8				346	362		12	720		
<i>Fulica americana</i>					100	100		3537	0.03	100	11150		200	11450	253	45.2569		1445	500	1945	642.2	3.02865151	8157.2	669.1	216.8				231	30281	657		31169		
<i>Helimnis fulica</i>	35	100			30	165		3537	0.05	30			50	80	253	0.31621				0	142.2		0	8157.2	669.1	216.8				381	212		0	592	
<i>Eurypyga helias</i>					0		3537	0.00						0	253	0			0	142.2		0	8157.2	669.1	216.8				0	0		0	nd		
<i>Aramus guaranauna</i>	75	300		30	405		3537	0.11	10	53	5	30	98	253	0.38735				0	142.2		0	8157.2	669.1	216.8				934	259		0	1193		
<i>Burhinus bistriatus</i>					0		3537	0.00						0	253	0			0	142.2		0	8157.2	669.1	216.8				0	0		0	nd		
<i>Pluvialis squatarola</i>	75				75		3537	0.02		4	10			14	253	0.05534				0	142.2		0	8157.2	669.1	216.8				173	37		0	210	
<i>Pluvialis dominica</i>																																			150000
<i>Charadrius collaris</i>	75				75		3537	0.02		2			2	253	0.00791			0	142.2		0	8157.2	669.1	216.8				173	5		0	178			
<i>Charadrius alexandricus</i>					0		3537	0.00			10		10	253	0.03953			0	142.2		0	8157.2	669.1	216.8				0	26		0	26			
<i>Charadrius wilsonia</i>	10				10		3537	0.00					0	253	0		3	3	142.2	0.02109705		8157.2	669.1	216.8				23	0		5	28			
<i>Charadrius semipalmatus</i>	75		10		85		3537	0.02			10		10	253	0.03953		4	4	142.2	0.0281294		8157.2	669.1	216.8				196	26		6	229			
<i>Charadrius vociferus</i>		300	19	10	329		3537	0.09		14			14	253	0.05534			0	142.2		0	8157.2	669.1	216.8				759	37		0	796			
<i>Haematopus palliatus</i>	10				10		3537	0.00					0	253	0			0	142.2		0	8157.2	669.1	216.8				23	0		0	23			
<i>Himantopus mexicanus</i>	75	100	12	5	192		3537	0.05	20	90	10		120	253	0.47431			0	142.2		0	8157.2	669.1	216.8				443	317		0	760			
<i>Recurvirostra americana</i>					0		3537	0.00					0	253	0			0	142.2		0	8157.2	669.1	216.8				0	0		0	nd			
<i>Jacana spinosa</i>	500	1000	15	100	1615		3537	0.46	200	80	50	200	530	253	2.09486		4	4	142.2	0.0281294		8157.2	669.1	216.8				3725	1402		6	5132			
<i>Tringa melanoleuca</i>	10	10	1		21		3537	0.01	10	22			32	253	0.12648			0	142.2		0	8157.2	669.1	216.8				48	85		0	133			
<i>Tringa flaviceps</i>	10	10		10	30		3537	0.01			10		10	253	0.03953			0	142.2		0	8157.2	669.1	216.8				69	26		0	96			
<i>Tringa solitaria</i>	10	10	1		21		3537	0.01		1			1	253	0.00395			0	142.2		0	8157.2	669.1	216.8				48	3		0	51			
<i>Catoptrophorus semipalmatus</i>	10				10		3537	0.00	5		5		10	253	0.03953			0	142.2		0	8157.2	669.1	216.8				23	26		0	50			
<i>Heteroscelus incanus</i>					0		3537	0.00					0	253	0			0	142.2		0	8157.2	669.1	216.8				0	0		0	nd			
<i>Actitis macularia</i>	500	500	4	10	1014		3537	0.29	100	20	50		170	253	0.67194		20	20	162.2	0.12330456		8157.2	669.1	216.8				2339	450		27	2815			
<i>Bartramia longicauda</i>					0		3537	0.00					0	253	0			0	142.2		0	8157.2	669.1	216.8				0	0		0	350000			
<i>Numerius borealis</i>					50		3537	0.01			10		10	253	0.03953			0	142.2		0	8157.2	669.1	216.8				115	26		0	142			
<i>Numerius phaeopus</i>					0		3537	0.00					0	253	0			0	142.2		0	8157.2	669.1	216.8				0	0		0	nd			
<i>Numerius americanus</i>					0		3537	0.00						0	253	0			0	142.2		0	8157.2	669.1	216.8				0	0		0	50000		
<i>Limosa haemastica</i>					0		3537	0.00	10				10	253	0.03953			0	142.2		0	8157.2	669.1	216.8				0	26		0	26			
<i>Limosa fedoa</i>					20		3537	0.01		4			4	253	0.01581			0	142.2		0	8157.2	669.1	216.8				46	11		0	57			
<i>Arenaria interpres</i>					0		3537	0.00					0	253	0			0	142.2		0	8157.2	669.1	216.8				0	0		0	nd			
<i>Aphriza virgata</i>	10				10		3537	0.00					0	253	0			0	142.2		0	8157.2	669.1	216.8				23	0		0	23			
<i>Calidris canutus</i>	100				100		3537	0.03		20			20	253	0.07905			0	142.2		0	8157.2	669.1	216.8				231	53		0	284			
<i>Calidris alba</i>	20				20		3537	0.01					0	253	0			0	142.2		0	8157.2	669.1	216.8				46	0		0	46			
<i>Calidris pusilla</i>	20				20		3537	0.01					20	253	0.07905			0	142.2		0	8157.2	669.1	216.8				69	53		0	122			
<i>Calidris mauri</i>	200		8	10	218		3537	0.06	50				50	253	0.19763			0	142.2		0	8157.2	669.1	216.8				503	132		0	635			
<i>Calidris minutilla</i>	50				50		3537	0.01					0	253	0			0	142.2		0	8157.2	669.1	216.8				115	0		0	115			
<i>Calidris fuscicollis</i>	10				10		3537	0.00					0	253	0			0	142.2		0	8157.2	669.1	216.8				23	0		0	23			
<i>Calidris bairdii</i>	10	10		2	22		3537	0.01		6			6	253	0.02372			0	142.2		0	8157.2	669.1	216.8				51	16		0	67			
<i>Calidris melanotos</i>					0		3537	0.00					0	253	0			0	142.2		0	8157.2	669.1	216.8				0	0		0	0			
<i>Calidris alpina</i>	10				10		3537	0.00					0	253	0			0	142.2		0	8157.2	669.1	216.8				23	0		0	23			
<i>Calidris himantopus</i>					0		3537	0.00					0	253	0			0	142.2		0	8157.2	669.1	216.8				23	0		0	nd			
<i>Tryngites subruficollis</i>					0		3537	0.00					0	253	0			0	142.2		0	8157.2	669.1	216.8				0	0		0	15000			
<i>Philonachus pugnax</i>					0		3537	0.00					0	253	0.47431			0	142.2		0	8157.2	669.1	216.8				23	317		0	340			
<i>Limnodromus griseus</i>	10				10		3537	0.00		120			120	253	0.47431			0	142.2		0	8157.2	669.1	216.8				0	0		0	0			
<i>Limnodromus scolopaceus</i>					0		3537	0.00					0	253	0	</																			

Species	Atlantic slope				E	F	G	H	Pacific slope				M	N	O	P	Highlands		S	T	U	Total area of wetlands in Guatemala					Number of individuals per region					f		
	A	B	C	D					J	K	L	M-H					Q	R				V	W	X	Y	Z	a	b	c	d	e			
	Man	PNLT	Yax	BdP	Sum	km	km ²	Mean	Güija	SN	MG	Sum	km	km ²	Mean	n/km ²	Ama	Atit	Sum	km ²	Mean	n/km ²	km ²	km ²	km ²	km	km	Atl. coast	Pac. coast	Atl. slope	Pac. slope	Highlands	Total	
<i>Sterna fuscata</i>					0	60	0.00					0	65		0				0	142.2		0	8157.2	669.1	216.8	150	250	0	0					nd
<i>Chlidonias niger</i>				30	30		3537	0.01				0			253				0	142.2		0	8157.2	669.1	216.8					69	0			69
<i>Rynchops niger</i>				5	5		3537	0.00	100	200	50	100	450		253	1.77866			0	142.2		0	8157.2	669.1	216.8					12	1190			1202

*Species with only a number indicated in "Total" are species which breed entirely in North America and winter entirely in South America. It is assumed that all individuals (populations size given in Delany & Scott 2002) pass through Guatemala.

Column A-D: Abundance in A-Punta de Manabique; B-Laguna del Tigre National Park; C-Yaxhá; D-Bocas del Polochic.

Column E: E=A+B+C+D

Column F: Total of sampled Atlantic coastline in km.

Column G: Total of sampled Atlantic slope wetlands in km².

Column H: Mean number of individuals per km² on the Atlantic slope or indiv. per km coastline, H=E/G or H=E/G.

Column I-L: Abundance in I-Monterrico/Hawaii; J-Lake Güija; K-Sipacate-Naranjo; L-Manchón-Guamuchal.

Column M: M=I+J+K+L

Column N: Total of sampled Pacific coastline in km.

Column O: Total of sampled Pacific slope wetlands in km².

Column P: Mean number of individuals per km² on the Pacific slope or indiv. per km coastline, P=M/O or P=M/N.

Column Q-R: Abundance in Q-Lake Amatitlán; R-Lake Atitlán.

Column S: S=Q+R

Column T: Total of sampled Highland wetlands in km².

Column U: Mean number of individuals per km² in the Highlands, U=S/T.

Column V: Total area of wetlands on the Atlantic slope (according to MAGA 2002).

Column W: Total area of wetlands on the Pacific slope (according to MAGA 2002).

Column X: Total area of wetlands in the Highlands (according to MAGA 2002).

Column Y: Total length of Atlantic coastline (according to MAGA 2002).

Column Z: Total length of Pacific coastline (according to MAGA 2002).

Column a. Estimated abundance on the Atlantic coast: a=Y*H.

Column b. Estimated abundance on the Pacific coast: b=Z*P.

Column c. Estimated abundance on the Atlantic slope: c=V*H.

Column d. Estimated abundance on the Pacific slope: d=W*P

Column e. Estimated abundance in Highlands: e=X*U

Column f. Estimated abundance in Guatemala: f=a+b+c+d+e; nd-no data

Appendix VI. Photographs



Photo 1: Wetland habitat in the Laguna del Tigre National Park.



Photo 2: Wetland habitat in the Laguna del Tigre National Park.



Photo 3: Wetland habitat in the Laguna del Tigre National Park.



Photo 4: Coastal lagoon in the Punta de Manabique Wildlife Refuge.



Photo 5: Old river bed of the Motagua river in the Punta de Manabique Wildlife Refuge, on the border of Honduras.



Photo 6: Mangrove in the Monterrico-Hawaii Area of Multiple Use.



Photo 7: American White Pelican (*Pelecanus erythrorhynchos*) in a shallow lagoon in reed swamp in Monterrico.



Photo 8: Great Egrets (*Ardea alba*) in reed swamp in Monterrico.



Photo 9: White Ibis (*Eudocimus albus*) in Monterrico.



Photo 10: Little Blue Heron (*Egretta caerulea*) on a mangrove tree in Punta de Manabique.



Photo 11: Green Heron (*Butorides virescens*) in reed swamp in Monterrico.



Photo 12: Wood Storks (*Mycteria americana*), Great Egrets (*Ardea alba*), and Snowy Egret (*Egretta thula*) in reed swamp in Monterrico.



Photo 13: Royal Tern (*Sterna maxima*) in Punta de Manabique.



Photo 14: Black-necked Stilt (*Himantopus mexicanus*) in Punta de Manabique.



Photo 15: Jabiru (*Jabiru mycteria*), one adult and an immature, and Neotropic Cormorant (*Phalacrocorax brasilianus*) in Yaxhá.



Photo 16: Wood Stork (*Mycteria americana*) and Roseate Spoonbill (*Platalea ajaja*) in Punta de Manabique.



Photo 17: Black-crowned Night-Heron (*Nycticorax nycticorax*) in Monterrico.



Photo 18: Buff-breasted Sandpiper (*Tryngites subruficollis*) in Punta de Manabique.



Photo 19: Stilt Sandpiper (*Calidris himantopus*) and Pectoral Sandpiper (*Calidris melanotos*) in Punta de Manabique.



Photo 20: Wilson's Plover (*Charadrius wilsonia*) in Punta de Manabique.



Photo 21: Gray-necked Wood-Rail (*Aramides cajanea*), on a pond in Tikal.

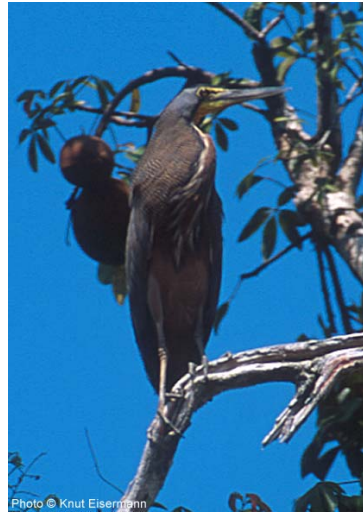


Photo 22: Bare-throated Tiger-Heron (*Tigrisoma mexicanum*) in Punta de Manabique.



Photo 23: Short-billed Dowitcher (*Limnodromus griseus*) in Punta de Manabique.



Photo 24: Black Skimmers (*Rynchops niger*) and Black-necked Stilts (*Himantopus mexicanus*) in Monterrico-Hawaii.