

OCCURRENCE, ABUNDANCE AND NOTES ON SOME THREATENED ECUADORIAN BIRDS IN THE EL CANCLÓN LAGOON, MANGLARES CHURUTE ECOLOGICAL RESERVE

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Resumen. – Ocurrencia, abundancia y notas sobre algunas aves amenazadas ecuatorianas en la Laguna El Canclón, Reserva Ecológica Manglares Churute. – Se presentan observaciones recientes sobre los avistamientos de aves amenazadas en la Laguna del Canclón y sus alrededores en la Reserva Ecológica Nacional Manglares Churute, Ecuador. Nueve especies amenazadas de acuerdo a las categorías de la IUCN en el ámbito nacional fueron registradas: Gritador Unicornio (*Anhima cornuta*), Pato Real (*Cairina moschata*), Pato Crestado (*Sakidiornis melanotos*), Gavilán Caracolero (*Rostbramus sociabilis*), Gavilán Dorsigris (*Leucopternis occidentalis*), Chachalaca Cabecirufa (*Ortalis erythroptera*), Perico Caretirrojo (*Aratinga erythrogaena*), y Perico Cachetigris (*Brotogeris pyrrhopterus*). De las especies observadas, tres aves se encuentran en la categoría en peligro (EN), mientras que cinco se encuentran en estado vulnerable. Las especies más frecuentemente observadas fueron el Gritador Unicornio y el Gavilán Caracolero. Dos especies corresponden a la categoría en peligro a nivel global (Gavilán Dorsigris y Perico Cachetigris). La abundancia relativa de estas aves tuvo un rango entre 1 y < 50 individuos durante todo el periodo de estudio (Febrero de 2001–Enero de 2002). El 50% de las especies amenazadas registradas en el campo fueron endémicas para Ecuador. El pastoreo y el pisoteo excesivo por el ganado y la expansión de la frontera agrícola son las principales amenazas que enfrentan las aves de este humedal Ramsar, localizado en la Región Tumbesina. Estrategias de manejo ambiental son urgentemente requeridas para mitigar las actividades antropogénicas y proteger el humedal y la biodiversidad local.

Abstract. – We present field observations on eight threatened birds occurring in the El Canclón Lagoon, Manglares Churute Ecologic Reserve, Ecuador. Nine IUCN–threatened species at the National level were sighted: Horned Screamer (*Anhima cornuta*), Muscovy Duck (*Cairina moschata*), Comb Duck (*Sakidiornis melanotos*), Snail Kite (*Rostbramus sociabilis*), Grey-backed Hawk (*Leucopternis occidentalis*), Rufous-headed Chachalaca (*Ortalis erythroptera*), Red-masked Parakeet (*Aratinga erythrogaena*), and Grey-cheeked Parakeet

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(*Brotogeris pyrrhopterus*). Three of these species are endangered (EN), while five have vulnerable status (VU). The most frequent observed birds were the Horned Screamer and the Snail Kite. Two species had endangered categories at the global level (Grey-backed Hawk and Grey-cheeked Parakeet). The relative abundances for these birds ranged from 1 to < 50 birds during the entire study period (February 2001–January 2002). Half (4/8) of the threatened species recorded were endemic to Ecuador. Cattle ranching of the native vegetation (browsing and trampling), deforestation, and agriculture development are the major causes of perturbation in this Ramsar wetland, located in the Tumbesian region. Environmental management strategies are strongly required to mitigate these human activities and protect the El Canclón Lagoon and the local biodiversity. *Accepted 8 January 2007.*

Key words: Threatened birds, abundance, wetland, forests, El Canclón Lagoon, Ecuador, habitat conservation.

INTRODUCCION

In Ecuador, El Canclón Lagoon is one of the 32 wetlands identified in the Ecuadorian coastal region and was declared as a Ramsar site in 1996. The surrounding floodplain has an area of 800 ha, and is located in the northern part of the Manglares Churute Ecological Reserve (MCER) (02°30'S, 79°42'W; Fig. 1) in the Guayaquil Gulf Estuary Basin (INEFAN & Fundación Natura 1997, Briones *et al.* 2001) of the Guayas province. Moreover, the El Canclón Lagoon is situated in one of the most important endemic bird areas (EBA) in the Neotropics for biodiversity conservation, the Tumbesian region, which extends from southwest Ecuador to northwest Peru (Best *et al.* 1995, Stattersfield *et al.* 1998). Its lentic bodies of water and surrounding wetland ecosystem constitute unique riparian habitats and refuges for Neotropical migrants as well as resident breeding birds.

Among the tropical plant species representatives of the area are floating and emergent water plants such as duckweed (*Lemna minima*), water hyacinth (*Eichornia crassipes*), sleeping-beauty waterlily (*Nymphaea blanda*), water lettuce (*Pistia stratiotes*), flat sedge (*Cyperus odoratus*) and cattails (*Thypha latifolia* and *T. domingensis*) (Sierra *et al.* 1999). In addition, riparian vegetation, lowland bushes, and tropical dry and humid forest remnants border the southeast, east and northeast edges of the

lagoon, which lies adjacent to the mountainous watershed of the El Mate, Perequete Chico, Perequete Grande, Cimalon, Pancho Diablo and Masvale hills. The area's unique habitat types, as well as its high level of bird endemism (~ 40%) (Alava *et al.* 2002), warrant the publication of all ornithological observations of the area, which may prove useful to future conservation efforts.

The aquatic bird species recorded in and around El Canclón Lagoon include mainly waterfowl such as Fulvous Whistling (*Dendrocygna bicolor*) and Black-bellied Whistling (*D. autumnalis*) ducks, Neotropical Cormorants (*Phalacrocorax brasilianus*), Purple Gallinules (*Porphyryula martinica*), Wattled Jacanas (*Jacana jacana*), and herons such as Great (*Ardea alba*) and Cattle (*Bubulcus ibis*) egrets (INEFAN & Fundación Natura 1997, Briones *et al.* 2001, Alava *et al.* 2002). A representative threatened species residing year-round in this wetland is the Horned Screamer (*Anhima cornuta*), a bird locally known "Canclón".

In March 2005, the Ecuadorian Ministry of the Environment declared El Canclón an Important Bird Area (IBA) for meeting three of the four BirdLife International–global criteria pointed out as follow: A1) Global threatened species (16 species); A2) Endemic species of the Tumbesian Region (28 species), and A3) Group of species restricted to a biome (26 species from the Equatorial Pacific Coast). Despite this, various anthropogenic

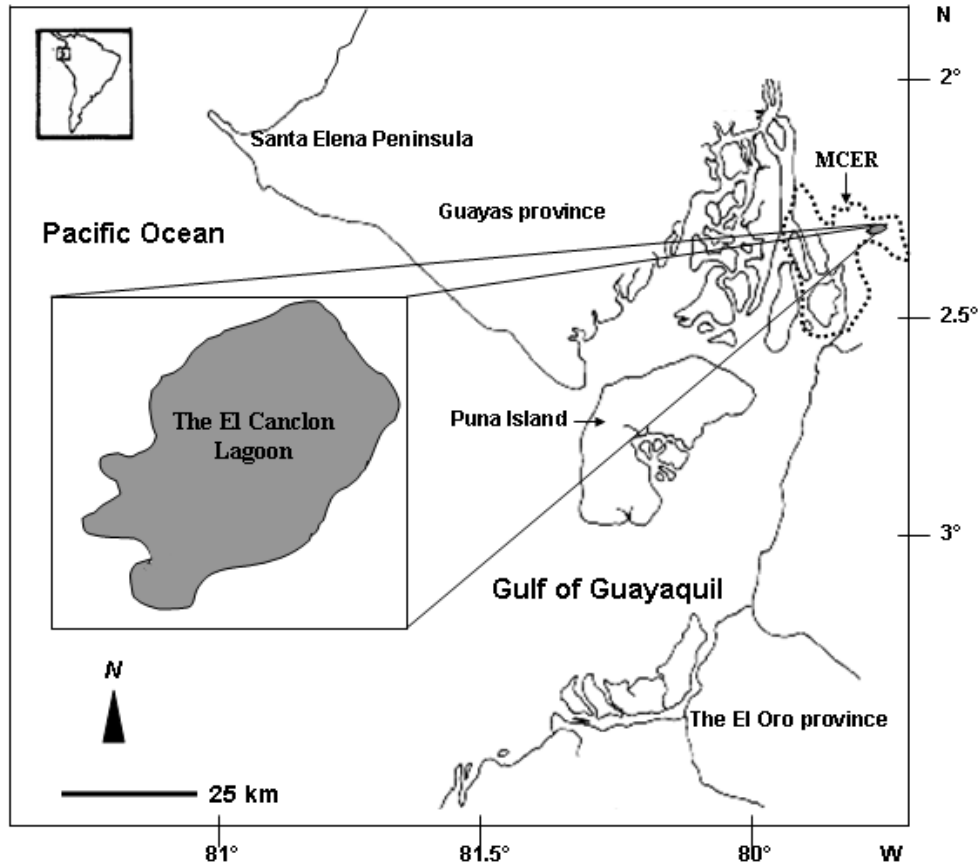


FIG. 1. Geographical location of the El Canclón Lagoon in the Manglares Churute National Ecological Reserve (MCER) in the Gulf of Guayaquil Estuary–Guayas River Basin, western Ecuador. Dash lines indicate the MCER boundaries.

activities such as uncontrolled cattle grazing of the native vegetation, deforestation, and agricultural sprawl (rice crops and farms) have negatively impacted this wetland, jeopardizing its conservation (Briones *et al.* 2001, Alava *et al.* 2002). Despite this level of disturbance, the El Canclón lagoon is still an important wetland area, giving refuge to large numbers of Black-bellied Whistling ducks and other waterbirds (e.g., Cattle Egret), as well as for rarely observed waterfowls (e.g., Fulvous Whistling Duck) and threatened species (Alava *et al.* 2002). In addition, this is the only

known breeding area for Horned Screamers in the coastal region of Ecuador, and one of the last wetlands hosting an important, but threatened, population of this species in western South America. Likewise, Tumbesian forests are being cleared by farming and ranching and highly threatened by browsing and trampling of domestic and invasive livestock (Dodson & Gentry 1991, Best & Kessler 1995). In western Ecuador, only about 4% of the original forest cover remained by 1998 (Dodson & Gentry 1991). Birds, as sensitive sentinels of environmental changes, can

TABLE 1. Inventory of threatened species in the El Canelón Lagoon and surrounding area (February 2001–January 2002).

Species	Status	Abundance*	National IUCN categories**	Global IUCN categories***
<i>Anhima cornuta</i>	Native	10–49	Endangered	Least concern
<i>Cairina moschata</i>	Native	1–9 (7)	Vulnerable	Least concern
<i>Sakidiornis melanotos</i>	Native	1–9 (3)	Endangered	Least concern
<i>Rostbrammis sociabilis</i>	Native	10–49	Vulnerable	Least concern
<i>Leucopternis occidentalis</i>	Endemic	1–9 (1)	Endangered	Endangered
<i>Ortalis erythroptera</i>	Endemic	1–9	Vulnerable	Vulnerable
<i>Aratinga erythrogenys</i>	Endemic	10–49	Vulnerable	Near threatened
<i>Protonotaria pyrrhopterus</i>	Endemic	1–9	Vulnerable	Endangered

*Abundance range (ind./day); the number between parenthesis indicates the actual or real number of individuals observed in the field.

**Ridgely & Greenfield (2001), Granizo *et al.* (2002).

***BirdLife International (2004).

reflect environmental quality and habitat requirements of forest ecosystems (Greenberg 1996). Thus, the continued monitoring of bird species in reserves and protected areas represents an opportunity to measure the health of such ecosystems and the effectiveness of conservation efforts.

No updated inventory of threatened species exists for this wetland, which has been traditionally under represented in Neotropical waterbird censuses carried out during the last decade (Granizo & Aldaz 2000, Santander & Muñoz 2004). Hence, this report presents new information gathered on occurrence, abundance, and historical distribution of eight species of threatened birds registered in and around the El Canelón Lagoon, southwest Ecuador, during a research and conservation project on population and habitat use of the Horned Screamer.

METHODS

Inventories were conducted along the perimeters of the El Canelón Lagoon at 4 m a.s.l. (Fig. 1) simultaneously during a study focus-

ing on a Horned Screamer population and habitat use assessment conducted from February 2001 to January 2002 (Alava *et al.* 2002). The field team consisted of four experienced birdwatchers, spending 3 days per week in the field, for a total census effort of 400 persons-h. Most observations were carried out in the mornings until noon (07:30–9:30 or 10:00–12:00 h), and during afternoon hours (15:00–17:00 h). Frequency and relative abundance (individuals/day) categories, based on ranges of numbers of individuals sighted for each species during the inventory period and used during the field work, were stated as follows: rare (1–9 ind./day), uncommon (10–49 ind./day), fairly common (50–99 ind./day), and common (>100 ind./day). Apart from water or wading birds, surveys also included other species associated or not with freshwater lakes. We follow Ridgely & Greenfield (2001) for taxonomy and species identification. For each threatened species identified in the present study, both the national (Ridgely & Greenfield 2001, Granizo *et al.* 2002) and global assigned categories (BirdLife International 2004) are noted.

RESULTS

Table 1 lists all bird species recorded, with respective relative abundances and threatened categories. Specific observations of red-listed species present at El Canclón Lagoon are described as follow.

Comb Duck (*Sakidiornis melanotos*). In December and January 2002, a total of three records of this species were made at the southeastern edge of the El Canclón Lagoon, where individuals were sighted on the water surface during normal flood conditions. The sightings of Comb Ducks in Ecuador's coastal regions have been sporadic and scattered, suggesting a marked rareness of this species in lowlands of southwest Ecuador. The first two specimens of this species were recorded on the slopes of the Cayambe Volcano in the Ecuadorian highlands during 1951–1952 (Norton *et al.* 1972). Additionally, flocks of about 15–25 individuals were observed in the early morning (06:30) along a mangrove channel of the MCER near the El Canclón Lagoon in November 1987 (Ortiz–Crespo 1988). At the extreme border of southern Loja and west Macara provinces, a few individuals, with a potential resident population, have been sighted along Rio Sabiango and Zapotillo area (Best *et al.* 1993, Ridgely & Greenfield 2001). Likewise, a total of 12 individuals were recently reported at the El Azúcar Dam, Santa Elena Peninsula (Guayas Province) in July 2004 during a Neotropical waterbird census (Santander & Muñoz 2004).

Muscovy Duck (*Cairina moschata*). The Muscovy Duck is currently rare and locally uncommon in lotic, lentic, and wetland (e.g., marshes) ecosystems in both east and southwest Ecuadorian lowlands, even though it was probably an abundant waterfowl in the past (Ridgely & Greenfield 2001). This species was seldom recorded, with 7 sightings at the

beginning of the rainy season from December 2001 to January 2002. All observed individuals showed the typical feather coloration of wild birds. These are the second most recent sightings of this species in the MCER after more than a decade since about 25 birds were recorded in MCER in March 1998 by J. C. Matheus (as cited by Ridgely & Greenfield 2001). This species has also been sighted in the Yaguachi marshes since 1980 (Ridgely & Greenfield 2001). Recently, one individual of this species was recorded at the Santay Island (a Ramsar wetland, located on the Guayas River, Guayaquil Gulf Estuary Basin) during the 2004–Neotropical waterbird census (Santander & Muñoz 2004). As with the Comb Duck, sightings of this species are extremely rare along the Ecuadorian coastal, and has been suggested that hunting pressure is the major cause of its population decline in recent years (Ridgely & Greenfield 2001).

Horned Screamer (*Anhima cornuta*). The Horned Screamer population on the Ecuadorian coast is generally restricted to the El Canclón Lagoon (Ridgely & Greenfield 2001, Granizo *et al.* 2002), and recent censuses reported an average of about 64 individuals (Alava *et al.* 2002). The species is also infrequently found in the Ecuadorian Amazon (Ortiz–Crespo 1988, Ridgely & Greenfield 2001). The species was officially confirmed for first time in the El Canclón Lagoon in the 80s by ornithologists (Roger Macias & Felix Man-Gin) from the University of Guayaquil (Ortiz–Crespo 1988, Ortiz–Crespo & Carrion 1991).

This bird was regularly observed around the perimeter and aquatic vegetation of the El Canclón wetland through the entire study period, with a relative abundance ranging from 1 to 26 ind./day. It was noted that this species was most abundant in areas showing less perturbation (west border), while it was less abundant in areas (east and south bor-

ders) with higher disturbance (cattle ranching, crops and farms; Alava *et al.* 2002). Several sporadic and isolated sightings of this species have been made by other wildlife biologists in other areas of the southwest Ecuadorian coast relatively close to the MCNER such as the Abras de Mantequilla, Ramsar site in Los Ríos Province (O. Quevedo pers. com.) and in neighboring locations e.g., Jambeli Foundation Wildlife Rescue Center, Balao, Guayas Province (J. Baquerizo pers. com., N. Hilgert pers. com.). Current sightings of this species and the existence of populations in the eastern Andean or Amazonian Ecuador are lacking. Recent reports are mainly from remote southeast, with fewer and isolated observations of individuals recorded in lotic (Pastaza, Aguarico and Lagartococha rivers) and lentic (ponds adjacent to Kapawi Private Ecologic Reserve) freshwater systems of Pastaza province (Ortiz-Crespo 1988, Ridgely *et al.* 1998, Ridgely & Greenfield 2001, Alava pers. observ.).

Snail Kite (*Rosthramus sociabilis*). This kite is a fairly common resident in freshwater marshes and adjacent roadside floodplains and rice crops along highways (sometimes perched on wood fences) in the lowlands of southwest Ecuador, from Manabí province to Los Ríos and east Guayas provinces (Ridgely & Greenfield 2001, Alava pers. observ.). From April 2001 to January 2002, several individuals were sighted, ranging from 10–< 50 ind./day, around the perimeter of the study area. Both immature and adults birds were observed. For instance, approximately 22 Snail Kites were observed perched in a tree at the western border of the El Canclón Lagoon on 21 February 2002. This wetland seems to represent a concentration site for this particular raptor associated with wet and flooded areas. For instance, approximately 30 individuals were counted, either alone or in pairs, along the Salitre highway, Guayas province on

1 October 2003.

At the beginning of 20th century, Chapman already reported Snail Kite sightings in the El Oro provinces (Santa Rosa). A substantial decline of the Snail Kite's population has taken place through most of its range since late 1970s when hundreds or thousands of birds were habitually seen in different areas (Chapman 1926, Ridgely & Greenfield 2001). Habitat loss and agricultural expansion (e.g., rice fields) have been suggested as the major causes of this decline. In addition to the previous overuse of currently banned organochlorine pesticides (e.g., DDT), use of organophosphate and carbamates compounds in short cycle crops (e.g., rice, tomato, alfalfa, and corn) and banana plantations to control pests might have potential toxic effects on this raptor in both the short (acute toxicity) and long term (chronic toxicity). This ecotoxicological issue needs to be investigated urgently since raptors are sensitive to the negative health impacts of pesticides.

Grey-backed Hawk (*Leucopternis occidentalis*). The species is an endemic raptor confined to western Ecuador in the provinces of Esmeraldas (southeast Muisne, Cerro Mutilus, Bilsa and southern Chontaduro), Manabí (mainly in the Machalilla National Park), Guayas (e.g., forest of the Chongon Colonche Mountains), Pichincha, Los Ríos, Azuay, El Oro and Loja (El Tundo Reserve), as well as adjacent north-west Peru (Ridgely & Greenfield 2001, BirdLife International 2006b). There, the Gray-backed Hawk has been described as inhabiting humid and montane wood-land, where it is uncommon.

On both 24 September 2001 and 9 January 2002, one individual was observed at the south part of the El Canclón Lagoon, soaring over a cattle ranch and remnants of tropical dry forest of the El Mate Hill. Pairs were seen daily in Loma Alta Ecological Reserve, Guayas Province, in the Colonche Mountains,

above 400 m, close to ravines and moist forest areas (Becker & Lopez-Lanus 1997). In 1999, nearby this reserve, this species was recorded in secondary forest and pasture-crop areas in villages around the Machalilla National Park (Puerto Cayo-Jipijapa road, Rio Ayampe and Rio Chico), Manabi Province (Freile *et al.* 2004). According to the 2004 diagnostic checklist of the birds of the Bosque Protector Cerro Blanco and the nearby vicinity (Guayas Province), this species is found along wet ravines of Cerro Blanco Protected Forest, where it is classified as uncommon (Sheets 2005, E. Horstman pers. com.). Both Cerro Blanco Forest and Machalilla National Park are two of the most important areas, still containing remnants of tropical forest, for conservation of this species of raptor (Ridgely & Greenfield 2001). Even though it seems to tolerate disturbed habitats at some degree (Best *et al.* 1993, Ridgely & Greenfield 2001), the continued fragmentation of western Ecuadorian forests jeopardizes the survival of this species in the long term.

Rufous-headed Chachalaca (*Ortalis erythroptera*). The Rufous-headed Chachalaca is an uncommon to locally fairly common species inhabiting semihumid and deciduous woodlands and margins of forest in the lowlands and foothills of the Tumbesian region of west Ecuador, including parts of Esmeraldas, Manabí, Guayas, Los Ríos, Chimborazo, Azuay, El Oro and Loja (Ridgely & Greenfield 2001, BirdLife International 2006a). Three records (<10 ind./day) were made on April 2001 around the lagoon, two of them recognized by calls of individuals along the edge of semidry forest remnants, and a direct sighting of at least three individuals running through perturbed patches of dry forest in the mountain foothills located at the northeast and southeast borders, respectively. All the sightings were made close to farms and cattle ranches located close to forest. Calls of this

species were frequently heard from transitional and garúa forest above 300 m in Loma Alta Ecological Refuge (Becker & Lopez-Lanus 1997). Previously, sightings have been recorded in Paraíso de Papagayos Ranch (secondary forest), Cantalapedra in Manabí Province (primary and secondary forests), and in two locations in the Loja Province: Achiotos (patches of highly disturbed forest) and Faique (continuous semi-deciduous forest) (Freile *et al.* 2004). In Cerro Blanco Protected Forest, it is recorded as fairly common (Sheets 2005). Forest fragmentation and habitat loss are the major causes the Rufous-headed Chachalaca's population decline (Ridgely & Greenfield 2001, BirdLife International 2006a).

Red-masked Parakeet (*Aratinga erythrogenys*). Ranging from rare to locally common, the Red-masked Parakeet is distributed along western Ecuador from west Esmeraldas (e.g., Muisne and Quinind), Pichincha, Manabí (e.g., Machalilla National Park), Los Ríos, and west Chimborazo to El Oro and Loja (Sozoranga area) provinces, inhabiting lowlands and subtropical zones encompassing deciduous and humid woodlands and forests (Ridgely & Greenfield 2001). This species is also found in northwest Perú (Best *et al.* 1993).

A few flocks of ten individuals were occasionally observed around the wetland (May 2001–January 2002). However, a flock of about 30–50 parakeets was heard and distantly observed flying toward the eastern part of the El Canclón Lagoon, where there are still semi-pristine remnants of Tumbesian-Region dry tropical Forest on the mountains bordering that side of the watershed (June 2001). This is probably among the largest groups of this species recorded in southwest Ecuadorian coast. In moist premontane or garúa forests (above 500 m) of Loma Alta Ecological Reserve, flocks of about 30 individuals were observed several times from December 1996

to January 1997 (Becker & Lopez-Lanus 1997). In Cerro Blanco Protected Forest, it is generally uncommon (Sheets 2004). Freile *et al.* (2004) reported numerous flocks, ranging from 5–80 individuals daily, in September 1999, at an Andean location (above 2000 m), Tiquibuzo (Bolivar Province), over isolated patches of secondary forest, and flocks of about 2–15 ind./day in locations of the Loja Province (Achiotes, Faique and around Mangarquillo and Canaveral villages) during April and May 2001. In addition, high numbers of this species have also been recorded at the Utuana (Loja Province) (Best *et al.* 1993). Since most of the records for Red-masked Parakeets were below 1300 m, the sightings above 2000 m may be occasional or seasonal (Ridgely & Greenfield 2001). This species has drastically declined and is subject to intense pressure from capture for the illegal pet trade throughout the Tumbesian region (local trade in Ecuador and Peru) to supply the demand from cities such as Guayaquil, Loja and Machala and Tumbes (northwest Peru) (Best *et al.* 1995, Ridgely & Greenfield 2001). For example, in the city of Guayaquil, individuals were even offered to the public in either popular market places or authorized mall pet stores (Alava pers. observ.), a situation that now is prohibited and being controlled by the local government of Guayaquil City (R. Carvajal pers. com.). Even though this species is still frequently observed in some parts of Loja Province, its populations seem to have declined (Freile *et al.* 2004).

Grey-cheeked Parakeet (*Brotogeris pyrrhopterus*). Gray-cheeked Parakeets inhabit deciduous and semihumid forest as well as fragmented and urbanized areas in the lowlands of southwest Ecuador from Manabí, Guayas, and Los Ríos through El Oro and west Loja (Sozoranga area) (Ridgely & Greenfield 2001). As with the Red-masked Parakeet, this species is also found in northwestern Perú

(Best *et al.* 1993).

Flocks of this parrot were rarely observed (<10 ind./day) around the disturbed perimeter of the El Canclón Lagoon (June 2001–January 2002). Fewer flocks, ranging from 4–20 ind./day, were reported flying in semi-disturbed forests, crops and human settlements in Achiotes, El Faique and Mangarquillo village in April and May 2001 (Freile *et al.* 2004). In Loma Alta, a single flock of 10 individuals was reported flying over degraded pasture at 600 m close to the garua forest (Becker & Lopez-Lanus 1997). The species is abundant at the Cerro Blanco Protected Forest (Sheets 2005), with flocks of 10–20 birds seen daily around the visitor center (E. Horstman pers. com.). In the last decade, uncontrolled selling of this species as pets was common in markets and by street vendors in Guayaquil (Alava pers. observ.). At present, conservation efforts and control of the illegal pet trade by non-governmental organizations (e.g., Fundación Natura Capítulo Guayaquil), and local authorities (Municipality of Guayaquil) have controlled, to a certain degree, the traffic of parrot species. The Grey-Cheeked Parakeet is seriously threatened, with potential extinction, because of the illegal bird trade (e.g., trapping and cage), as well as the considerable degree of habitat lost and disturbance of the Tumbesian forests (Best *et al.* 1993, Best *et al.* 1995). Further monitoring and studies on population trends for the conservation of this species are required (Ridgely & Greenfield 2001).

CONSERVATION REMARKS

Wetlands embrace a diversity of habitats for plants and wildlife, and are especially critical for waterbird conservation; they are of additional ecological value as natural resources for local human communities (Davis 1994, Ramsar Convention Secretariat 2004). Our observations of threatened birds in the El Canclón

Lagoon and surrounding confer to this site an important priority for bird conservation. Despite the fact that this wetland is already within the boundaries of an ecological reserve (MCER), the Forestry and Wildlife Service Office of the Ecuadorian Ministry of Environment should emphasize the significance and preservation of this area in local land development plans, as well as by enforcing the current MCER–environmental management plan which is not fully applied. We suggest that, in addition to regulations, local incentives and environmental education programs are needed. Governmental environmental agencies should consider, in their decision making and planning processes, the current status and trends of wildlife indicators (e.g., birds).

The El Canclón Lagoon is an important site for evaluating management strategies concerned with community-based conservation (CBC) such as best management practices (BMP) to reduce cattle grazing and trampling, controlled and sound agricultural practices and alternative economic activities (e.g., training of local people as nature guides or field assistants). In the future, environmental monitoring and control of these sustainable activities should be based, to some degree, on the patterns of abundance and presence/absence of selected species (e.g., *A. cornuta* and *R. sociabilis*). In addition, land use buffer zones (e.g., 100 m) between actively farmed areas and this Ramsar wetland would help to ensure the protection of the local biodiversity.

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