

NEST POACHING IN THE VENEZUELAN INSULAR SUBSPECIES OF THE BROWN-THROATED PARAKEET (*ARATINGA PERTINAX*)

Irene Zager^{1,2}, Kathryn M. Rodríguez-Clark^{1*}, Jessica R. Eberhard³,
Jon Paul Rodríguez^{2,4}, & Pablo A. Millán²

¹Laboratorio de Ecología y Genética de Poblaciones, Centro de Ecología, Instituto Venezolano de Investigaciones Científicas (IVIC), Apartado 20632, Caracas 1020-A, Venezuela. *E-mail: kmrc@ivic.ve, kmrodriguezclark@gmail.com

²Provita, Apartado 47552, Caracas 1041-A, Venezuela.

³Department of Biological Sciences and Museum of Natural Science, Louisiana State University, Baton Rouge, Louisiana 70803, USA.

⁴Laboratorio de Biología de Organismos, Centro de Ecología, Instituto Venezolano de Investigaciones Científicas (IVIC), Apartado 20632, Caracas 1020-A, Venezuela.

Resumen. – Saqueo de nidos en las subespecies insulares venezolanas del Perico Cara Sucia (*Aratinga pertinax*). – Durante mucho tiempo se ha sospechado el declive del Perico Cara Sucia en las islas venezolanas de La Tortuga y Margarita, debido al saqueo de pichones para el tráfico ilegal de mascotas, y por la destrucción de sitios de anidación resultante. Por eso, evaluamos el estatus de las dos subespecies involucradas, *Aratinga pertinax margaritensis* y *A. p. tortuguensis*, y examinamos la amenaza que representa el saqueo de nidos. Durante trabajos de campo en 2004, caracterizamos los patrones de los dormideros y sitios de anidación en las dos islas, y estimamos el tamaño poblacional de *A. p. margaritensis*. En la Isla Margarita, encontramos una población considerable (de por lo menos 1984 individuos), pero los 25 nidos encontrados sufrieron una tasa alta de saqueo (64%) y de destrucción (32%). Dado que los únicos dos dormideros activos de esta subespecie se ubicaron cercanos a o dentro del Parque Nacional Laguna de La Restinga, que también sufre de presiones antrópicas, nuestros resultados sugieren que esta subespecie se clasifica en el presente como En Peligro (B1a&b[v]). En La Tortuga, encontramos un número insignificante de *A. p. tortuguensis* en el este de la isla. Además, cada uno de los seis nidos encontrados mostró evidencias de saqueo regular y repetido. Estos resultados apoyan la clasificación propuesta por otros autores de esta subespecie como En Peligro, aunque técnicamente queda en la categoría de Datos Insuficientes.

Abstract. – The Brown-throated Parakeet has been long suspected to be in decline on the Venezuelan islands of Margarita and La Tortuga, due to poaching of nestlings for the illegal pet trade, and to resulting nest destruction. Therefore, we assessed the status of the two subspecies involved, *Aratinga pertinax margaritensis* and *A. p. tortuguensis*, and examined the threat presented by nest poaching. During fieldwork in 2004, we characterized roosting and nesting patterns on both islands, and estimated the population size of *A. p. margaritensis*. On Margarita Island, we found a considerable population (at least 1984 individuals), but the 25 nests found were subject to very high rates of poaching (64%) and destruction (32%). Since the only two active roosts of this subspecies were close to or within Laguna de La Restinga National Park, which is also under anthropogenic pressure, our results suggest that this subspecies classifies presently as Endangered (B1a&b[v]). On La Tortuga Island, we found negligible numbers of *A. p. tortuguensis* on the eastern portion of the island. Moreover, all six nests found had signs of repeated, regular poaching. These results support other authors' proposed classification of this subspecies as Endangered, but technically still leave it in the category of Data Deficient. Accepted 6 December 2008.

Key words: *Aratinga pertinax*, Brown-throated Parakeet, La Tortuga Island, Margarita Island, nest poaching, nesting site.

INTRODUCTION

Psittacids are one of the most endangered groups of birds in the world, due to a variety of threats, including habitat loss and fragmentation, competition for resources with (and predation by) non-native species, hunting for feathers and food, and natural disasters (Collar & Juniper 1992, Christian *et al.* 1996, Bennett & Owens 1997, Snyder *et al.* 1999). Among the most important of these threats is the capture of wild nestlings and adults for the pet trade (Collar & Juniper 1992, Snyder *et al.* 1999, Wright *et al.* 2001). Such poaching appears to be driven by the attractiveness of these birds as pets, lax law enforcement, large profit margins, and rural poverty (Thomsen & Mulliken 1992, Snyder *et al.* 1999, Rodríguez 2000, Wright *et al.* 2001).

In Venezuela, one of the most widely poached psittacid species is the Brown-throated Parakeet (*Aratinga pertinax*; Duque *et al.* 2005). Populations of this species are broadly distributed across northern South America and several southern Caribbean islands, with 14 different subspecies currently recognized (Forshaw 1989, Juniper & Parr 1998). Seven of these subspecies are found in Venezuela, and two are insular endemics: *A. p. margaritensis* on Margarita Island, and *A. p. tortuguensis* on La Tortuga Island (Hilty 2003). On Margarita, *A. pertinax* is sympatric with two other native psittacids, the Blue-crowned Conure (*Aratinga acuticaudata neoxena*) and the Yellow-shouldered Parrot (*Amazona barbadensis*), both of which are threatened (Desenne & Strahl 1994, Rodríguez & Rojas-Suárez 1999). In contrast, *A. p. tortuguensis* is the only native psittacid on La Tortuga. Both islands are included within the Caribbean Colombia and Venezuela Endemic Bird Area, which has

been assigned an “urgent” priority (Stattersfield *et al.* 1998).

Brown-throated Parakeets are widespread and common throughout their range, usually below 1200 m a.s.l., in open wooded habitats, including savannas, gallery formations, mangroves, arid scrubs, dry forests, and ranchlands (Forshaw 1989, Juniper & Parr 1998, Hilty 2003). During the day, the parakeets travel in pairs or small groups, foraging for a wide variety of fruits, flowers, nuts, and seeds (Forshaw 1989, Silvius 1995). At sunset, non-incubating individuals move to communal roosts, where sleeping aggregations can reach dozens to hundreds of birds (Juniper & Parr 1998, Harms & Eberhard 2003). Roost locations are permanent for some psittacids (e. g., Wright 1996), while for others roost locations change frequently, and even daily (Bradbury 2003). *A. p. margaritensis* roost locations appear to be stable on the scale of at least weeks, and in some cases several years (Harms & Eberhard 2003; V. Sanz unpubl.). Stable nocturnal aggregations may reduce predation risks, allow social interaction and the exchange of information on foraging sites, and permit pair-bonding between potential reproductive partners (Harms & Eberhard 2003, Munshi-South & Wilkinson 2006).

During the breeding season, reproductive Brown-throated Parakeets lay four to seven eggs in holes, usually excavated in arboreal termite mounds in open areas. Less frequently, they may excavate nests in earthen banks or use preexisting holes in trees, mangroves, fallen palm trunks, or rock formations (Forshaw 1989, Albornoz & Fernández-Badillo 1994a, V. Sanz unpubl.). Preferred mounds contain an active termite colony and have an external diameter of at least 50 cm, in which parakeets build a c. 22-cm diameter

nesting cavity with a bottom-opening entrance tunnel (width c. 15 cm; Albornoz & Fernández-Badillo 1994a).

A. p. tortuguensis and *A. p. margaritensis* are of particular concern due to their limited distributions, and their decline has long been suspected for several reasons (Desenne & Strahl 1994). First, anecdotal evidence points to widespread capture of nestlings for the pet trade on both islands (J. M. Briceño-Linares, J. Salazar pers. com.). Furthermore, poaching is known to be the most important threat to the other psittacids on Margarita (Sanz & Rodríguez-Ferraro 2006). Finally, the poaching techniques used on Brown-throated Parakeet nestlings appear to destroy limited nesting sites, which would otherwise be reused (P. A. Millán pers. observ.). In addition to poaching, nest predation and habitat degradation by non-native species may affect the parakeet population on La Tortuga (Desenne & Strahl 1994), while habitat loss due to human development has the potential to restrict the availability of roost sites on Margarita (Harms & Eberhard 2003). At present, these subspecies lack specific national protection, although they are listed in Appendix II of CITES (CITES 2008).

It has been suggested that the Brown-throated Parakeet dominates the Venezuelan national trade in parrots simply because it is the most abundant and thus least expensive psittacid available (Albornoz & Fernández-Badillo 1994b, Duque *et al.* 2005). However, poaching and trade of this species have been little studied anywhere within Venezuela, much less on these two islands of particular concern. With this in mind, we hypothesized that the poaching threat to *A. p. margaritensis* and *A. p. tortuguensis* is currently underappreciated, although population sizes on both islands may be robust at the moment. Therefore, we conducted a preliminary assessment of the population status of the two Venezuelan insular subspecies of Brown-

throated Parakeets and the threat posed by nest poaching.

METHODS

Study sites. Margarita lies 38 km north of the Venezuelan mainland, across from the Península de Araya (Fig. 1A; Hoyos 1985). It is the largest of the country's islands (934 km²), and has at least seven threatened endemic birds and mammals (Rodríguez & Rojas-Suárez 1999). The island is shaped roughly like a dumbbell, with eastern and western sides connected by a narrow sand spit and an associated mangrove lagoon, which are largely contained within Laguna de La Restinga National Park.

In the past, the known distribution of *A. p. margaritensis* included both sides of Margarita, as well as the nearby small islands of Coche, Cubagua, and Los Frailes (Phelps 1945; Yépez-Tamayo 1963). However, based on observations made in 2001, Harms & Eberhard (2003) concluded that *A. p. margaritensis* occurs essentially only on the western side (known as the Macanao Peninsula), and in the mangroves of La Restinga, and is scarce or absent in the more urbanized east. This accords with others' observations: although in 1995 Brown-throated Parakeets were regularly seen in El Tirano (eastern side), they had disappeared from there by 2003 (M. Albornoz unpubl.). Individuals were also observed in November of 2003 in Lagunamar (eastern side; V. Sanz unpubl.). However, presently, on the eastern side, small concentrations are probably found only in the arid areas close to the connecting sand spit, including the vicinity of the Sector Orinoco and the Tetas de María Guevara Natural Monument (V. Sanz unpubl.). We therefore restricted our work to these areas and the Macanao Peninsula (approximately 315 km², Fig. 1A), which are covered mostly with cactus and thorn scrub (Hoyos 1985). Because this is a distinctive

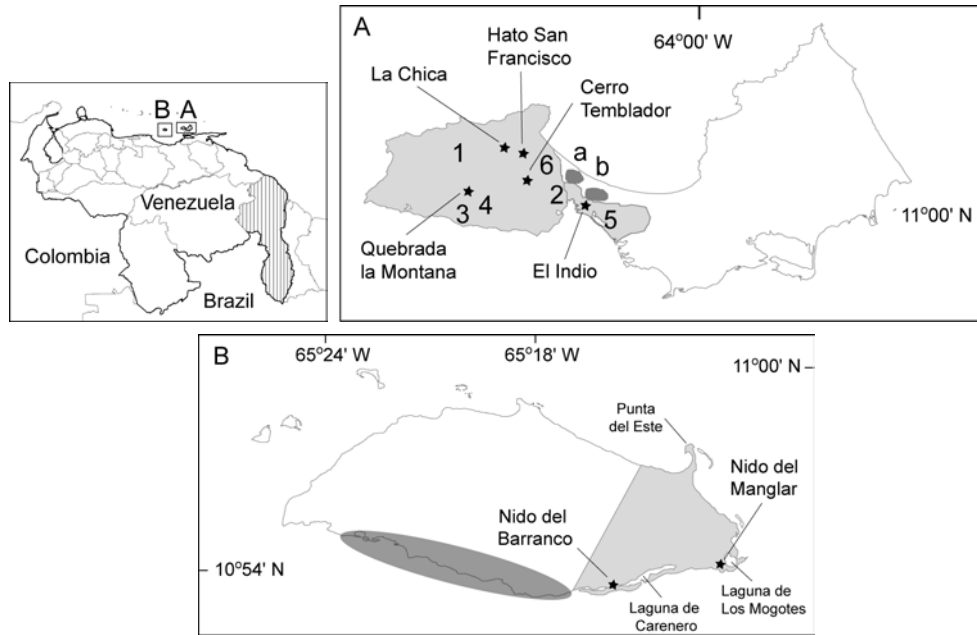


FIG. 1. Location of areas surveyed (light grey) and in which potential nests were found (stars) on: (A) Margarita Island, and (B) La Tortuga Island. Dark grey areas indicate where roosts were located (Margarita; a: Boca de Pasadero, b: Tetas de María Guevara) or where roosting and additional nesting sites may be located (La Tortuga). Numbers in (A) indicate census observation points: 1 - San Francisco; 2 - Manglar Este 1; 3 - Chacaracual 1; 4 - Chacaracual 2; 5 - Manglar Este 2; and 6 - Boca de Pasadero.

and well-known species, we augmented our own observations (below) with information from informal interviews with nine local residents.

La Tortuga is located 120 km west of Margarita, off the northern coast of Venezuela (Fig. 1B). At 156 km² it is the country's second largest island, and is flat and arid. A hiding place for pirates during the 17th century, today La Tortuga is uninhabited, but fishermen and tourism operators live there seasonally, and tourists visit occasionally (Fundación La Tortuga 2008). As on Margarita, we complemented our own observations (below) with informal interviews with two of these seasonal residents. To our knowledge, systematic field studies of *A. p. tortuguensis* have never been made. However, anecdotal

evidence suggests that parakeets may be more frequent in the western portion of the island, where vegetation is more abundant (Rodríguez & Rojas-Suárez 1999) and where limited historical data confirm their past presence (Phelps 1945). Due to logistical limitations, only the eastern portion of the island could be examined during the present study (approximately 35 km², Fig. 1B)

Study timing. We tried to conduct fieldwork close to but not in the midst of the breeding season. Nesting areas may be easier to locate in the breeding season, but population estimates based on roost site counts may be biased downward at this time, since incubating individuals and nestlings are excluded from counts (Casagrande & Beissinger 1997;

Cougill & Marsden 2004). The breeding season for *A. pertinax* on Caribbean islands appears to start after wet season rains, and lasts for several months between February and August (Harms & Eberhard 2003; V. Sanz unpubl.). We thus conducted fieldwork on Margarita from 21 June to 1 July 2004, which fell toward the end of the breeding season for that year (J. M. Briceño-Linares unpubl.). On La Tortuga, we worked from 5 to 10 March 2004, before the start of the rainy season and thus probably before the parakeets started nesting, since only inactive nests were found. Informal interviews with seasonal residents indicated moreover that on this island the reproductive season usually starts at the beginning of April, with peak activity between May and June.

Nests and poaching rates. We surveyed all Brown-throated Parakeet nests found in areas where we observed parakeets, where local residents indicated their presence, or where they were reported by previous studies, with the exception of the mangroves of La Restinga (Yépez-Tamayo 1963, Rojas-Suárez 1994b), which we could not survey for lack of a boat. On Margarita, this totaled five main locations (Fig. 1A), where we invested a total sampling effort of 72.5 person-hours walking approximately 16 km in nesting areas. On La Tortuga, we had no confirmed prior information concerning nesting sites, and so searched for a total of 84 person-hours, hiking approximately 120 km throughout the study area (Fig. 1B). More rapid hiking was possible on La Tortuga because of its flat terrain and lack of vegetation. During one of these hikes, a local seasonal resident showed us two nesting areas.

To determine poaching rates, we collected information about each potential nest we found, adapting methods developed for the Yellow-shouldered Parrot (*Amazona barbadensis*) nests on Margarita Island (Rodríguez-Ferraro & Sanz 1996; Table 1). On Margarita,

potential nests were defined as mounds with a diameter > 40 cm, at least 15 cm above the ground, and without any internal branches to prevent nest excavation. Since the Russet-throated Puffbird (*Hypnelus ruficollis*) also nests in arboreal termite mounds on Margarita, we recorded cavities as active or inactive parakeet nests only if they contained green feathers and had characteristic bottom-opening incubation chambers. On La Tortuga, nests were identified based on physical characteristics, interviews of seasonal residents, and the presence of eggshells and/or green feathers.

Roosts and population census. We used modifications of previously-established methods to locate roosts and estimate population size on Margarita (Albornoz *et al.* 1994; Harms & Eberhard 2003). First, we visited all places with reported roosts (except Quebrada la Vieja, where a roost was observed in 1994; V. Sanz unpubl.), as well as other places identified through interviews with nine local residents, in order to determine which were currently in use. However, the time available for searching was limited relative to the probable variability in roost use by this species (V. Sanz unpubl.), so small roosts may have been overlooked. We then chose six points near the roosts confirmed as active, and observed flying parakeets in the late afternoon and early evening (Fig. 1A). Three observers visited each point once for three hours. For each parakeet group observed, we recorded the number of individuals and the probable destination roost (based on flight direction and path).

To avoid double-counting, we then considered data only from observation points where destination roosts could be determined definitively. The three observation points included in the final population estimate ("Manglar Este 1", "Manglar Este 2" and "Boca del Pasadero") were all located along the edge of La Restinga's mangroves, closest

TABLE 1. Variables recorded for each potential *Aratinga pertinax* nest.

Variable	Description
Location	Geographic coordinates of the nest
Type of nest	Termite mound, tree hollow or cavity in an earth bank
Termite colony status	Either alive (with an active termite colony) or dead
Parakeet nest status	One of four categories of termite mound: (1) active nest: presence of hatchlings or eggs and green feathers, parakeets seen leaving the cavity, or fresh eggshells and green feathers; (2) inactive nest: presence of old eggshells and green feathers, excavation typical of the species (see text), and/or historical use known from interview data; (3) potential nest: without signs of parakeet reproductive activity, but with physical characteristics permitting future use; (4) non-nest: without physical characteristics permitting use as a parakeet nest
Physical damage	One of two categories of nest: (1) damaged: with anthropogenic or natural damage sufficient to prevent future use as a nest; (2) intact: without physical damage, or with insufficient to impede future use
Poaching/predation status	One of three categories of nest: (1) poached: Any evidence of human poaching, including footprints, bicycle tracks, presence of trash in the surroundings, characteristic holes in the termite mound, presence of a “stair branch” or other means of reaching the nest; (2) predated: presence of some sign of predation by animals, (3) not poached or predated

to the active roosts (Fig. 1A). We calculated the minimum population size as the sum of the total number of parakeets counted at these observation points.

On La Tortuga, since no *A. p. tortuguensis* roosts were found, a similar population census was impossible.

RESULTS

Aratinga pertinax margaritensis

Nests and poaching rates. All of the parakeets nests found on Margarita were in arboreal termite mounds. Of the 81 mounds found in the five nesting areas we located, 62 had physical characteristics permitting nest construction (Fig. 2). Of these, 14 had signs of Brown-

throated Parakeet reproductive activity in 2004. An additional 11 had evidence of parakeet reproduction in previous seasons, such that 40% of potential nesting mounds were used at some point by *A. pertinax*. However, 16 of these 25 past or present nests (64%) had some sign of poaching, as did seven of the 14 nests active in 2004. This implies a poaching rate of 50% during the reproductive season evaluated. Although we could not survey any nests that may exist in the mangroves of La Restinga, we expect any poaching that does occur there to be similar or even more severe to the five sites we surveyed, since fishermen poach essentially all nestlings of the other parakeet which breeds there, *A. acuticaudata neoxena* (J. M. Briceño-Linares unpubl.).

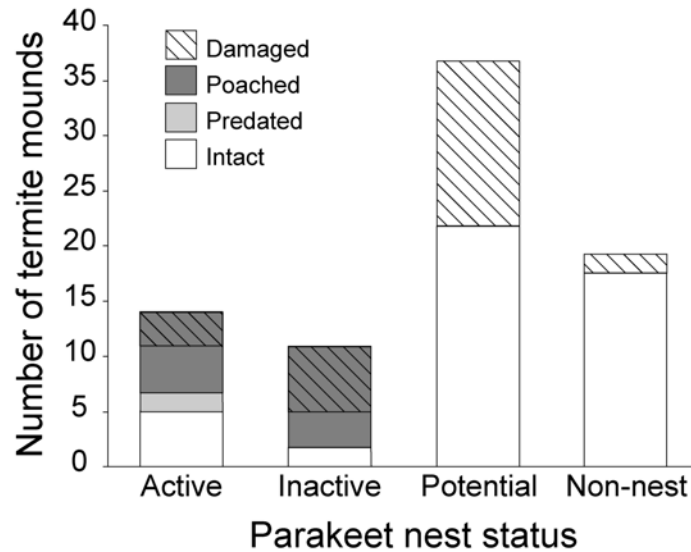


FIG. 2 Status of arboreal termite mounds found in June 2004 on the Macanao Peninsula, Margarita Island, with respect to Brown-throated Parakeet nests.

In addition to heavy poaching, we also encountered considerable damage to potential or present nests. Twenty-four of the 62 termite mounds with a nest or capable of containing one (39%) had severe damage from either natural or anthropogenic causes. Experienced poachers on Margarita typically only open a small hole in the mound, above the nest cavity, in order to check for eggs or nestlings (P. Millán pers. observ.). However, if the hole is too large and the mound has no active colony, it becomes unusable as a nest.

Informal interviews with local residents also indicated that poaching of *A. p. margaritensis* nests is common and increasingly destructive. Residents reported that poaching may be carried out by several members of a family, including the youngest, which has made nest destruction even more common. This coincides with other work indicating that the number of poachers in the island has grown while their average age has declined (Rodríguez *et al.* 2006). Interviews further-

more revealed that parakeet hatchlings were worth Bs. 15,000 each in 2004 (roughly US\$ 8 at that time, or the equivalent to one day's minimum wage), whereas healthy adults were worth more than twice that amount. Other psittacids in illegal circulation at the time were worth much more; interviews confirmed that this was because Brown-throated Parakeets are considered less attractive, and also because they are easier to find and extract, since nests are highly visible and accessible.

Roosts and population census. Of the four *A. p. margaritensis* roosts located in 2001 on Margarita (Harms & Eberhard 2003), only two were in use at the time of this study. Both were located in mangroves in or near Laguna de la Restinga National Park (one in Boca del Pasadero and the other north of Tetas de María Guevara; Fig. 1A). The other two roosts active in 2001 (in the Río Mucuy valley and in the town of San Francisco de Macanao) were inactive in 2004, even though local residents

indicated that they had been used in at least some of the intervening years. We found no evidence for additional roosts within the Macanao Peninsula, including at Chacaracual, where roosts have been observed occasionally in recent years (V. Sanz unpubl.). However, it is possible that some small roosts were overlooked.

Since only two main roosts were active, a relatively comprehensive census was possible even though simultaneous counts were not. Observations indicated that the parakeets from the western side of the Macanao Peninsula roosted in the western mangrove site (Boca de Pasadero), while parakeets that foraged to the east of La Restinga usually roosted in the eastern mangrove site (Manglar Este). After arriving, especially after sunset, most parakeets did not move from their first roosting spot; thus, group size counts from each of the three final observation points were considered to be independent, although a small level of double-counting was still possible. Summing the maximum number observed at each site (Table 2), we estimate that in June 2004 there were a minimum of 1984 Brown-throated Parakeets on Margarita.

Threat status. Although our census produced an estimate of the minimum, and not total, population size, inferences about the number of parakeets on Margarita are still possible. Clearly, we did not count small, overlooked roosts or individuals still incubating or not yet fledged. However, because of the timing and thoroughness of our study, we expect these omissions to be minimal. A more important factor is the challenge of counting many birds flying simultaneously, thanks to overlap and movement, and particularly when they are relatively distant. With this principal source of bias in mind, we believe that the total population size of *A. p. margaritensis* in 2004 was at most twice the minimum number recorded, or approximately 4000 individuals.

Combining the extent of occurrence of the subspecies (not much greater than 330 km²), a maximum estimated population size of ~4000, and only two known roosts, with a known continuing threat that appears to cut reproductive success by at least half, we classified *A. p. margaritensis* as Endangered, according to IUCN criteria B1a&b(v) (IUCN 2001). That is, the extent of occurrence was less than 5,000 km², there were fewer than five roosts, and similar poaching rates in similar species (Rodríguez *et al.* 2004; Pérez *et al.* 2006) allowed us to infer a probable decline in the number of mature individuals. This was reinforced by the fact that all but one of nine local people interviewed declared that they noticed a reduction in the number of parakeets on the island relative to 10–20 years ago. The subspecies also qualifies as Vulnerable according to IUCN criterion C2a_{ii}, but the precautionary principle dictates that the higher risk category be selected when discrepancies exist (IUCN Standards and Petitions Working Group 2006).

Aratinga pertinax tortuguensis

Nests and poaching rates. Although at the time of our fieldwork, the Brown-throated Parakeets on La Tortuga probably had not yet begun nesting, we found two areas used in previous years, as evinced by several old egg shells and green feathers. The first, in the mangroves off the coast of Laguna de los Mogotes (Fig. 1B), had three nests in cavities in live trees. The second, near Laguna de Carenero, contained three nesting burrows under an overhanging embankment of ancient coral rubble, bringing the total number of parakeet nests detected to six. We found poaching evidence in both areas: initials were carved in all the nesting tree trunks, and a crude ladder was found under the nesting burrows. In contrast to our results from Margarita, we found no termite mounds, with or without nests.

TABLE 2. Numbers of flying Brown-throated Parakeets observed at six observation sites on the Macanao Peninsula, Margarita Island. Asterisks indicate observation points closest to identified roosts, used for estimating total minimum population size.

Date	Location	No. of individuals
06/22/2004	San Francisco	29
06/23/2004	Manglar Este 1*	251
06/24/2004	Chacaracual 1	96
06/25/2004	Chacaracual 2	39
06/26/2004	Manglar Este 2*	112
06/27/2004	Boca de Pasadero*	1733

This small amount of direct poaching evidence combined with interview results to suggest that poaching is widespread on the island: one transient fisherman freely indicated that several of his colleagues poached parakeet nestlings, and that they often marked nests with their initials to indicate “ownership” of the parakeets nesting there. This is consistent with evidence from the similarly isolated La Blanquilla Island, where fishermen take up to 100% percent of Yellow-shouldered Parrot nestlings, in spite of the fact that it is a protected naval base with restricted access (Rojas-Suárez 1994a; Rodríguez-Ferraro & Sanz 2007). The nesting sites we found were close to the coast and thus relatively easily accessible. Given the characteristics of the nesting sites, the absence of termite mounds on the island, and the comments of several seasonal residents, we agree with Rodríguez & Rojas-Suarez (1999) that a higher density of nests may exist in the mangroves of the south-western coast of the island (Fig 1B). If this is the case, it is most likely that they are also poached heavily, due to their accessibility by boat. We thus suspect that the poaching rate on La Tortuga is also very high, as on Margarita.

Roosts and population size. Despite extensive searching, we found no roosts in the study area on La Tortuga. Roosts may be located to the west, near suspected nesting areas, where

mangroves are abundant along the coast (Fig 1B). This possibility was reinforced by the west-to-east flight paths of parakeets that we observed in the early mornings in the east-central portion of the island. Without identified roosts, a population census was impossible. Nonetheless, we observed at least 100 live individuals on La Tortuga during this study, although never more than 40 at a time. All were found in the middle and southern portions of the study area (Fig. 1B), which are very dry and open, with scarce spiny and scrubby vegetation. Because they were observed at separate locations, at different days and times, we have no way of estimating how many of these might be re-sightings of the same individuals. On the north-eastern (windward) side of the island, vegetation was scarce and no parakeets were observed. Toward the south-east, parakeets were sparsely distributed, and were observed mostly foraging for food in pairs or small groups (of eight or fewer individuals). These results confirm that the eastern portion of the island has a negligible population, such that if large numbers of *A. p. tortuguensis* do exist, they must be on the western side of the island.

Threat status. Previous authors have suggested that this subspecies be classified as Endangered (Desenne & Strahl 1994) or Data Deficient (Rodríguez & Rojas-Suárez 1999). We confirm that the extent of occurrence of the

subspecies is less than the total size of the island, and that it most likely experiences poaching rates sufficient to cause a decline in the number of mature individuals, both of which support a classification as Endangered (B1b(v); IUCN 2001). However, prior to a category change from Data Deficient to Endangered, further studies must be conducted, particularly on the western side of La Tortuga, to confirm that there are fewer than five primary roosts.

DISCUSSION

Nest poaching. Our results indicate that poaching probably removes half or more of nestlings from the populations of both insular subspecies of the Brown-throated Parakeet in Venezuela, *Aratinga pertinax margaritensis* and *A. p. tortuguensis*. Population viability analyses conducted for the other Venezuelan insular psittacids, *Amazona barbadensis* and *Aratinga acuticaudata neoxena*, show that these species are seriously threatened by nest poaching at a similar level (Rodríguez & Rojas-Suárez 1994; Rodríguez *et al.* 2004). Intense nestling extraction alters the age structure of a population, increasing the proportion of adults and reducing juveniles and young reproductive adults (Rodríguez & Rojas-Suárez 1994, Rojas-Suárez 1994b; Rodríguez *et al.* 2004). Because adults are long-lived, the population may appear healthy and stable at first, even with intense nestling poaching. However, the average age of the population gradually increases, eventually leading to abrupt collapse, when adults reach senescence and few juveniles take their place.

The extent to which this scenario applies to Brown-throated Parakeets remains unclear. The short-term masking of poaching effects is enhanced by a longer adult lifespan, and smaller psittacids are expected to have shorter lifespans than larger ones (Munshi-South & Wilkinson 2006; the scant information avail-

able concerning wild parakeet longevity suggests that they may live up to 20 years, compared with 30-35 years in larger parrots; Forshaw 1989; Rodríguez & Rojas-Suárez 1994; Rodríguez *et al.* 2004). This suggests that insular populations of *Aratinga pertinax* may be equally or more susceptible to poaching as larger insular Venezuelan psittacids.

A. p. margaritensis. Our most surprising result for Brown-throated Parakeets on Margarita was their classification as Endangered (B1a&b[v]), despite the fact that they clearly continue to be the most abundant psittacid on the island. Even with the limitations of our census, the number of parakeets observed directly in this study (Table 2) was greater than the total estimated present population of *Amazona barbadensis* (Rodríguez 2003; J. M. Briceño-Linares unpubl.). However, this relative abundance combines with a limited extent of occurrence, high poaching and a limited number of roosts to clearly merit this classification. Another of our results raises additional concerns about this subspecies' future: our surveys of potential nests revealed extensive damage (Fig. 2). Although we suspect that termite mound availability does not presently limit nesting, it may in the future if current patterns of deforestation and mound destruction continue (Albornoz & Fernández-Badillo 1994a).

In the near future, additional assessments of the population status of *A. p. margaritensis*, their reproductive success, and clutch survival rates should be conducted for successive breeding seasons: only such temporal information can confirm population declines (Primack *et al.* 2001, Wiley *et al.* 2004). We recommend that simultaneous censuses be conducted at the beginning and end of each breeding season, with observation points near currently active roosts. This will facilitate not only more precise estimates of population size, but also of juvenile recruitment and

future population dynamics (Rodríguez 2003). Such simultaneous censuses will require clarification of roosting patterns within the Macanao Peninsula. Our results suggest that the mangroves of the Laguna de La Restinga, a wetland of international importance listed under the Ramsar Convention, are crucial for *A. pertinax* roosting. According to local residents, and as suspected by previous researchers (Yépez-Tamayo 1963; Harms & Eberhard 2003) and confirmed by the present study, the mangroves of this national park appear to contain the only permanent roosts on Margarita. However, the relative importance of other transient roosts (such as those in Río Mucuy, San Francisco de Macanao, Chacarcual, and Quebrada La Vieja) can be clarified only via systematic multi-season studies.

A. p. tortuguensis. Although our results were insufficient to reevaluate the threat status of this subspecies (cf. Rodríguez & Rojas-Suárez 1999), we uncovered additional information supporting its proposed classification as Endangered (Desenne & Strahl 1994). We confirmed that its maximum extent of occurrence is less than the total size of La Tortuga, and found at least two lines of evidence (nest observations and interviews) suggesting that poaching is at levels known to cause population declines in similar species elsewhere. Interviews furthermore suggested that although fishermen still consider the species to be abundant, they feel that parakeets are now encountered less frequently than in the past, supporting the inference of a population decline.

We agree with previous conclusions that the collection of more information about *A. p. tortuguensis* should be a high conservation priority (Desenne & Strahl 1994, Rodríguez & Rojas-Suárez 1999). Our results indicate that future efforts to estimate this island's parakeet population should be conducted on the western and southern-central portion of the

island, focusing on locating roosts, in order to conduct a population census. If the mangroves along the south side of the island are in fact the main nesting and roosting areas, it will furthermore be important to increase nest surveys there to better estimate poaching rates.

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