

## A DISTINCTIVE NEW SUBSPECIES OF THE GREEN-CHEEKED PARAKEET (*PYRRHURA MOLINAE*, PSITTACIDAE) FROM BOLIVIA

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*Abstract.* We here describe a distinctive new subspecies of the Green-cheeked Parakeet (*Pyrrhura molinae*), easily recognized by the striking yellow marginal coverts along the leading edge of the wing bend, from arid, rain-shadowed valleys in southern Depto. La Paz, Bolivia. Notes on habitat, distribution, relative abundance and behavior are presented. We also discuss possible origins of the new subspecies and the general importance of isolated, rain-shadowed valleys in Depto. La Paz for the evolution of Andean dry forest birds. *Accepted 9 September 1997.*

*Key words:* Green-cheeked Parakeet, *Pyrrhura molinae*, Bolivia, Andes, subspecies, evolution.

### INTRODUCTION

On 21 November 1993, SM and MTF observed a flock of six *Pyrrhura* parakeets near Inquisivi, Depto. La Paz, Bolivia, resembling *P. molinae* except for striking yellow marginal coverts along the leading edge of the wing bend. No *Pyrrhura* species with yellow in the wing is known from Bolivia (Forshaw 1989, Remsen & Traylor 1989, Fjeldså & Krabbe 1990). During the following two months similar birds were frequently observed in the same area (the Río Khatu valley, Fig. 1), mostly in cultivated habitats, dry forests and

on shrubby slopes between 2050–3000 m. In January 1994, SM bought two live birds from an inhabitant of Inquisivi.

In September and October 1995, individuals of *P. molinae* with yellow marginal coverts along the leading edge of the wing bend were also found in several locations in the La Paz valley between 1250 and 2200 m during ornithological surveys conducted by SKH and MK (Herzog *et al.* 1997). The majority of birds seen in the La Paz valley, however, were “normal” green-winged birds referable to *P. m. molinae*. Additionally, mixed pairs of the yellow-winged form and the nominate subspe-

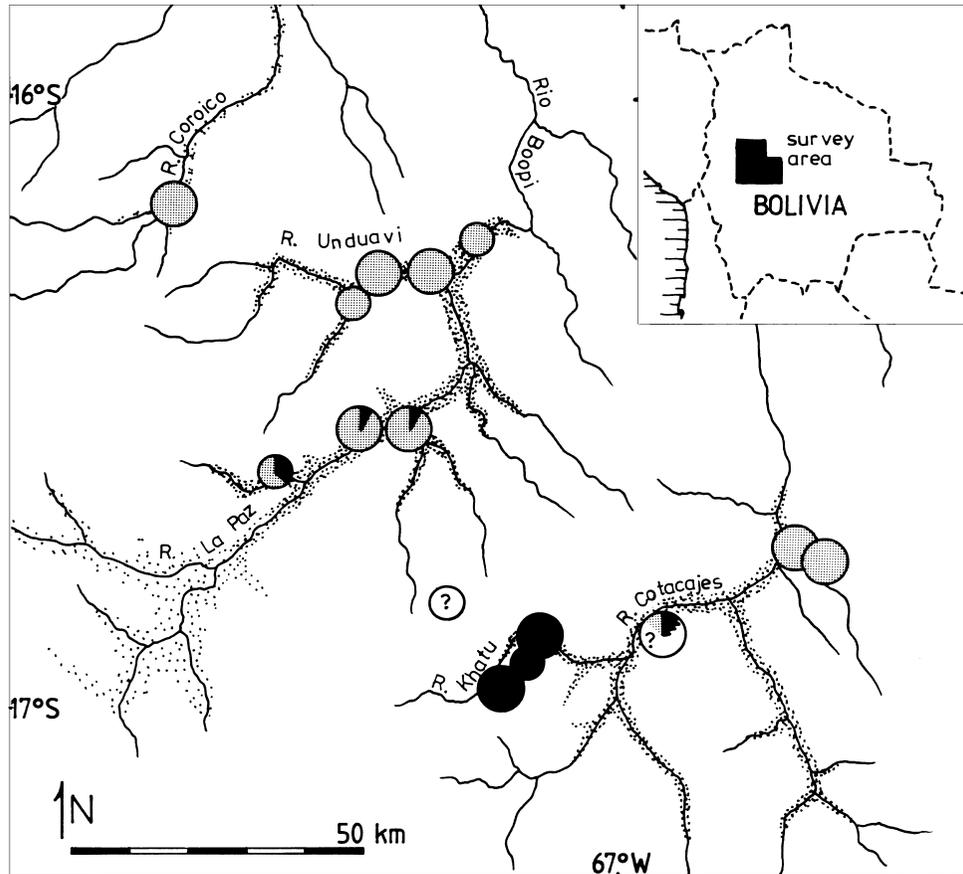


FIG. 1. Distribution of inter-Andean deciduous forest (stippled) and sightings of *Pyrrhura molinae* (circles) in the valleys of southern Depto. La Paz. Small circles represent sightings of < 10 individuals, large circles sightings of > 10 individuals (repeated sightings make exact population estimates difficult). Segments show estimated proportions of local populations of *P. m. flavoptera* (black) and *P. m. molinae* (gray). Open stippling in the upper La Paz valley (lower left) denotes low, degraded deciduous thorn and scrub forest at altitudes above 2500 m where *P. molinae* is not known to occur.

cies were found. We consider this previously undescribed form a subspecies of *P. molinae*, to be called: *Pyrrhura molinae flavoptera* subsp. nov.

*Holotype.* Adult male, No. CBF 2693 of the Colección Boliviana de Fauna (CBF), La Paz. Obtained by SM in January 1994 from an

inhabitant of Inquisivi, Prov. Inquisivi, Depto. La Paz, Bolivia. The owner reported to have bought it from a campesino in Sita (16°53'S, 67°07'W, elevation 2550 m), 4 km N Inquisivi on the opposite side of the Río Khatu valley. The specimen was prepared by Claudio Rosales of the CBF. Gonad size c. 2 mm. Blood specimens deposited at the Zoological

Museum, University of Copenhagen, samples SM3-080294 and SM4-080294.

*Paratype.* Adult male, No. CBF 2694 of the Colección Boliviana de Fauna, La Paz. Same data as for the holotype, including size of gonads. Blood specimens deposited at the Zoological Museum, University of Copenhagen, samples SM1-080294 and SM2-080294.

*Diagnosis.* Resembles other subspecies of *P. molinae* in most respects, but has one distinctive character: a variable number of yellow, salmon-colored, or scarlet feathers along the wing-bend and among the marginal underwing coverts of the wrist region.

The feathers of the crown are bluegreen, but this character is not fully diagnostic as it was also seen in one specimen of *P. m. molinae* from the Yungas of Cochabamba (Louisiana State University Museum of Zoology; J. V. Remsen, pers. comm.).

*Description of holotype.* Color names follow Ridgway (1912). Forehead and crown Benzo Brown, all feathers conspicuously edged bluegreen (Terre Verte, towards the nape Gobel Blue with the lateral feather edges approaching Grass Green). Back Grass Green, upper wing-coverts Grass Green grading to Meadow Green on the greater coverts. Secondaries Dark Viridian Green (but Grass Green along the outer edge). Along the wing-bend, 12 (left) and c. 20 (right) feathers are Light Cadmium more or less broadly tipped scarlet, and a few small coverts along the edge of the thumb are paler yellow, partly Salmon Color and tipped Carmelian Red; the remaining marginal coverts of the wrist region are Capri Blue. Primaries Capri Blue along the outer edge inclining to Ultramarine Blue near the shaft. All remiges Slate Color towards the inner edge. Narrow supercilium, cheeks, earcoverts Grass Green/

Calliste Green. Chin bare, throat and breast Slate-Olive (with a slight glaucous tinge towards the shoulders), most feathers Dark Olive-Buff along the sides and with transverse bars formed by penultimate Olive-Buff zone and deep gray tip; grading to Grass Green sides and Deep Turtle Green lower underparts, the feathers of the belly with Ocher Red centres; vent Dark Green. Tail Claret Brown.

*Measurements of holotype (mm).* Wing (chord) 139, tail 136, culmen from base (at skull) 19, body mass 73 g.

*Description of paratype.* Similar to the previous specimen, but more vivid (Grass Green) feather edges on the posterior crown, and Grass Green hind neck with Chessylite Blue feather centres. The color hue is, in general, more yellowish, back Calliste Green, breast feathers Hair Brown with a yellow wash and the subapical bar Ecru Olive. The scarlet of the wing-bend is continuous with the pale yellow edge of the thumb and with two blue-green marginal coverts inserted between a Salmon Colored and a yellow feather in the left wing.

*Measurements of paratype (mm).* Wing (chord) 131, tail 134, culmen from base (at skull) 19, body mass 69 g.

*Etymology.* We name this subspecies for its distinctive field mark, the yellow marginal coverts along the leading edge of the wing.

*Habitat and observed distribution.* Birds were found in any available habitat in rain-shadowed valleys at 1250–3000 m. The natural vegetation of these valleys consisted of deciduous and semi-deciduous forest dominated by *Schinopsis baenkeana*, *Schinus* sp., tall cacti (*Cereus* spp., *Samaipaticereus inquisiviensis*), and (in the La Paz valley) *Anadenanthera macrocarpa*

and *Acacia* sp. Most forests ranged in height from 5–10 m and were severely degraded by cattle grazing, timber extraction and occasional burning. Much of the area had been degraded to scrubland dominated by *Dodonaea viscosa*. Small patches of evergreen vegetation were found along creeks and rivers (dominated by *Erythrina* sp., *Piper* sp., *Acacia macracantha* and several Compositae), and agricultural fields, orchards and plantations of *Eucalyptus globulus* were scattered throughout the area. Once a group of 6 birds was seen in evergreen humid montane forest at 3000 m, but this clearly is not the preferred habitat of the subspecies.

*P. m. flavoptera* was observed in nearly all localities throughout the Río Khatu valley that we visited, from Quime (16°59'S, 67°13'W) downstream to Inquisivi, at elevations of 2050–3000 m, and at three localities in the Río La Paz valley (4.5 km NNW Miguillas, Prov. Inquisivi, Depto. La Paz, 16°33'S, 67°22'W, 1400–1700 m; Huara/Rancho Cieneguillas, Prov. Sud Yungas, Depto. La Paz, from 16°37'S, 67°28'W to 16°34'S, 67°25'W, 1250–1500 m; 17 km from Huara on the road to Lambate, Prov. Sud Yungas, Depto. La Paz, 16°38'S, 67°34'W, 2200 m). In the Río Khatu valley only this subspecies was observed, whereas in the La Paz valley mixed flocks with *P. m. molinae* were found. Most recently (October 1997), Niels Krabbe (pers. comm.) found *P. m. flavoptera* also in the upper Cotacajes valley at Saila Pata (Prov. Ayopaya, Depto. Cochabamba, 16°54' to 55'S, 66°55'W, 2550–2900 m). It is uncertain whether *P. m. molinae* also occurred in this area. On 26 November 1993, SM and MTF observed a group of five *P. molinae* near Licoma (Prov. Inquisivi, Depto. La Paz, 16°48'S, 67°14'W, 2300 m) between the Río Khatu and Río La Paz valleys. These birds probably belonged to the nominate subspecies, but the lack of yellow wing patches could not be determined with certainty.

As areas further E in the lower Cotacajes drainage are inhabited exclusively by the nominate subspecies (see discussion and Fig. 1) and based on the observed habitat requirements of *P. m. flavoptera* we estimate its total range size at 1000–1500 km<sup>2</sup>. Thus, the total population must be small, in the range of a few thousand birds. Because this subspecies seems to cope well with habitat degradation, however, we do not consider it to be under any immediate threat from habitat destruction.

*Relative abundance and variation in flock size and composition.* In the Río Khatu valley (observation period from November 1993 to January 1994, 15–20 September and 18 October 1995), the *flavoptera* morphotype was common and flocks ranged in size from three to nine individuals. The *molinae* morphotype was not found in the Río Khatu valley.

At Miguillas (22–25 September 1995), *P. molinae* was frequently encountered daily, from lone individuals up to groups of five. Individuals of the *flavoptera* type seemed to be less common than the *molinae* type. On 23 September, a single *flavoptera* type bird was seen in the morning and a “mixed pair” of *flavoptera* and *molinae* types was perched near our camp site in the afternoon. On the morning of 24 September, a *flavoptera* type pair and a flock of four, containing at least two *flavoptera* type individuals, were observed.

The species was also common at Huara/Rancho Cieneguillas (27 September to 2 October 1995), with the majority of individuals referable to the *molinae* morphotype. However, at least one *flavoptera* type bird was seen in a flock of four on 29 September. The following day a pair of *flavoptera* type birds, two *flavoptera* type birds in a group of three and at least one *flavoptera* type in a group of four were seen.

A group of four birds, observed 17 km

from Huara on the road to Lambate (29 September 1995), contained at least one bird of the *flavoptera* type and a possibly intermediate individual with very little yellow in the wing.

At Saila Pata (11–18 October 1997), N. Krabbe (pers. comm.) made 14 observations of *P. molinae* (from a single bird to flocks of up to 15) in deciduous forest. Two or three times he saw individuals well enough to determine that they were *flavoptera* type birds, including a flock of seven. The subspecific affinity of the remaining individuals could not be ascertained. Another five observations of *P. molinae* of undetermined subspecific affinity (a pair and flocks of seven and 10) were made in tall *Podocarpus* cloud forest at 3000–3200 m in the same area. Based on the observed habitat preferences of *P. m. flavoptera* we assume that these birds could represent the *molinae* type.

*General habits and feeding.* In general, the behavior of *P. m. flavoptera* resembled that of the species (Fjeldså & Krabbe 1990, Forshaw 1989). On 13–16 and 25–27 December 1993, SM and MF observed a group of three *P. m. flavoptera* that spent the night on a steep rock face. Every evening the screeching birds arrived just before dusk, then perched together on a small shrub on the rock face for 15–30 minutes while producing peculiar calls (see below). Finally, they would fly the remaining few meters to an overhanging section on the rock face where they disappeared for the night. No signs of breeding were observed, but it seems possible that they nested on the same rock face.

In both the Khatu and La Paz valleys birds were frequently observed feeding on fruits and flowers of *Cassia* sp. (Leguminosae). They were also found feeding in peach orchards in the Inquisivi area. Local people there reported that the parakeets would eat so many ripe peaches that they became too heavy to fly and were easy to catch. At Saila

Pata N. Krabbe (pers. comm.) repeatedly observed birds feeding on the flowers of *Erythrina* sp.

*Vocalizations.* Regrettably, we obtained no tape recordings. To our ears, flight calls of *P. m. flavoptera* sounded much like those of other subspecies of *P. molinae* elsewhere in Bolivia (tape recordings made by SM and SKH in Deptos. La Paz, Cochabamba, Santa Cruz, Chuquisaca and Tarija). An additional call was noted from birds perched on a rock face at dusk (see above). At regular intervals one of them would emit a loud, drawn-out “*kEEEE-el*”.

## DISCUSSION

Given the apparent extent of hybridization and the mixed pairs and flocks observed in the La Paz valley, we consider *P. m. flavoptera* to represent a subspecies of *P. molinae*. In the Cotacajes drainage *P. m. flavoptera* seems to occur primarily in the upper part of the valley system near the headwaters at 2000–3000 m (Fig. 1), whereas *P. m. molinae* occupies a wider elevational range from at least 1500–3100 m further E and closer to the humid outer slopes of the Bolivian Yungas (near the villages of Cotacajes and Cocapata, Depto. Cochabamba; Fjeldså *et al.* in prep.). *P. m. flavoptera* might also be found below 2000 m in the Cotacajes drainage, but based on surveys in the Cordillera Cocapata (Fjeldså *et al.* in prep.) it is unlikely to occur below 1700 m. Whether the two subspecies are currently intergrading in the Cotacajes drainage remains unknown. In the La Paz valley *P. m. flavoptera* appears to be restricted to elevations above c. 1200 m, where it is outnumbered by *P. m. molinae*. Considering the very small amount of suitable habitat in the upper La Paz valley (above 2200 m), pure *P. m. flavoptera* populations are not likely to exist here.

Due to the present contact between *P. m.*

*flavoptera* and *P. m. molinae* the conditions under which the former originated are unclear. The exclusive presence of *P. m. flavoptera* in the Río Khatu valley suggests that this subspecies may have evolved there in isolation and later dispersed to the La Paz valley as well as downstream into the Cotacajes valley. Distinctive morphological traits, such as yellow coverts at the wing-bend, may probably be established rapidly because of the small population size. Contrary to what is often thought, inbreeding depression is not necessarily a problem in tiny isolates that have remained small for a long time (e.g., Hauser *et al.* 1994, Templeton & Read 1994). Evolution by isolation in the Cotacajes drainage is further supported by the recent discovery of two other new taxa in the Khatu valley, *Cranioleuca henricae* (Maijer & Fjeldså 1997) and an undescribed subspecies of *Synallaxis frontalis* (SKH and MK, unpubl. data), the latter of which is apparently endemic to the Cotacajes drainage.

The presumed hybridization of *P. m. flavoptera* with *P. m. molinae* raises the question of how such a small population can maintain itself and to what degree genetic exchange exists between the *P. m. flavoptera* populations in the La Paz and Cotacajes drainages. It is possible that hybridization with *P. m. molinae*, especially if induced by man-made habitat changes, might eventually lead to the extinction of *P. m. flavoptera*. On the other hand, considering that both taxa may have been in contact for a longer time period with only limited intergradation, it is conceivable that, in spite of the observed hybridization, the two forms represent essentially separate reproductive and evolutionary populations. In this case, *P. m. flavoptera* would be considered a valid phylogenetic species (*sensu* Cracraft 1983). A detailed study of the degree of hybridization in the area of overlap is needed to establish the taxonomic and conservation status of *P. m. flavoptera*.

Due to their complex topography and cli-

matic gradients, rain-shadowed valleys of Depto. La Paz form isolated habitat pockets under present-day climatic conditions (Fig. 1). This may have provided favorable conditions for the maintenance of isolated populations of dry forest birds. These processes, however, are still poorly understood. Other species that are more widespread elsewhere and have tiny isolated populations in these valleys include *Upucerthia harterti* (La Paz valley, Herzog *et al.* 1997), *Poospiza boliviana* (La Paz valley, JF, unpubl. data) as well as *Poecilurus scutatus* and *Formicivora melanogaster* (Machariapo valley, Pearman 1993). These populations may not (yet) be morphologically distinctive, however. Similar patterns with a noticeable clumping of localized endemic species have also been found for plants (MK, unpubl. data).

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