LETTERS

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OBSERVATIONS OF A TREE-CAVITY NEST OF THE RUFOUS-LEGGED OWL AND PREDATION OF AN OWL NESTLING BY A CHIMANGO CARACARA IN ANDEAN TEMPERATE FORESTS

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Andean temperate ecosystems have lower avian species richness than other temperate, subtropical, and Andean forest types, but they contain many endemic species (e.g., 41% for birds; Vuilleumier 1985). Because of its high concentration of endemism and exceptional loss of native forest habitat (approximately 70%), the Andean temperate ecosystem is classified as a Global Biodiversity Hotspot (Myers et al. 2000). The Rufous-legged Owl (*Strix rufipes*) is an endemic forest-specialist raptor once considered one of the least-known owls in South America; this species has declining populations because of increasing habitat loss (Martínez and Jaksic 1996). Recent studies have shown that this species tolerates some habitat disturbance, but still requires a complex forest-stand structure comprising large, decaying trees, dead standing trees (snags), and a dense understory (Ibarra et al. 2014b, Ibarra and Martin 2015). Rufous-legged Owls in temperate forests are sit-and-wait predators with a diet composed mainly of arboreal and scansorial small mammals, but also smaller proportions of forest passerines and invertebrates (Martínez 1993, Martínez and Jaksic 1997, Figueroa et al. 2006, 2016). The few reported nests described for Rufous-legged Owls include one likely unusual nest on the ground in a pine (*Pinus radiata*) plantation (Estades 1998), and six cavity nests in large, decaying native trees (Vukasovic et al. 2006, Wallace 2010, Beaudoin and Ojeda 2011). In all these cases, however, information on Rufous-legged Owl nesting activity (e.g., incubation period, adult parental behavior, prey consumption) and nest fate was lacking.

Secondary Andean temperate forests and open areas are readily utilized by the Chimango Caracara (*Milvago chimango*), a common, yet poorly studied raptor (Figueroa 2015). This habitat generalist raptor feeds on carrion, human rubbish, invertebrates, lizards, small mammals, and

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nestling birds (Yáñez et al. 1982). Chimago Caracaras, however, have never been reported depredating other raptor nestlings. We here describe the nesting activity of a Rufous-legged Owl pair and report the depredation of an owl nestling by a Chimango Caracara in a secondary forest in southern Chile.

During the 2015–2016 breeding season, we searched for nests at 20 forest stands (each with an area >20 ha) in the Andean zone of the La Araucanía Region (39°15′ S, 71° W), southern Chile. We spent nearly 6 hr daily, 6 d/wk, from November to January searching for and monitoring nests of cavity-nesting birds ($n = 29$ species, T. Altamirano and J. Ibarra unpubl. data). On 20 November, while working in a secondary forest located at 444 masl and burned 70–75 yr ago (Veblen et al. 1992), we passed by a snag and an adult Rufous-legged Owl flushed from a cavity. We checked the cavity interior using a peeper wireless camera system on an extendable telescoping pole (TreeTop Peeper, Sandpiper Systems, Manteca, CA, U.S.A.) and found one Rufous-legged Owl egg. We deployed a camera trap (Reconyx RC55, Holmen, WI, U.S.A.) in front of the cavity nest to monitor breeding activity. We also visited the nest and checked its status, using the peeper camera, every 3–4 d until its fate was determined.

The tree-cavity nest utilized by the pair of Rufous-legged Owls was a relatively large crevice (33 cm wide and 94 cm in height at the entrance). The cavity was created by tree decay and located 4.8 m high, with the entrance facing east at 80°. The nest tree (roble; *Lophozonia obliqua*) was a residual snag or "habitat legacy." The tree was in an advanced stage of decay (i.e., rotten soft wood, no bark, no branches, broken top) and was among the largest trees (diameter at breast height [DBH] = 63.3 cm) within the forest stand (mean DBH ± SD = 31.8 ± 15.3 cm, $n = 150$).

Clutch size was one egg. The egg hatched on 21 December 2015 (video of the hatching event is available from the authors upon request). Because *Strix* species begin incubating with the first egg laid (König and Weick 2008), the incubation period for this recorded egg was at least 31 d. According to camera-trap data, the male delivered food to the female while she was incubating. Prey items, transferred from male to female either inside or at the entrance of the cavity, included austral opossums (*Dromiciops gliroides*) and other unidentified small mammals, and birds (Fig. 1b). Prey items also included invertebrates such as the forest beetle (*Chiasognathus grantii*). The male regularly brought excess prey that was stored in the nest for later consumption, with a maximum of five small mammals in the cavity bottom on 16 December.

By camera trapping, we recorded 38 nights and 106 prey delivery events, during the incubation and nestling periods together. The delivery of prey by the adult male started 1 hr later during the nestling period (approximately 2210 H) than during the incubation period (approximately 2113 H). The last delivery of the night occurred almost at the same time during the nestling and incubation periods (0559 H and 0541 H, respectively). During the initial stage of the nestling period, we observed both adults delivering food. However, the frequency of prey deliveries was higher during the incubation period ($\dot{x} \pm SD = 2.93 \pm 1.17$ deliveries/night, $n = 30$) than during the nestling period (2.25 ± 0.71 deliveries/night, $n = 9$; $t = 2.09$, $P < 0.05$).

Each time we visited the owl nest (17 times after it was found), we saw one or two Chimango Caracaras perched on a nearby tree, staring at the nest cavity, or flying and calling from the surrounding area (Fig. 1c). By camera trapping, we recorded nine instances of Chimango Caracaras either on the nest tree or entering the cavity. All these records occurred during the morning (0858–1155 H). Between 20 November and 7 December 2015 (during incubation), we recorded three visits of Chimango Caracaras to the nest tree. On 29 December 2015, 8 d after the owlet hatched, Chimango Caracaras visited the nest at 1022 H and again between 1142 H and 1155 H. During the last of these visits, a Chimango Caracara entered the cavity but did not depredate the nestling owl. The owl nestling was fed by the adults for the last time during the night of 29 December. The following day, a Chimango Caracara entered the cavity at 0901 H and left 1 min later with the 9-day-old nestling owl

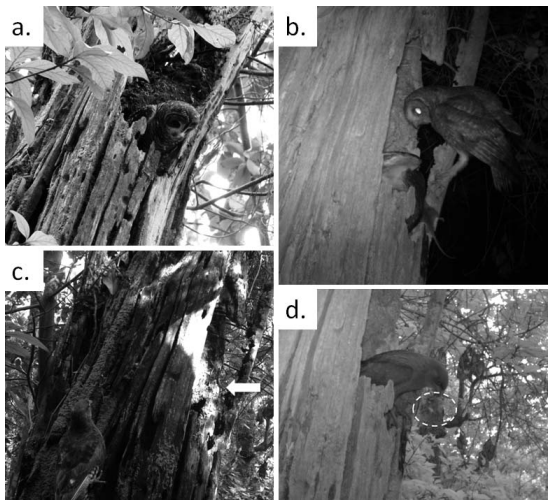

Figure 1. Breeding activity and fate of a nest of Rufous-legged Owl (*Strix rufipes*), recorded by a camera trap, in Andean temperate forests of southern Chile: (a) adult Rufous-legged Owl at the entrance of the monitored cavity nest; (b) male delivering an austral opossum (*Dromiciops gliroides*) to the female owl during incubation; (c) the first record of a Chimango Caracara (*Milvago chimango*) exploring the Rufous-legged Owl nest tree on 22 November 2015, during incubation (white arrow shows the location of the nest cavity); (d) Chimango Caracara leaving the cavity nest on 30 December 2015, with the owl nestling in its bill (9 d after the egg hatched; white dashed circle).

in its bill (Fig. 1d). Adult owls were never recorded at the nest cavity while Chimango Caracaras visited the nest. After this depredation event, a Chimango Caracara visited the nest cavity three times, on 1 January (0858 H), 3 January (0931 H), and 5 January 2016 (1027 H). Adult owls were never recorded between the depredation on 30 December and our last visit on 18 January 2016, and the cavity was not reused by any species.

Our record of a Rufous-legged Owl nest expands current knowledge on the life history of the raptor with the highest conservation priority in southern temperate forests (Pincheria-Ulbrich et al. 2008). We confirmed that the Rufous-legged Owl sometimes nests in secondary forest stands using tree cavities available in large habitat legacies (Perry and Amaranth 1997, Ibarra et al. 2014a). We also report the attack on the only nestling of this forest-specialist nocturnal owl by a habitat-generalist diurnal raptor.

The incubation period we recorded (approximately 31 d) for the Rufous-legged Owl is similar to that of other *Strix* owls (e.g., *S. woodfordii*, 31 d; *S. varia*, 28–33 d; *S. nebulosi*, 28–36 d; *S. occidentalis*, 28–32 d; *S. aluco*, 28–30 d; Duncan 2003, Lynch 2007, König and Weick 2008). Like most Strigiformes (Johnsgard 1988), Rufous-legged Owls showed biparental care during the nesting (incubation and nestling) period. However, we observed a difference in the roles of adult owls and frequency of prey deliveries between incubation and nestling periods. During incubation, the number of prey deliveries by the male (2.93 deliveries per night) was similar to the reported number for *Strix occidentalis lucida* (2.68 deliveries per night; Delaney et al. 1999). Our observation of a reduced number of prey deliveries during the nestling period may be associated with the female hunting her own prey (therefore, she does not need to be fed). Also, food available for the single nestling from the overstock left by the male might initially have reduced the rate of prey deliveries. In general, birds increase the number of prey delivery visits to nestlings as a function of nestling growth, with a general pattern of a rising phase followed by a plateau (for a review, see Grundel 1987). Therefore, our lower pattern of prey deliveries during the nestling period than incubation should be interpreted with caution because we only monitored a single nest during the first phase of the nestling life (first 9 d after hatching) until it was predated. Elsewhere, in Chile, adult Rufous-legged Owls delivered 19 prey items to a single nestling in two nights (Vukasovic et al. 2006). Our data on prey deliveries suggest the diet of nesting Rufous-legged Owls was similar to the one reported previously in temperate forests based on the analysis of owl pellets (Martínez 1993, Martínez and Jaksic 1997, Figueroa et al. 2006, 2016).

Because the Chimango Caracaras were unmarked, we do not know whether the same individuals visited the nest tree several times and finally attacked the nestling. However, pairs of this diurnal raptor are strongly territorial, often fiercely attacking other Chimango Caracaras (Baladrón et al. 2009); thus, we suspect the same pair detected, visited, and finally preyed on the nestling more than 1 wk after hatching. This diurnal raptor appears to have sacrificed the short-term energetic benefits associated with immediate attack that are expected to guide predator feeding decisions (Stephens and Anderson 2001). Chimango Caracaras are common and abundant, whereas Rufous-legged Owls are rare and likely declining raptors (Martínez 2005, Figueroa 2015). A high predation rate by Chimango Caracaras may have some consequences on the persistence of Rufous-legged Owls (Martínez 2005).

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