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SHORT-COMMUNICATION

Extreme use of feathers for nest construction by the Chilean Swallow (*Tachycineta leucopyga*) in the sub-Antarctic forests of southern Chile

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ABSTRACT: Nesting birds commonly incorporate feathers into nest linings given their insulation properties. Although use of feathers is common among swallows, here we provide the first recording of nests built almost completely with feathers (57–60% of total nests mass), by the Chilean Swallow (*Tachycineta leucopyga*) in southern Chile. Low temperatures or a high availability of feathers near the nesting sites could have elicited this response in the breeding birds, but further observations are needed to determine the frequency of the extreme use of feathers in this species, and the proximate causes promoting such behavior.

KEY-WORDS: breeding ecology, Isla Navarino, nest construction, nest insulation.

Nest construction is an essential process during the breeding cycle of most birds and it has important consequences for all stages of breeding attempts (Collias & Collias 1984). Given the role of nests in providing a stable environment for the development of eggs and nestlings and for the breeding adults themselves, careful construction and selection of building materials is considered vital for successful reproduction (Collias & Collias 1984, Hansell 2000). Typically, birds use plant materials to provide structural support for the nest and attach the nest firmly to a substrate (Hansell 2000). Non-plant materials may be used in nest lining. For example, feathers are often incorporated into nest linings, as they provide exceptional insulation properties (Barber 2013, Mainwaring *et al.* 2014). An increased use of feathers confers several thermal benefits, increasing the efficiency of egg incubation and nestling development (Winkler 1993, Lombardo 1994, Dawson *et al.* 2011), and enhancing reproductive output (Lombardo *et al.* 1995).

Despite the energetic benefits provided by the use of feathers, they are not an appropriate structural material and hence, they are limited to be used for nest lining. Hence, feather abundance compared to other materials in nests is usually low (Collias & Collias 1984, Hansell 2000). However, a few nest descriptions show that some species include more than 100 feathers in their internal linings (*e.g.* Tree Swallow, *Tachycineta bicolor*; Winkler 1993), and, in an exceptional case, more than 2600 feathers comprising *ca.* 40% of the nest mass, in the Long-Tailed Tit, *Aegithalos caudatus* (McGowan *et al.* 2004). Here we provide the first recording of nests built almost completely with feathers, by the Chilean Swallow (*Tachycineta leucopyga*) in the sub-Antarctic forests of southern Chile.

The Chilean Swallow is a secondary cavity nester that uses dry grasses for nest building, adding a variable amount of feathers for cup lining (Liljesthröm *et al.* 2009), similar to other *Tachycineta* swallows (see Dyrcz 1984, Brown *et al.* 1992, Allen 1996, Bulit & Massoni 2004, Townsend *et al.* 2008). This species has a large distributional range, reaching the southernmost portion of South America; some migratory populations breed between October and January in Isla Grande de Tierra del Fuego (Liljesthröm *et al.* 2009), and even further south in several islands of southern Chile (Jaramillo 2003). Given the low temperatures in these localities during the breeding season, Chilean Swallows add variable numbers of feathers before egg laying and during incubation, and it has been estimated that *ca.* 180 feathers can be incorporated to the structure of an average nest (Liljesthröm *et al.* 2009).

During a long-term breeding study focused on the furnariid Thorn-tailed Rayadito (*Aphrastura spinicauda*) at Isla Navarino (55°56'S; 67°39'W), located in the Magallanes and Chilean Antarctic Region, we observed Chilean Swallows occupying installed nest boxes (32 × 18 × 15 cm) since 2013 (see Botero-Delgadillo *et al.*

2015). We found five Chilean Swallow active nests during October–December 2013 and 2014. Clutch size ranged from three to five eggs (modal cutch size = 4 eggs), as has been reported for another population breeding in Tierra del Fuego (Liljesthröm *et al.* 2009). Three out of the five nests that we found were typical of this species, with a nest base made almost entirely of dry grasses and a nest cup lined with a variable number of feathers (see Liljesthröm *et al.* 2009). These three nests averaged 6.1 ± 1.1 cm in height and 78.2 ± 5.1 g total mass, similar to previous reports for the species and other members of *Tachycineta* breeding in nest boxes of similar size to our boxes (see Bulit & Massoni 2004, Liljesthröm *et al.* 2009). The remaining two nests had a small and thin base made of dry grass (mainly stems) and plant roots, and the nest cup was lined with several feathers; however, both had a feathered crown-like structure above the cup which concealed the eggs and accounted for most of the nests bulk (Figure 1). These "feather" nests heighted 16.2 and 18.9 cm, being up to three times higher than the nests described for *Tachycineta* swallows (see above). The nests base weighted 55.1 and 52.4 g, whereas the feathered structures weighted 73.5 and 78.1 g, respectively, comprising 57 and 60% of the nests total mass. We counted a total of 273 and 303 feathers in each nest, respectively. These feathers belonged to at least five species: Upland Goose, *Chloephaga picta* (71%); Ashy-headed Goose, *Chloephaga poliocephala* (18%); Great Horned Owl, *Bubo magellanicus* (3%); Chilean Swallow (2%); and feathers/down of unknown origin (6%). As observed in other populations of Chilean Swallows, feathers are commonly gathered from large aquatic birds, especially from Upland Goose (see Liljesthröm *et al.* 2009). This apparent preference for feathers from geese may reflect feather availability in the environment, since (i) geese tend to congregate in large flocks during the breeding season (Jaramillo 2003), (ii) large feathers may remain available longer than small feathers or may be more numerous, and/or (iii) carcasses of such large birds could be more easily located (see McCabe 1965).

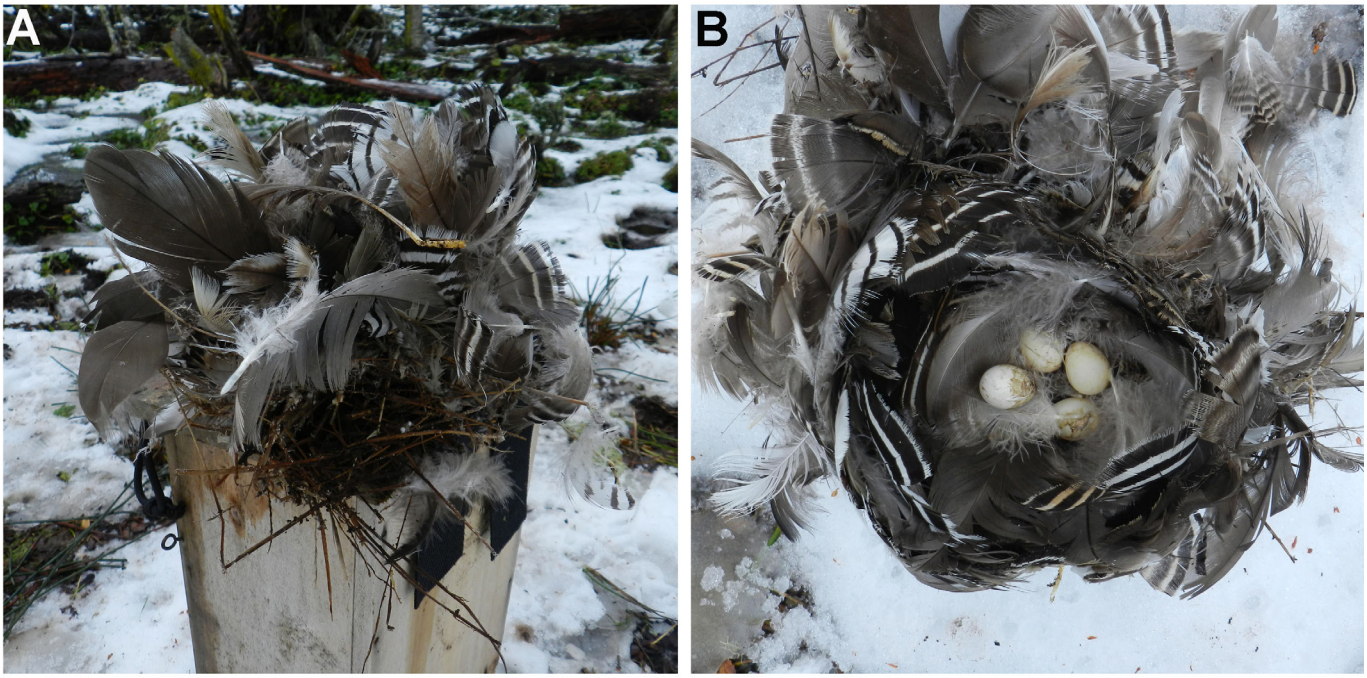

FIGURE 1. Details of the structure and content of a one of two "feather" nests of the Chilean Swallow *Tachycineta leucopyga* found during 2013 and 2014 at Isla Navarino, southern Chile. (**A**) the small base of plant materials is right below the feathered crown-like structure above the nest cup, with several feathers from *Chloephaga* geese; (**B**) four eggs were found in the nest center. Photos: Esteban Botero-Delgadillo.

Although *Tachycineta* swallows can use high amounts of feathers for nesting, the two nests that we described seem to be atypical, as feathers comprised almost the entire bulk of both nests and accounted for 57–60% of their total mass. Tree Swallows (*T. bicolor*) frequently include feathers (Lombardo *et al.* 1995, Dawson *et al.* 2011), averaging 40–50 per nest, sometimes exceeding 100 feathers (Sheppard 1977, Winkler 1993). White-rumped Swallows (*T. leucorrhoa*) can include up to 180 feathers (Bulit & Massoni 2004), similar to what have been described for Chilean Swallows breeding in Tierra del Fuego (Liljesthröm *et al.* 2009). This means that the "feather" nests had between two and three times the amount of feathers reported for species/populations of *Tachycineta* that use nest boxes in northern and southern latitudes.

Given the importance of feathers for nest insulation, especially in cold environments, it is conceivable that populations from any bird species breeding at higher latitudes will tend to include larger amounts of feathers in their nests compared to populations from more temperate environments (Mainwaring *et al.* 2014). Latitudinal

comparisons of nest structure between populations have shown that such environmental adjustment indeed occurs in a number of species (Briskie 1995, Rohwer & Law 2010, Crossman *et al*. 2011, Mainwaring *et al*. 2012). Furthermore, recent studies revealed that this variation also takes place within populations (Mainwaring & Hartley 2008). For instance, evidence suggests that seasonal variation of nest morphology occurs in Chilean Swallows, for breeding birds make temporal adjustments of the amount of feathers in their nests as the breeding season progresses and environmental temperature increases (Liljesthröm *et al*. 2009). Following this reasoning, we would expect a higher use of feathers in those populations breeding in the southernmost localities of the species range (*i.e.* Isla Navarino), but also in the nests built by those breeding birds starting their nesting attempts early in the breeding season. Unfortunately, our reduced sample size limits our chances to infer if this could be the case. Three of the nests we described were structurally similar to Chilean Swallow nests from Tierra del Fuego (Liljesthröm *et al*. 2009) and also to nests described for the White-rumped Swallow (Bulit & Massoni 2004), but it is not clear if this is the most common nest structure in our study population. Further data is needed for describing nests from this locality in more depth, and for studying nest variation and its potential causes.

The extreme use of feathers for nest building could be a consequence of a relatively cold breeding season, but given that we found both "feather" and "typical" nests during 2013 and 2014, we cannot suggest how likely is this scenario. However, an opportunistic use of abundantly available feathers near the nesting sites could be an appealing and simpler explanation for the presence of "feather" nests in this population of Chilean Swallows. It is probable that the breeding adults could easily access a vast amount of feathers near the nesting site, making feathers the most energetically convenient item to collect, either by finding a corpse or a *Chloephaga* nest (see *e.g.* McCabe 1965), which are mainly made of self-plucked feathers. In any case (*i.e.* environmental adjustment or an opportunistic use of feathers, or both), the amount of feathers used in these nests seem an exaggerated response from the nesting birds involved, and thus, could reflect a rare behavior in this population. Further careful observations of nesting Chilean Swallows in both natural and artificial cavities will help determine the frequency of the extreme use of feathers at this study site or at ecologically similar localities, and the proximate causes promoting such behavior.

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