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DESCRIPTION OF THE NEST, EGGS, AND PARENTAL BEHAVIOR OF THE CLARION WREN (*TROGLODYTES TANNERI*), A VULNERABLE ISLAND-ENDEMIC SONGBIRD

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Descripción del nido, huevos y comportamiento parental de la Matraca de Clarion (*Troglodytes tanneri*), una especie endémica insular vulnerable.

Key words: Clarion Wren, *Troglodytes tanneri*, nest description, egg description, parental behavior, Clarion Island, Revillagigedo Archipelago.

INTRODUCTION

The Clarion Wren (*Troglodytes tanneri*) is a small songbird restricted to Clarion Island, an oceanic island in the Archipelago of Revillagigedo, Mexico. This species lives in open habitats throughout the island, which is 6.4 km wide by 9.7 km long (Howell & Webb 1989, Brattstrom 1990). The total population size is estimated to be 340 to 400 mature individuals (BirdLife International 2012). The International Union for the Conservation of Nature (IUCN) lists this species as "vulnerable" due to the susceptibility of the island to an invasion by small mammalian predators (e.g., mice, rats; BirdLife International 2012). Most aspects of the Clarion Wren's ecology and behavior – including the details of their eggs, nests, and parental behavior – are unknown or poorly known. Previous research has provided anecdotal descriptions of nests and eggs with scant details (Anthony 1898, Brattstrom & Howell 1956, del Hoyo *et al.* 2005). Here, we provide the first comprehensive and quantitative description of the nests, eggs, and parental behavior of this endemic and vulnerable songbird.

METHODS

We studied Clarion Wrens from 5–19 December 2011 at five sites on Clarion Island around the Navy garrison (Fig. 1). We observed and followed 35 pairs of wrens between the hours

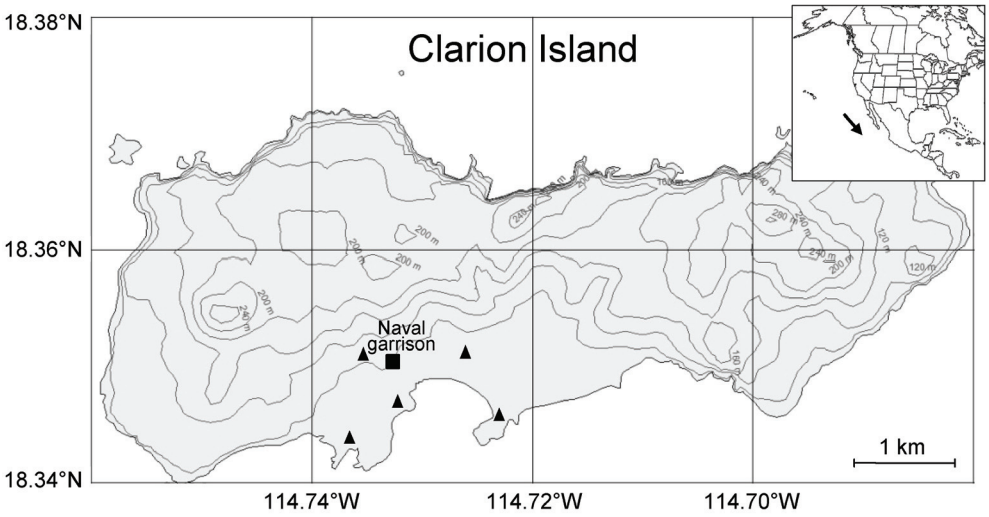

FIG. 1. Map of Clarion Island. Black triangles show the sites where Clarion Wrens were studied. The rectangle shows the location of the Navy garrison. Map based on open source map from Wikipedia.

of 06:00 to 17:00 h. We used mist nets to capture and band 42 birds, giving each animal a unique combination of colored leg bands to facilitate identification. Of these 42 birds, 19 birds were males holding a territory, 10 were males with an indeterminate territory or without territory, eight were females, and five were fledglings. We distinguished between the sexes by visual examination of the cloacal protuberance or brood patch. Later observations of vocal behavior confirmed that individuals categorized as males were more vocally active. We found 13 nests and were able to collect detailed measurements for nine of them (some nests were in cliff or sites with restricted access).

RESULTS AND DISCUSSION

Nests and nest construction. Clarion Wrens build their nests in cavities in diverse substrates like pockets of volcanic rock and sand, as well as cavities in anthropogenic equipment such as metal and rubber tubes, buildings, boats, and vehicles (Fig. 2). Nests were not restricted to abandoned equipment as reported by Santaella & Sada (1991); we observed three nests in buildings and a boat which were regularly used by humans. Nest cavities were at an average height of 183.2 ± 24.36 cm (all values are mean ± SE) from the ground (n = 9; range: 90 – 296 cm). The average entrance diameter of cavities was 7.6 ± 1.1 cm wide (n = 9; range: 3.5 – 13.5 cm) by 9.11 ± 1.2 cm tall (n = 9; range: 6 – 18 cm). Cavities had a depth of 25.8 ± 4.8 cm (n = 9; range: 7 – 51 cm). Inside the cavities, wrens placed small sticks and grass blades at the bottom, forming a nest cup with an inner diameter of approximately 3 cm and no more than 5 cm deep. Wrens lined these nest cups with feathers, making a platform that usually filled the bottom of the cavities. Unlike Anthony's (1898) observation, we did not find nests in thick bushes or open cups on the ground. The most open nest we observed was a nest being built by a pair of birds on the top of a water pump, in a semi-open site. This observation, together with Anthony's (1898) observation, suggests that this species' nesting behavior is

FIG. 2. Photographs of three nests of Clarion Wrens, showing the diverse substrates of nests used by this island-endemic songbird. The pictures reveal diverse substrates used by wrens: (a, b) a nest in a cavity in volcanic rock; (c, d) a nest inside a metal tube; (e, f) a nest inside an abandoned vehicle. Arrows show the entrance of the nests.

not restricted to cavities. Furthermore, the diversity of nests we found (e.g., Fig. 2) suggests that this species' nesting behavior is quite versatile with respect to nest placement.

Although we were not able to observe every step in the construction process of nests (i.e., pre-pairing and post-pairing), we observed the behavior of three pairs during

the post-pairing, nest-building stage. Both females and males helped in the construction of the nests, carrying sticks and grass to the nest. The effort, however, was not equally distributed across the sexes, with females consistently working more than males, as has been shown in the closely-related House Wren (*Troglodytes aedon*) (Johnson 1998).

During observations of nest construction (n = 4.5 h of observation at three different nests), males waited for females just outside the nest cavity, close to the nest entrance, singing a song every time females went out searching for nesting material. Often, males waited close to the nest, sometimes looking for food in the immediate proximity of the nest, and repeated their singing behavior every time the female brought material to the nest. On at least two occasions, we observed males following females to the site where the female was gathering material. The male then sang a song from atop a bush or a nearby perch while females gathered material from the ground. The male then followed females back to the nest. We observed two females carrying material to their nests continuously for multiple days; in the first case, we observed a female carrying nesting material for four continuous days, and in the second case six continuous days.

We also observed a pair reusing an old nest. The nest had been used previously by a neighboring pair, where we observed a female and two nestlings. Nine days later, we observed a different pair of birds begin adding material to the nest. This behavior has also been observed in House Wrens, a species known to prefer previously-used conspecific nests rather than empty cavities (Johnson 1998).

Eggs and clutch size. We found a single nest with eggs (Fig. 3). Eggs were short, rounded ovate to oval. We measured two of the eggs, and they had a length of 17.7 mm and a breadth of 14.0 mm. Brattstrom & Howell (1956) reported measurements of three eggs, with an average length of 19.8 mm and breadth of 14.0 mm. Adult Clarion Wrens have larger body sizes than adult House Wrens on the continent (House Wrens are the presumed ancestors of Clarion Wrens; Johnson 1998) and this pattern appears to hold true in the two species' eggs; House Wren eggs are 16.6 mm in length and 12.6 mm in breadth (Johnson 1998). Clarion Wren egg color was similar to House Wren egg color (Brattstrom & Howell 1956, Johnson 1998). The ground color of the eggs was white to pinkish white, with small, pink to brownish spots that were concentrated at the large end of the egg. Overall, the shell had a pink to brownish color at the larger end and a white to pinkish color in the smaller end, with more defined spots at the smaller end (Figs 3b–c). As with their size, the color of Clarion Wrens' eggs is similar to those of House Wrens, but with a smaller amount of spots and less brown coloration (Brattstrom & Howell 1956, Johnson 1998).

The only nest we observed with eggs had a clutch size of four eggs. We observed three additional nests that had four nestlings each; none of them with remaining eggshell in the nests. Together with our observations of fledglings (see below), we argue that the clutch size of Clarion Wrens appears to have a maximum of four. It is likely that the clutch size of the Clarion Wren is smaller in comparison with House Wrens, with reported clutch size ranging from 4 to 8 eggs (Johnson 1998).

Parental behaviour. We detected brood patches only for female Clarion Wrens. Of a total of 36 mature birds caught, eight females had a very pronounced brood patch extending from the breast to the abdomen. At least two of these birds were feeding nestlings. Of the 29 males captured, 24 had a very marked cloacal

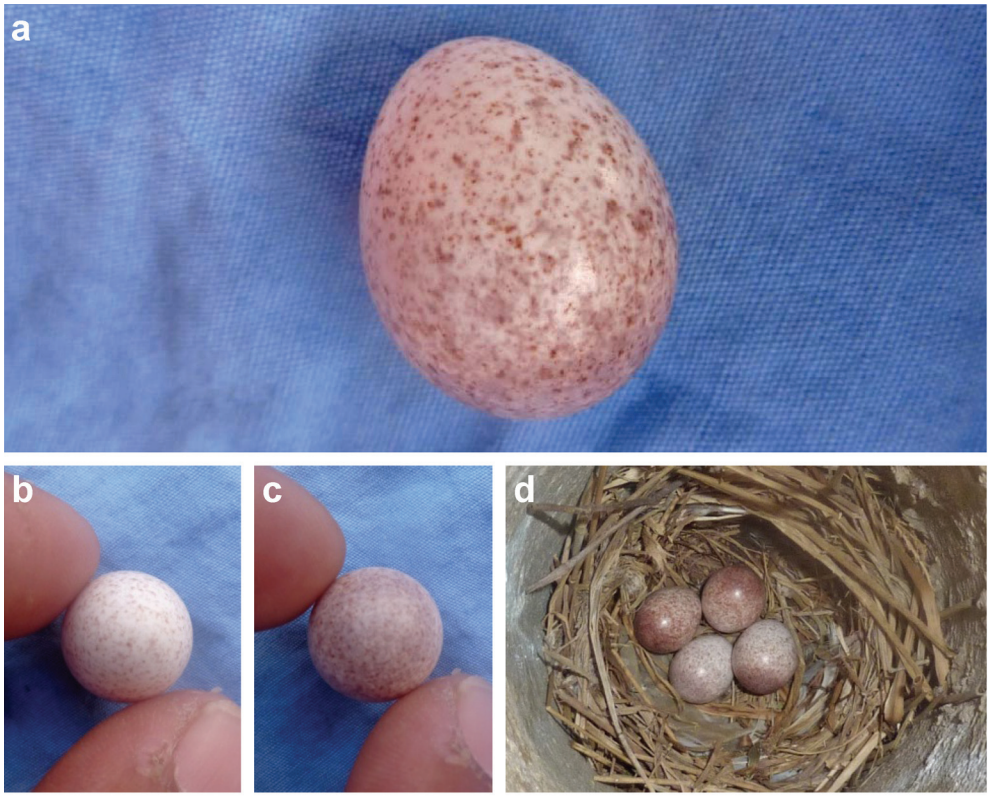

FIG. 3. Photographs of the eggs of a Clarion Wren. (a) Egg shells have a pinkish white ground color with pink to brownish spots. (b) The smaller end of the egg has sparser, well-defined spots. (c) The blunt end of the egg has denser spots. (d) A nest with a clutch of four eggs, which appears to be the typical clutch size for this species.

protuberance. The cloacal protuberance of males was typically extended approximately 3 mm.

We tracked the parental behavior of the pair that had eggs for four days from the day the nest was found until the day that two eggs were hatched. Both parents were banded. We collected observations at least twice per day. Every time we observed the nest, the female was inside the nest, suggesting that only females incubate in this species. The male was usually nearby the nest. Sometimes the male sang a song when we were close by, a behaviour that may be consistent with a predator warning system to the female inside the nest, a similar behavior has also been reported in House Wrens (Kendeigh 1952, Ziolkowski *et al.* 1997).

We observed eight pairs where both parents were feeding young. All our observations suggest that adults carry one prey item at a time. Prey consisted mainly of caterpillars, spiders, and crickets (*Gryllus alexanderi*, Otte & Cowper 2007), which are common insects on Clarion Island (Brattstrom 1990). We also observed parents removing fecal sacs and dropping them outside the nest at distances > 10 m.

In one territory where the breeding pair was banded, we observed a foreign male

feeding the fledglings of the banded male. It was not clear whether this male was the offspring from the territory-holding banded male from a previous year, or a neighbor. We did not observe any visual aggression from the territory-holding male against this "helper male". The helper male had no cloacal protuberance. We also observed the same individual going inside the nest of the territory-holding male, suggesting that Clarion Wrens may exhibit cooperative breeding. Although cooperative breeding is common among members of the Troglodytidae, it has been rarely reported in the genus *Troglodytes* (Stafford 1983, Johnson 1998, Timson & Farley 2003, del Hoyo *et al.* 2005).

After fledging from the nest, young birds remained within the territory of their parents. We observed one territory with three fledglings, five territories with two fledglings, and two territories with one fledgling. On five continuous days, we tracked two territories with fledglings. We found that fledglings frequently perched in small bushes. Both parents contributed to feeding the young. Although we did not measure the relative contribution by the parents, our observations suggest that females spent more of their time feeding the offspring, whereas males spent more time defending and singing in their territories. We do not know the length of the period that fledglings remain on their parent's territories; however, we observed one pair that was feeding two fledglings throughout the period from 5–14 December 2011. By 14 December, the pair had begun constructing a new nest, and after this day, we did not see the pair feed their offspring again. Our observations suggest that Clarion Wren offspring remain with their parents for at least 10 days, similar to the observed behavior of House Wrens (Kendeigh 1941).

The length and timing of the Clarion Wren breeding season is unknown. Young birds have been observed in May (in 1897; Anthony 1898, del Hoyo *et al.* 2005). Other observations reported some territorial defense and males actively singing in March (in 1953; Brattstrom & Howell 1956). Howell & Webb (1989) report parents feeding young in late February, and suggest that Everett's (1986) field observations are consistent with nesting in January. On 19 November 2011, we visited the island for one day and observed young birds in one territory. During our stay at the island in December 2011, we observed three pairs constructing their nests, one pair brooding, seven pairs with nestlings, and eight with fledglings. Based on our observations and previous reports (Anthony 1898, Brattstrom & Howell 1956, Everett 1986, Howell & Webb 1989), we believe that the breeding season starts, at least, in October and ends by May. However, whether there is only one reproductive peak per year is unclear. Research on other species of songbirds in the Revillagigedo Archipelago, other Pacific oceanic islands, and Atlantic islands shows that birds breed opportunistically when the weather is appropriate (e.g., Martínez-Gómez & Curry 1995, Grant *et al.* 2000, Hau *et al.* 2004, Illera & Díaz 2006). The same may be true of Clarion Wrens.

In general, our observations of the nests, eggs, and breeding behavior of Clarion Wrens are similar to the information available for other species in the genus *Troglodytes* (del Hoyo *et al.* 2005). Clarion Wrens share many similarities with House Wrens, their presumed mainland ancestor (Johnson 1998). Previous anecdotal observations by Anthony (1898) and Brattstrom & Howell (1956) provided some insight into eggs and nests of this island endemic, but our study provides the first details on position and structure of nests, clutch size, parental behaviour, and breeding activities. Uniquely, we have shown that Clarion Wrens use a diverse variety of substrates to build their nest, and we present the first documented instance of intraspecific

helping behavior in this poorly known species. Our report provides the first formal description of the eggs, nests, and breeding behavior of the Clarion Wren.

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