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CONSPECIFIC EFFECT ON HABITAT SELECTION OF A TERRITORIAL CAVITY-NESTING BIRD

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ABSTRACT.—The simulated presence of conspecifics has been proposed to attract territorial songbirds to protect nesting areas when the habitat is being disturbed by human activities. We studied the effects of conspecifics on the nest-site selection of the Thorn-tailed Rayadito (*Aphrastura spinicauda*; Furnariidae), a forest songbird that depends on cavities for nesting. Plantations represent usable habitat for foraging, but the scarcity of cavities restricts their use during the breeding period. The use of nest boxes is a documented measure to mitigate the negative effect of plantations on cavity users. We installed nest boxes in a plantation of *Pinus radiata* in south-central Chile, using the simulated presence of conspecifics as a potential tool to attract rayaditos to new available sites to nest. We simulated the presence of conspecifics through playback during 45 days prior nest building. Our results showed two contrasting outcomes. Firstly, conspecific simulation attracts rayaditos, by increasing their density before playback experiments by 75%. Secondly, rayaditos tended to avoid playback treatment sites as nesting started. The establishment of nests occurred 71% of the time and started 20 days earlier in control sites compared to playback treatment. Other secondary cavity-nesting birds, such as the House Wren (*Troglodytes aedon*; Troglodytidae) and White-throated Treerunner (*Pygarrhichas albogularis*; Furnariidae), also avoided playback plots as nesting sites. The scarcity of cavities in pine plantations may increase the aggressive defense of breeding territories, making cavity-nesting birds move to other previously known vacant sites to nest when they listen other birds in the nesting site. It is highly recommended to assess the behavioral response to conspecific and heterospecific birds before the establishment of a management measure aiming to attract or discourage the presence of a target species. Received 11 July 2013. Accepted 20 March 2014.

Key words: cavity-nesting birds, conspecific attraction, habitat selection, forest management, territorial behavior.

Avian social behavior, among other factors such as habitat quality and quantity, is a main feature influencing the selection of a suitable breeding site (Scott and Lee 2013). Individuals of the same species could represent a signal of avoidance or attraction for prospective settlers, when looking for habitat for survival and reproduction (Matyjasiak 2005, Doligez et al. 2008). An avoidance effect of conspecifics is usually observed in territorial species with aggressive interactions (Baltz and Clark 1999), whereas an effect of attraction is observed in gregarious species, such as colonial birds (e.g., Danchin et al. 1998, Vasquez and Kacelnik 2000, Serrano et al. 2001).

The classic model for density-dependent habitat selection predicts that individuals of territorial species might refrain from using areas with conspecifics to avoid density-dependent fitness losses (Fretwell and Lucas 1969). However, there is increasing evidence that some territorial birds

may be attracted by the presence of conspecifics, presumably because it is a sign of habitat quality or offers a higher probability of finding a reproductive partner. Ward and Schlossberg (2004) published the first account of territorial passerines being attracted by the simulation of conspecifics. Forest managers use simulated conspecifics to attract territorial songbirds to refuge zones in order to increase bird density and mitigate the effects of anthropogenic habitat disruptive actions (Ahlering and Faaborg 2006, Hahn and Silverman 2007). However, cues used to select breeding territories by many bird species are poorly understood, and the consequences of simulated conspecifics as a management technique are uncertain.

In habitat selection studies that have simulated the presence of conspecifics, little information about the conspecific effect on secondary cavity-nesting birds is available, even though they may be strongly affected by the reduction in nest-site availability because of forest management (Wiebe 2011). There is also a lack of information on the response of sedentary species to conspecifics, as most studies have focused on migratory territorial birds (e.g., Ward and Schlossberg 2004, Ahlering et al. 2006, Hahn and Silverman 2006).

Analyzing the effects of male song on female House Wrens, Johnson and Searcy (1996) assessed the effect of a simulated conspecific in a short-

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distance migrating and cavity-nesting bird. They provide evidence that the song of males can attract females as potential mating partners. However, that study did not evaluate the effect of conspecifics during nesting establishment, which is highly relevant in order to assess a measure aimed to attract cavity-nesting birds to protected areas when habitat is being disturbed.

We studied the response to conspecific simulations on the Thorn-tailed Rayadito (*Aphrastura spinicauda*; Furnariidae), a small insectivorous and territorial bird that inhabits the woodlands of Chile and southern Argentina, distributed from Fray Jorge National Park (30° S) to the Cape Horn region (56° S). The Thorn-tailed Rayadito gleans prey from twigs, branches, and trunks from understory to canopy and nests in cavities of trees (Grigera 1982, Moreno et al. 2005, Moreno et al. 2007) and sometimes in earth cavities or even in man-made constructions (Johnson and Goodall 1967). The Thorn-tailed Rayadito is considered a resident species in the forests of south-central Chile and does not engage in any extensive migration (Lencinas et al. 2005, Ippi et al. 2009).

Industrial plantations of exotic *Pinus radiata* have largely replaced the native forests of south-central Chile, affecting biodiversity by homogenizing the landscape (Muñoz-Pedrerós et al. 1996, Vergara and Simonetti 2003). These plantations represent usable foraging habitat for insectivorous birds (Estades and Escobar 2005), but the scarcity of cavities restricts their use during the breeding period for cavity-nesting birds (Vasquez and Simonetti 1999, Estades 2001). The Thorn-tailed Rayadito constitutes a proper model for the study of conspecific simulation as a management technique because of the species' dependence on cavities for nesting (Tomasevic and Estades 2006). The installation of nest boxes is an important measure to mitigate the negative effect of pine plantations on Thorn-tailed Rayaditos (Quilodrán et al. 2012). Therefore, we installed nest boxes for habitat improvement in an 18-year old pine plantation to evaluate whether the simulated presence of conspecifics can be used as a potential tool to attract Thorn-tailed Rayaditos to new available nesting sites.

METHODS

Study Area.—The study was carried out during the austral spring of 2009 (last week of Aug to first week of Dec), in a private plantation (San Pedro/Las Cañas) of *Pinus radiata* in the Maule

region, south-central Chile (near 35° 29' S, 72° 21' W). Originally the region was covered by a deciduous forest dominated by *Nothofagus glauca*, which started to be exploited in the early nineteenth century to provide wood for naval shipbuilding (San Martín and Donoso 1996). Currently, the area represents one of the largest plantations of *P. radiata* in the country, covering 76% of the Maule region landscape (Estades and Temple 1999).

Sampling Design.—We used 60 sampling plots of 50-m radius in 18-year-old pine plantations (Fig. 1). The plots were spaced at least 200 m from the center of each plot, where we set three nest boxes in distinct orientations. The plots were considered statistically independent, i.e., without pseudo-replication because of bird territories overlapping, as the activity of rayadito breeding pairs are known to be conducted within a radius of 30 m (see van Dongen et al. 2009). Nest boxes were 25-cm high, 16-cm wide, with an entrance hole diameter of 30 mm. They were mounted on tree trunks (>30 dbh) at 2.5–4.5 m above the ground and were checked weekly, registering any sign of nesting activity (i.e., intrusion of branches and feathers).

Conspecific Simulation.—The presence of conspecifics was simulated by playback through portable MP3 reproducers (iPulse digital) and speakers (XtremeMac MicroBlast) installed on tree trunks. They were placed in wood platforms at 2 m above the ground, in 30 of the 60 sampling plots. The remaining plots were considered as controls. Treatments were arranged in blocks of ten plots in order to avoid the influence of playback in control sites (see Fig. 1). The playback was composed of 45 min of different songs of Thorn-tailed Rayaditos, 5 min of the alarm call, 10 min of silence, and 10 min of sympatric heterospecific songs (belonging to the following species: *Troglodytes aedon*, *Pygarrhichas albogularis*, *Sporagra barbata*, *Anairetes parulus*, *Scytalopus magellanicus*, and *Eugralla paradoxa*). Each different track lasted 1 min and was repeated randomly. The heterospecific songs and silence were included to avoid habituation to the playback. The procedure was repeated for an hour between dawn and noon (0700 to 1200 h Chile Summer Time [CLST]) during the pre-nesting period (10 Aug to 24 Sept 2009). Treatment was ended when the first signs of nesting were recorded. The sound level was standardized to a maximum of 80 dB measured

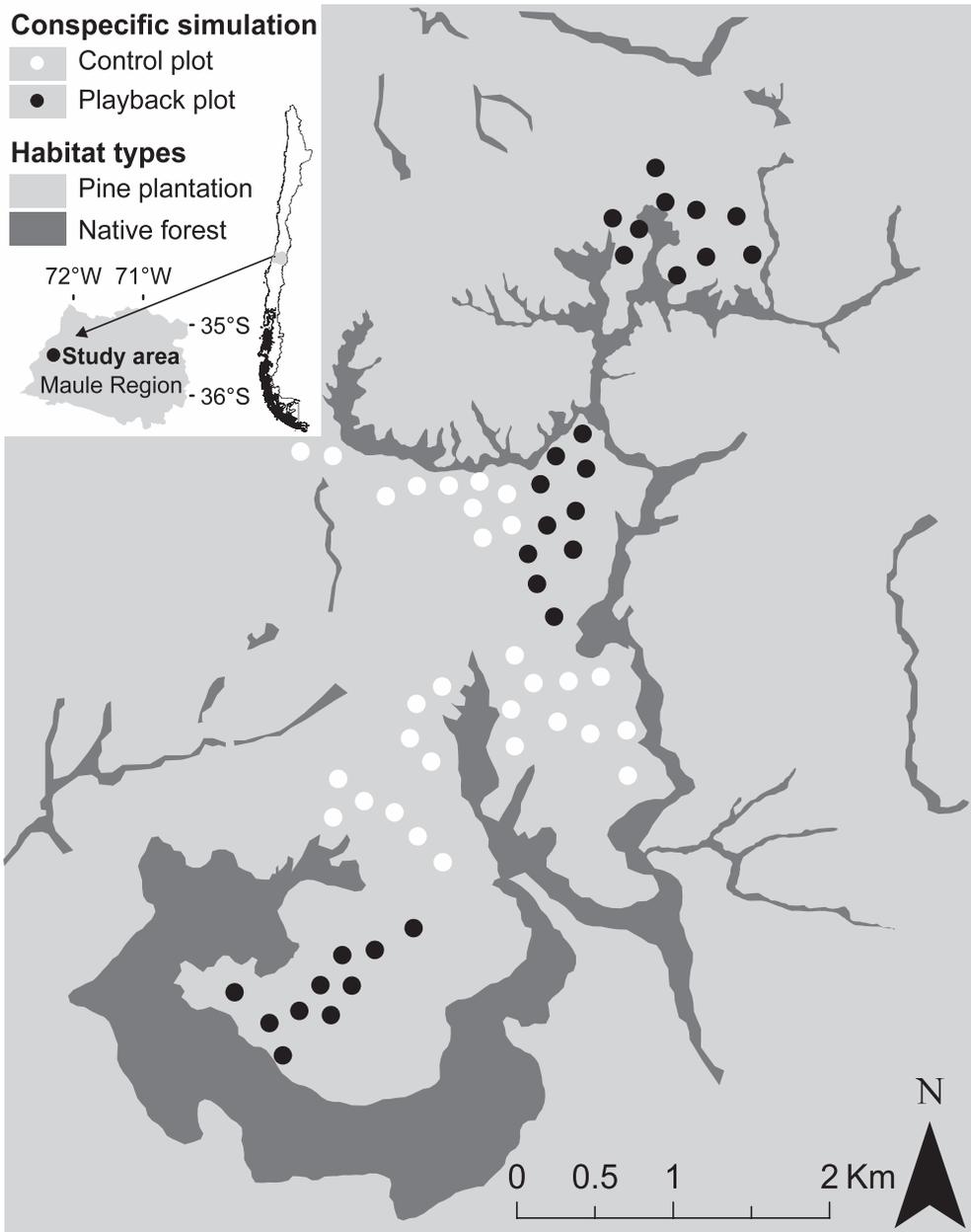


FIG. 1. Study area in the pine plantation San Pedro/Las Cañas, Maule region, south-central Chile (near $35^{\circ} 29' S$, $72^{\circ} 21' W$). The remnants of native *Nothofagus* forest (dark grey) are embedded in a plantation of *Pinus radiata* (light grey). This study consisted of nest box installations and simulation of Thorn-tailed Rayaditos (*Aphrastura spinicauda*) by using playbacks in order to evaluate the effects of conspecifics on nest-site selection.

at 1 m from the speakers. No decoys (e.g., stuffed birds) were used because of their low efficiency in experiments of conspecific attraction in other species (see Ward and Schlossberg 2004, Ahlering et al. 2006).

Bird Counts.—We estimated density of Thorn-tailed Rayaditos by using a distance sampling method (i.e., variable-radius point counts; Buckland 1987). The number of birds was recorded in five concentric rings at each sampling plot

(maximum radius of 50 m, 10-m increments from each plot's center), during two consecutive 5-min counts, separated by a pause of 5 min. Observations were conducted between sunrise and midday (0700 and 1200 h). The procedure was repeated four times. First, before starting the playback treatment (pre-treatment count), then twice during the playback period (during treatment counts, separated by 5 weeks), and subsequently, a final count, 2 months after the end of the playback treatment, which coincided with the end of nesting activities (post-treatment count). Playback treatment was stopped during the days of counting. No counts were conducted on rainy days.

Vegetation Attributes.—In order to control for the potential influence of vegetation in nest-site selection, we characterized the vegetation in a 50-m radius circle on every sampling plot, estimating the number of trees per hectare, canopy height, mean diameter at breast height (dbh) and basal area of trees with dbh >10 cm. We visually estimated percentage cover of shrub, ferns, grasses, and fallen dead trees. Foliage volume was determined by dividing each plot in four different layers: 0–0.30 m, 0.31–2 m, 2.01–6 m and >6 m. At each level, foliar cover was estimated visually and total foliar volume was calculated as the sum of the coverage of every layer multiplied by its height in meters (see Estades and Temple 1999).

Data Analysis.—Generalized Linear Mixed Models (GLMM) were used to explore the effects of conspecific simulation on breeding site selection. Data structure corresponded to six blocks (3 for controls and 3 for playback treatments) with 10 plots in each one. Blocks were incorporated as a random effect in all analyses. The rayadito local density (individuals per hectare) was analyzed with a Gaussian distribution, incorporating the interaction between playback treatment and the counting periods as fixed effects. The latency of nest box use (time spent in using nest boxes since the beginning of the experiment with playback, measured in days) was analyzed with a Poisson distribution taking into account the subsample of occupied plots. The plot occupancy was considered a dummy variable response in a GLMM with binomial distribution. We used the playback treatment as a fixed effect in these two analyses, incorporating the third count of rayadito local density as a covariable, which coincides with the beginning of nesting activity. The model selection

considered the smallest value of the Akaike information criterion (AIC) and a likelihood ratio test on marginal effects of fixed factors (see Appendix).

With a 95% confidence interval, the vegetation did not differ between playback and control plots (Table 1). Although predominant vegetation was pine (*P. radiata*), the presence of native specimens of hualo (*Nothofagus glauca*), coigüe (*Nothofagus dombeyi*), canelo (*Drimys winteri*), arrayán (*Eugenia apiculata*), chaura (*Gaultheria* sp.), and peumo (*Cryptocarya alba*) was recorded in the understory. Additionally, we used foliage volume, the number of trees per hectare, canopy height, dbh, and basal area as predictors of the local density of Thorn-tailed Rayadito (Gaussian GLMM). None of these vegetation variables have significant effects on the density of Thorn-tailed Rayaditos, when we consider all sampling plots or only the plots with playback treatment ($P = 0.53$, $F_{5,54} = 0.84$, $n = 60$, $P = 0.5$, $F_{5,24} = 0.9$, $n = 30$). We also evaluated whether the distance among nests had an effect on the establishment in control or playback plots (Binomial GLMM). The distance between nests did not affect the establishment of rayaditos in the nest boxes installed in the pine plantation ($Z = 0.48$, $P = 0.63$, $n = 60$). Therefore, we did not consider the vegetation attributes or the distance between nests as covariates in the models that explore the effect of playback treatment on nest-site selection of Thorn-tailed Rayaditos. All the analyses were performed using the software R (R Development Core Team 2012). When performing GLMMs, we used multiple comparisons to assess the distance among nests by using the packages lme4, multcomp, and spatstat.

RESULTS

The selected model that explains the local density of Thorn-tailed Rayaditos considered the period of time in which we counted birds and performed the treatment with playback (Fig. 2, see Appendix). During the first count, which was executed before the start of playback treatment (pre-treatment count), no difference on rayadito abundances was observed between control and playback plots (Estimate \pm SD = -0.23 ± 0.7 , $Z = -0.31$, $P = 0.99$, $n = 60$). One week after beginning the conspecific simulation (first during treatment counts), the abundance increased significantly in plots with playback treatment; rayadito local density increased by 38.7% compared to

TABLE 1. Vegetation characteristics of playback ($n = 30$) and control ($n = 30$) plots in a plantation of *Pinus radiata*, south-central Chile.

	Playback ^a	Control ^a
Foliage volume (m ³)	5.390 ± 0.55	5.275 ± 0.47
Shrub cover (%)	40.16 ± 6.50	38.63 ± 6.72
Fern cover (%)	0.19 ± 0.11	0.18 ± 0.14
Herb cover (%)	12.13 ± 4.69	16.53 ± 5.06
Dead trees cover (%)	24 ± 5.65	20.06 ± 5.05
Number of trees (n°/ha)	608 ± 38.4	600 ± 54.5
Canopy height (m)	21.80 ± 0.89	21.82 ± 1.00
DBH (m)	0.88 ± 0.04	0.86 ± 0.06
Basal area (m ²)	879 ± 76.4	816 ± 77.7

^a Values presented as mean ± 95% CI.

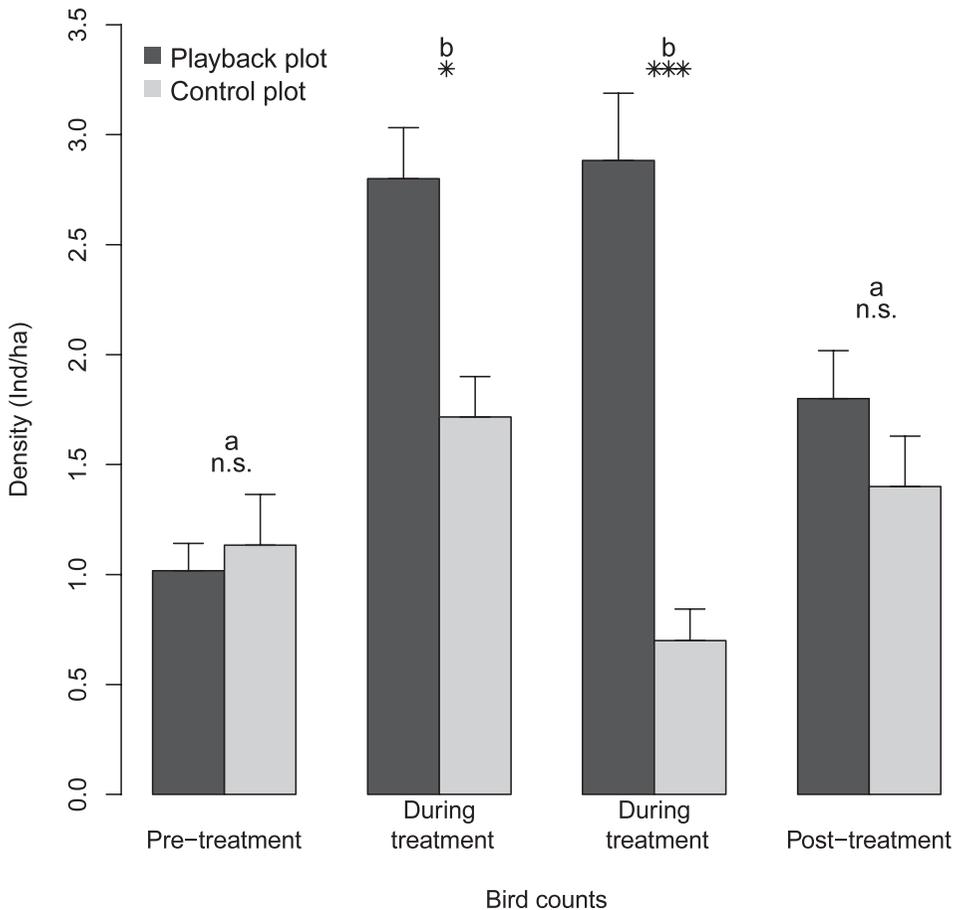


FIG. 2. Bird counts in playback and control plots. The counts were performed before, during (twice, separated by 5 weeks), and after the treatment of conspecific simulation by playback. The effects of playback treatment and period of counting were tested using a Linear Mixed Model with blocks as a random effect (see Methods). Asterisks denote significant differences between playback and control plot (* $P < 0.05$, *** $P < 0.001$, n.s. not significant). Different letters indicate significant difference ($P < 0.05$) across counting periods (*treatment* × *count* interaction, see Appendix).

control plots (Estimate \pm SD = 2.17 ± 0.7 , $Z = 2.84$, $P = 0.01$, $n = 60$). Five weeks later, the simulation was still active (second during treatment counts), and this difference increased to 75% (Estimate \pm SD = 4.37 ± 0.7 , $Z = 5.74$, $P < 0.001$, $n = 60$). However, 2 months after the end of the playback treatment and the full settlement of nests (post-treatment count), no significant differences in abundance between the control and playback plots were observed, returning to the trend observed before starting the conspecific simulation with playbacks (Estimate \pm SD = 0.8 ± 0.7 , $Z = 1.05$, $P = 0.07$, $n = 60$). Therefore, a positive effect of the conspecific simulation on the abundance of rayadito was observed during the treatment with playback.

Rayaditos started their nesting activity in 34 sampled plots. When a breeding pair occupied one of the three available nest boxes, no additional breeding pair was recorded at the same time in the two remaining boxes. The model selected for the latency in using plots for nesting considered the single effect of playback treatment, in the plots that the nesting activity started 20 days later in comparison to control plots (Estimate \pm SD = -0.93 ± 0.15 , $Z = -5.96$, $P < 0.001$, $n = 29$). An alternative model, incorporating the additional effect of rayadito local density, was not rejected by the model selection procedure (see Appendix). In this model, the local density of rayaditos had a negative effect on the latency in nest boxes used (Estimate \pm SD = -0.11 ± 0.02 , $Z = -4$, $P < 0.001$, $n = 29$). These results indicate a negative effect of the conspecific simulation on the preference for nesting sites.

No effect of rayadito local density was recorded on plots occupied by Thorn-tailed Rayaditos (Estimate \pm SD = -0.27 ± 0.19 , $Z = -1.14$, $P = 0.16$, $n = 60$). However, during the initial days of the nesting period, they used 57% of the sampling plots, and of these 29% were playback and 71% were control plots. When engaged in breeding activities, rayaditos preferred control sites more frequently, revealing a negative effect of playback treatment on breeding site selection (Estimate \pm SD = -1.75 ± 0.59 , $Z = -2.93$, $P = 0.003$, $n = 60$), and they maintained the same trend when considering only those pairs that finished building the nest and hatched nestlings in the nest box (Estimate \pm SD = -0.98 ± 0.54 , $Z = -1.8$, $P = 0.06$, $n = 60$).

Other secondary cavity-nesting species also used the nest boxes. For example, the White-

throated Treerunner (*Pygarrhichas albogularis*; Furnariidae) used 27% of the sampling plots. Although no effect of rayadito local density was recorded on the nesting preference of treerunners (Estimate \pm SD = -0.25 ± 0.2 , $Z = -1.3$, $P = 0.19$, $n = 60$), they significantly avoided playback plots for nesting (Estimate \pm SD = -1.46 ± 0.65 , $Z = -2.24$, $P = 0.02$, $n = 60$). The House Wrens (*Troglodytes aedon*; Troglodytidae) used 13% of the sampling plots. We recorded a negative effect of both rayadito local density (Estimate \pm SD = -1.19 ± 0.5 , $Z = -2.04$, $P = 0.04$, $n = 60$) and playback treatment (Estimate \pm SD = -2.18 ± 1.1 , $Z = -1.97$, $P = 0.04$, $n = 60$) on the nesting preferences of wrens. We also recorded one pair of Plain-mantled Tit-Spinetail (*Leptasthenura aegithaloides*; Furnariidae) nesting in a control site. These results indicate a negative effect of playback treatment on the nesting establishment of others sympatric cavity-nesting species.

No effects of plot occupancy by heterospecifics were registered on the nesting preference of House Wrens (Estimate \pm SD = 0.63 ± 0.9 , $Z = 0.73$, $P = 0.47$, $n = 60$), White-throated Treerunners (Estimate \pm SD = 0.91 ± 0.6 , $Z = 1.41$, $P = 0.16$, $n = 60$), and Thorn-tailed Rayaditos (Estimate \pm SD = 0.72 ± 0.6 , $Z = 1.14$, $P = 0.25$, $n = 60$).

DISCUSSION

The simulated presence of conspecifics reduced the use of nest boxes by breeding Thorn-tailed Rayaditos. As expected, rayaditos more frequently explored the playback sites during the pre-breeding weeks, but as nest building started they tended to avoid these sites for nesting. These results could be explained by the social behavior of rayaditos. Even if they are highly territorial during the breeding season (Ippi et al. 2011), they form mixed-species flocks during the rest of the year, being characterized by a high level of intraspecific gregariousness and stimulating the formation and cohesion of conspecific and heterospecific flocks (Vuilleumier 1967, Ippi and Trejo 2003).

The aggressive social interactions during the breeding season could outweigh the benefits of conspecific attraction in the pre-nesting period, because a close male would represent a direct threat to the territory, paternity, or success of the offspring (Fotheringham et al. 1997). During breeding season, rayaditos establish a nesting territory that is protected aggressively against both conspecific and heterospecific intrusions

(Ippi 2009, Ippi et al. 2011). Furthermore, when holes are a limiting resource for nesting, birds may avoid cavities already occupied to escape competitive interaction among reproductive individuals (e.g., Gustafsson 1987).

Although White-throated Treerunners often join mixed-species flocks while foraging (Ippi and Trejo 2003), they avoided rayadito simulation sites for nesting, as was also observed for wrens. While it is not possible to demonstrate if there are dominant or subordinate species in our system, the simulation of Thorn-tailed Rayaditos during playback could represent social cues about the costs associated with competition for conspecific and sympatric heterospecific species. Fletcher (2007) simulated the presence of conspecifics and heterospecifics for strong and weak competitor passerines: the dominant species was attracted by both signals, while the subordinate species was still attracted by conspecifics but avoided heterospecifics.

The use of social signals in habitat selection studies has been widely documented in birds (e.g., Alatalo et al. 1982, Doligez et al. 2008). The usage frequency of this signal varies according to age and reproductive experience. It is usually more important for inexperienced young or for males from unsuccessful reproductive events (Etterson 2003, Nocera et al. 2006). Social cues could also be important in environments where the individual encounters large landscapes, as occurs for migratory birds, where the time available to explore and assess the quality of different patches of habitat is less than that for resident species (Forsman et al. 2009). Migratory species, using signaling from conspecifics, could reduce the costs associated with finding resources for nesting (Doligez et al. 1999, Mukhin et al. 2008). Contrary to Thorn-tailed Rayaditos, other territorial songbirds attracted by conspecifics during the breeding season, display a migratory behavior that could also influence the attraction effect of playbacks (e.g., Mills et al. 2006, Betts et al. 2008).

The potential value of social cues positively discriminated for habitat selection could show a trade-off with negative competitive relationships between individuals (Seppanen et al. 2007). For instance, nest-box experiments with Collared Flycatcher (*Ficedula albicollis*) have demonstrated the use of social cues on breeding habitat selection after migration. The breeding success of conspecific pairs is associated with the distribution of nests in the following reproductive season.

Competitive interaction for nest-boxes with conspecifics, as well as with heterospecifics, as Great Tits (*Parus major*) or Eurasian Blue Tits (*Cyanistes caeruleus*), could cause less competitive individuals to disperse to less successful breeding areas (Doligez et al. 2002, Doligez et al. 2004, Parejo et al. 2005).

Considering the attraction effect of conspecific on the abundance of Thorn-tailed Rayaditos before nesting and the formation of mixed species flocks, a projection of this study could be to assess whether a shorter use of conspecific simulation generates a different trend in the use of nest boxes. The songs may have acted as an initial attraction to visit sites where there were unknown cavities for birds, but they did not have the negative effect of simulating the existence of an individual with a persistent territorial behavior. Although we used the same protocol validated by Ahlering et al. (2006) to implement the playback experiments, the use of several types of songs in our study, with some songs being either territorial or heterospecific songs, might have been confusing for individual Thorn-tailed Rayaditos (Ippi et al. 2011). This study was conducted in a pine plantation only, and may produce different results in other habitat types. The scarcity of cavities in pine plantations could increase the value of having access to breeding territories, which could be defended more aggressively than those in native forest, where there are abundant resources to nest. Future studies could use bird tracking and analysis in different habitats in order to confirm the attraction and avoidance of conspecifics prior and post nesting activity.

The simulated presence of conspecifics has great potential as a tool for conservation and wildlife habitat management. It has been used successfully to attract territorial or colonial endangered birds to areas of protection (e.g., Podolsky and Kress 1992, Kress 1997, Ward and Schlossberg 2004, Harrison et al. 2009) and it has been shown to mitigate the negative effects of habitat fragmentation (Fletcher 2006, 2009). However, it does not seem to be a recommended tool for attracting Thorn-tailed Rayaditos to new available sites to breed in pine plantation. Their non-migratory behavior could make rayaditos less subject to social cues in habitat selection than the previously studied species with long migratory patterns, the scarcity of cavities in pine plantation could increase the aggressive defense of breeding territories, influencing rayaditos to move to other

previously known vacant sites to nest. Further management measures should assess the behavioral response of conspecific and heterospecific birds before the establishment of an approach aiming to attract or discourage the presence of target bird species. Finally, incorporating social cues that positively or negatively affect the decisions about habitat use have the potential to improve the predictive power and the management implications derived from models of habitat selection.

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APPENDIX. Model selection of fixed effects. The selected model has the smallest value of Akaike Information Criterion (AIC). We performed a likelihood ratio test between the selected model and the ones with less than two units of AIC difference.

Models	AIC	Δ AIC	df	Likelihood ratio test	
				χ ²	P
Rayadito density (n = 60, var(1block) = 0.08)					
<i>Treat + Period + Treat x Period</i>	768.88	-			
<i>Treat + Treat x Period</i>	768.88	<0.01	10	<0.01	0.99
<i>Period + Treat x Period</i>	768.88	<0.01	10	<0.01	0.99
<i>Treat x Count</i>	768.88	<0.01	10	<0.01	0.99
<i>Treat + Period</i>	794.86	25.98			
<i>Period</i>	800.36	31.49			
<i>Treat</i>	816.22	47.34			
-	821.72	52.85			
Rayadito latency (n = 29, var(1block) = 0.08)					
<i>Treat</i>	228.26	-			
<i>Treat + Ray</i>	228.63	0.37	4	1.63	0.20
<i>Treat + Ray + Treat x Ray</i>	229.57	1.31	5	2.69	0.26
<i>Treat + Treat x Ray</i>	229.57	1.31	5	2.69	0.26
<i>Ray + Treat x Ray</i>	242.53	14.27			
<i>Treat x Ray</i>	242.53	14.27			
<i>Ray</i>	250.13	21.87			
-	263.41	35.15			
Rayadito occupancy (n = 60, var(1block) = 0.04)					
<i>Treat</i>	78.01	-			
<i>Treat + Ray</i>	80.01	1.99	4	<0.01	0.99
-	81.90	3.90			
<i>Treat + Ray + Treat x Ray</i>	82.00	3.99			
<i>Treat + Treat x Ray</i>	82.00	3.99			
<i>Ray</i>	82.16	4.15			
<i>Ray + Treat x Ray</i>	83.15	5.14			
<i>Treat x Ray</i>	83.15	5.14			
Treerunner occupancy (n = 60 ^a)					
<i>Treat</i>	67.94	-			
<i>Treat + Ray</i>	69.86	1.92	4	0.08	0.77
-	71.59	3.65			
<i>Ray + Treat x Ray</i>	71.60	3.66			
<i>Treat x Ray</i>	71.60	3.66			
<i>Ray</i>	71.71	3.77			
<i>Treat + Ray + Treat x Ray</i>	71.83	3.89			
<i>Treat + Treat x Ray</i>	71.83	3.89			
Wren occupancy (n = 60 ^a)					
<i>Ray</i>	42.26	-			
<i>Treat + Ray</i>	43.55	1.29	4	0.71	0.40
<i>Treat x Ray</i>	43.55	1.29	4	0.71	0.40
<i>Ray + Treat x Ray</i>	43.55	1.29	4	0.71	0.40
<i>Treat</i>	45.37	3.10			
<i>Treat + Ray + Treat x Ray</i>	45.38	3.11			
<i>Treat + Treat x Ray</i>	45.38	3.11			
-	49.12	6.86			

Treat = treatment plot (control vs playback); *Period* = counting period of rayadito density; *Ray* = rayadito local density (third period, which coincides with starting nesting activity); *var* variance of random factor; *x* = interaction.

^a Random intercept 1block removed due to negligible variance (*var* < 0.001).