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## Overwintering Bicknell's Thrush (*Catharus bicknelli*) in Puerto Rico—rare and local

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*Photo: Christopher C. Rimmer*



## Overwintering Bicknell's Thrush (*Catharus bicknelli*) in Puerto Rico—rare and local

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**Abstract** To clarify the distribution, relative abundance, and habitat associations of overwintering Bicknell's Thrush (*Catharus bicknelli*) in Puerto Rico, we conducted extensive surveys during the winters of 2015 and 2016 in a variety of forested habitats at varied elevations. We detected 11 Bicknell's Thrushes, 10 of which were at high elevations in the Cordillera Central, from Monte Guilarte State Forest (1,060 m above sea level [asl]) and Cerro Morales (827 m asl) in the west, to the Cerro Punta area (1,199–1,228 m asl) in the east. A single individual was found just outside the border of El Yunque National Forest at 748 m asl. These results confirm that Bicknell's Thrush is a rare and local, though possibly regular, overwintering species in Puerto Rico. Our findings affirm the strategic importance of continuing to focus conservation efforts on Hispaniola, especially in the Dominican Republic.

**Keywords** Bicknell's Thrush, *Catharus bicknelli*, elfin forest, playback surveys, probabilistic sampling, Puerto Rico

**Resumen** Estadía invernal de Zorzal de Bicknell (*Catharus bicknelli*) en Puerto Rico: raro y local—Para esclarecer la distribución, la abundancia relativa y las asociaciones de hábitats de la estadía invernal de Zorzal de Bicknell (*Catharus bicknelli*) en Puerto Rico, llevamos a cabo amplios muestreos durante los inviernos de 2015 y 2016, en una variedad de hábitats boscosos a diversas altitudes. Detectamos 11 individuos de esta especie, 10 de ellos en elevaciones altas en la Cordillera Central, desde el Bosque Estatal de Monte Guilarte (1.060 m sobre el nivel del mar [msm]) y el Cerro Morales (827 msm) al oeste, hasta el área de Cerro Punta (1.199–1.228 msm) en el este. Un solo individuo fue encontrado en las afueras de los límites del Bosque Nacional El Yunque a 748 msm. Estos resultados confirman que Zorzal de Bicknell es una especie rara y local, aunque posiblemente sea un residente invernal regular en Puerto Rico. Nuestros hallazgos confirman la importancia estratégica de continuar centrando los esfuerzos de conservación en La Española, especialmente en la República Dominicana.

**Palabras clave** bosques pequeños, *Catharus bicknelli*, muestreos de playback, muestreo probabilístico, Puerto Rico, Zorzal de Bicknell

**Résumé** Hivernage de la Grive de Bicknell (*Catharus bicknelli*) à Porto Rico: espèce rare et localisée—Pour mieux connaître la répartition, l'abondance relative et les habitats de la Grive de Bicknell (*Catharus bicknelli*) en hivernage à Porto Rico, nous avons effectué de nombreux relevés au cours des hivers 2015 et 2016 dans divers habitats forestiers situés à différentes altitudes. Nous avons détecté 11 Grives de Bicknell, dont 10 en altitude dans la Cordillère centrale, de la forêt domaniale de Montagne Guilarte (1.060 m au-dessus du niveau de la mer) et de Cerro Morales (827 m d'altitude) à l'ouest, jusqu'à la région de Cerro Punta (1.199 à 1.228 m d'altitude) à l'est. Un seul individu a été trouvé juste à l'extérieur de la limite de la forêt nationale d'El Yunque, à 748 m d'altitude. Ces résultats confirment que la Grive de Bicknell est une espèce hivernante rare et localisée, bien qu'éventuellement régulière, à Porto Rico. Nos conclusions confirment l'importance stratégique de la poursuite des efforts de conservation sur Hispaniola, en particulier en République dominicaine.

**Mots clés** *Catharus bicknelli*, échantillonnage probabiliste, forêt naine, Grive de Bicknell, Porto Rico, relevés avec repasse

Bicknell's Thrush (*Catharus bicknelli*), a range-restricted habitat specialist, is among North America's rarest and most at-risk breeding songbirds. Wintering on only four islands in the Greater

Antilles, this species faces multiple threats at both ends of its migratory range (Rimmer and McFarland 2013, Townsend *et al.* 2015). Estimated to number fewer than 120,000 individuals globally (Hill and Lloyd 2017), Bicknell's Thrush is a species of high hemispheric conservation concern (Rosenberg *et al.* 2016) that is classified federally as a Threatened species under Canada's Species at Risk Act (COSEWIC 2009) and designated as globally Vulnerable by the International Union for the Conservation of Nature (BirdLife International 2016). The International Bicknell's

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Thrush Conservation Group (IBTCG), established in 2007, has addressed the numerous threats faced by Bicknell's Thrush in its Conservation Action Plan (Lloyd and McFarland 2017).

Among high priority actions identified by the IBTCG are expanded surveys for Bicknell's Thrush in areas where a winter habitat model (McFarland *et al.* 2013) indicated potentially suitable habitat. Specifically, the IBTCG recommended extending Bicknell's Thrush surveys beyond Hispaniola to further clarify the species' distribution and habitat use in Puerto Rico. In the winter habitat model, Puerto Rico was shown to contain 10% (3,271 km<sup>2</sup>) of all potential winter habitat, although less than 10% of this modeled habitat occurs within currently protected areas on the island (McFarland *et al.* 2013). The montane and cloud forests most often used by overwintering Bicknell's Thrush are considered to be among the most highly endangered forests in the Greater Antilles, and they support exceptionally high rates of endemism (Latta 2005).

Previous surveys and banding operations have indicated that Bicknell's Thrush is a rare and local winter resident in Puerto Rico. Scattered individuals have been found in the Luquillo Mountains at 450–720 m above sea level (asl) and in Sierra de Cayey at 720 m asl (Arendt 1992, McFarland *et al.* 2013, J.M. Wunderle pers. comm.). Two birds were mist-netted in Guánica State Forest and Biosphere Reserve, one in 1985 and one in 2005, both in karstic, dry forest habitat (J. Faaborg pers. comm.). The Bicknell's Thrush winter habitat model (McFarland *et al.* 2013) indicated that a considerable extent of potentially suitable habitat exists along the central highlands of Puerto Rico. This region had never been surveyed for the species. A survey in the highlands of the Luquillo Mountains in eastern Puerto Rico showed that only three Bicknell's Thrush individuals were documented after surveying 242 points for presence-absence of this species in 1996 (J.M. Wunderle unpubl. data). This led to the conclusion that Puerto Rico is not a core part of the species' winter range (Rimmer *et al.* 2001). However, recent advances in understanding Bicknell's Thrush overwintering ecology and habitat use, coupled with refinements to field survey methods, suggested the need for expanded surveys in Puerto Rico.

The overall goal of our surveys was to clarify the distribution and habitat use of Bicknell's Thrush across the island. Specifically, we sought to (1) determine the midwinter (January–March) distribution and abundance of Bicknell's Thrush in Puerto Rico and (2) compare these findings to prior empirical and modeled winter distribution data for the species (McFarland *et al.* 2013).

## Methods

Our field sampling design used 1-km<sup>2</sup> cells from the winter habitat model described in McFarland *et al.* (2013). To identify survey locations, we first downloaded the raster output of the model from Data Basin ([databasin.org/datasets/538a313832bb-4d3c805fa7fe8bc28983](http://databasin.org/datasets/538a313832bb-4d3c805fa7fe8bc28983)). Each 1-km<sup>2</sup> cell in the raster included an associated predicted probability of occurrence of suitable habitat. We grouped these cells into three categories based on the predicted probability that suitable habitat for Bicknell's Thrush occurred in the cell: < 25% (low), 25–50% (medium), and > 50% (high). We selected a random, spatially balanced sample of 60 cells using a generalized random tessellation stratified scheme, weighting the sample to include 30 cells with predicted proba-

bility of occurrence > 50%, 20 cells with predicted occurrence 25–50%, and 10 cells with predicted occurrence < 25%. Once we had drawn a sample of cells to survey, we visited each cell and identified 3–5 locations suitable for point counts. Suitability was based on the extent of forest cover—at least 50% of the area in a 50-m radius around each point was forested—and accessibility; all points were along public roads or trails. To maintain independence of counts conducted at different points, we placed each point at least 250 m from its nearest neighbor. Point locations were spatially referenced via GPS and marked with metal tree tags.

Between 22 January and 30 March 2015, we conducted standardized 10-min counts at each point, beginning shortly after sunrise. Each point count was divided into four 2.5-min intervals conducted in immediate succession, with 1-min playbacks of Bicknell's Thrush vocalizations broadcast before the second and fourth periods. Individuals of all species detected in each count period were recorded in four circular distance bands from the point of observation (1–10 m, 10–25 m, 25–50 m, and > 50 m). No counting occurred during the two 1-min playback periods; in all cases, Bicknell's Thrushes that began vocalizing during the playback period continued to vocalize in the subsequent counting period. Results of all point counts conducted in 2015 are available in Lloyd and Rimmer (2017).

Due to extremely low encounter rates of Bicknell's Thrush during our 2015 surveys (see Results), in 2016 we abandoned the probabilistic sampling approach and instead conducted rapid, exploratory surveys between 23 January and 3 April across a range of habitats and geographic areas in Puerto Rico. We sought to cover a variety of forested habitats at all elevations, including forest types not predicted by the McFarland *et al.* (2013) model to support habitat for the species. Targeted survey areas included low-lying karst forests along the island's north coast, dry forests in the Guánica region, and remote high-elevation forested tracts that were outside the scope of 2015 surveys because of logistical constraints. We believed that this method would better supplement data from our 2015 surveys by enabling more thorough coverage of habitats and geographic areas that Bicknell's Thrush might occupy in Puerto Rico. We also believed that this approach would be more conducive to involving volunteer birders because most surveys could be conducted more opportunistically than the standardized point counts in 2015, with fewer logistical constraints. We encouraged amateur birders and professional ornithologists to conduct Bicknell's Thrush surveys in any type of forest habitat on the island. However, availability of volunteers proved to be limited and ultimately all surveys were completed by the coauthors and project field technicians.

Survey protocols in 2016 were less strictly standardized than in 2015 and involved conducting stationary or walking counts supplemented by broadcasts of Bicknell's Thrush vocalizations. We recorded individuals of all species detected during each survey. Both stationary counts and walking counts lasted at least 5 min and consisted of alternating 30–60 sec Bicknell's Thrush playback broadcasts with 30–60 sec periods of passive listening. We recorded the location of each stationary count and the start and end points of each walking count, as well as the coordinates of any Bicknell's Thrush detected during a walking count. All data collected in 2016, as well as data on two individual thrush-

es detected opportunistically in 2015, were entered into eBird (Sullivan *et al.* 2009), with supplemental information (e.g., geographic coordinates) recorded in the appropriate comment field.

## Results

In 2015, we conducted 211 point counts on 43 of the 60 1-km<sup>2</sup> cells selected for sampling (Fig. 1). Only one Bicknell's Thrush was recorded (a naive point-occupancy rate of 0.5%) at 1,261 m elevation in elfin forest in the Cordillera Central region (Fig. 1). Two other individuals were opportunistically located outside of point counts, both near Cerro Punta in Cordillera Central at elevations of 1,165 m and 1,274 m. All birds were detected via response to playbacks and likely would have otherwise escaped detection. Areas of predicted high occurrence from the McFarland *et al.* (2013) model yielded no detections.

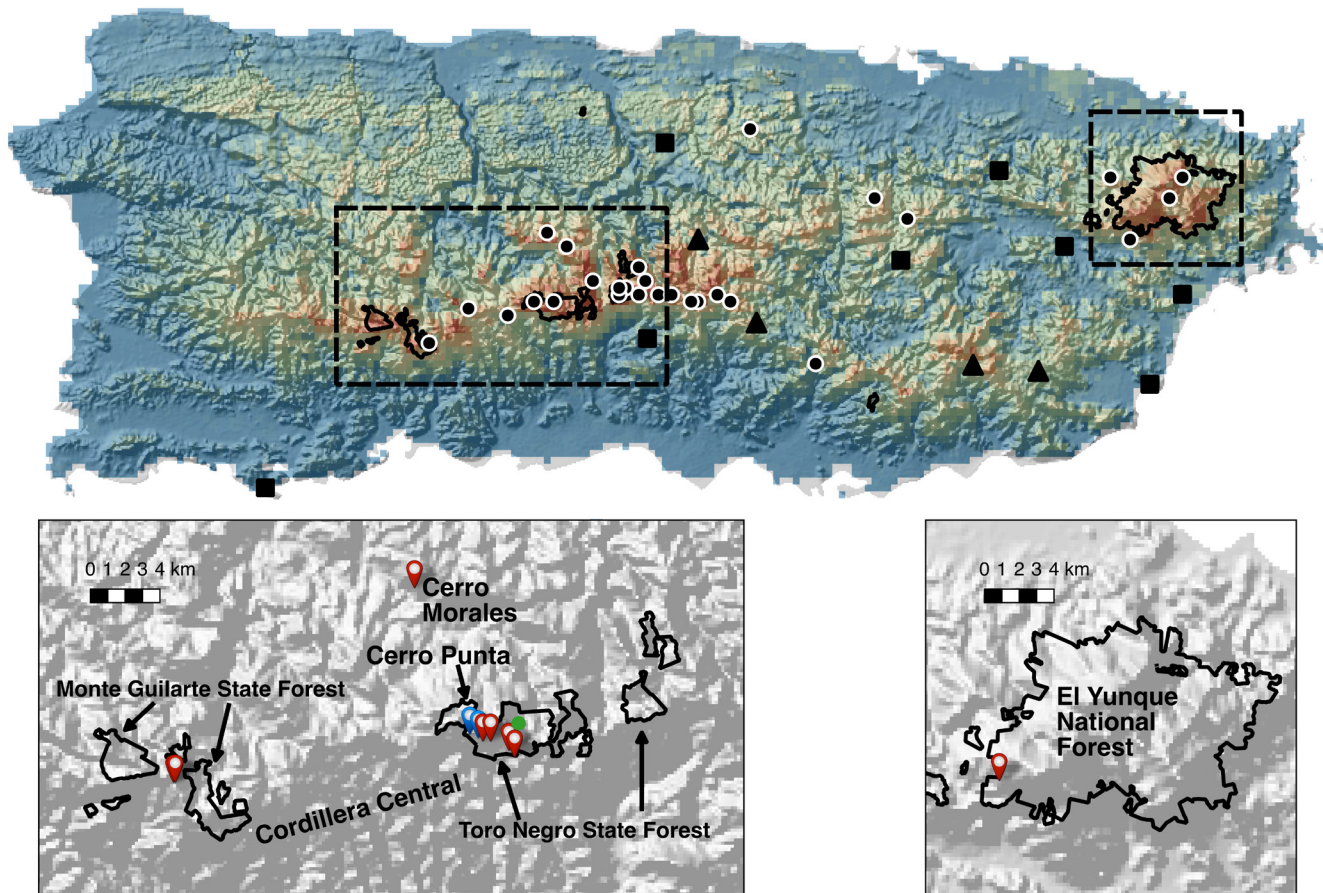
In 2016, we conducted Bicknell's Thrush presence/absence surveys at 35 discrete locations. We detected eight Bicknell's Thrushes. Seven of these were found at mid-high elevations in Cordillera Central, from Monte Guilarte State Forest (1,060 m asl) and Cerro Morales (827 m asl) in the west to the

Cerro Punta area (1,199–1,228 m asl) in the east (Fig. 1). A single individual was found on the El Toro trail near the border of El Yunque National Forest on 3 April at an elevation of 748 m asl (Fig. 1). As in 2015, all thrushes responded to playback and would likely have otherwise gone undetected. At no point did we detect more than a single Bicknell's Thrush at one time.

On 26 January 2016, we mist-netted and banded a Bicknell's Thrush in Monte Guilarte State Forest following its detection during a walking survey. Morphometric measurements and plumage characters confirmed the bird's specific identity and indicated that it was a 2+ year-old male. We detected a vocalizing thrush at this same site on 24 March and suspected that it was the same individual, which would suggest the possibility that some of the overwintering Bicknell's Thrush in Puerto Rico maintain discrete territories.

## Discussion

Our results—based on extensive surveys which incorporated a probabilistic sample of standardized point counts in 2015 and ad-hoc rapid inventories across the landscape in 2016—suggest-



**Fig. 1.** Shaded relief map of Puerto Rico showing the predicted suitability of habitat for Bicknell's Thrush, ranging from low (green; < 25% probability of suitable habitat) to medium (yellow; 25–50% probability) to high (orange and red; 75–95% and > 95% probabilities, respectively). Blue areas are considered non-habitat according to the McFarland *et al.* (2013) model. Surveyed cells of 1 km<sup>2</sup> are shown as black squares (low probability of suitable habitat), black triangles (medium probability of suitable habitat), and black dots with white outline (high probability of suitable habitat). Three surveyed cells are not shown (one in each class of habitat suitability) because they did not have GPS locations recorded. Inset maps show the locations of incidental observations of Bicknell's Thrush recorded in 2015 (blue markers) and 2016 (red markers) and the single point count where Bicknell's Thrush was recorded in 2015 (green dot); black-bordered polygons depict protected areas.

ed that Bicknell's Thrush was not present in large numbers in Puerto Rico. We detected 11 individuals at 10 discrete locations, and never more than a single bird at any one site. We observed some evidence of clustering, detecting four individuals between km 18.3 and km 20.4 along Rt. 143 east of Cerro Punta and two individuals within 126 m of one another in Monte Guilarte State Forest.

The encounter rates we observed during point counts in 2015 were substantially lower than those documented in other parts of the winter range of Bicknell's Thrush. For example, point counts in two protected areas of the Dominican Republic's Cordillera Septentrional, Loma Quita Espuela and Loma Guaconejo, following similar protocols to those we used in 2015 in Puerto Rico, yielded an encounter rate of 30.3% ( $n = 99$  survey points) (K.P. McFarland unpubl. data). Eighty percent of detections in these two protected areas were of single individuals, while 20% of points yielded detections of two individuals. At a nearby private reserve, Reserva Privada Zorzal, point counts conducted in 2016 similarly yielded higher detection rates than in Puerto Rico: Bicknell's Thrushes were detected at 48 of 107 points, a naïve point-occupancy rate of 44.9% (Almonte *et al.* 2016), and 46% of point count detections were of single individuals while 54% of points yielded detections of two to five individuals. The very low encounter rates that we observed in this study underscore the rarity of Bicknell's Thrush in Puerto Rico.

Our results were potentially biased because most surveys were constrained to roadways or existing trails, especially along Route 143 east of Cerro Punta. We were unable to access potentially suitable habitat away from the road due to steep terrain and nearly impenetrable elfin forests. Thus, it is probable that we failed to detect birds inhabiting some interior forest patches on the island. However, many surveys in both 2015 and 2016 were conducted along narrow trails in forests that were minimally fragmented or impacted by human activities. As such, we consider it unlikely that more extensive surveys of interior forest would change our conclusion that Bicknell's Thrush is a rare and patchily distributed species in Puerto Rico.

Despite detecting only 11 Bicknell's Thrushes in Puerto Rico during the 2015 and 2016 surveys, this study adds valuable information about the overwintering distribution and abundance of this globally vulnerable species. Most importantly, our results support the strategic importance of focusing conservation efforts for Bicknell's Thrush in Hispaniola, especially the Dominican Republic. Elsewhere within the species' known winter range, previous distributional surveys in Cuba (1999–2005) and Jamaica (1998) have similarly revealed that Bicknell's Thrush occupied a very limited distribution and occurred at low densities (McFarland *et al.* 2013). Field surveys conducted in eastern Cuba during 2017 and 2018 yielded comparable findings (CCR and JDL unpubl. data). Despite predictions of the winter habitat model, these results and our findings in Puerto Rico suggest that we should not expect to locate large populations of Bicknell's Thrush on islands other than Hispaniola.

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