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Movement and Home Range of the Puerto Rican Screech-Owl *(Otus nudipes)* in the Luquillo Experimental Forest

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ABSTRACT. – Home range and site fidelity of the Puerto Rican Screech-Owl *(Otus nudipes)* were examined in the Luquillo Experimental Forest of Puerto Rico. Two individuals, one adult and one juvenile, were radio-tagged and tracked for several weeks during the rainy season in the summer of 1989. Owls exhibited a persistent tenacity for one relatively small foraging area, in which they also roosted during the day. Although the home ranges of both individuals were located in close proximity to each other, little overlap occurred. These owls had home ranges considerably smaller (by a factor of 10 or more) when compared to other similarly sized owls in temperate zones.

RESUMEN. – El ámbito nativo y la fidelidad de habitáculo de mucaro de Puerto Rico *(Otus nudipes)* fueron examinados en el Bosque Experimental de Luquillo, Puerto Rico. Dos individuos, un adulto y un juvenil, fueron equipados con radiotransmisores y restreados por varias semanas durante la estación lluviosa en el verano de 1989. Aunque los ambitos de los dos individuos estaban situados muy cerca uno del otro, hubo poco solapamiento. Los ámbitos nativos de estos buhos son considerablemente más pequeños (por un factor de 100 más) que los de otros buhos de tamaño similar en zonas templadas.

INTRODUCTION

Owls have been frequent subjects of behavioral and ecological studies involving analyses of home range and movement patterns. Most of this work has been done in temperate areas of Europe and North America (Baekken et al., 1987; Forbes and Warner, 1974; Haywood et al., 1987; Jacobsen and Sonerud, 1987; Smith, 1988; Smith and Gilbert, 1984). Little is known of the ecology or behavior of tropical owls.

The Puerto Rican Screech-Owl *(Otus nudipes)* is a small owl (25 cm in length) inhabiting forested areas of Puerto Rico and the Virgin Islands. Its presence is easily detected by the distinctive, loud, and frequent calls throughout the night. We provide information on movement patterns and home range of *O. nudipes* in the Luquillo Experiment Forest (LEF) of Puerto Rico, where it is common.

METHODS

In July of 1990, recorded calls of the Puerto Rican Screech-Owl were played to lure owls into mist nets set along trails in the immediate vicinity of El Verde Field Station (description of site in Odum and Pigeon, 1970; Fig. 1). We captured three individuals (two adults and one juvenile). Before release at the capture site, the birds were marked with color leg bands. In addition, two of the owls (one adult—radio tag number 886, one juvenile—radio tag number 451) were fitted with radio transmitters (Holohil Systems, Ltd., Ontario Canada, model BD-2, wt. = 1.2 g) attached with a criss-cross backpack harness design (Smith and Gilbert, 1981).

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The location of each radio-tagged bird was determined by triangulation of signals obtained simultaneously by two field receivers. Both tagged owls were easy to locate from the ground, using hand held telemetry receivers (model TRX-1000S, Wildlife Materials, Carbondale, Ill.). Telemetry accuracy in the LEF using this system is extremely good, as evidenced by accuracy tests conducted in other studies (Gannon, 1991; Lindsey and Arendt, 1991). We were always able to locate each bird within 30 minutes of the beginning of our search. Each owl was located ("telemetrically captured") once per day, and either once or twice each night. Tracking continued until the end of July. Actual days of tracking differed for the two individuals because of the different dates of capture. Field triangulation was facilitated by superimposing a cartesian coordinate system over a map of the study area with O degrees at magnetic north. Logistics were simplified because of the series of well maintained trails throughout the forest. Two-way radios allowed observers to make simultaneous measurements which could be verified immediately while in the field.

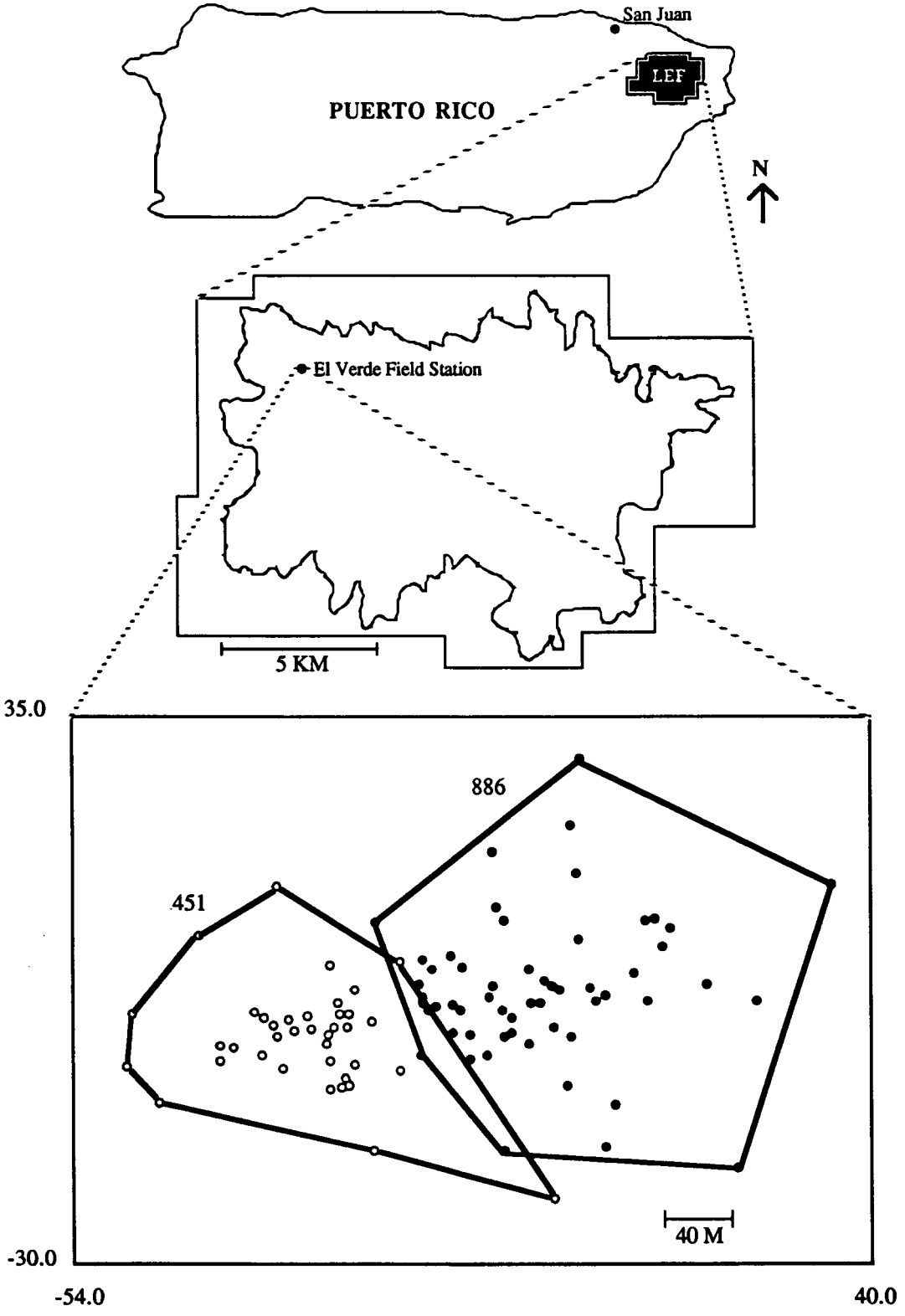
To estimate home range size and the number of captures needed to accurately evaluate home range, cumulative MCP estimates were calculated for both owls using computer program HomeRange (Huber and Willig, unpubl.). Typically, home range is an area of restricted use by an animal. "Restricted" implies that daily activities occur within a subset of the space in which they could occur. Nonetheless, most studies of home range do not distinguish between area traversed by an animal because of microgeographic associations and area produced as an artifact of random movement or wanderings. Since the mechanisms that generate these two types of home range are different, the ranges they generate should be distinguishable.

For each owl, the Minimum Convex Polygon (MCP) home range (Kenwood, 1987; White and Garroll, 1990) was calculated, as well as a set of vectors which connected successive telemetry capture points. Using the mean length and variance of these vector movement segments, program HomeRange (Huber and Willig, unpubl.) created a new set of vectors with order and direction of each successive capture point assigned randomly. This generated a new set of random coordinates for which a new MCP home range could be calculated. The simulation was performed 200 times for each individual. The 200 simulated MCP'S form a distribution under the null hypothesis (random movement) to which the observed MCP could be compared. If site tenacity occurs, and owls actually remain within a limited region, the observed home range should be statistically distinguishable from randomly generated home ranges with the same segment length mean and variance. In particular, actual MCP home ranges should be smaller than those obtained by random movement.

Similar protocols have been used by Case and Sidell (1983) to evaluate size assortment in neotropical avian fauna, by Willig and Moulton (1989) to examine processes structuring neotropical bat communities, by Munger (1984) to evaluate lizard movement patterns, and by Gannon (1991) to evaluate movement patterns of Puerto Rican bats. If owls move randomly, then observed home ranges should fall outside the lower 5% tail of the randomly generated home ranges.

RESULTS

Home ranges for both owls were much smaller than would be expected by chance if movements were random (886—MCP home range = 44,675 m^2, mean of randomizations = 308,780, significance = 0.005, n = 63 captures; 451—MCP home range = 22,925 m^2, mean of randomizations = 106,900, significance = 0.005, n = 38 captures). For both individuals, all the randomly generated home ranges were larger than the actual home range. Clearly, these owls are not nomadic; they remained within a well-defined area for long periods of time. Our netting observations support this. The adult that was captured, banded, and released without a radio transmitter was later captured twice at the same locality and in the same nets. During both periods we were netting bats and not attempting to capture owls.


San Juan
LEF
PUERTO RICO
N
El Verde Field Station
5 KM
35.0
886
451
40 M
-30.0
-54.0
40.0

The home range of the adult (886) stabilized after 21 captures, with an area of approximately 2.75 ha, but increased suddenly to nearly 4.5 ha at 54 captures. This increase was largely due to one long excursion outside the previously used area. Home range estimates of the juvenile (451) increased less rapidly than that of 886, and never stabilized even after 37 captures. The total area estimate was approximately 2.3 ha at the termination of the study. The total MCP home ranges for both individuals are plotted in Fig. 1 (bottom). Very little overlap occurred. Edges between the two ranges are distinct, with few captures in the area of overlap. These data indicate well-defined territories for each bird, which were rarely encroached upon.

DISCUSSION

It is difficult to draw any firm conclusions with observations on only two individuals, but these data allow for speculation. Differences in home range may be due to age differences. Since juveniles are less familiar or experienced with an area, they may stray shorter distances from a regularly used "core area." Another possibility is that established adults may exclude juveniles from their areas, resulting in a smaller juvenile home range. However, it may be more likely for an adult to direct aggression toward other adults which enter its territory, rather than against juveniles who pose little competitive threat.

Our use of MCP methodology facilitates comparisons with other owl studies using the same techniques. Home range size is thought to be correlated with body size. This has been demonstrated in some terrestrial vertebrates including lizards (Christian and Waldschmidt, 1984; Turner et al., 1969) and mammals (Swihart et al., 1988). We postulate for owls as well, that individuals of similar body size should have similar home range sizes. Previous studies on a variety of owls reveal a great deal of variation in home range size, both among individuals and among localities. Boreal Owls *(Aegolius funereus)* from Idaho, which are similar in size to the Puerto Rican Screech-Owl (25 cm in length) appear nomadic, with very large MCP home ranges averaging 845 ha (Haywood et al., 1987). Home range of individuals overlapped extensively, and no evidence supports the existence of territoriality. Jacobsen and Sonerud (1987) indicate that *A. funereus* from Norway has a much smaller home range (between 100 and 250 ha) with a relatively small amount of overlap. In that study, MCP home range estimates leveled-off after 10-20 days. The MCP estimates for somewhat larger Hawk Owls *(Surnia ulula,* 38 cm), also from Norway, varied from 150-900 ha (Baekken et al., 1987) but never stabilized. Instead, they increased throughout the monitoring period. The same was true for Eastern Screech-Owls *(Otus asio,* 25 cm) in southern Connecticut, with MCP home range averages of approximately 33 ha in one study (Smith, 1988) and 26 ha in another (Smith and Gilbert, 1984) each month throughout the year and never stabilized. Even the smaller Saw-whet Owl *(A. acadicus,* 18 cm) has a substantially larger home range than *O. nudipes,* in excess of 280 acres (Forbes and Warner, 1974).

Home range size and patterns of space use of the Puerto Rican Screech-Owl differ from those of temperate owls. The home range of *O. nudipes* in our study was extremely small in comparison to those of various temperate species of similar size, including continental populations of the closely related Screech-Owl. *Otus nudipes* apparently uses considerably less space, by a factor of ten or more, than other species examined over a similar time period. Areas are well defined, and do not overlap ranges of other individuals.

Habitat differences between temperate and tropical areas may account for much of these differences, but more extensive studies are necessary. Such habitat factors as food availability and the number of ad-

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FIG. 1. Location of the Luquillo Experimental Forest (LEF) and El Verde Field Station (top and middle). Bottom—minimum convex polygon plot of the home ranges of two owls *(O. nudipes),* 886 (adult, solid circles) and 451 (juvenile, open circles). Numbers outside the square are geographic coordinates.

equate nesting sites, as well as owl density and energetic may play a significant role in structuring movement patterns of the Puerto Rican Screech-Owl. In addition, variation in home range due to factors such as age, sex of individuals, and seasonality, may be of great importance.

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