Project Corzuela

Density estimates of grey brocket deer (*Mazama gouazoubira*): validation of a sampling technique in Chancaní Reserve, Córdoba, Argentina.

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December 2006

Management problem

The purpose of this study was to validate a sampling technique for the estimation of population density of grey brocket deer (*Mazama gouazoubira*) in Chancaní Reserve, Córdoba Province, Argentina.

To evaluate brocket deer populations it is important to use a standardized method that can be used in successive years for periodic controls. The Reserve under study is the only conservation unit that protects the arid Chaco ecosystem, its flora and fauna, in Argentina. Although not in a vulnerable state, the grey brocket deer is highly affected by the increasing hunting pressure by locals who exploit its coat and meat. The results of this study will be an important contribution to the status of the species, the status of the Chaco ecosystem, and the role of the Reserve in the conservation of both.

Previous studies

There are currently no studies in Argentina that provide information as to the density or abundance of the species. Estimates in Bolivia indicate a density of 6.33 ind/km2 in the rainy season and 33.24 ind/km2 in the dry season, being the only study available with identical technique (Rivero et al 2004). Although in Argentina both the red and the grey brocket deer are considered as not threatened (Low risk minor preoccupation category), neighbouring countries maintain a more conservative criteria about its status, as that suggested by Juliá and Richard (1999). In Bolivia, the grey brocket deer has been categorized as "Insufficiently known" and "Commercially threatened" by IUCN (1990) and as "Data Insufficient" by IUCN (1994), and the Argentine subspecies has been measures to protect brockets, given the lack of an effective hunting control (Richard & Juliá 2001). More recently, in 2000, the IUCN changed the worldwide status of the grey brocket deer to "Data Deficient", calling for base studies of the species.

The population under study is found in the arid Chaco ecoregion in central Argentina. This ecoregion is highly degraded due to overgrazing, deforestation and invasion of exotic grasses. Sustainable hunting is also a constant threat to the species. Without an initial count and further research it is not possible to know the effects, if any, of these factors on the population.

Main Objective

- To validate a sampling technique with the aim of estimating the density of the grey brocket deer in wild areas of the arid Chaco.

Specific Objectives

- To determine the variables taken in account in population density evaluation: maximum days of persistence of the pellets on the ground and number of daily defecations per individual of the species in the Chaco.
- To estimate the population density of grey brocket deer in Chancaní Reserve and surrounding areas in different seasons to obtain an accurate estimate.
- Evaluate habitat use and behaviour patterns of brocket deer in Chancaní reserve.

Methods and work plan

In order to estimate population density of a species it is necessary to pick a technique that will work for the species in question as well as the habitat where they live. Out of the possible techniques, pellet group count was chosen because of its success with elusive species found in closed vegetation habitats. This technique can be applied with two types of plots. Unlike accumulation plots, temporary plots are fast, precise and cost effective (Neff 1968, Freddy 1983, Edge & Marcum 1989, Campbell et al. 2004, Rivero et al. 2004, Smart et al. 2004, Hemami et al. 2005). Therefore, population density estimation of the grey brocket deer in Chancaní was based on group pellet counts in temporary plots.

Persistence time of the pellets on the ground

Fresh pellets from different grey brockets in the Reserve were collected and placed along a straight line at 10-m intervals in a homogeneous area of mature forest in the Reserve. The number of pellets was counted in each group. The groups were checked every 15 days in order to estimate the maximum number of days of persistence, until less than 10% of the pellets were recognizable. The general criteria for this experiment followed Harestad & Bunnell (1987).

Daily defecation rates

Since the daily defecation rate for the specie in the wild is unknown, and studies of this factor from animals in captivity has proven to be small because of food and daily activity factors, for the current estimation, we decided to use the rate recommended in the bibliography. Neff (1968) in a revision of daily defecation rates of North American deer suggests a number of 13 defecations/day for small forest deer.

Population density estimates

For each season, seventy 600-m^2 plots were distributed randomly throughout the Reserve and a 5 km buffer zone. Plot assignation was determined using a 150m^2 cell grid on top of an aerial image of the region. The number of plots fixed was determined through an estimate of the minimum number of samples (Sutherland 1996), calculated with values obtained by an initial sampling conducted in November 2005. The plots were marked and their satellite position was established using a GPS. Two investigators walked each plot identifying and recording the number of pellets observed at each point.

The density estimate of the grey brockets was determined using the following equation:

$$\text{Density} = \frac{\textit{Pellet groups per unit area}}{\textit{defecation rate} \bullet \textit{pellet persistence time}}$$

Assuming that pellet abundance is proportional to the number of individuals present in an area and the daily defecation rate, this equation divides the number of pellets/area by the daily defecation rate to obtain an estimate of use (days x animal)/area. The population density (animals/area) is obtained by dividing the resulting value by the days the pellets persist on the ground (Ojasti & Dallmeier 2000).

Habitat use:

Habitat variables were measured in each plot visited during the winter season, which included: tree and shrub diversity and density, canopy and ground cover, as well as the altitude of each plot (m. above sea level). Structural variables were drawn using IDRISI and distances were measured to main roads, inner roads and water sources. Both types of variables were then related to the presence or absence of pellet groups.

Behaviour:

5 trip cameras were set up around the Reserve, in defecation sites of different individuals. The resulting photographs were analyzed for sex and age differences and daily activity patterns.

Results

Pellet persistence time

The maximum number of days that pellets persisted on the ground was estimated at 100, considering that in this period, none of the pellet groups had more than 10% of the original pellets. This value in days is considered in this project as the maximum persistence time on the ground in this area.

Brocket deer density estimation

Summer estimates:

The population of grey brocket deer during the summer season was an average of 4.41±6.86 individuals/km^2 (average±SD). This density value was estimated through pellet group counts in randomly distributed plots (Figure 1). The terms used in the equation for this calculation, with respect to the points developed before, were:

- Maximum persistence days of the pellets on the ground: 100,
- Number of daily defecation per individual: 13 (recommended number, Neff 1968).

Winter estimates:

The population of grey brocket deer in Chancaní Reserve during the winter season was an average of 6.30±7.35 individuals/km^2 (average±SD).

Habitat Use:

After the study was started, we realized that the Reserve had distinct vegetation zones resulting in a heterogeneous environment. Following the description of Cabido & Pacha (2002), we divided the area in five general sub environments and recalculated the density estimates with the pellet counts in each region. The densities estimated per vegetation zone, using the equation above and integrating the established coefficients, during the summer ranged between 0.96±2.63 and 8.97±9.45 individuals/km^2 (average±SD). The densities estimated for winter ranged between 5.40±6.16 and 7.81±7.44 individuals/km^2 (average±SD).

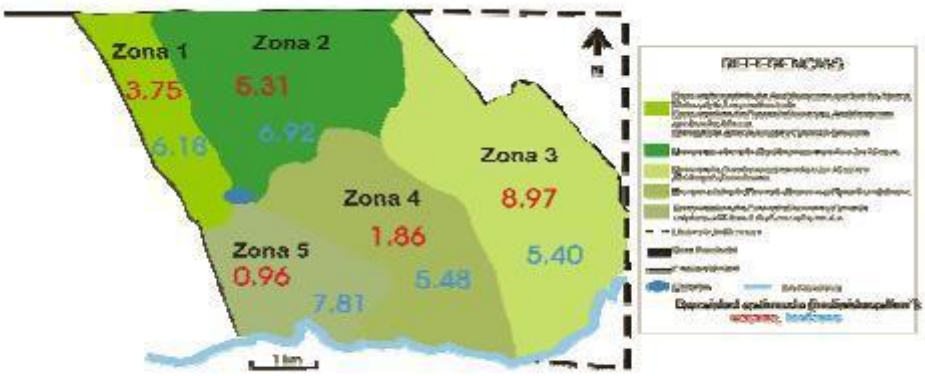

Figure 1. Grey brocket density estimates in two seasons in each vegetation zone in Chancaní Reserve.

During the summer, a larger concentration of individuals was found near inner roads, at higher altitudes, and in more diverse and dense vegetation zones of the Reserve. During winter time, the brockets are found all over the Reserve but particularly in areas near the source of water.

Behaviour:

Of the 78 records obtained, 47% were of females, 24% adult males, 13% juvenile males and 16% could not be identified. The defecation sites seem to be of individual use, although they are found in shared territories. Each site was visited several times a day and on different days, although not consecutive. This leads us to conclude that each individual has more than one site that is used on alternate days. As to the daily activity, most of the activity during the summer days was significantly concentrated during the morning, and in winter there were no differences among times.

Figure 2. Different individuals registered by the trip cameras. A) Adult female defecating B) Adult female C) Young male D) Adult male.

Conclusions

- The method used (pellet group count) with temporary plots is highly recommended, for it is of rapid application and low cost.
- We estimate an average population of grey brocket deer of individuals per km2 in Chancaní Reserve, the last well preserved forest in the arid Chaco,
- During the summer, brocket distribution in the Reserve is not homogeneous ranging between 0.96 and 8.97 individuals/km2, depending on the vegetation zone. During the winter, brocket distribution in homogenous ranging between 5.40±6.16 and 7.81±7.44 individuals/km2.
- The terms used in the density estimation equation are based on two factors for this region: 100 days as the persistence time of the pellets on the ground and 13 as the daily defecations per individual.
- In the summer, a larger proportion of brockets were found in areas near inner roads, at higher altitude, and in the more conserved region of the Reserve. In the winter, however, the source of water played a key role in the brocket's homogenous distribution.

Activities performed

- Presentation of thesis entitled "Estimación de la densidad poblacional de la corzuela parda (*Mazama gouazoubira*) en la Reserva Chancaní (Córdoba, Argentina): puesta a punto de una técnica de muestreo"
- Presentation of winter estimates and habitat use at the II Congreso Nacional de la Conservación de la Biodiversidad. Abstracts accepted and two postres presented entitled: "Estimación de la densidad de *Mazama gouazoubira*: validación de una técnica de muestreo en el chaco árido argentino" and "Variaciones estacionales en el uso de hábitat de M*azama gouazoubira* en la Reserva Chancaní, Córdoba, Argentina."
- Presentation of preliminary results at the XXI Congreso Nacional de Ecologia. August 2006. Abstract accepted and poster presented entitled "Estimación de la densidad poblacional de la corzuela parda (*Mazama gouazoubira*) en la Reserva Chancaní, Córdoba, Argentina"

- Presentation of a written report with results to the Agencia Córdoba Ambiente (regulating entity of Chancaní Reserve).

Future activities

The results of this study are the first density estimates of the species in the arid Chaco region of Argentina. In the future, we plan to estimate the density outside the Reserve as well as in other areas of Argentina. Currently, we are working on a scientific paper that will hopefully be published within the next year.

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