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DISTRIBUTION OF ENDANGERED VERTEBRATES IN BAÑADOS DEL ESTE BIOSPHERE RESERVE, URUGUAY

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ABSTRACT: *Distribution of endangered vertebrates in Bañados del Este Biosphere reserve, Uruguay*.– We used published and unpublished data on endangered mammals, reptiles and amphibians to identify areas of high endangered-species richness within Bañados del Este Biosphere Reserve (Uruguay). We then compared that information with an extant proposal of conservation zones for the reserve. All the endangered species analysed were recorded within the proposed protection zones. However, due to the lack of updated information about the distribution of species outside of those areas, it was not possible to compare their value for the protection of endangered species with that of other sectors of the reserve. In the last 22 years less than 25% of the reserve has been surveyed. While the southern part has been relatively well sampled, the greatest richness of endangered species was recorded in the poorly studied northern part, near to the border with Brazil. Hence, a high priority for the development of sound management strategies for the reserve is to expand the knowledge of the current distribution and abundance of the species within it. In particular the area of Cerro Largo, as it constitutes the most promising area for the identification of new sectors rich in endangered species.

RESUMEN: *Distribución de vertebrados amenazados en la Reserva de Biósfera Bañados del Este, Uruguay*.– Utilizamos información publicada e inédita sobre mamíferos, reptiles y anfibios amenazados para identificar áreas de gran riqueza de especies amenazadas dentro de la Reserva de Biósfera Bañados del Este (Uruguay). Esa información fue luego comparada con una propuesta de zonificación de la reserva. Todas las especies analizadas fueron registradas dentro de las zonas propuestas como de conservación. Sin embargo, dada la falta de información actualizada sobre la distribución de estas especies fuera de esas zonas, no fue posible comparar su valor para la protección de especies amenazadas con el de otros sectores de la reserva. En los últimos 22 años menos del 25% de la reserva ha sido relevado. Mientras que el sector sur ha sido relativamente bien estudiado, la mayor riqueza de especies amenazadas se registró en la poco estudiada zona norte, cerca del límite con Brasil. Es por lo

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tanto altamente prioritario incrementar el conocimiento de la distribución y abundancia de las especies dentro de la reserva, para el desarrollo de estrategias exitosas de manejo de la misma, en particular en el Departamento de Cerro Largo, que constituye el sector más promisorio para la identificación de nuevas áreas con alta riqueza de especies amenazadas.

Keywords: Biosphere reserve, endangered species, GIS, Uruguay.

Palabras clave: Reserva de biósfera, especies amenazadas, SIG, Uruguay

Introduction

UNESCO's Biosphere Reserves are areas of terrestrial, coastal and/or marine ecosystems internationally recognised within the framework of UNESCO's Programme Man and the Biosphere (MAB). They are intended to fulfil conservation, development and logistic support functions. Physically, each reserve should contain three elements: core areas, which are securely protected sites for conserving biological diversity, monitoring minimally disturbed ecosystems, and undertaking non-destructive research; buffer zones, which usually surround core areas and are used for co-operative activities compatible with sound ecological practices; and transition zones, which may contain a variety of agricultural activities, settlements and other uses, in which stakeholders work together to manage and sustainably exploit the area's resources (BATISSE, 1982, 1993; UNESCO, 1984; KELLERT, 1986).

In Uruguay, Bañados del Este Biosphere Reserve incorporates grasslands, woodlands, wetlands, a system of coastal lagoons, rocky shores, sandy oceanic beaches, dunes, and a strip of oceanic waters. Created in 1976, it encompass an area of 200,000 hectares but a project to expand it to a total area of 3,850,000 hectares is currently in consideration (PROBIDES, 1999). The area is particularly rich in birds, especially aquatic and migratory species, and includes a series of RAMSAR sites (PROBIDES, 1999). Besides its biological richness, the reserve includes one of the most important productive regions of the country, most of which is devoted to cattle-grazing. Forestation and tourism are also important activities in the region, along with agriculture. In 1995 approximately 55% of the country's rice was produced in 80,000 ha of reserve (PROBIDES, 1999).

These activities often enter into conflict with the conservation goals of the reserve. Overgrazing, water pollution, deforestation, water canalisation, wastes production, damming, modification of beaches and dunes structure affect some of the most environmentally valuable and sensitive areas all over the reserve (PROBIDES, 1999). This diversity of interests has proved to be

a major limitation for the integrated management of the area. Consequently, this ambitious project is still in its first stages. Its implementation and the creation of regulations that ensure the functioning of the area as a fully operative Biosphere Reserve will probably take decades. A master plan proposing new boundaries for the reserve and setting the general guidelines for its management was produced in 1999 (PROBIDES, 1999).

This master plan identifies 10 regions within the reserve that should be primarily devoted to the protection of biodiversity (PROBIDES, 1999). However, despite these proposed protection zones are rich in conservation appeal due to landscape and ecosystemic features, little has been studied in terms of species diversity and population densities. The aim of this note is to evaluate the potential of these areas in successfully protecting the national endangered fauna in the reserve.

Data on the distribution of species has been unsystematically collected throughout the reserve over the past hundred years (Soutullo, in press). Although very opportunistic and meagrely sampled, this data may be used as part of a geographical information system (GIS) to indicate where the most endangered species are currently found and hence, to highlight which areas are important to be designated as core areas. GIS are powerful tools for the analysis of data from disparate resources, such as this, and gives valuable insight to conservation managers about the value of conservation areas (e.g., SMITH et al., 1995; LI et al., 1999; BRICKLE, 2002). Available information on mammals, reptiles and amphibians was used to identify areas of endangered-species richness, which were then compared to those suggested as protection zones in the proposal.

Methods

Data for the analysis was extracted from a database compiled from national zoological collections, bibliography and field data, that holds data on mammals, reptiles and amphibians recorded within the reserve during the last hundred years. The database is the result of a joint project of the national museum of natural history, PROBIDES and the NGO VIDA SILVESTRE. Complied in 2001, it is the most exhaustive source of data on these groups within the reserve (SOUTULLO, in press). For each individual, the database includes species name, national conservation status and zoological group, locality, geographic position in cartographic co-ordinates (degrees and minutes) and date of the record. Species conservation status follows GONZÁLEZ (2001a).

Although records of the reserve's fauna have been collected for more than a century (SOUTULLO, in press) for this analysis we used records of endangered species collected between 1980 and 2001. We did so to avoid excessively restricting the data set, but at the same time provide an updated analysis of the conditions in the reserve. The reserve has been exposed to diverse transformations during the 20th century (PROBIDES, 1999) and considering older records would have provided a distorted perception of current conditions.

Due to the high disparity in the quality of the data, we constructed an index to expresses how exhaustive the available information for each locality in the database was (i.e., those localities in which at least one specimen of any species, threatened or not, was recorded between 1980 and 2001). The index was calculated by counting how many times each locality was visited (i.e., times at least one specimen was recorded in the locality during the study period). To account for the imprecision of the information available on the date of the records, for a given locality, species and year, only records from different months were considered as different. Although these values are a rough estimation of sampling effort (e.g., they do not take into account the extension of the sampling period or whether records were the results of planned surveys or haphazard observations), we consider they provide an acceptable description of how well different sectors of the reserve have been studied.

We used Arcview GIS 3.2 to plot the known distribution of endangered species and identify the areas that hold larger proportions of them. We also calculated the percentage of the reserve surveyed between 1980 and 2001 and examined differences in sampling intensity between sectors. Results were compared with the proposed system of protection zones to assess whether it would provide protection to all endangered species. To do that we created a GIS consisting of data of 259 localities and 62 records of 19 endangered species and a digital map of the reserve. A geo-referenced grid with square cells of 100 km^2 (10 km x 10 km) was produced to divide the reserve into quadrants for the analyses. Cell size represents what we estimate is the precision of our data. Data of the individuals recorded in each locality were used to calculate the number of endangered species in each locality. The number of endangered species in each grid cell (quadrant) was calculated by counting the number of different species recorded in all the localities included within each cell. The proportion of the reserve sampled between 1980 and 2001 was calculated as the proportion of all the cells within the reserve that were visited at least once during that period. Sampling intensity was calculated for each quadrant by adding the number of visits to all the localities included within each grid. A map showing the proposed protection zones was then introduced into the GIS and aligned with the base map to compare the results of our analyses with such zones.

Results

Nineteen endangered species of mammals, amphibians and reptiles were recorded within Bañados del Este Biosphere Reserve in the last 22 years. Individuals of all these species were recorded within the proposed protection zones. Table 1 shows the number of quadrants in which each endangered species was recorded. The greatest species richness was recorded in the northern part of the Biosphere Reserve, near the border with Brazil, where eight different species were found within one single grid cell (Fig. 1). Only another eight cells harbour more than one endangered species. Indeed, endangered species were recorded only in 29.6% (32 of 108 grid cells) of the quadrants visited in the last 22 years. Only 21.9% (108 of 494 grid cells) of the total area of the Biosphere Reserve was surveyed in that period, with 38.0% (41 of 108 grid cells) of the sampled areas visited solely once. Yet, sampling effort has not been consistent throughout the reserve (Fig. 2). Southern areas have been sampled most intensively, with the main focus being in the coastal regions. Sampling in other areas has been much sparser. There is a lack of recent information about the presence of species in most sectors of the reserve.

Discussion

Despite the importance of having updated and accurate information on the distribution of endangered species in a reserve, Bañados del Este Biosphere Reserve has not been thoroughly surveyed recently. The relatively good sampling in the Atlantic coastal region is probably a consequence of easy accessibility and the presence of urban and tourist centres. Indeed, it is likely that the areas next to Laguna de Castillo and Laguna Negra are well studied as a consequence of the presence of protected areas with rangers gathering data throughout the whole year along with the frequent visits of scientists.

Grid cells with the largest numbers of endangered species were recorded in the north and coastal regions of the reserve (Fig. 1). The later observation is probably a consequence of the sampling effort already discussed, while the former suggests that within the reserve the northern region harbours an increased proportion of endangered species.

All this suggests that, as a high priority for the development of sound management strategies, the knowledge of the current distribution and abundance of the species within the reserve should be expanded (see also

Table 1 – Nationally endangered mammals, reptiles and amphibians recorded between 1980 and 2001 within Bañados del Este Biosphere Reserve, Uruguay. Grid cells indicate the number of 10 km x 10 km quadrants in which each species was found.

Mammals	**Quadrants**
Akodon reigi	3
Cabassous tatouay	4
Chironectes minimus	1
Cuniculus paca	4
Gracilinanus agilis	6
Leopardus wiedii	1
Lynchailurus braccatus	2
Nasua nasua	2
Ozotoceros dichotomys	2
Sphiggurus spinosus	2
Tamandua tetradactyla	2
Reptiles	
Acanthochelys spixii	1
Echinanthera poecilopogon	1
Liomis almadensis	2
Phrynops williamsi	1
Phylodrias olfersii	2
Amphibians	
Ceratophrys ornatus	1
Hyla minuta	4
Melanophryniscus montevidensis	8

SOUTULLO, in press). Intensive surveys in the sectors not recently surveyed are of utmost importance. In particular the area of Cerro Largo (which

despite being very poorly studied harbours more than 50% of the endangered species considered in this analysis) should be more exhaustively surveyed, as it constitutes the most promising sector for the identification of new areas rich in endangered species. Evidence of that is the fact that in the last 10 years two of the species analysed, *Cuniculus paca* and *Chironectes minimus*, were recorded for the first time in Uruguay precisely in that region (GONZÁLEZ, 2001b). Species still not recorded in the reserve or even Uruguay are likely to occur there. The high biological value of the northern region becomes evident when it is considered that the southern edge of the Atlantic forest hotspot ends nearby, at the Brazilian-Uruguayan border (MYERS et al., 2000).

Although we found that the proposed protection zones would harbour 100% of the species studied (Fig. 2), the majority of the sampling was conducted within those areas. Therefore, the lack of recent sampling outside them fails to indicate the diversity of endangered-species in other sectors of the reserve, and thus if other areas should be protected instead. Although our analysis shows that the proposed protection zones will contribute to the protection of all the endangered species, this does not mean that they are able to sustain viable populations of those species. Analyses considering population densities and habitat suitability might show that in order to ensure the preservation of these species, other sectors of the reserve should be protected. It is therefore necessary to deepen the research on these topics to complement the already extant ecosystemic and landscape analyses of the reserve.

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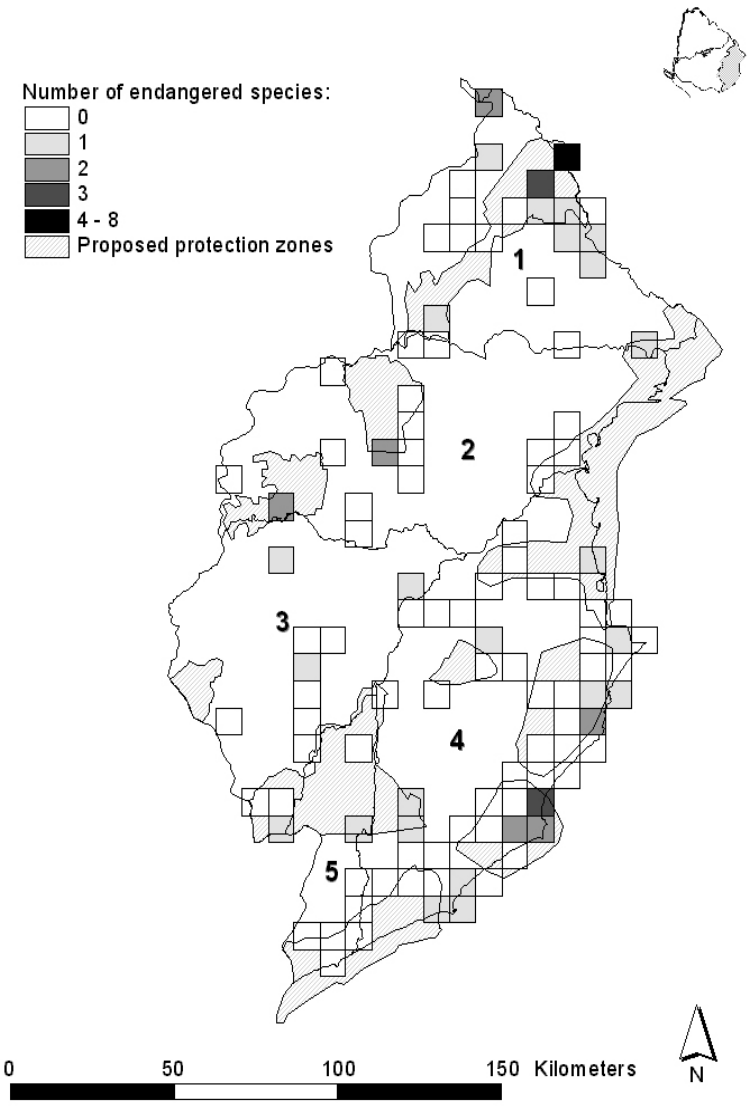

Fig. 1.– Location of ten areas proposed as protection zones and the number of endangered species recorded between 1980 and 2001 in 108 10 km x 10 km sampled quadrants are shown. Major political divisions included within the reserve: 1 – Cerro Largo, 2 – Treinta y tres, 3 – Lavalleja, 4 – Rocha, 5 – Maldonado.

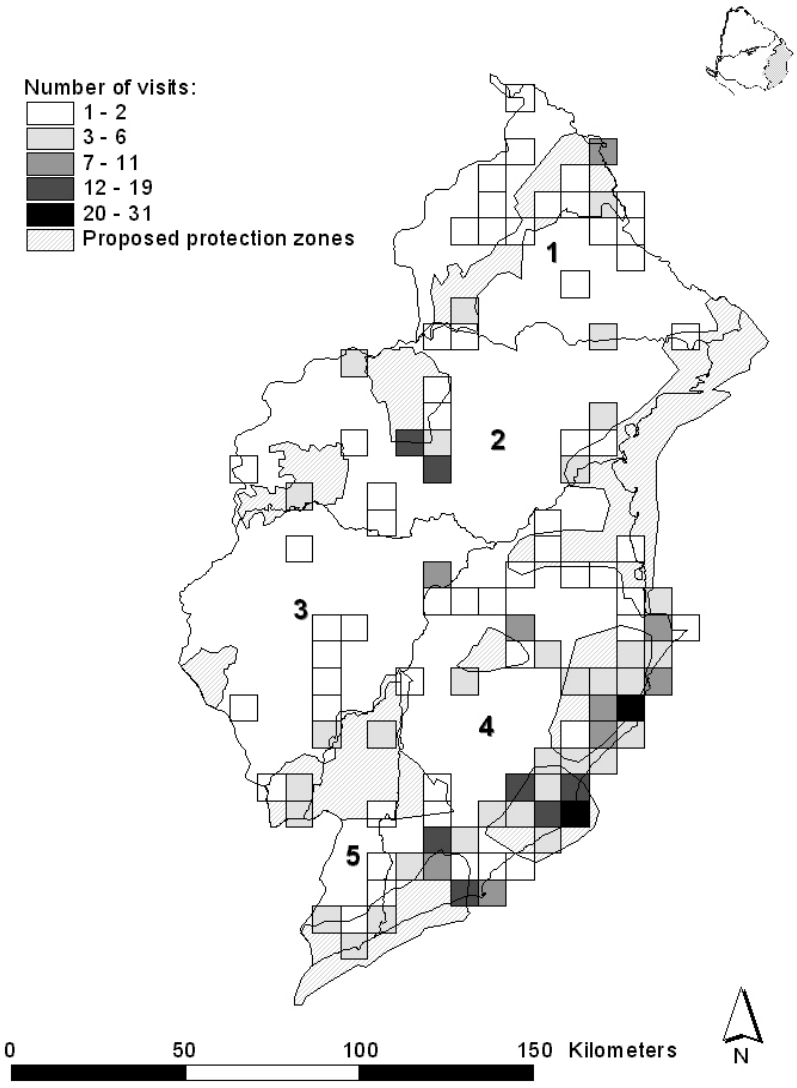

Fig. 2 – Geographic distribution of sampling effort in Bañados del Este Biosphere Reserve, Uruguay (32/ to 35/S; 53/ to 55/W) between 1980 and 2001. Location of ten areas proposed as protection zones and the number of visits to the 108 10 km x 10 km quadrants sampled in that period are shown. Major political divisions included within the reserve: 1 – Cerro Largo, 2 – Treinta y tres, 3 – Lavalleja, 4 – Rocha, 5 – Maldonado.

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ERRATA: Comunicaciones Zoológicas, 201.

Please note the following misspellings in Table 1 (p. 6):

Ozotoceros dichotomys instead of *Ozotoceros bezoarticus*
Liomis almadensis instead of *Liophis almadensis*
Phylodrias olfersii instead of *Philodryas olfersii*
Ceratophrys ornatus instead of *Ceratophrys ornata*

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