Rev. Ecol. Lat. Am.
Vol. 5 Nº (1-2) Art. 2 pp. 13-20, 1998
ISSN 1012-2494
D.L. pp 83-0168

Recibido: 27-07-98
Aceptado: 14-08-98
Publicado: 31-08-98
© 1998 CIRES

ABUNDANCE AND DISTRIBUTION OF MARSH DEER *Blastocerus dichotomus* (ARTIODACTYLA: CERVIDAE) IN THE PANTANAL, BRAZIL

Mauro, R.A.; Mourão, G.M.; Coutinho, M. E.; Silva, M.P. & Magnusson, W.E.*
<rodiney@cpap.embrapa.br>
Centro de Pesquisa Agropecuária do Pantanal/EMBRAPA, CP 109 Corumbá, MS, Brazil.
* Departamento de Ecologia, Instituto Nacional de Pesquisas da Amazônia, CP 478, Manaus, AM, Brazil.

ABSTRACT

An aerial survey was used to estimate the abundance of marsh deer, ***Blastocerus dichotomus***, in the Pantanal wetland of Brazil (140,000 km^2). We used the double-count method to obtain a correction factor for the observed densities.Marsh deer occur in almost all of the area sampled. The population was estimated as 36,314 (±4,923) individuals. The highest densities were found to the north and northeast of Uberaba Lake, and in the inundation area of Negro River in the southeast of the Pantanal. There is no evidence of a decline in the marsh deer population in the Pantanal since 1974.

Key Words: ***Blastocerus dichotomus***, Cervidae, Artiodactyla, Marsh Deer, Brazilian Pantanal, Aerial Survey, Brazil.

ABUNDÂNCIA E DISTRIBUÇÃO DE CERVO-DO-PANTANAL *Blastocerus dichotomus* (ARTIODACTYLA: CERVIDAE) NO PANTANAL MATO GROSSENSE, BRASIL

RESUMO

Um levantamento aéreo foi utilizado para estimar a abundância de cervo-do-pantanal, no Pantanal do Brasil (140.000 km^2). Nós usamos o método de dupla-contagem para obter o fator de correção para as densidades observadas. O cervo ocorre na maior parte da área amostrada. A população foi estimada em 36.314 (±4.923) indivíduos. As maiores densidades foram encontradas no norte e nordeste da lagoa Uberaba, e na área de inundação do rio Negro no sudeste do Pantanal. Não existe evidencia de um declínio na população de cervos no Pantanal desde 1974.

Palavras Chaves: ***Blastocerus dichotomus***, Cervidae, Artiodactyla, Cervo-do-pantanal, Pantanal, Levantamento aéreo, Brasil.

FICHA

MAURO, R. A.; MOURÃO, G. M.; COUTINHO, M. E.; SILVA, M. P. & MAGNUSSON, W. E. 1998.- ABUNDANCE AND DISTRIBUTION OF MARSH DEER ***Blastocerus dichotomus*** (ARTIODACTYLA: CERVIDAE) IN THE PANTANAL, BRAZIL. Rev. Ecol. Lat. Am. **5**(1-2): 13-20

INTRODUCTION

The marsh deer, can attain a weight of 150 kg and a shoulder height up to 120 cm, and is the largest cervid in South America. It is one of the few deer known to be restricted to wetlands such as seasonal streams, swamps, and flooded savannas (Schaller & Hamer, 1978). It is also one of the scientifically least known cervids (Schaller & Vasconcelos, 1978).

The International Union for Conservation of Nature and Natural Resources (IUCN 1982) considers the marsh deer to be vulnerable. The United States Department of Interior (USDI 1980) lists the species as endangered, and it is on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The concern of these organizations stems from an assumed reduction in the density of this species plus the destruction of its habitat through river impoundments, the draining of flooded areas, and the potential effects (such as competition and disease transmission) of cattle ranching within its habitat.

The original distribution of marsh deer extended from southeast Peru, through Paraguay, Bolivia, northeast Argentina, northwest Uruguay and into Brazil, where it reached the southern margin of Amazonian forest (IUCN, 1982). Within Brazil, the major proportion of appropriate habitat is in the Pantanal. Located in the upper Paraguay River basin, this is the largest floodplain in the world, comprising about 140,000 km^2. The Pantanal has little tree cover and limited ground access, and is therefore particularly well suited for the use of aircraft in large-vertebrate population surveys. Such surveys have already been employed in other areas (*e.g.*, for birds by Briggs *et al.*, 1985; for kangaroos by Caughley & Grigg, 1981; Bayliss & Giles, 1985; for cervids by Büechner *et al.*, 1951; Petrides, 1953; Gasaway *et al.*, 1985; White *et al.*, 1989). Aerial survey has frequently proved to be the most economical and effective method to count large vertebrates that are widely distributed in open areas (Caughley & Grice, 1982; Caughley, 1979).

Schaller & Vasconcelos (1978) used aerial survey to estimate densities of marsh deer for 4 areas in the Brazilian Pantanal. These authors assumed that marsh deer occur in only a limited area of the Pantanal and estimated a total of 5,150 marsh deer for the Pantanal as a whole, suggesting that the population could not be greater than 7,000 individuals.

In their study, Schaller & Vasconcelos (1978) presumed that they saw almost all deer within their transects. However, studies of the efficiency of aerial survey demonstrate that frequently only a relatively small proportion of animals in transects is observed (Caughley, 1977). In our study we used a double-count technique to correct for this bias and to estimate the distribution and population size of marsh deer over the whole Pantanal.

STUDY AREA

The Pantanal (Fig. 1) slopes gradually from east to west (about 25 cm/km) and from north to south (about 2 cm/km) (Carvalho, 1986). The climate is sub-humid tropical, with an average annual temperature of 26ºC and rare frosts

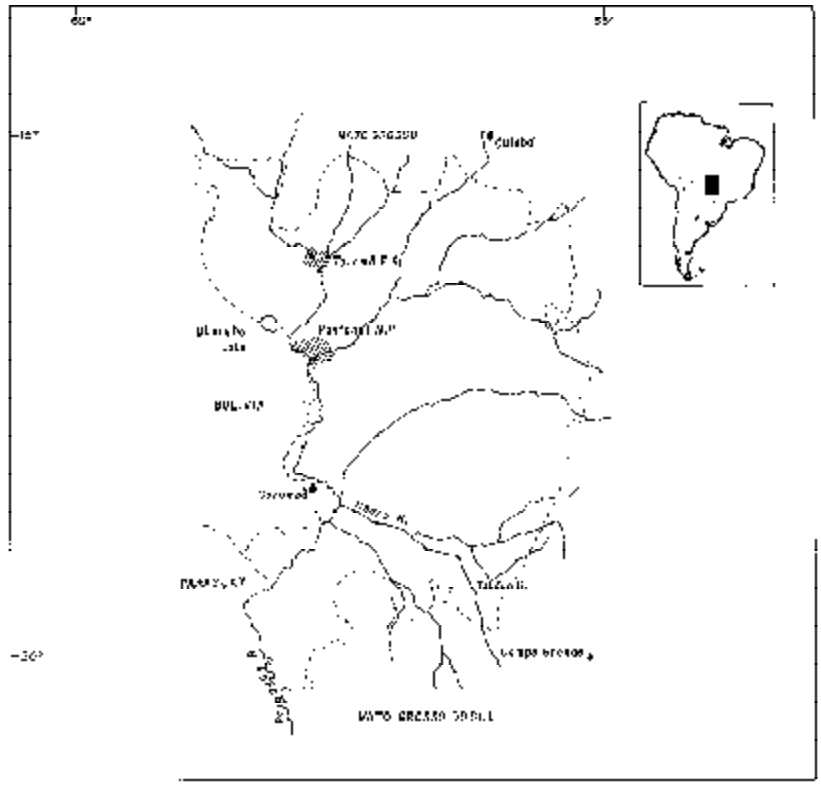

Fig 1: Brazilian Pantanal with indications of Taiamã Ecological Station and Pantanal National Park.

(Cadavid Garcia, 1984). The region receives an overall average of about 1,100 mm of rain per year, which falls mainly between October and March. Besides this seasonality, the Pantanal shows considerable interannual variation in rainfall, with series of very wet and very dry years running in cycles of about 8 years (Cadavid Garcia, 1984; Adámoli, 1986). The region has been in a wet cycle since 1974.

The vegetation of the Pantanal is a complex mosaic with influences from Cerrado (savanna), Amazonian forest, Chaco, and Atlantic Coastal forest (Prance & Schaller, 1982; Allem & Valls, 1987). These elements show varying degrees of interpenetration, depending on proximity to the biome in question. Overall, the majority of the Pantanal is composed of seasonally flooded fields and marshlands (Fig. 2).

METHODS

We counted deer during the dry season (18 September-13 October 1991). The entire Pantanal was sampled by fifty east-west transects, spaced at intervals of 6' (latitude). The total sample area was 2,108 km^2, and the sample intensity was 1.78% (Mauro, 1993). The survey was divided into 33 sessions and 1,157 intra-transect units. The sessions included transects of variable lengths and were flown during mornings or afternoons. Session limits were determined by the range of the aircraft or light availability.

Our aerial survey team included a pilot, a navigator, and 4 observers in a Cessna 206 flying 60 m above ground level at a speed of 200 km/hr. Each observer counted animals seen within a 200 m-wide strip defined by rods fixed to struts on either side of the aircraft. The placement of these rods was calibrated for each observer using ground references.

The navigator timed and directed the transects based on 1:250,000-scale maps. Three of the 4 observers counted several vertebrate species in addition to marsh deer. The fourth observer evaluated habitat type in each transect unit.

Fig 2: One view of the vegetation in the Pantanal during the aerial survey, with different vegetal formations demonstrates the influences from various biomes.

Table 1: Marsh deer density and estimated population, according to stratification based on flooding level and duration (Brasil, 1979), in the Brazilian Pantanal (1991). SE= standard error.

level of flooding	density (ind/km^2)	SE	number of transects	area (km^2)	estimated population	SE
HIGH	0.38	0.09	43	40,569	15,376	3,489
MEDIUM	0.24	0.06	43	66,680	16,070	4,121
LOW	0.09	0.04	41	30,286	2,847	1,242

POPULATION ESTIMATION

Relative densities by habitat strata, an overall population estimate, and standard errors were calculated using the method of Caughley & Sinclair (1994) for sampling without replacement. The 50 east-west transects were our sample units. We employed the ratio estimate method, which is customarily used when sample units are of different sizes, as is the case with transects across an area of irregular shape.

Since counts differ among observers, we used the double-count method (Magnusson *et al.*, 1978; Caughley & Grice, 1982) to correct individual counts for marsh deer not seen in the transects. In this method, two observers simultaneously count the deer in an area delimited by the strut rods. The double counts were made in 108 units of 3' 13" longitude, which were divided into subunits of approx. 1.1 km. The probability of Observer 1 seeing a deer, P1, is estimated by P1=B/(B+S2), where B is the number of animals seen by both observers, and S2 is the number of animals seen by Observer 2 but not by Observer 1. The probability of Observer 2 seeing a deer is estimated similarly. The calculation of these sighting-probabilities serves as a base for calculating a multiplicative correction factor (C): C=1/P, where P is the probability of a given observer seeing a given animal in a given transect.

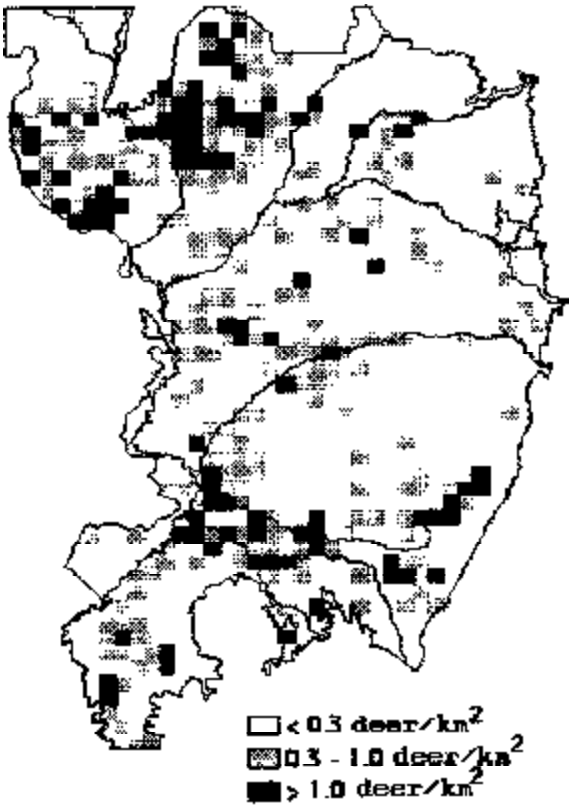

Fig 3: Distribution and density of marsh deer (***Blastocerus dichotomus***) in the Brazilian Pantanal.

POPULATION ESTIMATION IN HABITAT STRATA

Habitat strata were examined to determine whether marsh deer densities differed across habitat types. If such differences exist, then knowledge of them would facilitate sample stratification for future surveys. We divided the entire study area in strata based on flooding and vegetation. Strata were based either on the level and duration of flooding (low, medium, or high; Brasil, 1979), or the following 6 habitat classifications:

1. areas with flooded fields or savanna vegetation;
2. areas occupied predominantly by ponds;
3. areas of seasonal streams;
4. deeply flooded areas;
5. areas dominated by trees;
6. areas of Chaco forest or dominated by trees of the genera *Tabebuia* or *Copernicia*.

RESULTS

In calculating a double-count correction factor, long count intervals overestimate the size of B (the number of animals seen by both observers) and consequently result in underestimates of total population size (Caughley & Grice, 1982). Therefore, we used what we believed to be the shortest practicable count interval (18 seconds) to calculate the overall correction factor and to estimate the population of marsh deer for the Pantanal. Because any count interval can overestimate B, our population estimates are likely to be conservative.

Table 2: Relation between marsh deer abundance and stratification based on habitat type[1] in the Brazilian Pantanal (1991). SE= standard error.

Stratum	density (ind/km²)	SE	number of transects	area (km²)	estimated population	SE
1	0.29 [a]	0.05	46	65,022	18,922	3,222
2	0.09 [b]	0.05	5	4,220	393	207
3	0.13 [b]	0.06	23	29,178	3,910	1,634
4	0.26 [a]	0.09	18	10,487	2,685	901
5	0.16 [b]	0.04	23	22,748	3,662	901
6	0.19 [b]	0.04	14	5,879	1,099	429

[1] 1= areas with flooded fields or savanna vegetation; 2= areas occupied predominantly by ponds; 3= areas of seasonal streams; 4= deeply flooded areas; 5= areas dominated by trees; 6= areas of Chaco forest or dominated by ***Tabebuia* or *Copernicia***.

Stratification based on degree of flooding (Brasil, 1979) influenced the density of deer observed, with higher densities occurring in areas of greater flooding (Table 1). Stratification by habitat types also influenced the number of deer seen; higher densities were recorded for habitat 1 than for habitat 2 (Table 2).

Although marsh deer were observed in almost all areas of the Pantanal, low densities occurred in the central and eastern regions. The highest densities (> 10 deer/km²) were to the north and northeast of Uberaba Lake and in the area flooded by the Negro River (Fig. 3).

POPULATION ESTIMATES

The probability of seeing deer varied among observers. No observer saw more than 79% of the deer in the transects. Based on the uncorrected counts of the most efficient observer, the number of marsh deer in the Pantanal would be estimated at 28,594 ±3,876. Correcting this observer's counts by our double-count multiplicative factor, we estimate the Pantanal marsh deer population for 1991 to be 36,314 ±4,923 animals (0.259 ±0.04 deer/km²).

Fig. 4: Familiar group of Marsh Deer in the Pantanal during the aerial survey.

DISCUSSION

Differences in deer densities among strata suggest habitat preferences for the species. Our stratification could serve to define strategies for future surveys, concentrating sampling intensity within areas of higher deer densities and thus improving the accuracy and precision of the population estimate (Caughley, 1977; Caughley & Grigg, 1981; Bayliss & Yeomans, 1989 a, b). If it were our purpose to design a survey to determine the density of marsh deer in any given year, the sampling could be stratified to concentrate on flooded areas. However, the chief concern of our survey has been to further our understanding of the biology of the marsh deer, and particularly to monitor interannual changes in population size for marsh deer and other species. Addressing such questions requires the continuation of systematic observations which repeat the methodology of previous surveys.

The concentration of deer encountered in and around the Taiamã Ecological Station, and in the flood-margin of Uberaba Lake in the northern region of the Pantanal, might have resulted from the local seasonality of flooding. According to Schaller & Vasconcelos (1978), these areas provide appropriate conditions for marsh deer during the dry season, with water depth of < 70 cm and a great abundance of food (primarily rooted aquatic plants). It is also possible that the high deer densities occur because those areas are almost inaccessible to people.

Marsh deer occur over most of the southern Pantanal is relatively uniform. Long-time residents say that the Taboco River marsh (a tributary of the Negro River) and the area flooded by the lower Negro River have always had great concentrations of marsh deer (personal communications). Furthermore, many ranches in this region have trophy collections of marsh deer antlers. Our aerial survey revealed substantial concentrations of deer in these areas, suggesting that populations there remain vigorous.

In the northern Pantanal, the greatest concentrations of marsh deer are located in flooded fields surrounding Uberaba Lake. In the southern Pantanal, the highest densities are in marshy areas along the Negro River. This suggests that the distribution of marsh deer is more closely related to water depth than to our vegetation type (Fig. 4).

Obviously, the distributions we report pertain specifically to our dry-season sample. Schaller & Vasconcelos (1978) report that flooding can force marsh deer in the Poconé Pantanal to make seasonal migrations of up to 50 km. This phenomenon could explain the concentration of marsh deer observed in a narrow band along the interface of flooded and dry land in the Negro River area and Uberaba Lake.

The double-count method should be used in aerial surveys whenever applicable to increase accuracy. The method of Caughley & Grice (1982) for estimating population size assumes that no more than one animal exists within each transect subunit used to calculate the correction factor. Since this is not necessarily the case with aerial surveys, the double-count correction factor often leads to underestimates of population size. Thus, our overall estimate of marsh deer abundance (36,314 ±4,923) is conservative. This number clearly differs from the estimates for marsh deer given by Schaller & Vasconcelos (1978). It indicates that vigorous populations existed in 1991, although higher densities were confined to habitat flooded to a depth of approximately 70 cm.

It is very difficult to compare our estimate of the deer population with that of Schaller & Vasconcelos (1978) because of differences in methodology. Our survey covered the entire region, whereas the former survey was limited to certain areas where deer were thought to be abundant. Also, we flew at a lower altitude (60 vs. »100m), which probably increased the proportion of animals sighted, although even at 60m a substantial proportion may not be observed (see Caughley, 1974). The double-count correction technique that we used, which had not yet been developed at the time of the former survey, also helped us to refine our population estimate. Schaller and Vasconcelos presumed that densities of marsh deer outside their study areas were very low or zero. Our surveys do not confirm that assumption for 1991. Extrapolating their estimates of density to the entire Pantanal returns estimates of total numbers (23,000 or approximate 0.164 deers/km^2) similar to ours.

MANAGEMENT IMPLICATIONS

In spite of lack of new data, it has been claimed since 1978 that the population of marsh deer in the Pantanal is declining from a maximum of 7,000 individuals. However, current general surveys are important for species presumed to be vulnerable or endangered. The importance of consistently acquiring new data has recently been dramatically illustrated by the rediscovery of an “extinct” 50 kg peccary in the chaco of Paraguay and Argentina (Mares, 1986). Our present study has demonstrated that, within the Pantanal, marsh deer are far more abundant than had been suspected. Outside of the Pantanal, however, the status of the marsh deer remains unknown and may be critical.

It has been reported that the (presumed) decline in populations of the marsh deer may have been exacerbated by diseases contracted from cattle (Schaller & Vasconcelos, 1978). However, there are no studies on the incidence of bovine disease in marsh deer. Although we have no way of knowing whether Schalle's and Vasconcelos (1978) estimates were accurate, we can affirm that marsh deer have not been declining from a high of 7,000 individuals in 1978. During that period the population either increased dramatically or remained relatively stable. We believe the latter is more likely. Furthermore, our research indicates that the two species have different habitat preferences. The interaction of cattle and marsh deer in areas of mutual distribution needs to be studied.

Indirect evidence suggests that the number of marsh deer has been reduced by hunting in some areas. Furthermore, a significant amount of habitat may have been lost to wetland drainage and agricultural development outside of the Pantanal. However, the extent of these problems has not been quantified.

The greatest concentrations of marsh deer (>1 deer/ km^2) were encountered: (1) near the confluence of the Paraguay and Bento Gomes Rivers, (2) in and around the Taiamã Ecological Station, and (3) in the flood-margin of Uberaba Lake, near the Bolivian border. The animals within the Taiamã Ecological Station constitute the only viable population of marsh deer known to exist within a protected area in Brazil. Because of its deep flooding, the Pantanal National Park does not provide adequate habitat for maintenance of viable marsh deer populations. Within the Park, our data indicate that deer were either absent or occurred at very low densities.

Within extensive areas such as the Pantanal, aerial surveys can provide information about patterns of distribution and seasonal abundance of endangered species. It is necessary that these surveys be conducted regularly (preferably at least annually) to monitor the densities of large vertebrates. Aerial surveys can help determine conservation priorities and can thereby help avoid the waste of scarce resources in dealing with problems which are not critical.

ACKNOWLEDGEMENTS

This research was supported by the World Wide Fund for Nature (WWF), Sociedade de Defesa do Pantanal (SODEPAN) and Centro de Pesquisa Agropecuária do Pantanal (CPAP-EMBRAPA). We thank Dr. Clarence Abercrombie and Dr. Stephen Hamilton for the critical review and suggestions.

REFERENCES

Adámoli, J. (1986). A dinâmica das inundações no Pantanal. In *Anais do 1 º Simpósio sobre Recursos Naturais e Sócio-econômico do Pantanal*. ed. EMBRAPA/DDT, Brasília, pp. 51-62.

Allem, A. C. & Valls, J. F. M. (1987). *Recursos Forrageiros Nativos do Pantanal Mato-Grossense*. ed. EMBRAPA/ CENARGEN, Brasília, DF.

Bayliss, P. (1986). Factors affecting aerial surveys of Maine fauna, and their relationship to a census of dugongs in the coastal waters of the Northern Territory. *Aust. Wildl. Res.*, **13,**27-37.

Bayliss, P. & Giles, J. (1985). Factors affecting the visibility of kangaroos counted during aerial surveys. *J. Wildl. Manage*., **49,**686-692.

Bayliss, P. & Yeomans, K. M. (1989a). Distribution and abundance of feral livestock in the "Top End" of the Northern Territory (1985-86), and their relation to population control. *Aust. Wildl. Res.*, **16,**651-676.

Bayliss, P. & Yeomans, K. M. (1989b). Correcting bias in aerial survey populations estimates of feral livestock in northern Australia using the double-count technique. *J. Appl. Ecol.*, **26,**925-933.

Brasil. (1979). *Estudos de Desenvolvimento Integrado da Bacia do Alto Paraguai*. ed. Superintendência do Desenvolvimento da Região Centro-Oeste, Ministério do Interior. Brasília, DF.

Briggs, K. T.; Tyler, W. B. & Lewis, D. B. (1985). Comparison of ships and aerial surveys of birds at sea. *J. Wildl. Manage*., **49,**405-411.

Büechner, H. K.; Bress, I.O. & Bryan, H.F. (1951). Censusing elk by airplane in the Blue Mountains of Washington. *J. Wildl. Manage.*, **15,**81-87.

Cadavid Garcia, E. A. (1984). *O Clima no Pantanal Matogrossense*. EMBRAPA/CPAP, Corumbá, Brasil.

Carvalho, N. O. (1986). Hidrologia da Bacia do Alto Paraguai. In: *Anais do 1 º Simpósio sobre Recursos Naturais e Sócio-econômicos do Pantanal*, ed. EMBRAPA/DDT, Brasília, pp. 43-49.

Caughley, G. (1974). Bias in aerial survey. *J. Wildl. Manage.*, **38,**921-933.

Caughley, G. (1977). *Analysis of vertebrate populations*. John Wiley & Sons, London.

Caughley, G. (1977). Sampling in aerial survey. *J. Wildl. Manage.*, **41,** 605-615.

Caughley, G. (1979). Sampling techniques for aerial censuses. In: *Aerial surveys of fauna populations*. Australian National Parks and Wildlife Service, Canberra, pp. 15-23.

Caughley, G. & Grigg, G. C.(1981). Surveys of the distribution and density of kangaroos in the pastoral zone of South Australia, and their bearing on the feasibility of aerial survey in large and remote areas. *Aust. Wildl. Res.*, **8,**1-12.

Caughley, G. & Grice, D. (1982). A correction factor for counting emus from the air, and its application to counts in Western Australia. *Aust. Wildl. Res.*, **9,**253-259.

Caughley, G. & Sinclair, A. (1994). *Wildlife Ecology and Management*. Blackwell Scientifique Publications, Cambridge.

Cochran, W. G. (1963). *Sampling Techniques*. 2nd edn John Wiley & Sons, New York, NY.

Gasaway, W. C.; Dubois, S. D. & Harbo, S. J. (1985). Biases in aerial transect surveys for moose during May and June. *J. Wildl. Manage.*, **49,**777-784.

IUCN (International Union for Conservation of Nature and Natural Resources) (1982). *The IUCN mammal red data book*, Part 1, IUCN, Gland.

Magnusson, W.E., Caughley, G.J. & Grigg, G.C. (1978). A double-survey estimate of population size from incomplete counts. *J. Wildl. Manage.*, **42,**174-176.

Mares, M.A. (1986). Conservation in South America: problems, consequences, and solutions. *Science*. **233,**734-739.

Mauro, R.A. (1993). Abundância e padrão de distribuição de cervo-do-pantanal *Blastocerus dichotomus*(Illiger, 1815) no Pantanal Mato-Grossense. MSc thesis, Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais.

Petrides, G.A. (1953). Aerial deer counts. *J. Wildl. Manage.*, **17,**97-98.

Prance, G.T. & Schaller, G.B. (1982). Preliminary study of some vegetation types of the Pantanal, Mato Grosso, Brazil. *Brittonia* **34,**228-251.

Schaller, G. B. & Vasconcelos, J.M.C. (1978). A marsh deer census in Brazil. *Oryx* **14,**345-351.

Schaller, G.B. & Hamer, A. (1978). Rutting behaviour of Pére David's deer, *Elaphurus davidianus*. *Zool. Gart. N. F*. **48,**1-15.

USDI (United States Department of the Interior) (1980). *Republication of the lists of endangered and threatened species and correction of technical errors in final rulers*. Federal Register, USA.

White, G.C.; Bartmann, R.M. ; Carpenter, L.H. & Garrot, R.A. (1989). Evaluation of aerial line transects for estimating mule deer densities **.** *J. Wildl. Manage.*, **53,**625-635.

Revista de ECOLOGÍA LATINOAMERICANA

Héctor F. AGUILAR, Editor

ÁREAS DE INTERÉS

Ecología Animal, Vegetal y Humana. Ecología Marina. Etnología. Ecofisiología Animal y Vegetal. Centros de Endemismos, Refugios, Humedales, Estuarios, Reservas Forestales y de Fauna, Especies, Manejo de Bosques Naturales. Conservación de Ecosistemas y Especies. Especies en Consideración. Etnobotánica. Etnozoología. Biodiversidad. Historia Natural. Estadística, Teoría Ecológica. Modelos Ecológicos, Ecología Aplicada a: Invertebrados, Ornitología, Mastozoología, Herpetología, Entomología, Ictiología, Biología Marina. Sistemática. Taxonomía. Comunidades animales y Vegetales. Patrónes y Procesos en Ecosistemas. Contaminación Ambiental. Análisis Ambiental. Control Ambiental. Cambios Globales. Ecología de Poblaciones. Dinámica de Poblaciones. Agroecología. Ciclos de Nutrientes. Manejo de Vida Silvestre. Biogeografía. Evolución. Coevoluvión, Interacción Planta-Animal. Inventarios. Impacto Ambiental. Áreas Protegidas. Control Biológico. Calidad de vida. Calidad de Agua. Limnología. Ecología de Aguas Dulces. Desarrollo sustentable. Conservación. Eventos y Comentarios a Libros.

PO BOX 397 * MÉRIDA 5101 * VENEZUELA * FAX: (+58 74) 71 29 39 * cires@ciens.ula.ve