# Detectability of capybaras in forested habitats

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## Abstract

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Direct count has been commonly used as an abundance index to estimate wildlife population size. However, systematic errors in sample-based estimators are common in sampling animal populations. At this study we aimed to estimate capybara's observability, through a detectability index in forested habitats. Sampling surveys of capybaras population was obtained by direct count (abundance index) and also by complete count (census). The average detectability index of capybaras in forested habitats was 0.63 ± 0.32 for a single observer. The variability in the detectability index among habitats was due to the presence of more or less dense vegetation. This information might be useful for management purposes of the species in the agroecosystems of southeastern Brazil where species is widespread and overabundant.

***Key words:*** *Hydrochoerus hydrochaeris, capybara, abundance index, direct count, detectability index*

## Resumo

Pinto, G.R.M.; Ferraz, K.M.P.M.B.; Couto, H.T.Z. and Verdade, L.M. **Detectabilidade de capivaras em habitats florestais**. *Biota Neotrop*. Jan/Abr 2006, vol. 6, no. 1 http://www.biotaneotropica.org.br/v6n1/pt/abstract?article+bn01906012006. ISSN 1676-0611

O método de contagem direta de animais tem sido freqüentemente utilizado como índice de abundância para estimar o tamanho de populações silvestres. Entretanto, erros sistemáticos de parâmetros baseados em amostras são comuns em amostragens de populações de animais silvestres. Neste estudo, nós estimamos a observabilidade de capivaras, através de um índice de detectabilidade em habitats florestais. As amostragens da população foram realizadas através da contagem direta (índice de abundância) e da contagem total (censo). O índice médio de detectabilidade de capivaras do observador em habitats florestais foi de 0,63 ± 0,32. A variabilidade no índice de detectabilidade entre os habitats ocorreu devido à vegetação ser mais ou menos densa. Esses resultados deverão ser úteis para o manejo da espécie em agroecossistemas do sudeste brasileiro onde a espécie é amplamente distribuída e abundante.

***Palavras-chave:*** *Hydrochoerus hydrochaeris, capivara, contagem direta, índice de abundância, índice de detectabilidade*

## Introduction

Direct count has been commonly used as an abundance index to estimate wildlife population size (Lancia et al. 1996, Thompson et al. 1998, Williams et al. 2002). Although, systematic errors in sample-based estimators are common in sampling animal populations, good estimates of population size are essential for wildlife management and conservation, as well as control (Williams et al. 2001). Unfortunately, as Williams et al. (2002) have pointed out, the issue of variable detection rate has received insufficient emphasis in both observational and experimental studies in ecology. Karanth et al. (2003) provided a critical review about the census-based paradigm. They emphasize the importance of proposing alternative approaches concerning the problems of spatial sampling and observability. Bayliss (1987) related some of the variables that may affect the consistent detection of animals on a survey as observer experience, distance to animal, noise, animal behavior, weather and cover habitat.

Observability refers to the typical inability to detect and count all animals from the surveyed population, making observers to estimate the underlying detection probabilities from sample counts (Lancia et al. 1996, Thompson et al. 1998, Williams et al. 2002, Karanth et al. 2003). As Karanth et al. (2003) have pointed out, it has been generally assumed that the estimated proportion of the total area actually by survey (a) and the estimated proportion of counted animals in the surveyed area (p) is equal to 1, or that all animals are detected on the sampled area, assuming that a true animal census is carried out.

Capybaras (*Hydrochoerus hydrochaeris*), the largest grazing herbivore widely distributed in South America (Ojasti 1973, Azcárate 1980, Nowak & Paradiso 1991, Eisenberg & Redford 1999), have been considered as a potential plague in east central region of the State of São Paulo, Brazil, due to their higher population density in anthropogenic habitats (Verdade & Ferraz 2006) usually associated with crop damage (Ferraz et al. 2003), and the spread of Brazilian Spotted Fever (Labruna et al. 2004). Their high reproductive capacity, generalist food habits, and low habitat requirements are some aspects of the species biology that could contribute for their success in anthropogenic landscapes. In addition, the Brazilian hunting prohibition (Federal Law No. 5.197 from January 1967), the great food availability provided by the growth of cultivated lands, and the predators decline due to habitat loss (Costa et al. 2005) are the possible causes of the species population booming in these areas (Verdade & Ferraz 2006).

Capybaras are usually surveyed or monitored in many open flat habitats during their foraging activity by terrestrial (Ojasti 1973, Azcárate 1980, Cordero & Ojasti 1981, Macdonald 1981, Schaller & Crawshaw 1981, Herrera 1986, Jorgenson 1986, Alho et al. 1989, Herrera & Macdonald 1989, Verdade & Ferraz 2006) and aerial direct counts (Mourão et al. 1994; Mourão & Campos 1995, Mourão & Magnusson 1997). Correction procedures (as formerly suggested by Caughley 1977) are recommended in circumstances where the total population is unknown and its estimate is either needed or desired. However, it is likely that capybaras are less detectable in forest than in open areas. This problem could be more relevant in areas with high hunting pressure where capybaras forage at night time (Ojasti 1973, Verdade 1996).

This study aims to estimate capybara's detectability by an abundance index in forested habitats. This information might be useful for management purposes of the species for development correction factor in the counts of capybaras.

## Material and Methods

Four study sites located in Campinas, east central region of the State of São Paulo, Brazil, were selected for this study (Figure 1). The study sites were carefully selected in order to provide accurate estimates of the true population size. This was only possible because all of them were fenced areas (i.e., no immigration) and the number of adults was previously known by the local offices. The observer only needed to check the births and deaths occurred in each survey. Habitats description is listed in Table 1.

Sampling surveys of capybara population was obtained by direct count (abundance index) and also by complete count (census) in 26 days on a weekly basis from March to September 2002. First, the observer just counted visible animals (direct count) while walking around the main water body in the study sites. Afterwards, he counted all animals he could find in the area (complete count). So the observer could have both estimates at the same time: the number of animals counted and the number of animals present in the area (true population size).

Detectability index ($\beta$), also called detection probability and observability, was estimated according to Lancia et al. (1996), Thompson et al. (1998) and Williams et al. (2002) as follows: $E(C_i) = \beta_i N_i$, where expected value of count C in time *i* is equal to the detectability ($\beta$) in time *i* multiplied by the true population size N in time *i*. The probability of seeing or catching an animal ($\beta$) will generally be less than 1. As the detectability index is the chance of confirming the occurrence of an animal within some defined space and time (Thompson et al. 1998), this index could be used as observer error estimative in the estimates of animal population size.

## Results and Discussion

The average detectability index of capybaras in forested habitats was 0.63 ± 0.32 (ranging from 0.31 to 0.95) for a single observer (Table 1). This means that the observer could be able to detect from 31% to 95% of the true capybara population in such conditions.

Thompson et al. (1998) pointed out that to be unbiased detectability index ought to assume that there is no influence of any factors such as weather, individual behavior, age and so on. As the observer and also the methodology of capybaras counting were the same during the whole study period we assume that the variability in the detectability index among habitats was due to the presence of more or less dense vegetation. The study sites Taquaral and Unicamp2 were habitats with no dense vegetation and large open areas where animals could be easily detected by the observer. Also, they were areas intensively used by people for leisure activities which means that animals could be more used to human presence. This could explain the higher detectability index by the observer in watching capybaras in these habitats.

Only 31.6% of the total population could be explained by the direct count considering all the study sites ($p<0.001$), described by the following equation: Total population survey = 6.992 + 0.7635(sampling population survey). In Taquaral, 35.3% of the capybara total population could be explained by the direct count ($p < 0.001$), described by the following equation: Total population survey= 7.150 + 0.6541(sampling population survey). The others sites had no significant relationship in the regression models between total and sampling population surveys. The weak relationship between total and sampling population surveys could be explained by the low variability of the total population numbers and the high variability of the abundance index in all study sites.

Despite the fact that our results are still preliminary they emphasize the importance and necessity of estimating observer error in animal counts for population size estimative, not only in forested habitats, but in open habitats too (Mourão et al. 1994). Verdade & Ferraz (2006) verified that distance between observers and capybaras can result in counting bias even in open habitats. When knowing observer error in counting animals it is possible to estimate population size in similar habitats. In addition, Bayliss (1987) recommend rigidly standardized survey procedures for minimizing sampling error.

In management programs, a harvest can be controlled either by placing a quota on offtake or by controlling harvesting effort (Caughley & Sinclair 1994). The control of harvest by quotas could not work properly with populations that fluctuate along time or those whose estimate is imprecise like capybaras in forested habitats. For those, controlling harvesting effort (as suggested by Caughley & Sinclair 1994) could be more effective.

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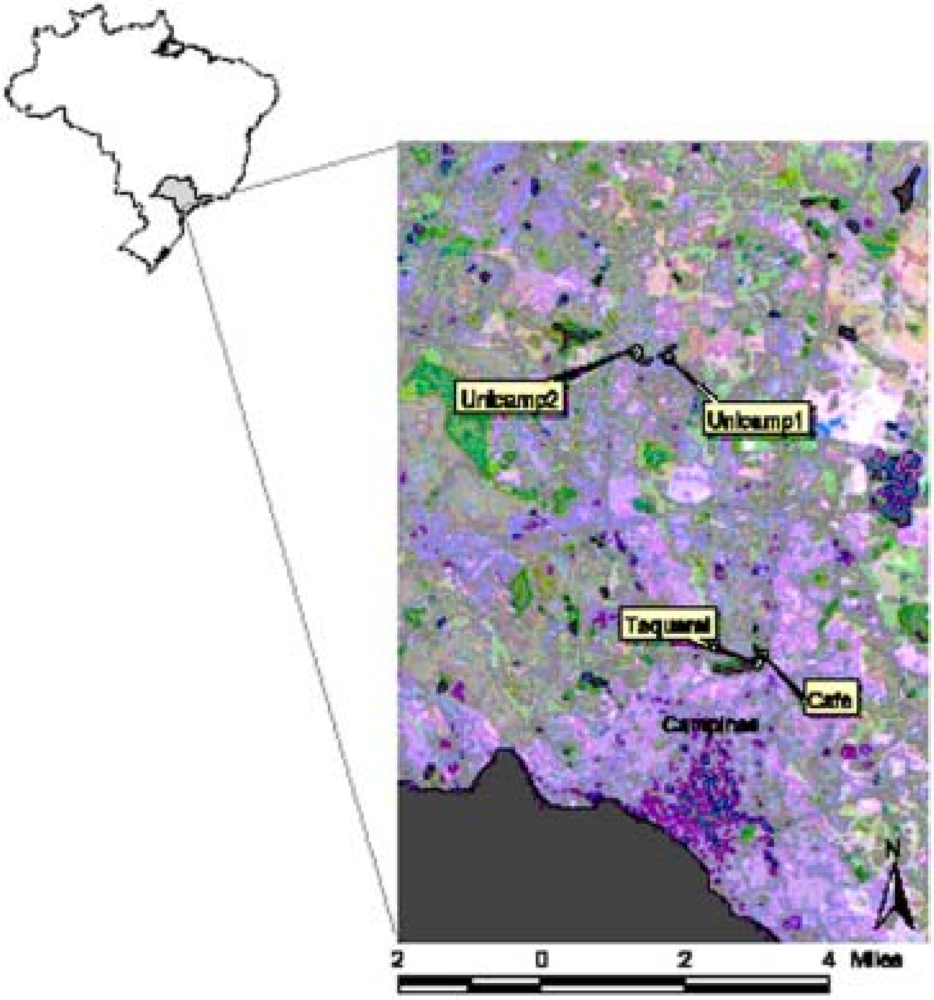


*Figure 1. Location of the study sites, Campinas, east central region of the State of São Paulo, Brazil.*

*Table 1. Habitat description and detectability index (β) (mean ± standard deviation) of an observer of counting capybaras in forested habitats.*

| **Study sites** | **Habitat description** | **Detectability Index (β) (mean ± standard deviation)** |
|---|---|---|
| Café | Three artificial ponds (3 ha) surrounded by dense vegetation and open areas (pasture), not intensive used by people for leisure activities | 0.54 ± 0.30 |
| Taquaral | Artificial pond (14 ha) surrounded by scarce vegetation and open areas intensively used by people for leisure activities | 0.69 ± 0.23 |
| Unicamp1 | Artificial pond (4 ha) surrounded by dense vegetation, not used by people for leisure activities | 0.61 ± 0.39 |
| Unicamp2 | Artificial pond (7 ha) surrounded by vegetation and open areas intensively used by people for leisure activities | 0.69 ± 0.34 |