

**ANÁLISIS DE LAS ESPECIES NO  
HEMATÓFAGAS CAPTURADAS DENTRO DEL  
PLAN DE ERRADICACIÓN DE *Desmodus  
rotundus* (E. GEOFFROY, 1810) EN EL CHOCÓ  
BIOGEOGRÁFICO COLOMBIANO**

## ABSTRACT

Between November 2002 and April 2003 we carried out mist-netting samples in the Central region of the Colombian Biogeographic Chocó to determine bat species potentially affected by a vampire eradication plan taking place at this area. A total of 417 individuals were captured representing the families: Phyllostomidae, Vespertilionidae, and Molossidae, corresponding to 9 subfamilies, 16 genera, and 30 species. Only 7.91% (N = 33) of the captures corresponded to hematofagous bats showing a low proportion in comparison with non-hematofagous species. A high variability in bat species composition was found among sampling localities. Our data indicate that species affinity and species richness at the Central portion of the Chocó may be influenced by the ecosystemic complexity of the region and the degree of disturbance at each sampling locality respectively. The hematophagous species *Desmodus rotundus* was found as part of all bat species assemblages among our sampling localities. Therefore, a differential effect of non-hematophagous species affected by eradication plans in Central Chocó is expected.

**Keywords:** Bat control; Diversity; Chiropterans; Colombian biogeographic Chocó; *Desmodus rotundus*.

## RESUMEN

Entre noviembre de 2002 y abril 2003 se llevaron a cabo muestreos con redes de niebla en la región central del Chocó biogeográfico Colombiano para determinar las especies de murciélagos potencialmente afectados por planes de la erradicación de vampiros llevado a cabo en esta área. Se capturaron un total de 417 individuos pertenecientes a las familias: Phyllostomidae, Vespertilionidae, y Molossidae, correspondientes a 9 subfamilias, 16 géneros, y 30 especies. Únicamente el 7.91% (N = 33) de las capturas correspondieron a murciélagos hematófagos que demostraban una proporción baja en comparación con las especies non-hematófagas. Una alta variabilidad en la composición de especie de murciélagos fue encontrada entre lugares de muestreo. Nuestros datos indican que la riqueza y la afinidad de especie en la porción central del Chocó puede estar influenciada por la complejidad ecosistemática de la región y el grado de disturbio en cada zona de muestreo respectivamente. La especie hematófaga *Desmodus rotundus* fue encontrada en todas los lugares de nuestro muestreo. Por lo tanto, se espera un efecto diferenciado de la especie no hematófagas afectada por planes de la erradicación en Chocó central.

**Palabras clave:** Control de murciélagos; Diversidad; Quirópteros; Chocó biogeográfico colombiano; *Desmodus rotundus*.

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# ANALYSIS OF THE NON-HEMATOPHAGOUS BAT SPECIES CAPTURED WITHIN THE PLAN OF ERADICATION OF *Desmodus rotundus* (E. GEOFFROY, 1810) IN THE COLOMBIAN BIOGEOGRAPHIC CHOCÓ

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## INTRODUCTION

Out of the 1116 currently recognized bat species only three species correspond to hematophagous bats: *Diaemus youngi*, *Diphylla ecaudata*, and *Desmodus rotundus* (Simmons 2005). The majority of the reported cases of attacks by hematophagous bats to humans and domestic animals are caused by the common vampire bat *D. rotundus*. The attacks of *D. rotundus* toward livestock cause the lost of thousands of animals a year in the Neotropics due to anemia, different types of infections commonly developed on the wounds caused by vampire biting, and more importantly because of the transmission of

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the rabies virus (Mayen 2003, Lord 1998, and Greenhall 1983). Rabies transmission to humans because of vampires biting is also considered an important problem in some rural and urban Neotropical areas (Filipe Dantas *et al.*, 2005).

Mechanisms commonly used to control *D. rotundus* populations include roosting site destruction or poison of animals. *Desmodus rotundus* is commonly found roosting with other species. In addition, it has been reported that vampire bats are very vagile animals and they can use several roosting places for short periods of time (Trajano 1996). This continuous movement among roosting sites increases the likelihood of interaction between vampires and a large number of non-hematophagous bat species. Because of the interaction that exists between vampire bats and non-hematophagous species indiscriminate vampire eradication methods are particularly problematic when they are implemented in areas of high bat species diversity. The indiscriminate destruction of roosting sites affect other non-hematofagous bat species commonly associated with *D. rotundus*. Non-hematofagous species affected by plans of vampire's eradication include frugivore bat species considered important seed disperser; nectarivourous bat species, specialized in the pollination of thousands of Neotropical plants; as well as insectivore bat species, naturally contributing to the control of insect populations (Mayen 2003, Arita 1987, Arizona 1993, Constantine *et al.* 1972, Fleming *et al.* 1994).

The Central portion of the Biogeographic Chocó is characterized by its high chiropteran diversity. Mantilla-Meluk and Jiménez-Ortega (2006) reported a total of 92 bat species, representing 52% of the total number of species known in Colombia and 8.25% of the global bat diversity. Eradication Plans including bat poisoning have been implemented in Central Chocó by the «Instituto Colombiano Agropecuario (ICA)» and the «Departamento Administrativo de Salud del Chocó (Dasalud)». In spite livestock is not the main economic activity in the region, commonly consisting of few animals per family, *D. rotundus* attacks to domestic animals and humans has been increasing during the past 10 years turning into

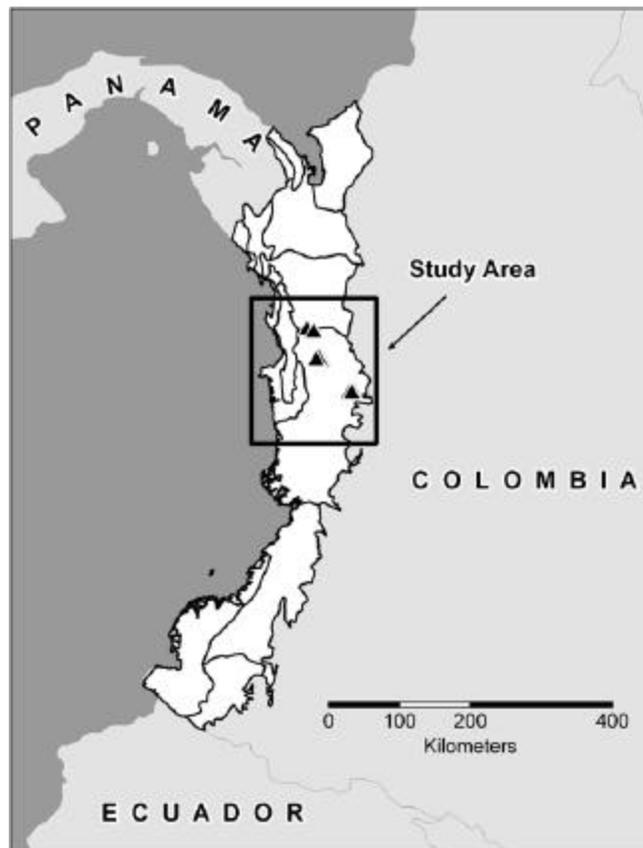


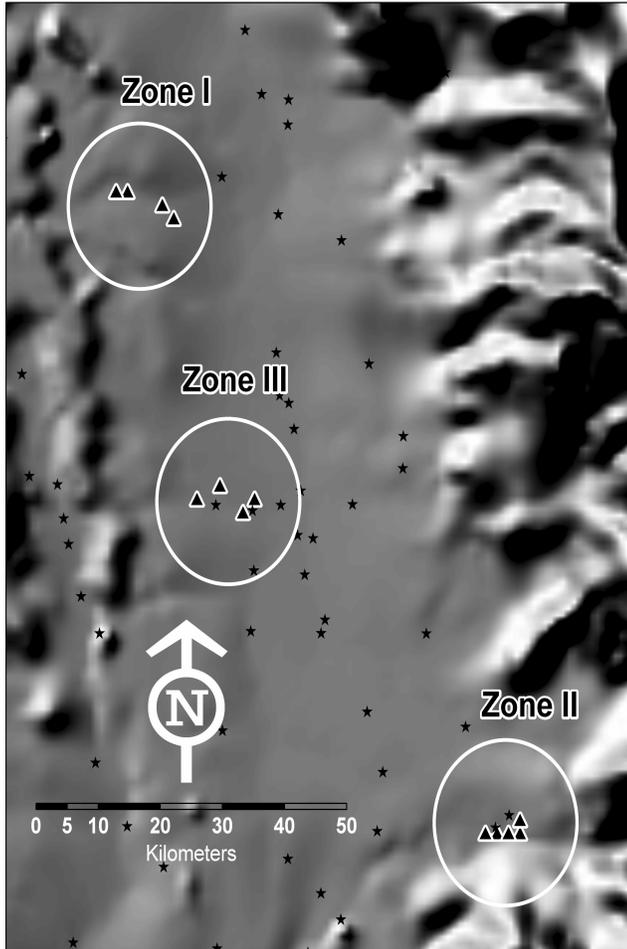
Figure 1. Study area in Central Chocó.

a priority within health planning at the Colombian Chocó.

We investigate the bat diversity associated to localities in the Central Chocó where plans of eradication have been implemented in order to determine which species may be affected by the implementation of the vampire eradication plan (Figure 1).

## STUDY AREA

Our study area includes 17 localities where eradication plans of vampire bats were conducted located within the biogeographic district of Atrato-San Juan (Hernández-Camacho *et al.* 1992). Sampling sites include rural and suburban areas at the Municipios of Tadó, Quibdó, and Medio Atrato and were divided into three sampling subunits as follows: Zone I (Río Buey, at Medio Atrato), Zone II (Angosturas, Carmelo, and Playa de Oro at



**Figure 2.** Sampling localities discriminated by sampling zone. Stars represent populated places at the study area.

Tadó), Zone III (Guarandó and Campo Bonito, at Quibdó) (Figure 2). Sampling localities were divided into the proposed three groups following a proximity criterion. Data on ecology and climate of sampling sites are presented in Table 1.

## METHODS

### Bat assemblage's composition at vampire eradication plan localities

Bat netting was conducted between November 2002 and April 2003 at 17 localities in Central Chocó chosen by the ICA to implement an eradication plan of vampire bats. Each locality was sampled for two or three nights when vampire bats were trapped and poisoned with

anticoagulants. Between six and seven mist-nets (6 x 3 m and 12 x 3 m) were set on the ground close to animal enclosures and human houses. Mist-nets were open between 6 and 8 hours starting at 18:00. The frequency of capture was estimated for both hematofagous and non-hematofagous species. In the same way capture success, abundance, and species richness was calculated for each one of our sampling localities.

### Affinities among sampling localities

A cluster analysis was performed based upon Jaccard Index similarity values by the application of the software PAST version 1.15 (Hammer and Harper 2003). Species compositions in our samples were compared with data reported by Mantilla-Meluk and Jiménez-Ortega (2006) for the Central Chocó region.

### Disturbance

To investigate the effect of disturbance on bat species composition among our samples a disturbance index (ID) modified from Ruán Tejada (2006) was applied. Disturbance index was calculated based upon the number of populated places, roads, electric lines, livestock, lost of vegetation cover, ranked between 0 and 3 as follows: 0) no disturbance (imperceptible) 1) low impact, 2) moderate impact, 3) high impact.

## RESULTS AND DISCUSSION

Sampling effort accounted for 17496 hour.mt-net, with a total of 417 captures and a sampling success of 0.024 individuals/hour.mt-net. Non-hematofagous bats account for 384 individuals with a sampling success of 0.022 individuals/hour.mt-net, while hematofagous bats only account for 33 individuals with a sampling success of 0.002 individuals/hour.mt-net.

In spite our sample efforts were oriented toward the capture of hematofagous bats and mist-nets were set close to human constructions in areas characterized by some degree of disturbance we obtained a relatively high cumulative number of species in comparison with

**Table 1**  
**Sampling localities and environmental variables at the study area (Poveda *et al.* 2004)**

Zone	Estation	Lat N.	Lon. W	Landscape Unit	Precipitation	Relative humidity	Life-Zone
I	1 San Antonio	6°05'	76° 53'	Alluvial Plains	Moderate to High	Moderate	bp-T
Río Buey	2 Finca Mi Lucha	6°06'	76° 56'	Alluvial Plains	Moderate to High	Moderate	bp-T
(Medio Atrato)	3 Finca La Central	6°06'	76° 57'	Alluvial Plains	Moderate to High	Moderate	bp-T
II	4 Comunidad Indígena La Vuelta	6°04'	76° 52'	Alluvial Plains	Moderate to High	Moderate	bp-T
Angosturas,	5 Corral de Virgelina Conrado	5°18'	76° 22'	Moderated Hills	Moderate to High	Moderate	bp-T
Carmelo, Playa	6 Corral de Juan M. Rentería	5°18'	76° 25'	Moderated Hills	Moderate to High	Moderate	bp-T
de Oro (Tadó)	7 Corral de Nicolás Mosquera	5°18'	76° 24'	Moderated Hills	Moderate to High	Moderate	bp-T
	8 Corral de Tomás Sánchez	5°19'	76° 22'	Moderated Hills	Moderate to High	Moderate	bp-T
	9 Estacion Ambiental Playa de Oro	5°18'	76° 24'	Moderated Hills	Moderate to High	Moderate	bp-T
	10 Corral Angostura	5°18'	76° 25'	Moderated Hills	Moderate to High	Moderate	bp-T
	11 Corral Luis S. Mosquera	5°18'	76° 23'	Moderated Hills	Moderate to High	Moderate	bp-T
III	12 Finca Las Palmas	5°42'	76° 46'	Alluvial Plains	Medium	Moderate	bp-T
Guarandó,	13 Corral Estanislao Rodríguez	5°43'	76° 45'	Alluvial Plains	Medium	Moderate	bp-T
Campo Bonito	14 Finca Laureano Mena	5°42'	76° 46'	Alluvial Plains	Medium	Moderate	bp-T
(Quibdó)	15 Finca Jose Palacios	5°42'	76° 46'	Alluvial Plains	Medium	Moderate	bp-T
	16 Corral Rómulo Rentería	5°44'	76° 48'	Alluvial Plains	Medium	Moderate	bp-T
	17 Corral en El Pueblo	5°43'	76° 50'	Alluvial Plains	Low	Moderate	bp-T

previous works conducted in the Central Chocó region (Roa-García *et al.*, 2006; Abella *et al.*, 2006; Moreno *et al.*, 2005; Soler 1997; UTCH *et al.*, 1996). Our samples included representatives of the bat families Phyllostomidae, Vespertilionidae and Molossidae arranged into 16 genera, and 30 species representing 32.6% of the species listed by Mantilla-Meluk and Jiménez-Ortega (2006) for the Central Chocó region. Phyllostomid bats were the most abundant chiropterans in the area represented by 27 species arranged in 14 genera (Tables 2 and 3). Previous studies point on very heterogeneous assemblages of bat species among different localities at the Biogeographic Chocó (Mantilla-Meluk and Jiménez-Ortega 2006). In our samples 50.00% (15/30 spp) were found in unique sampling localities and only 20.00% (6/30 spp) were common to all sampling localities including *Artibeus lituratus*, *Carollia perspicillata*, *C. castanea* y *Platyrrhinus helleri*, and *D. rotundus*. Our data indicate that species affinity and species richness at the Central portion of the Chocó may be influenced by the ecosystemic complexity of the region. Our study area included contrasting landscape units such as Alluvial Plains (AP) (Zones I, III) and Moderated Hills (MH) (Zone II). According to

our cluster analysis affinities in bat composition among our samples was determine by distance separating sampling localities. Sampling Zone I and III are separated by 43.3 Km, Zones I and II are separated by 103.2 Km (Figure 3). The two mentioned landscape units AP and MH were not recovered in terms of bat species affinity in our cluster analysis.

To evaluate the effect of disturbance on bat species composition among sampling localities an index of disturbance was calculated for each sampling locality. Zone I in our samples was characterized by low disturbance values and enclosed the highest species richness (24 spp), followed by Zone II with intermediate disturbance values and holding 14 spp. Finally, Zone III which has the lowest number of species (12 spp) presented the highest values of disturbance (Table 2). These data suggest a relationship between the degree of disturbance and species richness at Central Chocó. Despite that the total number of captures of *D. rotundus* was low it seems that the abundance of vampires is also associated with the degree of disturbance at each sampling locality. The less disturbed area in our samples was Zone I where only 6 specimens of *D. rotundus* were

**Table 2**  
Summary of the results on bat sampling at Central Chocó in the present study

Zone	Captures							Non-hematophagous			Hematophagous			Composition					
	Disturbance Index (ID)	Mist-nets (mt.)	Time (hours)	Sampling effort (hours.mt-net)	Sampling success (n/hours.mt-net)	Sampling success hematophagous	Sampling success non-hematofagous	Preserved specimens Released	Abundance	Treated	Preserved specimens	Abundance	Families	Subfamilies	Genera	Richness	Unique species	Abundance	
I	4	92	45	4140	0,034	0,001	0,033	57	79	136	5	1	6	3	8	14	24	10	142
II	12	114	82	5262	0,024	0,002	0,021	84	29	113	10	3	13	3	7	11	17	1	126
III	7	114	71	8094	0,018	0,002	0,017	57	78	135	8	6	14	3	5	7	12	3	149
<b>Total</b>	<b>320</b>	<b>198</b>	<b>17496</b>	<b>0,024</b>	<b>0,002</b>	<b>0,022</b>	<b>198</b>	<b>186</b>	<b>384</b>	<b>23</b>	<b>10</b>	<b>33</b>	<b>3</b>	<b>9</b>	<b>16</b>	<b>30</b>	<b>10</b>	<b>417</b>	

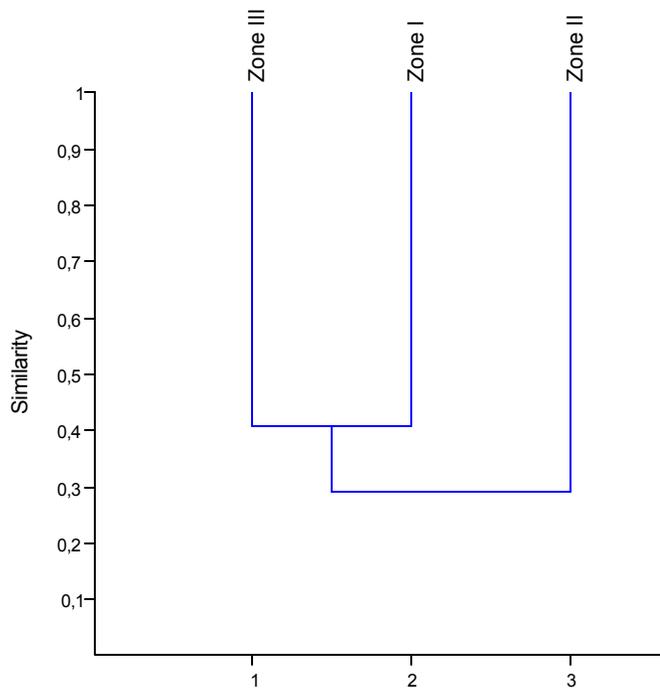
**Table 3**  
Species collected discriminated by sampling zone

Species	Zone I	Zone II	Zone III
<i>Phyllostomus discolor</i>	*		
<i>Phyllostomus hastatus</i>	*		
<i>Lonchophylla handleyi</i>	*		
<i>Lonchophylla robusta</i>	*	*	
<i>Glossophaga soricina</i>	*		
<i>Carollia castanea</i>	*	*	*
<i>Carollia perspicillata</i>	*	*	*
<i>Artibeus anderseni</i>			*
<i>Artibeus cinereus</i>		*	
<i>Enchistenes hartii</i>	*		*
<i>Artibeus jamaicensis</i>	*	*	
<i>Artibeus lituratus</i>	*	*	*
<i>Artibeus obscurus</i>	*		
<i>Artibeus phaeotis</i>	*		
<i>Artibeus toltecus</i>		*	*
<i>Artibeus watsoni</i>			*
<i>Chiroderma salvini</i>	*		
<i>Chiroderma villosum</i>	*		
<i>Mesophylla macconnelli</i>	*		
<i>Platyrrhinus chocoensis</i>		*	
<i>Platyrrhinus helleri</i>	*	*	*
<i>Uroderma bilobatum</i>	*		*
<i>Vampyressa nimphae</i>	*	*	
<i>Sturnira luisi</i>	*	*	
<i>Sturnira mordax</i>	*	*	
<i>Desmodus rotundus</i>	*	*	*
<i>Eptesicus brasiliensis</i>			*
<i>Myotis nigricans</i>	*		
<i>Molossus currentium</i>	*	*	
<i>Molossus molossus</i>	*		*
<b>Total N.º of Spp.</b>	<b>24</b>	<b>14</b>	<b>12</b>

collected. Areas with the highest values of disturbance (Zones II and III) presented a greater number of captures of *D. rotundus* (13 and 14 individuals respectively) (Figure 4). Relative abundance of phyllostomid bats has been suggested as a good indicator of disturbance among Neotropical ecosystems (Medellin *et al.*, 2000) and high abundances of *D. rotundus* has been proposed as indication of disturbance (Fenton *et al.*, 1992).

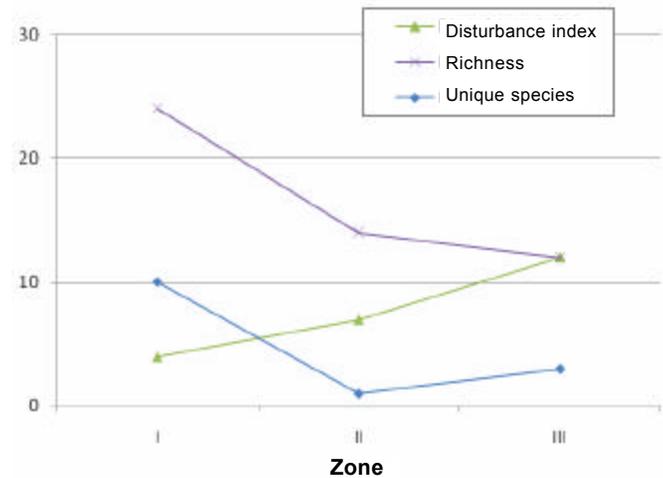
The Central Chocó region is currently affected by a massive process of deforestation. Logging industry constitutes the second most important income to the Colombian department of Chocó (CODECHOCÓ 2003). At our sampling sites the disturbance caused by deforestation can be visualized by data available on volume of wood extracted per year as follows: Zone I (Medio Atrato) 23,000 m<sup>3</sup>, Zone II (Tadó) 10,000 m<sup>3</sup>, and Zone III (Quibdó) 40,000 m<sup>3</sup> (CODECHOCÓ 2003).

In spite of the high variability in bat species composition found among our samples, the hematophagous species *D. rotundus* was present in all assemblages across our sampling localities. Since eradication methods of common vampire bats are indiscriminately applied in Central Chocó it is expected that they have a differential effect on different assemblages of species at the study area. It is difficult to evaluate the actual effect of the particular



**Figure 3.** Cluster analysis showing similarities in composition among the three sampling zones in Central Chocó.

eradication method used in complex ecosystems such as those enclosed by the Central Chocó region but it is likely to think that they have a stronger effect on assemblages characterized by higher number of bat species. Our data provide some elements to help judge better the application of eradication methods of vampire bats and at the same time establish the bases to understand the dynamics of bat species in complex ecosystems. We point on the importance of conducting parallel samplings of non-hematophagous species accompanying campaigns of eradication. Samples of non-hematophagous species provide elements to decide about the more convenient



**Figure 4.** Disturbance Index (ID) modified from Ruán Tejada (2006), richness and uniqueness of species at sampling zones.

and effective eradication methods in each case, as well as elements to mitigate the negative effects of vampire eradication methods on non-hematophagous bat populations. Besides of that, the logistic used to conduct eradication plans campaigns offer wonderful opportunities to know more about the biology of different bat species.

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