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Check List
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Lists of Species

Chiroptera, mid-Calima River Basin, Pacific Slope of the Western Andes, Valle del Cauca, Colombia

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Abstract: The Calima River Basin is part of the Chocó Biogeográfico Ecoregion in the Pacific Coast of Colombia. Here, we compile a bat species checklist recorded for the Basin and describe the bat diversity patterns found in the mid-Calima Basin (the gradient from 300 – 1,400 m a.s.l.). The checklist comprises 55 bat species for the Basin. In the mid-Calima, 31 bat species occur (permanently or seasonally). Our results show complementary diversity patterns of bat assemblages living below and above 1,000 m. We also identified an overlap zone between 800 – 1,200 m a.s.l. where at least three pairs of sister species coexists. The sampled area is located where the Chocó and the Andes biogeographical regions are connected. The Calima River Basin has high bat richness, high variation in species composition along the elevational gradient, and harbours threatened and endemic species, highlighting its importance for conservation.

Introduction

The Chocó Biogeográfico is a very wet region which includes the whole Pacific Coast of Colombia and a portion of north-western Ecuador and the Caribbean Coast in Panamá. This region (usually called Ecoregion) has been identified as a global biodiversity hotspot (Terborgh and Winter 1983; Olson and Dinerstein 1998; Myers *et al.* 2000) with high levels of endemism in diverse biological groups (Gentry 1986; Faner-Langerdoen and Gentry 1991). There are multiple proposals about the limit where Chocó and Andean faunas are overlapped based on a set of environmental variables and suggesting different elevational limits (*i.e.* Galvis and Mojica 1993; Poveda-M. *et al.* 2004).

The knowledge about the bat assemblages from the Chocó Biogeográfico is mainly based on short sampling efforts in localities below 300 m a.s.l. (see Mantilla-Meluk and Jiménez-Ortega 2006), with few studies examining localities at mid-elevation (Alberico and Orejuela 1982; Cadena *et al.* 1999; Dávalos and Guerrero 1999; Ospina-Ante and Gómez 1999). Therefore, there are many gaps in our understanding of species distribution (Mantilla-Meluk and Jiménez-Ortega 2006) and diversity patterns at local and regional scales. In the Ecoregion, when accepting 800 m a.s.l. as superior elevational limit, almost 100 species of bats have been recorded (Muñoz-Saba and Alberico 2004; Mantilla-Meluk and Jiménez-Ortega 2006), representing 58% of the bat fauna reported for Colombia (Alberico *et al.* 2000). Sixty two out of these almost 100 species belong to the leaf-nosed bat family (Phyllostomidae), which represents 52%, of the phyllostomids registered for Colombia (Alberico *et al.* 2000; Mantilla-Meluk *et al.* 2009).

The Calima River Basin is a portion of the Chocó Biogeográfico Ecoregion into the Valle del Cauca Department, Colombia. The lowlands in the Calima River Basin, near the San Juan River, were sampled in the early 1900´s (Chapman 1917) and later during different periods 1970-2000 (*i.e.* Alberico 1981). The sector of the Calima River Basin that we will call 'mid-Calima' was sampled with larger effort during the 1980's in order to evaluate the environmental impacts of the hydroelectric building project 'Calima III' (EPSA, CVC unpublished data). Some specimens from the area had been deposited in collections in Colombia and around the world (see Muñoz-Saba and Alberico 2004).

Based on this background, we identified into the mid-Calima an 'overlap zone' where highland and lowland species could occur syntopically. Our aim with this study is to describe the bat diversity pattern along the elevational gradient in the mid-Calima River Basin and to highlight the importance of this region.

Materials and methods

Study area

The Calima River Basin is located at the western slope of the Cordillera Occidental, into the Valle del Cauca Department, Colombia. The watershed encompasses *ca.* 1,400 km^2, and has more than 120 km in length. The River source is located over 3,600 m at the Cerro Calima, initially flowing south and then turning west a few kilometers before the Calima river dam. From this point, it flows west until it reaches the San Juan River at *ca.* 50 m a.s.l. from the border between Valle del Cauca and Chocó Departments. The watershed comprises two administrative units called Municipios (Calima-Darién and Buenaventura) (Figure 1). There are multiple ecosystems present in the region: very wet tropical (50 m a.s.l.), wet (800 m a.s.l.), and premontane rain forest (1,300 m a.s.l.). Average rainfall ranges from 7,000 to 8,000 mm/yr in very wet tropical forest, from 3,000 to 4,000 mm/yr in wet forest, and 1,000 to 2,000 mm/yr in premontane rain forest. Rainfall is highest in October in very wet tropical forest, but in wet tropical and premontane rain forest the highest precipitation occurs in November. The precipitation tendency is similar year round in wet tropical and premontane rain forest, while in very wet forest there is more contrast between months (CVC 1988 – 1991; Figure 2).

The Calima River Basin still contains large forest tracts that had been protected because they are important to the hydroelectric power generation. The forested areas encompass elevations from 60 m a.s.l. (Estación Agro-Forestal Bajo Calima) to 1,400 m a.s.l. (Calima power dam reservoir), and further up to the páramo area at 3,600 m a.s.l.. Here we need to introduce a clarifying sentence: despite the middle elevation area of a basin in a strict sense should refer to a higher elevational range (around 1800 m, in this case), because of the background and the regional use, most people is familiarized with the mid-Calima area starting at the power dam (1400 m) running through Río Chancos area (300 m), which corresponds to the surveyed area for this work. Additionally, the portions of the mid Calima between 800 – 1,200 m a.s.l. has been recognized as an Important Bird Area (Birdlife International 2006), and part of the forest block above 2,200 m a.s.l. has been included into the El Duende Regional Reserve highlighting the ecological importance of the region. Some portions of the Basin had been transformed by multiple agricultural uses and logging between 0-200 m a.s.l. and 1400-2,200 m a.s.l.. This spatial context makes the Basin a pin point scenario to explore the diversity patterns into the region.

We analyzed two data sets to gain insight into the diversity patterns of bat assemblages: a checklist compiled from bat collections made on the known portion of the Calima River Basin (60 – 1,400 m a.s.l.), and a list obtained during fieldwork developed into mid-Calima. Most of the existing collections from lowlands belong to the Estación Agro-Forestal Bajo Calima (4°0’2.304” N, 76°56’55.399” W) located at *ca.* 60 m a.s.l.. This site is separated by 30 km from Río Chancos (the first sampling site in mid-Calima). The bat diversity was assessed in the mid-Calima which encompasses three sites, covering a section approximately 19 km in length and a 1,000 m elevation range from 300 to 1,400 m a.s.l.. The sites were chosen in mature forest, near the confluences of three river tributaries of the Calima River: 1) Río Chancos (RC) lower elevation, 300 to 400 m a.s.l., 3°57’30.681” N, 76°43’56.700” W, 2) Río Azul (RA), piedmont, 600-700 m a.s.l., 3°55’57.484” N, 76°40’32.182” W and 3) Río Bravo (RB), lower montane, 1,300-1,400 m a.s.l., 3°53’11.346” N, 76°35’24.606” W.

Analysis

We used the bat species list for the Calima River Basin reported by Muñoz-Saba and Alberico (2004) to compare with our field data; this is the only bat list from the Chocó Biogeográfico with records from the Calima Basin obtained from specimens deposited in national and international collections. We updated the taxonomy following Simmons (2005), Velazco (2005), McCarthy *et al.* (2006), Mantilla-Meluk *et al.* (2009), Oprea *et al.* (2009), Velazco and

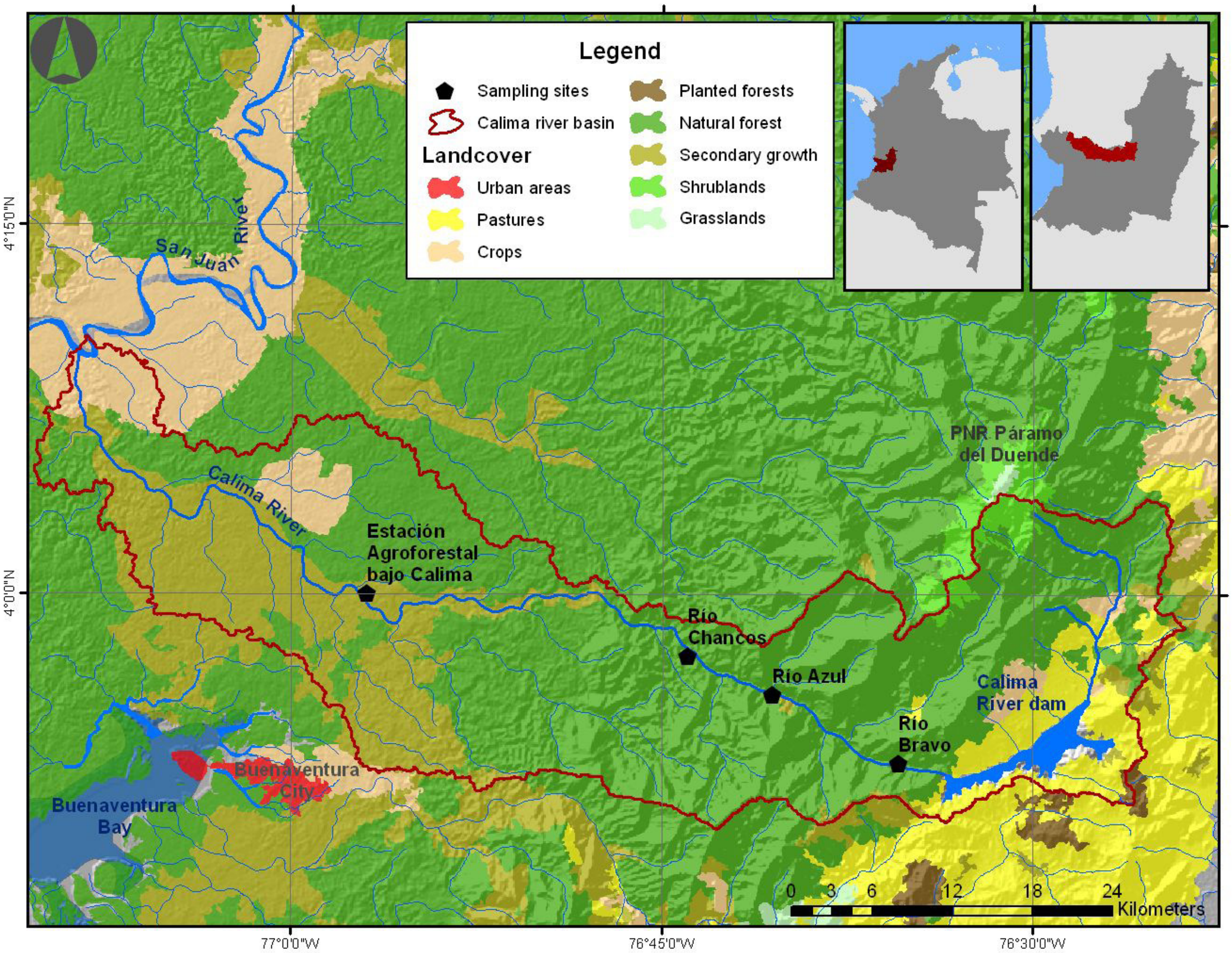

Figure 1. Calima River Basin and sampling sites. Covertures shape from IDEAM *et al.* (2007).

Gardner (2009), and Velazco *et al.* (2010). Although we reviewed recent species designations (*i.e.* Mantilla-Meluk and Baker (2006), Oprea *et al.* (2009), Velazco and Gardner (2009)) we decided to keep the field identification of our captures because more than 90% of the individuals were released alive in field.

The fieldwork was developed from April 1996 to January 1997 covering a consecutive rainy and dry season (Figure 2). We did not sample in August and November 1996. During the sampling periods, the three sampling sites (RC, RA and RB) were visited eight times (once a month, four days per site). We used ten mist nets (12 m long and 36-mm mesh) set at ground level following standardized procedures developed into forest covertures. Nets were kept open between 18:00 and 24:00 hours and checked hourly. We avoided sampling during third-quarter and full moon. We calculated capture effort for each sampling site in mist net hours. One mist net hour (mnh) corresponds to one 12-m mist net open for one hour. Our capture effort was 1,920 mnh into each sampling site and 5,760 mnh for all the sampling period in the Basin.

Bats were removed from the mist nets and placed temporarily in soft cloth bags before they were measured, weighed and identified using dichotomous keys for the bats of Colombia (Alberico unpublished, Muñoz 1995). About 10% of bats (UV11729-11738, UV 11743-11787, UV 11809) were collected for further identification, prepared as voucher specimens and deposited in the mammalogy collection at the Universidad del Valle, Cali, Colombia (UV) for further reference.

We analyzed the structure and composition of the assemblages with regard to species richness and abundance. Richness was calculated as the number of species and abundance as $\log_{10}$ of the number of captures. We compared the three rank abundance curves using a Kolmogorov-Smirnov-two-sample-test (see Magurran 2004, Rex *et al.* 2008). We compared bat assemblages composition using Sorensen and Bray Curtis similarity indices. Analyzes were ran with PAST (Hammer *et al.* 2004). We also calculated species turnover between stations following the partition additive model: Gamma = Beta + Alfa; under this model, Alfa is defined as the mean richness found in a set of samples and Beta diversity as the mean richness not found in the samples (see Veech *et al.* 2002, Crist *et al.* 2003, Gering *et al.* 2003). For conservation status and population tendency, the species were grouped following Simmons (2005) and IUCN (2010).

Results and Discussion

We compiled a bat species checklist for the Calima River Basin encompassing 55 species (Table 1), which corresponds to 32% of the species reported in Colombia (Alberico *et al.* 2000) and 62% of species reported by Muñoz-Saba and Alberico (2004) for the Chocó Biogeográfico of Colombia. The leaf-nosed bats (45 species) correspond to the 24 % of the 118 species reported by Mantilla-Meluk *et al.* (2009) for Colombia.

During our surveys in the mid-Calima we captured 547 individuals belonging to 31 species. This represents 80% of bat species reported before in the area (39 species; Table 1). We found four families: Phyllosmomidae (28 spp.), Noctilionidae, Vespertilionidae, and Emballonuridae (1 sp. each). Our sample added new species records to the bat diversity known for the mid-Calima (*Myotis nigricans* (Schinz, 1821)) and the Basin: *Noctilio albiventris* Desmarest, 1818, and *Sturnira bidens* (Thomas, 1915). Also, we captured 13 species in elevations where they had not been captured before. Another seven species were not captured in localities where they were captured before. In RC we captured 22 species, only 14 species of which were known for this area. In RA, 20 species had been reported, of which we captured 17. In RB we found 14 species, 9 of which were known from past samplings.

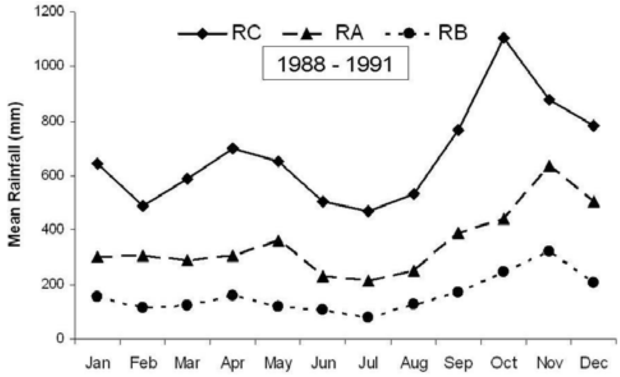

Figure 2. Rainfall average from 1988-1991 at the mid-Calima, Colombia. RC (Río Chancos, lowland, 300 to 400 m), RA (Río Azul, piedmont, 600-700 m), and RB (Río Bravo, lower montane, 1300-1400 m).

Species richness differed among sites and was highest in RC (22 species; 19 phyllostomids and a single individual of each of the other families). In RA and RB only phyllostomid species were reported, 17 and 14 species, respectively. The rank abundance curves (Figure 3) were not significantly different (RC-RA: $D = 157, P > 0.05$, RC-RB: $D = 138, P > 0.05$; RA-RB: $D = 111, P > 0.05$). Beta diversity across sampling sites was 40 % and similarity between RC and RA was over 70 % (Figure 4), as these sampling sites (RC and RA) have fifteen species in common. This result shows that the richness across sites into lower elevations (300-600 m) changes little, but it changes substantially above 1,000 m a.s.l..

High richness in lowland rainforests is a pattern observed for bats in different regions (Graham 1983, 1990, Muñoz 1990, Patterson *et al.* 1996, Brown 2001, Sánchez-Cordero 2001, Monteagudo and León 2002, Bejarano-Bonilla *et al.* 2007, McCain 2006, 2007, Flores-Saldaña 2008). This pattern indicates that some species might be restricted to particular elevations, and might result from congenerics coexistence. Previous studies have found that distribution of bat species along elevation gradients has lead to physiological adaptations to their preferred elevation (Graham 1983, Soriano 2000, McCain 2007).

Although the distance between Estación Agro-Forestal Bajo Calima and RC is 30 km, the two sites share at least 70% of the species. In contrast, the 19 km between RC and RB encompass a higher species turnover. Some species, such as *Trachops cirrhosus* (Spix, 1823), *Trinycteris nicefori* (Sanborn, 1949), *Lophostoma silvicolum* (d'Orbigny, 1836) and *Lichonycteris obscura* Thomas, 1913, were only present in lowlands, below 100 m a.s.l.. In fact, 20 % of the species listed for the Basin had been reported only from the Estación Agro-forestal Bajo Calima area. On the other hand, *Artibeus* sp., *Sturnira bidens* (Thomas 1915), *Sturnira erythromos* (Tschudi, 1844) and *Platyrrhinus vittatus*

(Peters, 1860) are mountain representatives occurring above 1,000 m a.s.l.. This shows a distribution pattern into the Calima River Basin that permits differentiation of the bat faunas along the Basin gradient (Table 1, Figure 4); similar tendency was recorded in other regions (*i.e.* Graham 1983, Brown 2001; Monteagudo and León 2002).

The rank abundance curves showed a common tendency: four species highly abundant. *Carollia perspicillata* (Linnaeus, 1758) was the most abundant species at the three sites. Although sites share many species, their abundance differs (Figure 3). *Artibeus phaeotis* (Miller, 1902), *A. glaucus* Thomas, 1893 and *Rhinophylla alethina* Handley, 1966, were abundant in RC and RA, whereas *A. jamaicensis* Leach, 1821, *Sturnira* cf. *ludovici* and *A. phaeotis* were abundant in the mountain site (RB). A few species with single captures at each site were obtained: *Cormura brevirostris* Wagner, 1843, *Lonchoplylla robusta* Miller, 1912 and *Anoura cultrata* Handley, 1960 for RC, *Micronycteris megalotis* (Gray, 1842) for RA, and *Glossophaga soricina* (Pallas, 1766), *S. bidens* and *Enchisthenes hartii* Thomas, 1892 for RB. Some of these species had been reported as abundant in other localities but they had low abundances in the Basin (*i.e. G. soricina*, *M. megalotis*), while Chocoan endemic species were abundant (*i.e. R. alethina, Platyrrhinus chocoensis* Alberico and Velasco, 1991*).*

The seasonality is also important in the bat fauna diversity because it is linked with resources availability and their reproduction (Dinerstein 1986, Willig *et al.* 1993, Sampaio *et al.* 2003, Moya *et al.* 2008, Loayza and Loiselle 2008, 2009). Thus diversity changes with regard to both number of species and abundance throughout the year (*i.e.* species come or leave). This illustrates a pattern of seasonal occurrence, where species migrate between locations of different elevations throughout the entire watershed. This seasonal dimension in diversity could affect the altitudinal range of overlap between species according to plant phenology and resources availability. Although this aspect has not been determined for bats and is not discussed here, some evidence observed suggest different occurrence pattern along the elevational gradient for some species (*i.e. E. hartii, P. chocoensis, Sturnira koopmanhilli* McCarthy, Albuja and Alberico, 2006) that will require evaluation.

The overlap zones are important in the biogeographical context because species that exhibit a distributional replacement tendency may co-exist at temporal and spatial scales. Alberico and Velasco (1994) commented about the replacement pattern exhibited by *P. chocoensis* and *Platyrrhinus dorsalis* (Thomas, 1900) from lowlands to mountains. Indeed, the mid-Calima River Basin acts as overlap zone where both species are co-existing. A similar pattern was observed for *Platyrrhinus* sp. A. and *P. vittatus*, the first one reported below 1,000 m a.s.l. and second over 1,000 m a.s.l.. In the same way, *Anoura caudifer* (É. Geoffroy Saint-Hilaire, 1810) and *Anoura cadenai* Mantilla-Meluk and Baker, 2006 could be another example of congenerics separated by the 1,000 m isoline. Both cases were found in this study.

In conclusion, the mid-Calima richness (31 species)

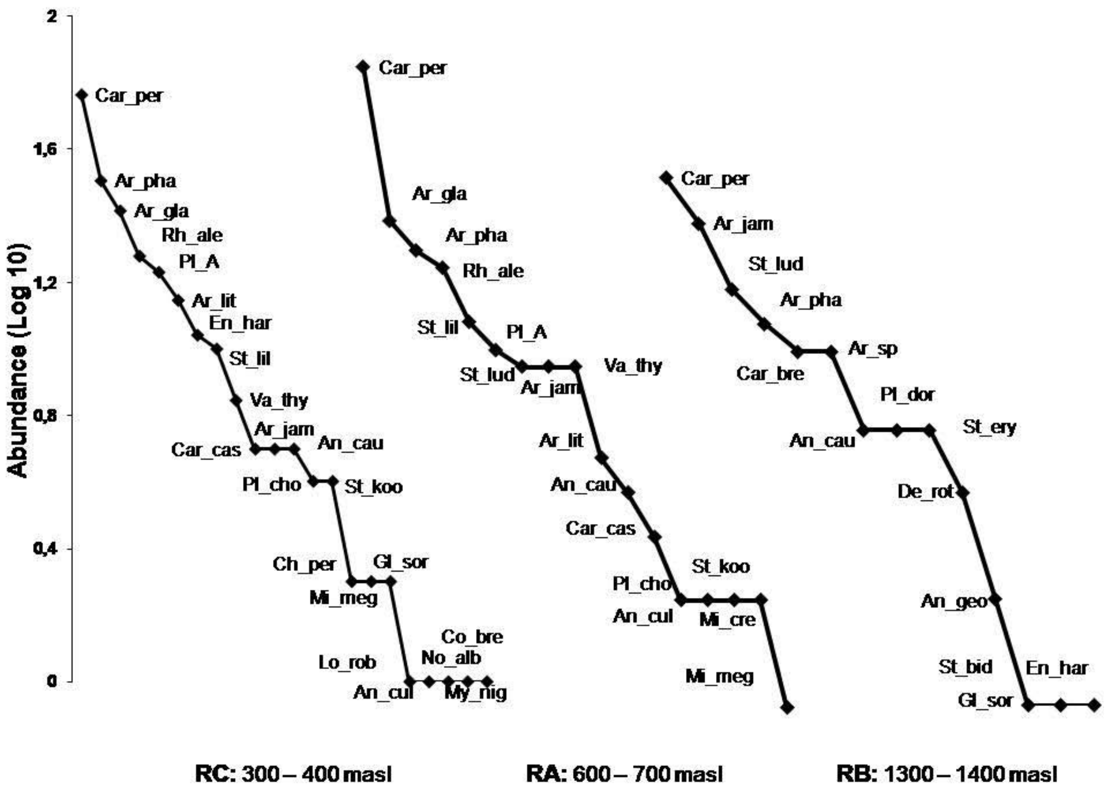

Figure 3. Rank-abundance curves for the bat assemblages found: RC (left), RA (center) and RB (right) during sampling in the Calima Medio, 1996-1997. Abbreviations indicate species identity as follows: *Anoura caudifer* (An_cau), *A. cultrata* (An_cul), *A. geoffroyi* (An_geo), *Artibeus jamaicensis* (Ar_jam), *A. lituratus* (Ar_lit), *A. phaeotis* (Ar_pha), *A.* sp. (Ar_sp), *A. glaucus* (Ar_gla), *Carollia brevicauda* (Car_bre), *C. castanea* (Car_cas), *C. perspicillata* (Car_per), *Choeroniscus periosus* (Ch_per), *Cormura brevirostris* (Co_bre), *Desmodus rotundus* (De_rot), *Enchisthenes hartii* (En_har), *Glossophaga soricina* (Gl_sor), *Lonchophylla robusta* (Lo_rob), *Micronycteris megalotis* (Mi_meg), *Mimon crenulatum* (Mi_cre), *Myotis nigricans* (My_nig), *Noctilio albiventris* (No_alb), *Platyrrhinus chocoensis* (Pl_cho), *P. dorsalis* (Pl_dor), *P.* sp A. (Pl_A), *Rhinophylla alethina* (Rh_ale), *Sturnira bidens* (St_bid), *S. erythromos* (St_ery), *S. lilium* (St_lil), *S.* cf. *ludovici* (St_lud), *S. koopmanhilli* (St_koo) and *Vampyressa thyone* (Va_thy).

differs over 60% between the three sites into the Basin; above 800 m a.s.l. exists an elevation range where sister species are co-existing. Despite the relatively small geographic scale covered in this study (Basin portion), we were able to identify an elevational range where species showed the higher overlap (800 – 1,200 m a.s.l.). However, it is necessary to consider that the interaction between environmental variables and elevation gradient could influence the altitudinal range movement. Finally, the high richness, the variation in species composition from one elevation to another, the presence of two endangered, two vulnerable, three near threatened species (Table 1) and Chocó endemic species (*i.e. R. alethina*, *Choeroniscus periosus* Handley, 1966, *S. koopmanhilli*) highlight the Calima River Basin as a relevant zone for conservation.

Table 1. Bat checklist of the Calima River Basin, Pacific Slope of the Cordillera Occidental, Valle del Cauca, Colombia. EN = Endangered; LC = Leas Concern; NT = Near Threatened; VU = Vulnerable.

SPECIES	ENGLISH NAME	EAFBC *ca.* 60 m asl.[1]	MUÑOZ-SABA AND ALBERICO 2004 0-800 M A.S.L.[2]	MID-CALIMA 300-1400 M A.S.L.				UICN STATUS / POPULATION TENDENCY[4]
				RÍO CHANCOS (RC)	RÍO AZUL (RA)	RÍO BRAVO (RB)	OTHER SOURCES[3]	
Eptesicus brasiliensis (Desmarest, 1819)	Brazilian Brown Bat		X					LC / Unknown
Myotis nigricans (Schinz, 1821)	Black Myotis	X	X	X				LC / Stable
Promops centralis Thomas, 1915	Big Crested Mastiff Bat						X	LC / Unknown
Balantiopteryx infusca (Thomas, 1897)	Ecuadorian Sac-winged Bat						X	EN / Decreasing *
Cormura brevirostris Wagner, 1843	Wagner's Sac-winged Bat	X	X	X			X	LC / Unknown
Peropteryx kappleri Peters, 1867	Greater Dog-like Bat						X	LC / Unknown
Saccopteryx leptura (Schreber, 1774)	Lesser Sac-winged Bat		X					LC / Unknown
Thyroptera tricolor Spix, 1823	Spix's Disk-winged Bat	X	X					LC / Unknown
Furipterus horrens (F.G. Cuvier, 1828)	Thumbless Bat						X	LC / Unknown
Noctilio albiventris Desmarest, 1818	Lesser Bulldog Bat			X				LC / Stable
Carollia brevicauda (Schinz, 1821)	Silky Short-tailed Bat	X	X			X	X	LC / Stable
Carollia castanea H. Allen, 1890	Chestnut Short-tailed Bat	X	X	X	X		X	LC / Stable
Carollia perspicillata (Linnaeus, 1758)	Seba's Short-tailed Bat	X	X	X	X	X	X	LC / Stable
Rhinophylla alethina Handley 1966	Hairy Little Fruit Bat	X	X	X	X		X	NT / Unknown *
Desmodus rotundus (É. Geoffroy Saint-Hilaire, 1810)	Common Vampire Bat	X	X			X	X	LC / Stable
Anoura caudifer (É. Geoffroy Saint-Hilaire, 1810)	Tailed Tailless Bat	X	X	X	X	X	X	LC / Unknown
Anoura cadenai (Mantilla-Meluk and Baker, 2006)	--------------------------------		X				X	----------------------
Anoura cultrata Handley, 1960	Handley's Tailless Bat		X	X	X		X	NT / Decreasing *
Anoura geoffroyi Gray, 1838	Geoffroy's Tailless Bat					X	X	LC / Stable
Choeroniscus periosus Handley, 1966	Greater Long-tailed Bat	X	X	X			X	VU / Unknown *
Glossophaga soricina (Pallas, 1766)	Pallas's Long-tongued Bat	X	X	X			X	LC / Stable
Lichonycteris obscura Thomas, 1913	Dark Long-tongued Bat	X	X					LC / Unknown
Lonchophylla concava Goldman, 1914	Goldman's Nectar Bat	X	X					NT / Unknown *
Lonchophylla robusta Miller, 1912	Orange Nectar Bat			X			X	LC / Unknown
Lonchophylla thomasi J.A. Allen, 1904	Thomas's Nectar Bat	X	X					LC / Unknown
Lophostoma silvicolum (d'Orbigny, 1836)	White-throated Round-eared Bat	X	X					LC / Unknown
Micronycteris megalotis (Gray, 1842)	Little Big-eared Bat			X	X		X	LC / Unknown
Mimon crenulatum (É. Geoffroy Saint-Hilaire, 1810)	Striped Hairy-nosed Bat	X	X		X		X	LC / Stable
Phyllostomus discolor (Wagner, 1843)	Pale Spear-nosed Bat	X	X				X	LC / Stable
Phyllostomus hastatus (Pallas, 1767)	Greater Spear-nosed Bat	X	X				X	LC / Stable
Tonatia saurophila Koopman and Williams, 1951	Stripe-headed Round-eared Bat	X	X					LC / Stable
Trachops cirrhosus (Spix, 1823)	Fringe-lipped Bat		X					LC / Stable
Trinycteris nicefori (Sanborn, 1949)	Niceforo's Big-eared Bat	X	X					LC / Unknown
Artibeus jamaicensis Leach, 1821	Jamaican Fruit-eating Bat	X	X	X	X	X	X	LC / Stable
Artibeus lituratus (Olfers, 1818)	Great Fruit-eating Bat	X	X	X	X		X	LC / Stable
Artibeus phaeotis (Miller, 1902)	Pygmy fruit-eating bat	X	X	X	X	X	X	LC / Stable
Artibeus sp.	--------------------------------					X	X	----------------------

Table 1. *Continued.*

SPECIES	ENGLISH NAME	EAFBC *ca.* 60 m asl.[1]	MUÑOZ-SABA AND ALBERICO 2004 0-800 M A.S.L.[2]	MID-CALIMA 300-1400 M A.S.L. RÍO CHANCOS (RC)	RÍO AZUL (RA)	RÍO BRAVO (RB)	OTHER SOURCES[3]	UICN STATUS / POPULATION TENDENCY[4]
Artibeus glaucus Thomas, 1893	Thomas's Fruit-eating Bat	X	X	X	X		X	LC / Stable
Chiroderma salvini Dobson, 1878	Salvin's Big-eyed Bat						X	LC / Stable
Enchisthenes hartii Thomas, 1892	Velvety Fruit-eating Bat	X	X	X		X	X	LC / Unknown
Mesophylla macconnelli Thomas, 1901	Macconnell's Bat	X	X				X	LC / Unknown
Platyrrhinus chocoensis Alberico and Velasco, 1991	Choco Broad-nosed Bat	X	X	X	X			EN / Decreasing *
Platyrrhinus dorsalis (Thomas, 1900)	Thomas's Broad-nosed Bat					X	X	LC / Unknown
Platyrrhinus sp A.	Western Broad-nosed Bat			X	X		X	----------------------
Platyrrhinus helleri (Peters, 1866)	Heller's Broad-nosed Bat	X	X					LC / Stable
Platyrrhinus vittatus (Peters, 1860)	Greater Broad-nosed Bat						X	LC / Unknown
Sturnira bidens (Thomas, 1915)	Bidentate Yellow-shouldered Bat					X		LC / Unknown
Sturnira erythromos (Tschudi, 1844)	Hairy Yellow-shouldered Bat					X	X	LC / Stable
Sturnira lilium (É. Geoffroy Saint-Hilaire, 1810)	Little Yellow-shouldered Bat	X	X	X	X		X	LC / Stable
Sturnira luisi Davis, 1980	Louis's Yellow-shouldered Bat	X	X				X	LC / Unknown
Sturnira cf. *ludovici*	Highland Yellow-shouldered Bat				X	X	X	LC / Unknown
Sturnira koopmanhilli McCarthy, Albuja and Alberico, 2006	Chocoan Yellow-shouldered bat			X	X		X	VU / Unknown [5]
Vampyriscus nymphaea (Thomas, 1909)	Striped Yellow-eared Bat	X	X					LC / Unknown
Vampyressa thyone Thomas, 1909	Northern Little Yellow-eared Bat	X	X	X	X		X	LC / Unknown
Vampyrodes caraccioli (Thomas, 1899)	Great Stripe-faced Bat		X					LC / Unknown

1 EAFBC (Estación Agro-Forestal Bajo Calima) and nearby areas are localities visited by the Universidad del Valle Zoology students during almost two decades for fieldwork practices (unpublished data).
2 Muñoz-Saba and Alberico 2004 (Calima 0-800). They defined this altitudinal range as the limit for the species list they have presented but some species were not recorded in the Calima River Basin because of the wider scope of their work.
3 Camargo and Tamsitt (1990), Muñoz-Saba and Alberico (2004), Mantilla-Meluk et al. (2009) and various unpublished EPSA and CVC's internal reports.
4 IUCN categorization / population tendency by Simmons (2005) and IUCN (2010)
5 Current threat proposed for Colombia (Vulnerable / Unknown: Rojas-Díaz and Saavedra-Rodríguez *in press*). This categorization resulted from the interaction of taxon recent description, restricted range and patch-discrete distribution, and lack of knowledge about its biology.

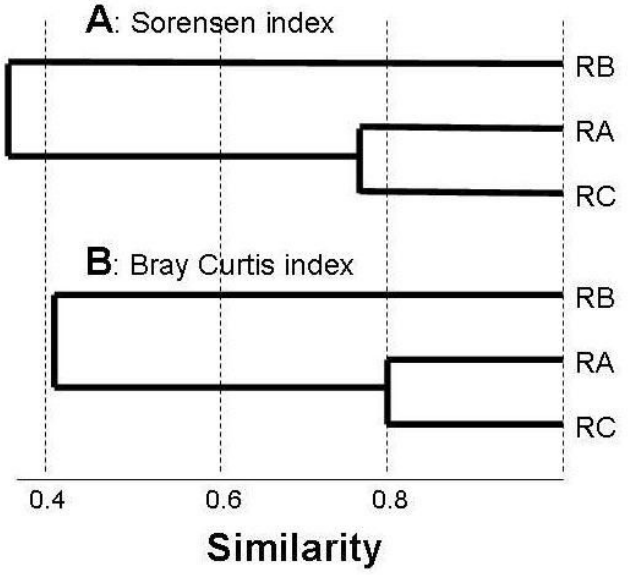

Figure 4. Cluster analysis using sampling sites of bats in the mid-portion of the Calima River Basin. The sites of the study are described in text and shown in Fig. 1. A) Species presence-absence using Sorensen index and simple linkage method, and B) Species abundance using Bray Curtis and simple linkage method.

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