TEMPORARY EXHIBITION

BATS

BETWEEN MYTH AND REALITY

DIGITAL GUIDE

Photography: Emmanuel Rojas Valerio

Foreword

The Jade Museum of the Instituto Nacional de Seguros creates temporary exhibitions with a multidisciplinary perspective, accompanied by specialists in the fields of archaeology, biology, and education, with the purpose of developing quality contents associated to the collections, which may be useful to the audience.

This exhibition is framed within the Corporate Sustainability Policies, which are oriented to the culture of prevention, mitigation and resilience to climatic change; as well as environmental protection and conservation, promoted by the Instituto Nacional de Seguros.

This initiative involves not only the archaeological collections of the Jade Museum; they are complemented by those of the National Museum of Costa Rica, the Museum of the Central Bank and the Museum of Zoology at the Centre for Research in Biodiversity and Tropical Ecology (CIBET) of the University of Costa Rica.

The exhibition BATS, BETWEEN MYTH AND REALITY is a continuation of the project “Walk of the Museums,” as we established related contents and offered audiences the possibility of visiting each Museum with a theme associated to fauna, and ecosystems of different species, based on a reading originated on the archaeological collections.

A question arises during the visit of the exhibition: Why were flying mammals so important within their cultural area, to be symbolized as ritual objects, used by human groups?

This question opens the door to learning and appreciating their valuable contribution, from an archaeological and biological perspective; so, backed up on mediation proposals, visitors are invited to fly on the wings of bats, of past and present, to think about our preconceptions and fears, as well as the conservation of every type of wildlife, for the benefit of humanity and Planet Earth.

Laura Rodríguez-Rodríguez
Jade Museum and of Pre-Columbian Culture, INS.
San José, Costa Rica, November 2020

Tropical moist forest. Tirimbina Biological Reserve, Sarapiquí, Costa Rica.
Photography: Marjorie Navarro Villalobos

Introduction

LThe exhibition BATS, between myth and reality emerges as an initiative between the Jade Museum and of Pre-Columbian Culture of the Instituto Nacional de Seguros (INS) and the Programs for the Conservation of Bats of Costa Rica (PCMCR) and Mexico (PCMM), whose goal is generating an understanding spirit of the benefits offered by bats within nature and the human population in general.

Bats are exceptional animals in nature, the only flying mammal perching or hanging from its feet. Most live in colonies and are nocturnal. These characteristics have propitiated the appearance of myths and legends depicting them both positively and negatively since pre-Columbian times and until today.

Bat's symbolism in pre-Hispanic societies is appreciated for their realistic and stylized representations of this mammal, expressed in archaeological pieces and images.

The script intends to provide information on bats: their characteristics, habits and contributions to human beings; similarly, some threats faced by these mammals are mentioned. this is presented by means of graphic inputs, pictures taken in their habitat and specimens from the Zoology Museum of the Centre for Research in Biodiversity and Tropical Ecology (CIBET), University of Costa Rica.

The cultural theme is supported by the archaeological collections of the Jade Museum, the Museum of the Central Bank and the National Museum of Costa Rica, consisting of pre-Columbian

pieces elaborated in jade, ceramics and stone; all of them inspired in narrations of mythical scenes, featuring and granting bats a symbolism, and the relationship human beings had with this animal as part of their animistic line of thought.

This theme is reconstructed with photographic images, of winged plates and shamans - bats supplied by the Gold Museum of the Bank of the Republic of Colombia.

Similarly, the representation of bats in cave art is highlighted, and how they are part of myths and legends throughout the cultures in America.

The exhibition's closing theme invites us to reflect on the threats affecting bats and wildlife, the same damaging the planet and human beings, as are loss of habitat, draughts and high temperatures.

Virginia Novoa Espinoza
Archaeology. Jade Museum, Instituto Nacional de Seguros

Laura Navarro Noriega
Program for the Conservation of Bats in Mexico (PCMM/Bioconciencia)

Bernal Rodríguez-Herrera
Program for the Conservation of Bats in Costa Rica; Professor of the School of Biology, University of Costa Rica (PCMCR/UCR)

San José, November 2020

Great fruit-eating bat, Phyllostomidae (*Artibeus lituratus*). Talparo, Trinidad and Tobago. Photography: Merlin Tuttle's Bat Conservation Org.

Bats and the five vowels towards their conservation

Bernal Rodríguez Herrera, Ph.D.
Director. Centre for Research in Biodiversity and Tropical Ecology.
Professor, School of Biology.
University of Costa Rica.
Program for Bats Conservation of Costa Rica.

Human beings depend on biodiversity: we make everyday use of other species for food, to create medicines, dress ourselves, etc. Seldom are we aware of this: little do we care to learn about this frail and rich resource Costa Rica has. We grow up knowing about elephants, lions, kangaroos, but little do we know of the Woolly Opossum, the Silky Anteater, shrews, and least of all, bats, all of them present in our forests, some even in our cities.

"Bat" this word learned since childhood is taught as the single one including all 5 vowels. Bat really means "blind mouse," nothing further from the truth because they are neither mice nor blind. These are two examples of the many myths surrounding this group of mammals. What is true of the bat is that it's the only existing flying mammal; it is found almost all around the world; they can live many years, some hibernate and others are migratory; they are very social; they communicate and fly using a radar (echolocation); they have different colors and sizes (white, orange, brown, large, small, etc.)

In Costa Rica they are the most diverse group of mammals, with most species. There are around 115 species in the country, starting at sea level up to the highest point of Cerro de la Muerte. This country is shared with bats, so we should learn more about them.

The abundance of bat species reflects on its ecology. There are species flying over one kilometer-high eating insects; others fly

inside the forest; still others in open areas and cities. Insectivorous bats provide an environmental service by controlling harmful insect pests which attack crops or transmit diseases. Fruit-eating ones disperse seeds, aiding in forest regeneration and in keeping forests and conserving tree populations, the ones most important to us. Species feeding on nectar pollinize flowers, later to be transformed into fruits which feed us. In short: bats play important roles in ecology and provide us great benefits.

What we see today in this exhibition is the accumulation of many years of study; the first human populations, indigenous groups, had started generating knowledge on bats. There are travelers' chronicles from the 18th century making reference to bats in our country. During the 20th century many researchers, mainly foreigners, published important scientific articles of investigations carried out in Costa Rica. Fortunately, each day there are more people involved in transmitting scientific knowledge to society, searching to improve people's quality of life. This exhibition is aimed that way: transferring knowledge to the public, so we can make better decisions, so the negative impact on the environment decreases, so biodiversity is preserved, as we depend on it.

Flying mammal

Bats are mammals; their skin is covered with hair; they nurse their young with milk and are the only mammals having a real flight, allowing them to travel great distances.

Their habits are nocturnal and live as groups or colonies. They hang or perch from their feet.

Common sword-nosed bat (*Lonchorhina aurita*). Gamboa, Panama.
Photography: Merlin Tuttle’s Bat Conservation Org.

Flight

They are the only mammals who can fly in the dark with great accuracy and in long distances; unlike other mammals as flying squirrels (genus Glaucomys, native of North America), which can glide using a large membrane joining their hand and foot.

White-throated Round-eared Bat (*Lophostoma silvicola*).
Scientific illustration: José Fabricio Vargas M.

Winged hand

a. The scientific name of bats is Chiroptera; this word comes from Greek and means winged hand.

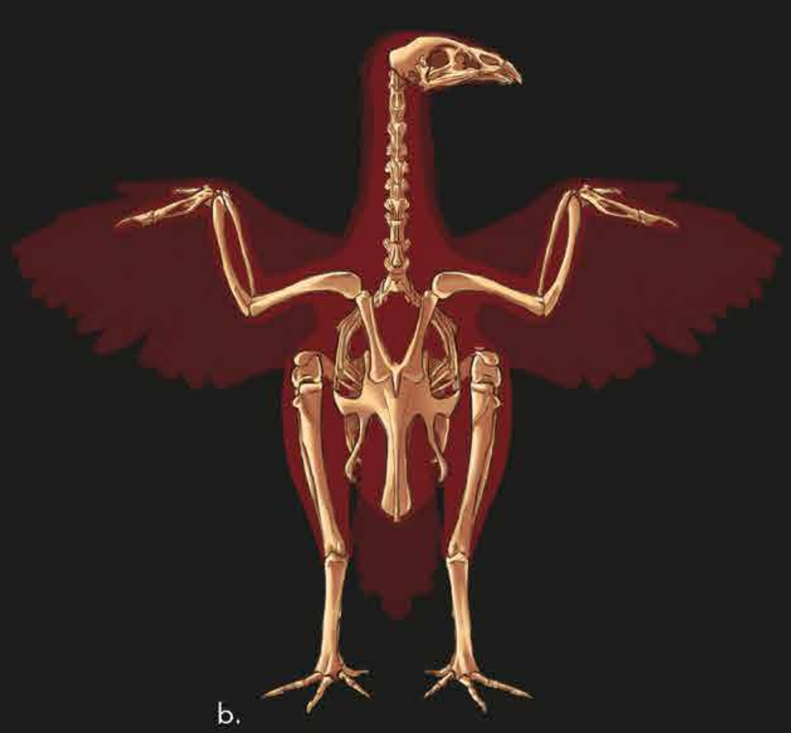
Bats have a membrane between the fingers of the “hands,” called “patagious” used to fly and to capture insects.

Its wings are quite varied in their shape, according to feeding type.

b. Some species have another membrane comprising the hind limbs or “legs” and tail; this is called “uropatagium”. Their shape varies per species and they use them to capture insects and stabilize flight.

Scientific illustration: José Fabricio Vargas M.

a.



b.

c.

d.

Difference of the internal anatomy of a bat, a human being, a bird, and a mouse.

a. Bat b. Bird c. Mouse d. Human being

Uropatagium

Reproduction

These mammals reach sexual maturity being barely months-old; there are some species known to reach over 40 years.

In some species, the mother may fly all night searching for food, with her offspring sucking her breast. In others, the offspring is left at the refuge, in maternity colonies with an adult female in charge of caring of the offspring; in other cases, the baby is left alone in the refuge, until the mother returns.

Females have only one offspring per delivery, once or twice a year; as soon as they are born, they are nursed for several weeks. Gestation may last between 40 days and 10 months according to the species.

Maternity.
Stripe-headed Round-eared Bat (*Tonatia saurophila*).
Photography: Emmanuel Rojas Valerio.

Indiana Bat Colony (*Myotis sodalis*). Kentucky, USA.
Photography: Merlin Tuttle's Bat Conservation Org.

a. *Vampyrum spectrum*

b. Myotis sp.

Comparative illustration of sizes of bats in Costa Rica.

Size and weight

The size and weight of bats varies. The largest bat of Latin America is 90 cm long from wing to wing, while the smallest one is 9 cm.

The weight varies from 2 g to 1 200 g.

Scientific illustration: José Fabricio Vargas M.

Perch or hang from the feet

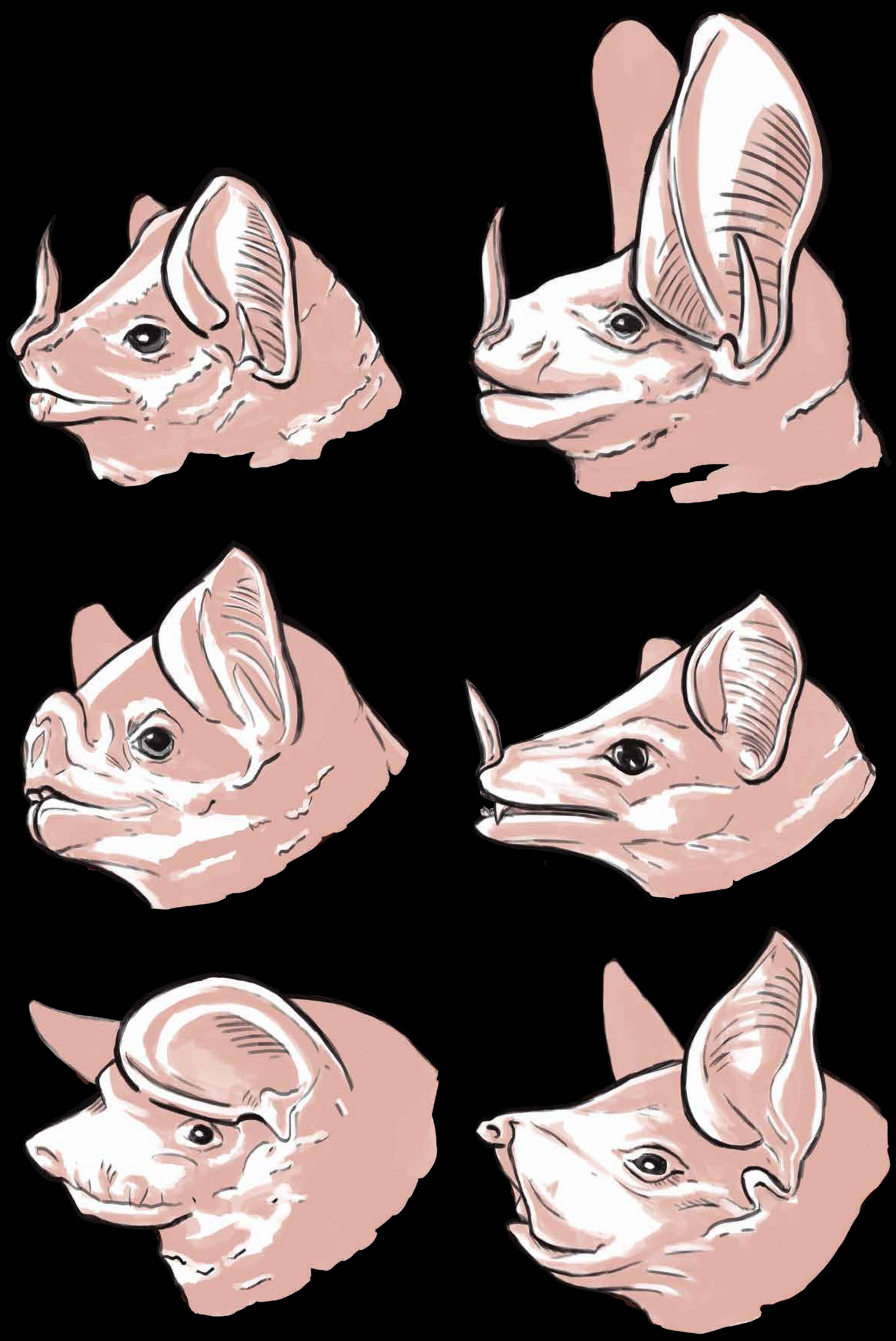
During the daytime, bats carry out numerous activities while being perched; for example, rest, groom, socialize and give birth. Unlike other mammals, bats have a specialized circulatory system which prevents blood flow toward its head while they hang.

Great fruit-eating bat, Phyllostomidae (*Artibeus lituratus*).
Tirimbina Biological Reserve, Sarapiquí, Costa Rica. Photography: Emmanuel Rojas Valerio.

Watching in the dark

Most bats, besides their sight and sense of smell, have a sonar or echolocation system assisting them to avoid obstacles and find food. For this they employ the nose (nostrils) and mouth, emitting high-pitch, rapid sounds. Some species have a membrane in the nose area called nasal plate or sheet allowing them to direct sounds.

The ears, which in many species are large in size, frequently have a skin lobe called “tragus” which improves their capacity to perceive echo.



Scientific illustration: José Fabricio Vargas M.

ECHOLOCATION

High-frequency sound system, inaudible to human beings, where sound waves are emitted which propagate in the air in the shape of a fan. Echoes produced when hitting objects, plants and animals return, allowing bats to identify their environment and food.

Scientific illustration: José Fabricio Vargas M.

Refugees,
between the forest and the city

Bats live in almost all the planet, excepting the poles. They have adapted to living in caves, trees, under leaves, inside termite mounds and human constructions like bridges, structures in archaeological sites, buildings, churches or in house ceilings.

White bat (*Ectophyla alba*) in tent-shelter.
Scientific illustration: José Fabricio Vargas M.

Bat shelter.Tirimbina Biological Reserve, Sarapiquí, Costa Rica. Photography: Marjorie Navarro Villalobos

Bat shelter. Tirimbina Biological Reserve, Sarapiquí, Costa Rica. Photography: Emmanuel Rojas Valerio

Bats in shelter. Tirimbina Biological Reserve, Sarapiquí, Costa Rica.
Photography: Emmanuel Rojas Valerio

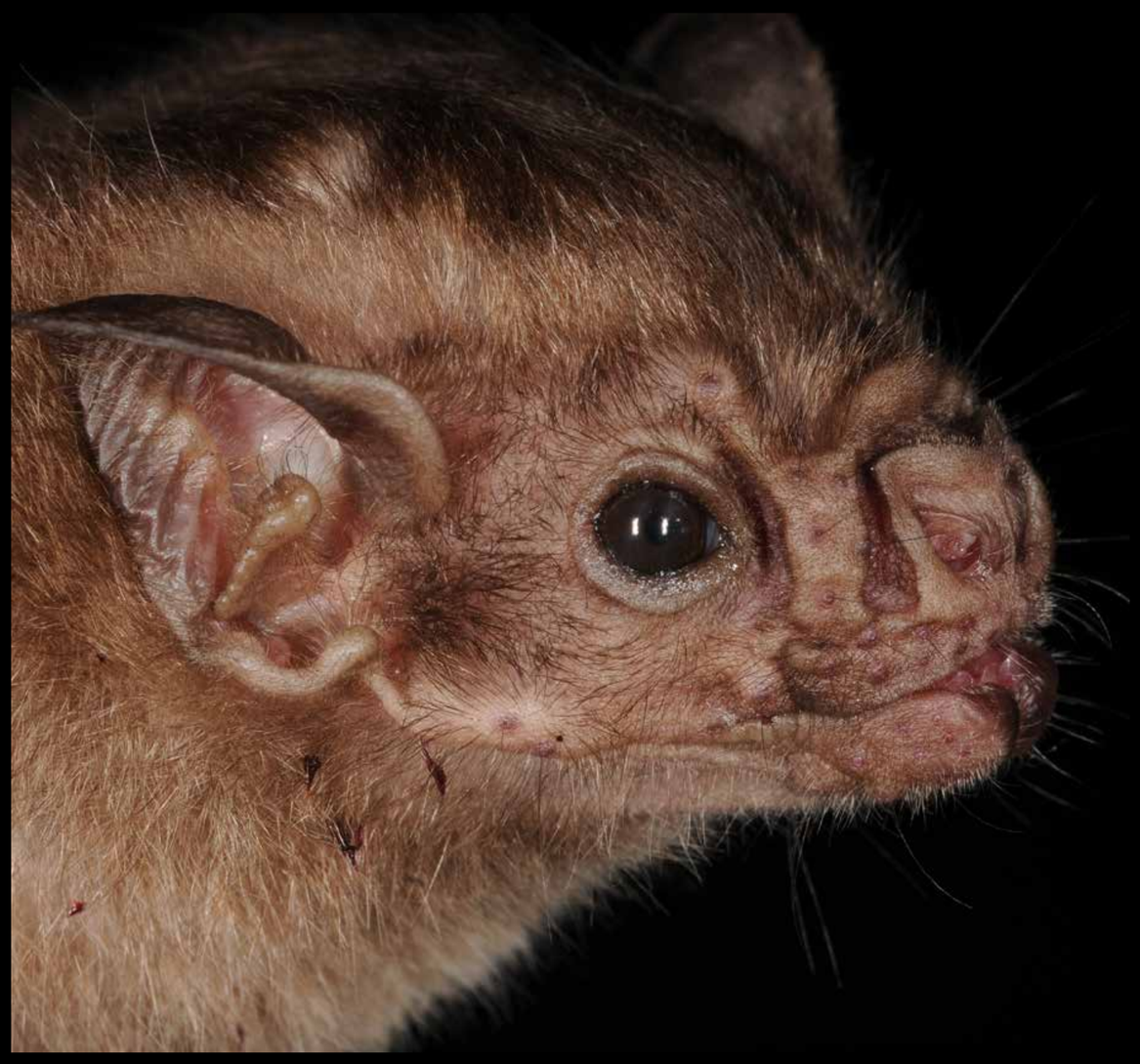
Bat shelter.
Tirimbina Biological Reserve, Sarapiquí, Costa Rica.
Photography: Emmanuel Rojas Valerio

Bat shelter. Tirimbina Biological Reserve, Sarapiquí, Costa Rica. Photography: Emmanuel Rojas Valerio

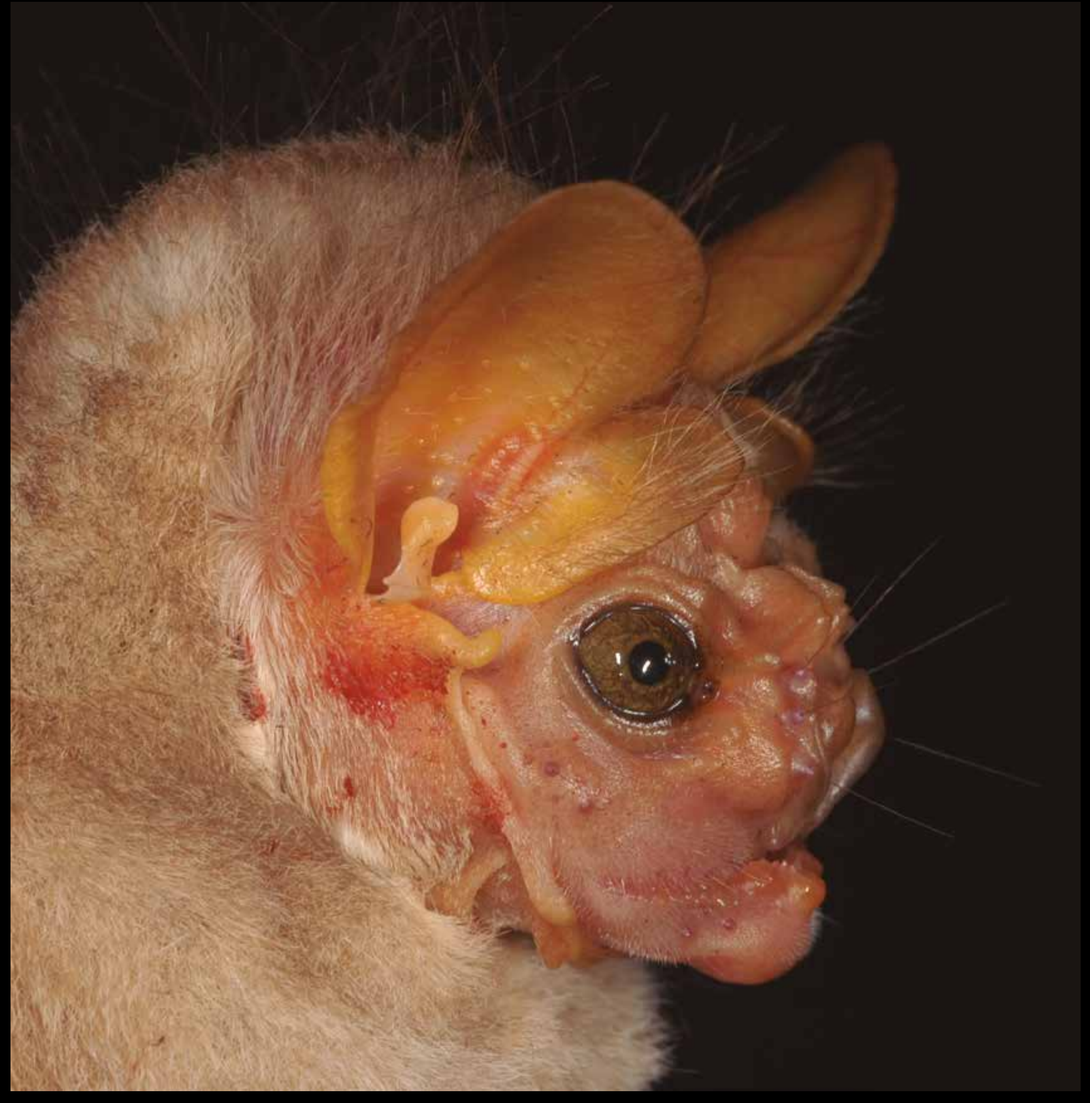
Diversity

In Costa Rica there are 115 recorded bat species, corresponding approximately to 10% of world species. The shape of their face, fur color and size vary according to species and their natural history.

White bat. *Ectophyla alba*.



White-winged vampire bat. *Diaemus youngi*.



Wrinkle-faced bat. *Centurio senex*.

False vampire bat. *Vampyrum spectrum*.

Photographies: Marco Tschapka y Emmanuel Rojas Valerio

White-throated round-eared bat. *Lophostoma silvicolum.*
Fotografía: Marco Tschapka

Endemic
and charismatic bat species of America

Bats are almost found in all the world, except in polar regions. Globally there are 1,406 bat species, of which 115 are found in Costa Rica, and 165 in Mesoamerica.

CUBA

Pteronotus fulvus, common name less naked back bat.

Photo by: Carlos Mancina, Ecology and Systematics Mastozoology Institute, Havana

MÉXICO/ MEXICO

Myotis vivesi, common name Mexican fishing bat.

Photo by: Marco Tschapka, Institute of Evolutionary Ecology and Conservation Genomics, University of Ulm

EL SALVADOR

Pteronotus fulvus, common name less naked back bat.

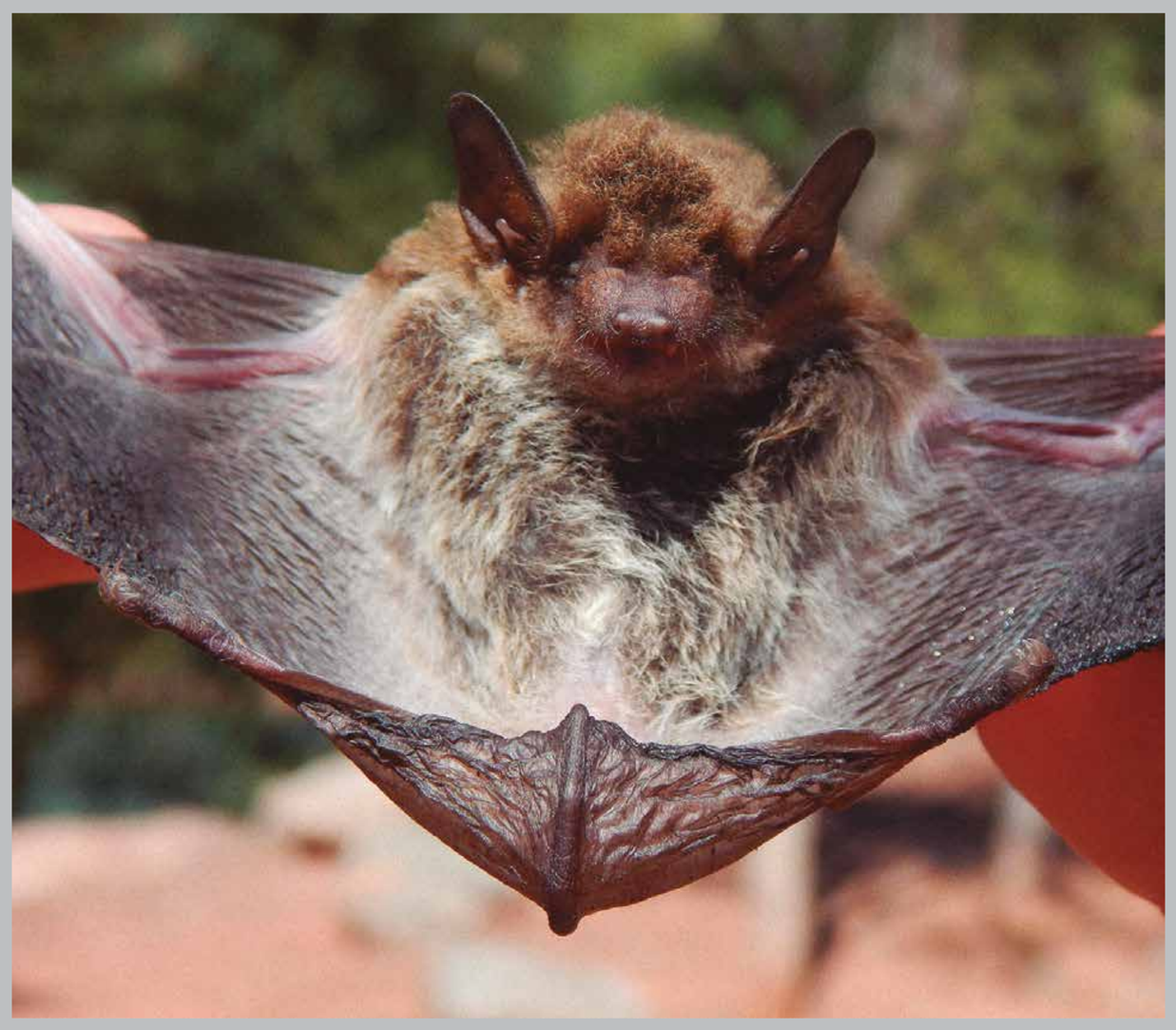
Photo by: Melissa Rodríguez, photo from El Salvador,
El Salvador Living Territories Association

HONDURAS

Ectophylla alba, common name Honduran white bat.

Photo by: David Villalobos, Bats Conservation Program of Costa Rica

ARGENTINA



Eptesicus ulapesensis, Argentinian endemic bat.

Foto por: Sabrina Villalba, Programa para la Conservación de Murciélagos de Argentina

BRASIL/ BRAZIL

Xeronycteris vieirai in La Caatinga Caves. Brazil dry forest endemic bat.

Photo by: Juan Carlos Vargas Mora, Sociedade Brasilera Para o Estudio de Quirópteros

Bat *Lichonycteris obscura*. Liana *Marcgravia nervosa*.
Photography: Marco Tschapka

Preferred diet

Bats are responsible for pollinating flowers, as well as for seed dispersal of many tropical plant species, commercial and wild. Owing to this, tropical forests are regenerated naturally.

They also feed on insects that could be agricultural pests, controlling their populations and decreasing harm to crops. Others feed on small vertebrates.

There are only three hematophagous species worldwide, that is, feeding on blood.

Hairy-legged vampire bat (*Diphylla ecaudata*). México.
Photography: Merlin Tuttle's Bat Conservation Org.

Frugivorous

Are responsible of seed-dispersal. Their snout is short, with strong teeth and large mandible. Using their sense of smell and echolocation they find trees with ripe fruit, pluck them and fly to a branch nearby where they perch to eat its pulp.

Piscivorous

Are large and have strong wings, their feet have long and sharp claws. When they detect movement on the water's surface, they fly dragging their claws inside the water until they catch a fish.

Nectarivers

They are responsible for pollination. Their snout and tongues are long they use to introduce them into the flower's corolla to feed on its nectar. They also have the capacity for sustained flight by the flower.

Carnivores

Are large and strong with huge teeth. Consume small vertebrates as frogs, birds, rodents and even other bats.

Insectivores

Are responsible of agricultural pest control. They use their large uropatagium to catch insects (moths, beetles, mosquitoes) they later crush with their sharp teeth. They can consume up to 600 insects in one hour approximately 3,000 per night.

Hematophages

Only three species of bats feed on blood. They have a very specialized digestive system allowing them to digest blood, eliminating excess water. They are also known as vampires.

Predators

Snakes, rapacious birds and some mammals such as racoons are bats predators.

Southeastern myotis (*Myotis austroriparius*) captered at the entrance to a Florida cave, being eaten by a gray rat snake (*Pantherophis spiloides*). Predation. Photography: Merlin Tuttle’s Bat Conservation Org.

Pest control bat. Pallid bat (*Antrozous pallidus*). Arizona, United States of America.
Photography: Merlin Tuttle's Bat Conservation Org.

Environmental services of the bats

Despite the prejudice people have regarding bats, these animals provide many environmental services to human beings; such as dispersal of seeds assisting on forest regeneration, pollination of edible plants for human beings and control of pests damaging to agriculture.

Bats have also been the basis and inspiration to create important scientific inventions and discoveries for humanity’s development.

Winged Fumigators

Pest control: most bats feed on insects, while doing so they become biological controllers; since they are insect predators, of those bearing diseases like dengue, and harmful as the cotton moth.

Flying Farmers

Seeds dispersal: bats feeding on fruits disperse the seeds consumed; when they germinate, they will contribute in reforestation.

Specialized Cupids

Pollination: while feeding on nectar, bats' bodies collect pollen, being transported to other flowers; when they are visited it facilitates the sexual reproduction of plants.

Source of inspiration

Airplanes: the first airplanes to fly based their wings' shape on those of bats as well as their way of flying.

Medicines: Blood-feeding bats' saliva has been studied to develop anticoagulant medicines.

Fertilizers: their excreta, guano, is a high-quality fertilizer due to its nutrients.

Piper aduncum, common name spiked pepper

The spiked pepper is a shrub located on the margins of forests. We find it on the first stages of plants regeneration; so it is of vital importance for maintenance of ecosystems.

Fruit bats are excellent agents of seed dispersal for this variety of plants.

Tirimbina Biological Reserve, Sarapiquí, Costa Rica. Photography: Marjorie Navarro Villalobos

THE BAT and pre-Hispanic peoples

Virginia Novoa Espinoza
Archaeologist, Curator.
Jade Museum, INS.

The bat is one of the most widely depicted mammals in archaeological objects, elaborated by cultural groups in America (Mexico, Central America, South America) and the Caribbean; its shape or anatomical characteristics were portrayed in different types of raw materials, specially stone, jade, ceramics, bone and gold. This subject has been analyzed by different scholars; by exploring archaeological contexts, iconography, biology, ethnology, geology or using archaeometric and speleological techniques (Aguilar, C. H., 1965; Perera M. Á., 1979; Balser C., 1980; Snarskis, M., 1985; Guerrero J.V.,1986; Legast, A.,1987; Clarac de Briceño, J.,1991; Hartmann, C.V.,1991; Marcano V. ,1991; Pereira, M. S., & Vargas, M. E. B.,1998; Pérez Riaño, P. F.,1999; Ferrero, L., 2000; Espinosa, M. T. M., 2006; Plazas Clemencia, 2004, 2007, 2010; Vieras, A. I. C., 2011; Núñez, Y. C., 2010, 2012; Navarro L. & J. Arroyo-Cabrales; 2011; Retana-Guiascón, O. G., & Navarijo-Ornelas, M. L., 2012 ; Gómez, N. A., Scharff, M. W., Carmona Macías, M., Arroyo-Cabrales, J., & Navarro-Noriega, L., 2016; García-Casco, A., & Sáenz-Samper, J. , 2018; García Arévalo M.A.,2019), among other lines of investigation.

In Costa Rica's case, representations of this animal are frequently seen in stone, jade, ceramics and gold as metates, ceremonial mazes, effigy vessels and metal pendants; where beings are depicted as humans-bats or the bat figure in different positions, be it with displayed wings, in ascending position, with human features or of other animals.

It is worth noting that bat representations in ceramic objects of the Greater Nicoya Archaeological region are associated to a human-animal symbiosis; frequently attached to the walls of vessels or forming the vessel's body and wings protruding from its costume, and easily distinguishable bat features and human bodies.

The bat has important peculiarities which possibly had an effect on the indigenous groups' archetypes, which caused them to include them as symbolic referent in their world of beliefs, myths and legends, related to the origin of the world, death deities, the underworld, human sacrifices, the earth, darkness, fertility or spiritual flight.

These characteristics of bats, inspiring societies of the past is what we will learn of in the temporary exhibition Bats, between myth and reality; it also reflects on the mythological and shamanic aspects, related to the cult of bats (symbiosis-spiritual flight), displayed on artifacts called winged pendants, which refer to a shape evoking deployed wings in flight; many of these highlight the bat as central figure.

The bat's flight seems intimately related to shamanic ceremonies, performed in the guidance of the souls of the dead to the afterlife; as the shaman coming out of the cave, between death and symbolic resurrection, at night time (Aguilar 1965).

The visual communication strategies applied on the solution of the different museographic resources, give visitors the opportunity to reach into the refuges where bats perch and groom themselves; the possibility of observing their anatomy, variety of shapes and colors. They also allow learning of the environmental services provided

by this mammal to human beings. There is also mention of Latin American strategies promoted by researchers and communities for the conservation of this mammal (Rodríguez B. y R. Sánchez, 2015; Rodríguez-Herrera, B.; Nabte, M.; Cordero-Schmidt, E; Sánchez-Talavera, R; y A. Arias-Aguilar, 2015).

Complementing the archaeological patrimonial objects exposed, belonging to collections of the Jade Museum (13) and the National Museum of Costa Rica (18), this show will be the occasion to appreciate human-bat die-cut images with their costumes of the Tairona culture and winged pendants of the Bank Museum collection of the Republic of Colombia. Similarly, gold figures related to the representation of human beings-bats of the Central Bank of Costa Rica Museum's collection, referred as replicas in detail.

Even if bats' representations and myths are diverse in other pre-Hispanic societies of America, more similarities of Costa Rican artifacts are assumed symbolically, against stylistic differences at interregional level.

Archaeological evidence notes how peoples worshipped and coexisted on the same ecosystems with this mysterious mammal lord of darkness: the bat.

Bats
in pre-columbian cultures

Bats did not go unnoticed by pre-Hispanic cultures; proof of this are their representations, found practically in all Latin America and the Caribbean.

Specialized artisans portrayed the features characterizing this mammal realistically or naturalistically, suggesting customary contact and observation they had with the environment.

In some cases, its figure was depicted in flight with open wings or in perched position. In others, they are depicted in combination with human figures or other animals. In some cultures, it was associated to death deities, the underworld, human sacrifices to the earth, to darkness, to fertility or the spiritual flight.

Bat-figure bracket-handle bottle. Mochica culture, Northern coast, Peru.
200 B.C. – 600 A.C. Period. Larco Museum Collection, Peru.

Winged

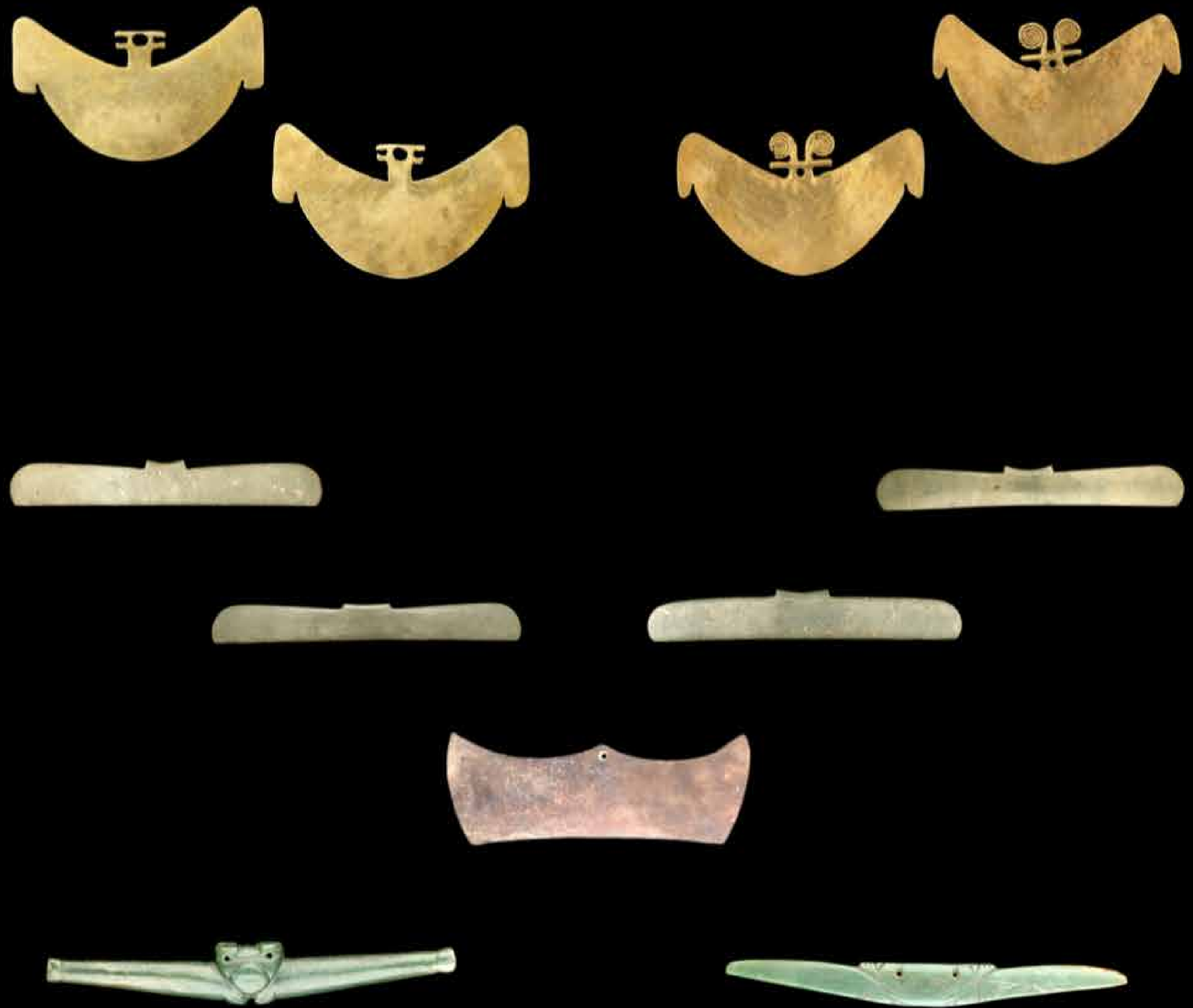
The pre-Columbian people of what currently is Costa Rica, Panama, Colombia and part of Venezuelan territories; they elaborated flying pendants in jade and other minerals; they were so called for the rectangular shape of the plates used, simulating extended wings during flight.

In Costa Rica some pendants are noted for having bats as central figure or a face associated to human beings with spread wings and carved with felines, serpents, crocodiles and fish.

1.

2.

3.



1. Bat-shaped pectorals. Calima Valley. Malagana Period. 100 B.C. – 400 A.C. Valley of Cauca, Colombia. Gold Museum Collection, Bank of the Republic of Colombia.

2. Bat-shaped earmuff pendants. Tolima Region, Tolima medio. 1 B.C.- 700 A.C. Period. Gold Museum Collection, Bank of the Republic of Colombia.

3. Stylized representations of bats; winged pendant plates Sierra Nevada de Santa Marta, Colombia. Tairona Period 900 A.C. – 1600 A.C. Gold Museum Collection, Bank of the Republic of Colombia.

Winged deities

Bats, due to their characteristics, have been admired, feared and also re the protagonists of myths and legends related with world creation, death and spiritual transformation in different cultures.

Bat in flight position shaped vessel. Greater Nicoya Archaeological Region
1350 BC - 1520 AC. Jade Museum Collection-INS

Bat people

The representation of human beings-bat in jade and gold objects, vessels, jars, sculptures and paintings were of common use among Mesoamerican people as the Olmec and Maya, as well as pre-Hispanic groups of Lower Central America and Colombia.

These characters with human body and animal features, wearing costumes imitating spread wings in flight; besides the projections on the upper part of the same, perhaps exaggerating fingers. These objects could be related to spiritual leaders, who have the power to transform, adopting the shape of bats and communicate to the world of spirits and the underworld.

Vessel with bat representation. Greater Nicoya Archaelogical Region
500 AC- 800 DC Period. National Museum of Costa Rica Collection.

Detail of vessel with bat representation. Greater Nicoya Archaelogical Region.
500 AC- 800 DC Period. National Museum of Costa Rica Collection.

Detail of pot with human being representation with an attire showing wings and projection of bat fingers. Greater Nicoya Archaeological Region. 300-500 BC. National Museum of Costa Rica Collection.

Bat shamans

According to beliefs, religious leaders or shamans, obtained healing powers and to act as liaison between the people and the spiritual world, as well as to control fertility of the earth, adopted the shape and attributes of bats.

Among pre-Columbian groups of Costa Rica and the tairona culture in Colombia, bats with human figure were depicted in jade, gold and ceramics. In some cases, the feet are in ascending position and they wear elaborate headdresses. These male characters have been called “man bat”. There have also been found some female representations with bat features.

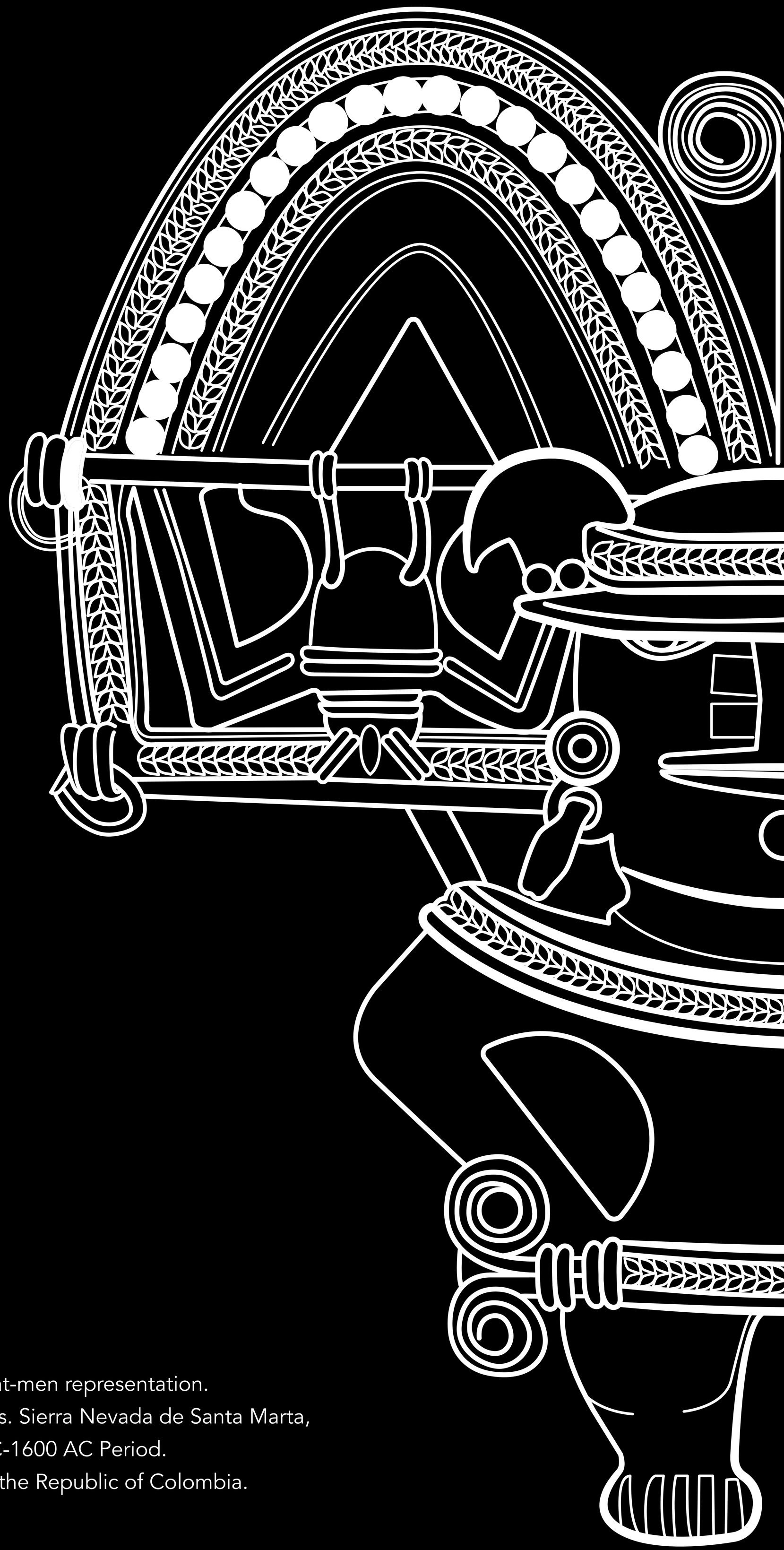
Gold anthropozoomorphic pendant, depiction of bat-men. Sierra Nevada de Santa Marta, Tairona Culture. Colombia. 900 AC-1600 AC Period. Gold Museum Collection, Bank of the Republic of Colombia.

Gold anthropozoomorphic pendant, depiction of bat-men. Sierra Nevada de Santa Marta, Tairona Culture. Colombia. 900 AC-1600 AC Period. Gold Museum Collection, Bank of the Republic of Colombia.

Gold anthropozoomorphic pendant, depiction of bat-men. Sierra Nevada de Santa Marta, Tairona Culture. Colombia. 900 AC-1600 AC Period. Gold Museum Collection, Bank of the Republic of Colombia.

Perch

or hang from the feet



Redrawing from gold pendants, bat-men representation.
Detail of hanging bat on headdress. Sierra Nevada de Santa Marta,
Tairona Culture. Colombia. 900 AC-1600 AC Period.
Gold Museum Collection, Bank of the Republic of Colombia.

Hanging bat-shaped ceramic ocarina. Sierra Nevada de Santa Marta, Tairona Culture. Colombia. 900 AC-1600 AC Period. Gold Museum Collection, Bank of the Republic of Colombia.

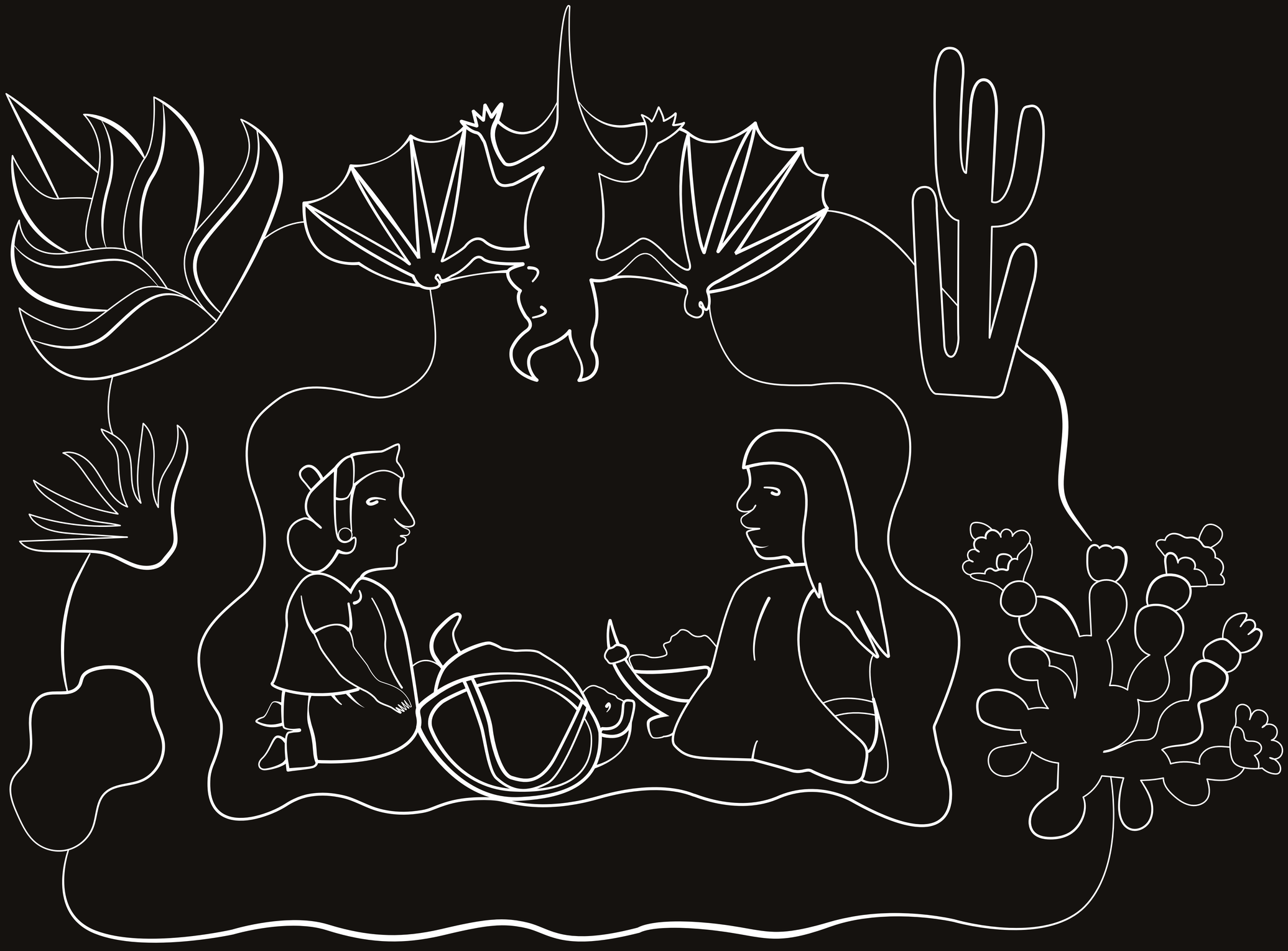
Cult to bats

In American pre-Columbian cultures, bats were widely depicted in pieces elaborated in ceramic, gold, jade, and stone, highlighting the characteristics of this mammal in many of the objects, in natural or stylized way, as would be the case of spread wings during flight, hanging from their feet or physiognomy of face and ears.

Detail of ectangular pendant with a bat central figure.
Greater Nicoya Archaeological Region. 500AC -800BC
Jade Museum Collection-INS

The cave and the shaman

Bats as dwellers of the night and dark places like caves, propitiated the emergence of myths in pre-Hispanic peoples related to shamans, since they would withdraw to dark places or caves during the initiation ceremony, to perform healings or mediate with the spirit world.

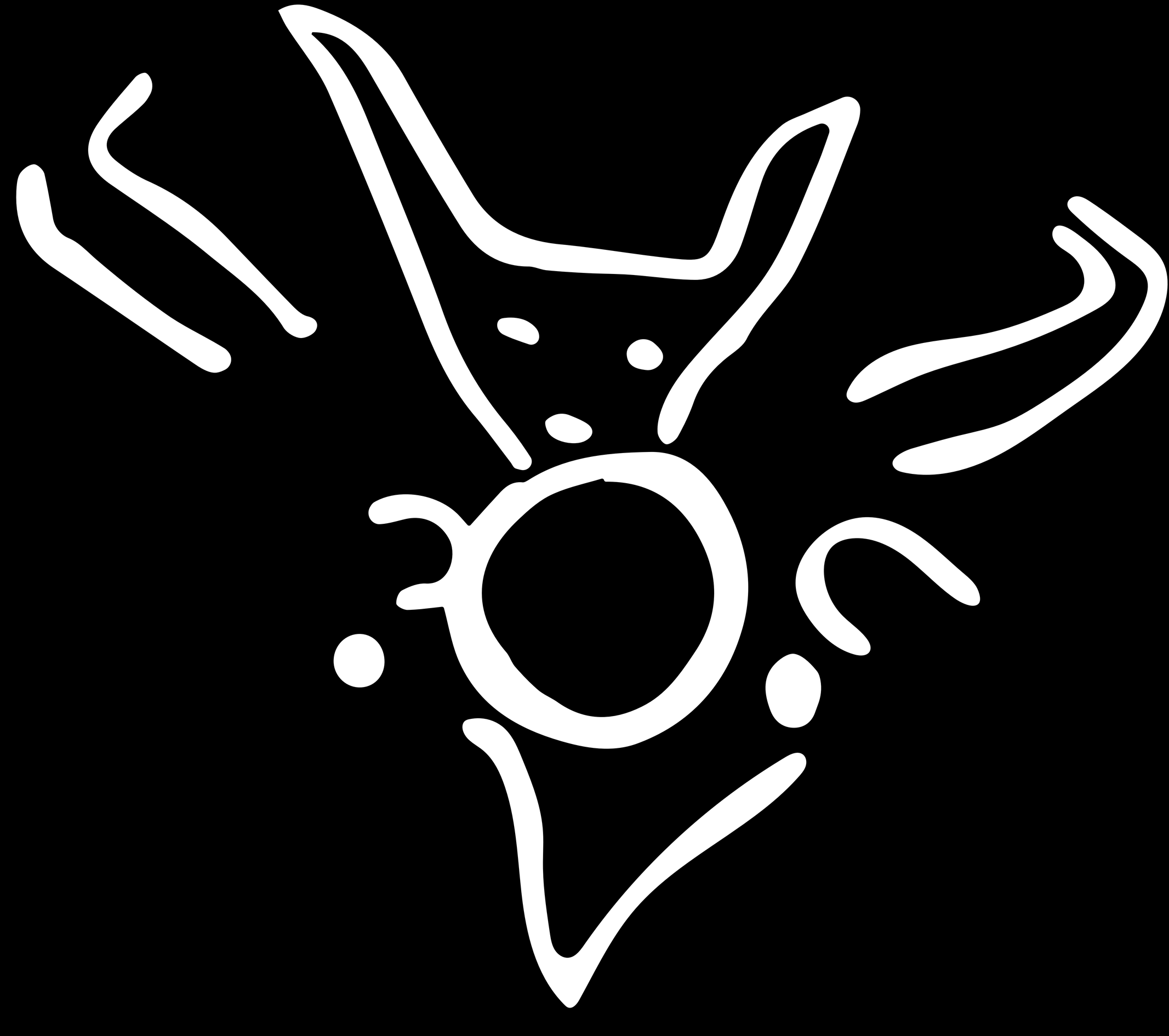


Redrawing based on the codex “Mapa Tlotzin, AMOXCALLI project

Bats in petroglyphs and rupestrian painting

Bats representations were portrayed in blocks of rock, sometimes using paint and carved in haut and bas reliefs on rocky surfaces.

In some areas of Greater Antilles, guano or bat excrement was used to paint people and animal figures, including bats on the walls of caves.



Drawing of design: Gabriela Zeledón. Photography: Gabriela Zeledón

Petrogravure, Flechas Archaeological Site (G-748 Fh).
Photography: Cristina Hernández.

Conservation of Bats: A Challenge to Reflect On

Dr. Laura Navarro Noriega
Coordinator of Education and
PCMM Communication / Bioconciencia

This exhibition is a clear example of how bats have not gone unnoticed by people; however, their way of attracting attention has not always been positive. Rather, bats' nocturnal habits, their capacity to fly and the difficulty to observe them have easily provoked repeated emotions from generation to generation.

Changing the emotions triggered by these surprising animals is difficult, since they are connected to the deeper human essence. They are linked to creation myths, but also to death. Symbolically, bats are present on intrinsic aspects of humanity, as appreciated in this show.

This exhibition is an opportunity to understand bats differently, in their two dimensions, biological and cultural. It becomes an educational resource; on one hand it lets us understand aspects of natural history of the species; on the other hand, it shows the representations made by pre-Hispanic cultures.

In that sense, care and conservation of bats is a challenge to reflect on the deep aspects defined by our relationship with nature and with those mammals. It also enables addressing values such as respect and responsibility with diversity; ecosystem services provided by them or the great discoveries made while studying some species.

The Program for the Conservation of Bats in Mexico (PCMM) was created over 25 years-ago by a multidisciplinary group working in three parallel areas since the beginning. One of them is scientific research of bat species, their characteristics, habits, etc. The second one is education and communication, where educational strategies are developed as well as dissemination for better coexistence and conservation; finally, developing specific projects to intervene and propitiate conflict resolution which might jeopardize their conservation. Many other countries of the region such as Costa Rica have worked on similar schemes; RELCOM - Latin American and Caribbean network for the Conservation of Bats was created 15 years-ago, with 21 countries currently working on the same three areas.

The continuity of this labor, the medium and long term goals, work groups, the enthusiasm of so many people have enabled forming an army of persons knowledgeable on bats over the years, who are fond of them; who are willing to defend and care for them under adverse circumstances. They are the result of many years of constant work, of countless persons in Latin America and the Caribbean, who have undertaken research on the different bat species; who have imparted courses, workshops, lectures, conferences and have developed educational materials such as books, identification guides, posters, stories, didactic materials, radio programs, etc., for different groups: children, teen-agers, women, guides, future teachers.

Time has shown people’s relationship with bats is increasingly different today; respect and appreciation for these incredible animals are salient features.

Agave. Photography: Joe Pilie.

Contributions to the daily life

Because of the environmental services provided by bats, human beings enjoy the food and products enjoyed daily.

Due to the services they provide, we can get cotton to make clothes, tomatoes, corn and other fruits with which we feed ourselves. In Mexico, because of agave pollen dispersal done by bats, tequila and mescal are produced.

Corn. Photography: Katherine Volkovski.

Threats

Bats are facing numerous threats to survive. Human activities have produced elimination of populations, putting many bat species worldwide at serious risk.

- Loss of habitat by agriculture, livestock farming and urbanism.
- Destruction and disturbance of refuges and colonies.
- Indiscriminate use of pesticides.
- Killing of bats for lack of knowledge and unjustified fear.

Conservation initiatives

Bats Conservation Programs called PCM (for its acronym in Spanish), working all over Latin America and the Caribbean under three areas: investigation, conservation and education. Currently 21 countries have their own PCM. Together they form the Latino American and Caribbean Network for Bats Conservation (RELCOM), which is an international network aimed at sensitizing people regarding bats' importance and their conservation.

In Costa Rica, PCMCR works through lectures and workshops addressed to all audiences. It also carries out an Annual Bats Counting, with the participation of community members and university students.

Photography: Program for the Conservation of Bats in Mexico

Our footprint:
towards sustainability

Carolina Castillo Abdalla, Anthropologist
Education, Jade Museum, INS.

Human beings' footprint on the planet has marked an accelerated rhythm of social, economic and technological growth. This has affected the delicate and perfect balance in the relationship between living beings and their environment. Global interconnectedness generates a domino effect, since any damage to biodiversity on a specific place of the planet will somehow affect other people, animals and the environment.

Industrial revolution on its different stages has generated permanent damages on the planet; high consumption and production levels, deforestation on tropical zones (where biodiversity is greatest) and pollution from fossil fuel use, to mention a few, hold the world hostage.

We are interconnected; while we rest, for example, an entire nocturnal ecosystem is perfectly active to maintain the natural balance of the atmosphere. But for most human beings what happens to forests is irrelevant; it is perceived as distant and foreign; however, its impact has clearly resulted in social and cultural losses for humanity; irreparable damages of natural diversity, taking thousands of years to generate; as well as collateral damages for humanity: diseases, famines, and floods, among other.

Nevertheless, there is hope this might improve, while there is a part of the world's population interested in adapting to climate change and generating individual and collective commitments, proposing sustainability policies at institutional level such as social, environmental and cultural organizations. These actions may reach

museum spaces to generate activities addressing environmental and social education, exploration and reflection on this alternative future for the planet.

Strategic alliances between researchers, institutions and museum spaces mark progress in that direction, including common goal and actions towards sustainability. Actions from the Jade Museum, INS, shall incorporate questions people pose regarding the accelerated ongoing impairment of the social and natural areas, and their consequences; it also envisages building joint meetings that defend those living creatures and nature -who are voiceless-, yet backed by researchers and interdisciplinary teams (biologists, conservationists, museum educators, museographers, archaeologists, among others), a contribution can be made and overcome negative beliefs, generating empathy towards biodiversity, since in the end the damage caused will render each dweller of the earth vulnerable.

With the exhibition “Bats, between myth and reality”, a valuable opportunity is offered to learn more about a diverse and extraordinary species. An example of how biodiversity is responsible of balancing ecosystems, with a variety of life styles. We also depend on it to survive. Therefore, the role of living beings, bats in this case, in this interconnected system is just as important as humans.

Archaeological and ethnographic data indicate that bats were not ignored by pre-Columbian people, who swiftly incorporated them as symbolic allies, portraying them in jade, ceramics, stone and gold; so, they were incorporated into their universe of beliefs and myths related to death, shamanic flight and the creation of the world, among others.

This exhibition is an invitation to learn, first-hand, of the environmental benefits provided by bats to humanity; for example, pollinizing the plants we consume every day; how they eat tons of insects and in doing so, protect plantations and avoid the need for

greater use of agrochemicals; they disperse seeds and naturally regenerate forests; they produce organic and natural fertilizers with their nutrient-rich excrements. Hematophagous bats' saliva has been studied to develop an anticoagulant medicine. (Novoa-Espinoza. V; Navarro-Noriega, L.; Rodríguez-Herrera, B.; 2019).

Due to their nocturnal habits and appearance, many legends have been weaved around them- both by country and city dwellers-, social constructs which have unleashed a chase reaction against these mammals, caused by fear or disgust, but finally fueling countless injustices, going from persecution and death, being captured as exotic animals by some cultural groups or vandalizing their refuge areas.

This insight intends to achieve an understanding of human beings as one more species of the planet; it is imperative to question the threats we have caused to nature and other beings. How could we better relate with our surroundings and attain sustainable practices and do the right thing for the conservation and protection of our sole refuge: planet earth; since each one of its passengers counts in this worldwide network.

Our only refuge: The planet

The threats affecting bats today are the same than those disturbing the planet and human beings: loss of habitat, droughts, increased temperatures, undeniable effects of climate change, directly associated to human activities for industrialization, fuel burning, deforestation and large-scale agriculture.

We are still on time to minimize its consequences if we compromise to decrease the environmental footprint, consume sustainably, employ alternative means of transport, among other individual and collective actions.

Photography: Emmanuel Rojas Valerio

What to do if you find a bat?

1. If a bat enters your house: open the doors and windows and turn off the light. Wait until he goes out by himself.
2. You can catch it and carefully put it in a carton box to release it. For the good of both, wear a mask throughout the process.
3. Avoid touching bats; they might get nervous and bite in self-defense.
4. In case of a bite you should go to emergencies service for a vaccine.

Participate from your country’s conservation program activities.

October is the month of bats

Profit and do these activities aiding people to get to know them better.

References
THE BAT and pre-Hispanic peoples

Acevedo, L. (2016). El murciélago en el material cerámico del área cultural Tairona. Bogotá: Tesis, Universidad Nacional de Colombia

Aguilar, C. H. (1965). Religión y magia entre los indios de Costa Rica de origen sureño (No. 6). Universidad de Costa Rica.

Carmona Macías, M., Arroyo-Cabrales, J., & Noriega, L. N. (2016). Los murciélagos en las Culturas Prehispánicas de Oaxaca. Mitos y Simbolismos en la Cultura Mixteca, 81-104.

Clarac de Briceño, J. (1991). Reflexiones etnológicas acerca de la placa alada de la arqueología venezolana. Boletín Antropológico, 21, 21-29.

Espinosa, M. T. M. (2006). El culto al dios Murciélago en Mesoamérica. Arqueología mexicana, 14(80), 17-23.

Fernández P. (1999). Símbolos de prestigio y expresiones de rango en la Costa Rica prehispánica. En Oro y Jade Emblemas de poder en Costa Rica. Costa Rica. Pp.38-66.

Ferrero, L. (2000). Costa Rica Precolombina (6ª. reimp. de 1ª. ed.). San José: Editorial Costa Rica.
García Arévalo M.A. (2019). Taínos, arte y sociedad. Banco Popular Dominicano. República Dominicana. Pp.1-396.

Gómez, N. A., Scharff, M. W., García-Casco, A., & Sáenz-Samper, J. (2018). Placas aladas de las sociedades Nahuange y Tairona (100–1600 d.C.), Sierra Nevada de Santa Marta, Colombia: Materia prima y áreas de procedencia. Latin American Antiquity, 29(4), 774-792.

Guerrero, Juan Vicente. (1986). “El contexto del jade en Costa Rica”. En: Vínculos: Revista de Antropología del Museo Nacional de Costa Rica. San José: MNCR. Vol. 12 (1-2), 69-82.

Hartman, C. V. (1991). Arqueología costarricense: textos publicados y diarios inéditos. Editorial de la Universidad de Costa Rica.

Legast, A. (1987). El animal en el mundo Tairona. Fundación de Investigaciones Arqueológicas Nacionales: Publicaciones, (33), 1-121.

Navarro-Noriega, L., & Arroyo-Cabrales, J. (2011). Los murciélagos y los hombres en la historia prehispánica de los mayas. JA Arroyo-Cabrales, A. González-Christen, D. Canales-Espinoza, F. León-Burgos, ML Franco-Morales, L. Navarro-

Noriega et al.(Coords.), Los murciélagos de Calakmul. Guía ilustrada, 61-76.

Nuñez-Cortés, Y. (2015). El Sitio Punta Zancadilla (L-100). Canto Rodado: Revista especializada en patrimonio, (10), 39-56.

Perera, M. Á. (1979). Arqueología y arqueometría de las placas líticas aladas del Occidente de Venezuela. Universidad Central de Venezuela, Facultad de Ciencias Económicas y Sociales, División de Publicaciones.

Pérez Riaño, P. F. (1999). Arqueología en el suroccidente de la Sierra Nevada del Cocuy o Chita (Departamento de Boyacá). Fundación de Investigaciones Arqueológicas Nacionales, (69).

Plazas, C. (2007). Vuelo nocturno: el murciélago prehispánico del Istmo centroamericano y su comparación con el murciélago tairona. Fundación de Investigaciones Arqueológicas Nacionales (FIAN).

--- (2010).¿Nurlita, el humano-murciélago kogui, heredero del icono Tairona?. ARQUEOLOGÍA, 159.

Sánchez, M. P., & Vargas, M. E. B. (1998). Motivos faunísticos en la cultura indígena costarricense. Estudios de Lingüística Chibcha.

Retana-Guiascón, O. G., & Navarijo-Ornelas, M. L. (2012). Los valores culturales de los murciélagos. Revista Mexicana de Mastozoología (Nueva Época), 2(1), 18-26.

Rodríguez B. y R. Sánchez (Eds.). (2015). Estrategia centroamericana para la conservación de los murciélagos.

Rodríguez-Herrera, B.; Nabte, M.; Cordero-Schmidt, E; Sánchez-Talavera, R; y A. Arias-Aguilar (2015). Murciélagos y techos. Bats and ceilings. San José: Universidad de Costa Rica.

Snarskis, M. (1985). La iconografía comparativa de metales y otros medios en Costa Rica precolombina. In 45 Congreso Internacional de Americanistas: Metalurgia de América Precolombina (pp. 87-136).

Vieras, A. I. C. (2011). La placa alada: su universo conocido y una intuitiva analogía con el cuerpo humano. Boletín antropológico, 29(82), 94-115.

References
Our footprint: towards sustainability

Novoa-Espinoza. V; Navarro-Noriega, L.; Rodríguez-Herrera, B. (2019). Conceptual Script. Temporary Bats Exhibition, Between myth and reality. Jade Museum and of Pre-Columbian Culture. INS.

Production
Jade Museum And Of Pre-Columbian Culture Of Costa Rica
Instituto Nacional de Seguros (INS)

Curators

Virginia Novoa Espinoza
Curator in Archaeolgy, Jade Museum,
Instituto Nacional de Seguros

Laura Navarro Noriega
Bats Conservation Program of Mexico (PCMM/Bioconciencia)

Bernal Rodríguez Herrera
Bats Conservation Program of Costa Rica and Professor and investigator at the School of Biology,
University of Costa Rica (PCMCR / UCR)

Agradecimientos

To institutions, photographers and illustrators

Liz Rojas, Museography. MJCP-INS
Marjorie Navarro, Graphic Design. MJCP-INS
Sergio García and Lilliam Barrientos, Collections. MJCP-INS
Cristina Hernández, Archaeologist, Instituto Costarricense de Electricidad (ICE). Photographs of Petrographs, Flechas Archaeological Site (G-748 Fh).
Carlos Mancina, Ecology and Systematics Mastozoology Institute.
David Villalobos, Costa Rican Bat Conservation Program (PCMCR)
Emanuel Rojas Valerio, La Tirimbina Biological Reserve, Sarapiquí
Gabriela Zeledón, Petrograph bat image, Flechas Archaeological Site (G-748 Fh).
José Fabricio Vargas, Scientific Illustrations
Sueter Studio, Animations
Juan Carlos Vargas Mora, Brazilian Society for Study of Chiroptera
Luz María Mohar, AMOXCALLI Project, Mexico.
Marco Tschapka, Institute of Evolutionary Ecology and Conservation Genomics, University of Ulm
Melissa Rodríguez, El Salvador Living Territories Association
Merlin Tuttle's Bat Conservation Org.
Bogota Gold Museum, Colombia
Larco Museum, Peru
AMOXCALLI Project, Mexico. Redraw of the Codex Map Tlotzin.
Sabrina Villalba, Bats Conservation Program of Argentina (PCMAR)

Archaeological Collection
National Archaeological Heritage Collection in custody of the Jade Museum and of pre-Columbian Culture, INS, Costa Rica.
National Museum of Costa Rica Archaeological Collection.
Replicas based on the Central Bank of Costa Rica Museums Archaeological Collection. *

Biological Collection
Zoology Museum of the Biodiversity and Tropical Ecology Research Center (CIBET),
University of Costa Rica.

Bats Conservation Program of Mexico (PCMM/Bioconciencia)
Costa Rican Bat Conservation Program
Ragde Sánchez, PCM Costa Rica / Costa Rican Methodist High School
Board of Directors and staff La Tirimbina Biological Reserve, Sarapiquí

Biodiversity and Tropical Ecology Research Center (CIBET), University of Costa Rica
School of Biology University of Costa Rica
Jorge González and Ricardo Murillo, Zoology Museum of the Biodiversity and Tropical Ecology Research Center (CIBET), University of Costa Rica

Cleria Ruíz, Daniela Ramírez, Marlin Calvo, Cultural Heritage Protection Department,
National Museum of Costa Rica
Héctor García, Bogota Gold Museum, Colombia
Priscilla Molina and Marco Cerdas, Central Bank of Costa Rica Museums
William Vasquez (arqueólogo de Nicaragua), Professor The National University Autonomous of Honduras

Tropical moist forest. Tirimbina Biological Reserve, Sarapiquí, Costa Rica.
Photography: Marjorie Navarro Villalobos

Collection Catalog

Spiritual flight

Winged pendants

In this group, stylized pendants with spread wings are stand out, which are associated with a bat figure flying. Due to their shape, in archaeology are named winged plates.

Jade Museum Colletion

National Museum of Costa Rica Collection

Plate with a stylized bat figure flying. Alike plates are reported also in Venezuela and Colombia. 600 AC- 800 BC. Central-Caribbean Archaeological Region
4,9x20,3cm
Jade Museum Collection-INS. 4492

Pendant with perforation for horizontal suspension. Stylization of a bat with spread wings. 600 AC- 800 BC. Central-Caribbean Archaeological Region
10,3x2cm
Jade Museum Collection-INS. 1543

Pendant with perforation for horizontal suspension. Stylization of a bat with spread wings. Alike plates have been found in Colombia. 600 AC- 800 BC.
Central-Caribbean Archaeological Region
18,2x3,2cm
Jade Museum Collection-INS. 4491

Pendant with a central bat figure. 600 AC – 800 BC.
Mount Sele Archaeological Site. Greater Nicoya Archaeological Region
17,6x3,9cm
National Museum of Costa Rica Collection. 138 G-91 MS

Pendant with a flying bat . 600 AC – 800 BC
Greater Nicoya Archaeological Region
11x3,2cm
National Museum of Costa Rica Collection. 8490

Pendant with perforation for horizontal suspension, in the central part has a bat figure with extended wings. Presents a saurian figure on each wing.
Central-Caribbean Archaeological Region. 600 AC – 800 BC
4,9x20,3cm
Jade Museum Collection-INS. 6458

Pendant with stylization of spread wings. 600 AC- 800 BC.
Central-Caribbean Archaeological Region
13,1x3,4cm
National Museum of Costa Rica Collection. 31878

Winged pendant. 600 AC - 800 BC. Greater Nicoya Archaeological Region.
7,4x3,1cm
National Museum of Costa Rica Collection. 31803

Pendant with bat figure with extended wings. 600 AC – 800 BC
Central-Caribbean Archaeological Region
6,6x3,5cm
National Museum of Costa Rica Collection. 22595

Pendant with a bat figure on the central part. 600 AC – 800 BC
Central-Caribbean Archaeological Region
3.5x 5.3cm
Jade Museum Collection-INS. 8493

Pendant with a central bat figure with extended wings at whose ends
reptiles were represented. 600 AC – 800 BC
Central-Caribbean Archaeological Region
14,5x4,5cm
National Museum of Costa Rica Collection. 31806

Pendant with a central bat figure . 600 AC – 800 BC
Greater Nicoya Archaeological Region
11x3.2
National Museum of Costa Rica Collection. 30222

Pendant with a bat figure standing out the fingers on its wing
and a bulging belly. 600 AC – 800 BC
Greater Nicoya Archaeological Region
17.2 x 4.3
National Museum of Costa Rica Collection. 30202

Hanging Bat

Detail of Hanging panel *metate* with central scene of a perched bat. Central Archaelogical Region.
1-500 B.C. Period
National Museum of Costa Rica Collection

Hanging panel *metate* with central scene of a perched bat. Added to the supports, it has long-beak birds holding the dish. On its rim, it has trophy heads linked to the underworld or passing to the beyond. Central Archaelogical Region. 1-500 B.C. Period
69,5x53,2x90cm
National Museum of Costa Rica Collection. 10-98-10

Detail of Hanging panel *metate* with central scene of a perched bat. Central Archaelogical Region. 1-500 B.C. Period
National Museum of Costa Rica Collection

Detail of Hanging panel metate with central scene of a perched bat.
Central Archaelogical Region. 1-500 B.C. Period
National Museum of Costa Rica Collection

Winged deities

Bats, due to their characteristics, have been admired, feared and also re the protagonists of myths and legends related with world creation, death and spiritual transformation in different cultures.

Bat in flight position shaped vessel.
Greater Nicoya Archaeological Region. 1350 BC - 1520 AC
25x26cm
Jade Museum Collection-INS. 3837

Mammal attached to the body of the vessel
Greater Nicoya Archaeological Region. Period 1-500 AC
14.7x10.6cm
National Museum of Costa Rica Collection. 23640

Detail of mammal attached to the body of the vessel
Greater Nicoya Archaeological Region. Period 1-500 AC
14.7x10.6cm
National Museum of Costa Rica Collection. 23640

Cly table with mammals holding the plate.
Greater Chiriquí Archaeological Region. Period 1-500 BC
13x24,5cm
National Museum of Costa Rica Collection. 31264

Bat-shaped glass, possibly a female with a bulging abdomen.
100 AC-500 BC. Greater Nicoya Archaeological Region
10x8,9cm

Jade Museum Collection-INS. 864

Bat figure. Central Archaeological Region. Period 1-500 AC
5x5,5cm

National Museum of Costa Rica Collection. 29966

People-bat

In ceramics, human being representations carrying an attire that shows wings and projection of bat fingers are frequently. In some objects the face shows mammal features.

Detail of pot with human being representation with an attire showing wings and projection of bat fingers
Greater Nicoya Archaeological Region. 300-500 BC. National Museum of Costa Rica Collection

Pot with human being representation with an attire showing wings and projection of bat fingers.
Greater Nicoya Archaeological Region. 300-500 BC
52 x 52cm
National Museum of Costa Rica Collection. 31955

Pot with human being representation with an attire showing wings and projection of bat fingers
Greater Nicoya Archaeological Region. 300 AC - 500 BC
33 x 31,5cm
National Museum of Costa Rica Collection. 23033

Pot with human being representation with an attire showing wings and projection of bat fingers.
Greater Nicoya Archaeological Region. 300 AC - 500 BC
19 x 21cm

National Museum of Costa Rica Collection. 31657

Man-bat effigy vessel. Greater Nicoya Archaeological Region. 300 AC - 500 BC
18,5 x 19,4cm
Colección Museo del Jade-INS. 4894

Bat cult

Bat figure pendant with spread wings.
Greater Nicoya Archaeological Region.
500AC -800BC
Jade Museum Collection-INS. 6919

Bat representation with spread wings, presents a bulging abdomen.
Greater Nicoya Archaeological Region.
500AC -800BC
4,5x2,6cm
Jade Museum Collection-INS. 2127

Bat figure pendant with spread wings.
Greater Nicoya Archaeological Region
500AC -800BC
9,2x4,7cm
Jade Museum Collection-INS. 6919

Rectangular pendant with a bat central figure.
Greater Nicoya Archaeological Region.
500AC -800BC
3x1,8cm
Jade Museum Collection-INS. 6832

Bat figure pendant with spread wings.
Perforations for suspension in wings
Greater Nicoya Archaeological Region
500AC -800BC
4,5x2,3cm
Jade Museum Collection-INS. 1738

Group of ceremonial maces with bat head. The folds of the elongated ears and the animal teeth are detailed. Greater Nicoya Archaeological Region.
100AC – 500BC

1. Ceremonial mace with bat head, teeth and the folds of elongated ears are detailed.
Greater Nicoya Archaeological Region. 100AC – 500BC - 9,5x7,8cm
Jade Museum Collection-INS - 6066

2. Ceremonial mace with bat head, teeth and the folds of elongated ears are detailed.
Greater Nicoya Archaeological Region. 100AC – 500BC - 7,7x6cm
National Museum of Costa Rica Collection - 32790

3. Ceremonial mace with bat head. Incised lines detailing teeth, eyes and ears.
Greater Nicoya Archaeological Region. 100AC – 500BC - 7,7x6cm
Jade Museum Collection-INS - 3318

4. Ceremonial mace with bat head. The folds of the elongated ears and the animal teeth are detailed. Greater Nicoya Archaeological Region. 100AC – 500BC - 9,6x7,5cm
Jade Museum Collection-INS - 6065

5. Ceremonial mace with bat head, teeth and the folds of elongated ears are detailed.
Greater Nicoya Archaeological Region. 100AC – 500BC - 8,6x6cm
National Museum of Costa Rica Collection - B 939

Ceremonial mace with bat head. The folds of the elongated ears and the animal teeth are detailed. Greater Nicoya Archaeological Region. 100AC – 500BC - 9,6x7,5cm
Jade Museum Collection-INS - 6065

Ceremonial mace with bat head, teeth and the folds of elongated ears are detailed.
Greater Nicoya Archaeological Region. 100AC – 500BC - 7,7x6cm
National Museum of Costa Rica Collection - 32790

Ceremonial mace with bat head, teeth and the folds of elongated ears are detailed.
Greater Nicoya Archaeological Region. 100AC – 500BC - 9,5x7,8cm
Jade Museum Collection-INS - 6066

Hair Color:
camouflage with surroundings

Hair color may be gray, brown or white. This trait helps to camouflage them with their surroundings and escape predators. For example, fruit-eating bats which modify plants' leaves, usually have a pattern of white lines on their faces

In this group of skins you may also notice the diversity in size and shape of the head, ears, wings, nasal leaf, and claws.

1.

2.

3.

4.

5.

1. *Artibeus lituratus*, great fruit-eating bat

2. *Myotis elegans*, elegant myotis

3. *Lonchophylla robusta*, orange nectar bat

4. *Pteronotus mesoamericanus*,
Parnell's mustached bat

5. *Vampyriscus nymphaea*, leaf nosed bat

Collection of Zoology Museum of the Biodiversity and Tropical Ecology Research Center (CIBET), Universidad de Costa Rica

Internal anatomy

Unlike what’s believed, bats are different from rodents in their internal anatomy. Their structure is more similar to human beings as observed on the arm sample, only different in their elongated fingers.

Bat skeleton. *Carollia perspicillata*, Sebas short-tailed bat

Collection of Zoology Museum of the Biodiversity and Tropical Ecology Research Center (CIBET),
University of Costa Rica.

Skulls, jaws, and claws

The shape and size of the skull, jaw, teeth and claws vary in bats according to the type of nourishment. Those eating fruits have strong teeth and flat molars to grind the pulp as evident cranial ridges. Carnivores have large and strong teeth while insectivores have sharp ones to crush insects. In the case of fish-eating ones, their claws are long and sharp on the lower limbs; while those feeding on nectar have an elongated skull to be able to reach the nectar of flowers more effectively.

Skulls collection Museum of Zoology, Research Center on Tropical Biodiversity and Ecology (CIBET), University of Costa Rica

Artibeus jamaicensis, Jamaican fruit-bat

Glossophaga soricina, Pallas's long-tongued bat

Pteronotus mesoamericanus, Moustached bat

Pest Controllers

Most bats feed on insects which means they are biological controllers of agricultural diseases and pests. They use their uropatagium to capture insects such as moths, beetles, mosquitoes and locusts later grinding them with their sharp teeth. They can put an end to 600 insects in one hour and around 3,000 per night.

Amastus aconia (Erebidae). N.C. **Moth.**
Adhemarius gannascus (Sphingidae). N.C. **Moth.**
Automeris rubrescens (Saturniidae). N.C. **Moth.**
Steirodon (Tettigoniidae). N.C. **Bush cricket.**
Lamprophyllum (Tettigoniidae). N.C. **Bush cricket.**
Tropidacris cristata (Romaleidae). N.C. **Locust.**
Pelidnota (Scarabaeidae). N.C. **Bumblebee.**

Collection of Zoology Museum of the Biodiversity and Tropical Ecology Research Center (CIBET),
University of Costa Rica.

Agents of seed dispersal

Bats feeding on fruits disperse the seeds they consume. These can be as small as 1 millimeter or up to 2 centimeters. Many have medicinal, edible and economic qualities.

Spondias sp (Jocote, Jobo)

Collection of Zoology Museum of the Biodiversity and Tropical Ecology Research Center (CIBET), University of Costa Rica.

Calyotrogyne ghiesbreghtiana (rooster tail, vampire palm)

Collection of Zoology Museum of the Biodiversity and Tropical Ecology Research Center (CIBET), University of Costa Rica.

*Sideroxilon capiri (*Tempisque tree)

Collection of Zoology Museum of the Biodiversity and Tropical Ecology Research Center (CIBET), University of Costa Rica.

Genus *Mucuna* (monkey tamarind) flower pollinized by bats

Collection of Zoology Museum of the Biodiversity and Tropical Ecology Research Center (CIBET), University of Costa Rica.

Predators

Bats are vulnerable when attacked during their daytime rest or during nocturnal flight, by predators such as falcons, owls, toucans, serpents, raccoons, possums, cats, primates and in some cases, by other bats. Unfortunately some people kill or capture them out of fear, for fun or as exotic species.

Raccoons (Procyon lotor) are one of the main predators of bats.

Collection of Zoology Museum of the Biodiversity and Tropical Ecology Research Center (CIBET), University of Costa Rica.

Programa para la conservación de los murciélagos
Costa Rica
PCMCR

PCMM
México

BIOCONCIENCIA

ESCUELA DE BIOLOGÍA

MZUCR
Museo de Zoología

CIBET
Centro de Investigación en Biodiversidad y Ecología Tropical

TIRIMBINA

MUSEO DEL JADE
Y DE LA CULTURA PRECOLOMBINA
INSTITUTO NACIONAL DE SEGUROS

GRUPO | INS

MUSEO DEL JADE
Y DE LA CULTURA PRECOLOMBINA
INSTITUTO NACIONAL DE SEGUROS

GRUPO | INS