



The importance of socio-environmental perceptions of a bat colony in the Mayan ruins of Uxmal to promote environmental awareness and sustainable tourism

La importancia de las percepciones socio-ambientales de una colonia de murciélagos en las ruinas Mayas de Uxmal para promover la concientización ambiental y turismo sustentable

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Información del artículo

Recibido:
05/09/2022

Aceptado:
20/02/2023

Publicado:
14/02/2024

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Páginas:

201 - 219

<http://rperiplo.uaemex.mx/>

DOI <https://doi.org/10.36677/elperiplo.v0i46.19554>

Abstract

The presence of a colony of *Nyctinomops laticaudatus* inside the Mayan Ruins of Uxmal is believed by local authorities to damage the ancient structures due to the deposition of feces. It has therefore been proposed that the bats should be excluded, despite a lack of knowledge of the environmental services they provide. Our objective was to assess the socio-environmental perceptions regarding these bats of visitors to Uxmal. Surveys were applied to a sample of visitors, and their responses were categorized and analyzed using the Ordinary Least Squares Test of the Gnu Regression, Econometrics and Time-series Library program. Statistical analytical results indicated that perceptions towards conservation of bats were influenced by age, knowledge on feeding habits, diseases and threats which were the most important features mentioned. Socio-environmental perceptions were positive in general, so it is feasible that in the future authorities and visitors will accept the presence of bats in Uxmal and learn about their ecological role in the region, therefore providing attractive features as bats were very important for the Maya culture. We propose guidelines to establish an environmental education program with informative flyers as well and signs throughout the site explaining the importance of these bats for the region.

Keywords:

biocultural, environmental education, environmental services, guano, insectivorous bats.

Resumen

La presencia de una colonia de murciélagos *Nyctinomops laticaudatus* dentro de las ruinas Mayas de Uxmal es considerada por las autoridades como dañina a las antiguas estructuras debido a la acumulación de guano. Por ello, se ha propuesto remover estos murciélagos, asociado principalmente a una falta de conocimiento de los servicios ecosistémicos que proveen. El objetivo fue evaluar las percepciones socio-ambientales que tienen sobre los murciélagos los visitantes de Uxmal. Se aplicaron cuestionarios a una muestra de visitantes, y las respuestas se categorizaron y analizaron utilizando la prueba de mínimos cuadrados ordinarios con el programa Gnu regression, econometrics and Time-series Library. Los resultados estadísticos indican que las percepciones hacia la conservación de los murciélagos estuvieron mayormente influenciadas por edad, conocimiento sobre sus hábitos alimenticios, enfermedades y amenazas, que fueron los factores mayormente mencionados. Las percepciones socio-ambientales fueron positivas en general, por lo que es posible que en un futuro las autoridades y los visitantes acepten la presencia de murciélagos en Uxmal, y aprendan sobre su importante papel ecológico en la región como un importante atractivo debido a su relevancia en la cultura Maya. Proponemos establecer un programa de educación ambiental con folletos informativos, así como letreros en el sitio explicando la importancia de los murciélagos para la región.

Palabras clave:

biocultural, educación ambiental, servicios ecosistémicos, guano, murciélagos insectívoros.

Introduction

World Heritage Sites (WHS) are areas designated as protected by UNESCO for their historical, scientific or other significant values. There are currently 1 157 WHS in 167 countries throughout the world. Mexico contains 35 of these important sites, and a particularly interesting one is the Uxmal Mayan ruins in the state of Yucatan, where a large complex of ancient buildings is imbedded within a lush forest matrix. The site is visited by nearly 300 thousand visitors annually, who are attracted by the mixed attractions that Uxmal has to offer. One of the buildings at the site, known as the Governor's Palace, is a large structure with several chambers that is used as a roosting site for a large colony of broad-tailed bats (*Nyctinomops laticaudatus*) (Ortega *et al.*, 2010). Unfortunately, local authorities believe that these bats damage the Mayan structure through the deposition of guano, although such damage has not been documented or studied (Videla *et al.*, 2000; Soria, 2014), meanwhile *Nyctinomops laticaudatus* is a potential bat associated Rabies virus vector that causes disease with shorter clinical period and has lower pathogenic potential than strains from wild canids (Lu *et al.*, 2016; Fuoco *et al.*, 2019). For this reason, methods such as excluding bats by covering openings with mesh, have been proposed to exclude the bats from their roosting site in order to solve the perceived problem of guano deposition, without considering the environmental, ecological, and economical services the bats provide, or the possibility that with proper information the bat colony could in itself become an additional tourist attraction (Guevara & Sainoz, 2012). In the WHS internet website, UNESCO mentions the importance of including social and environmental perspectives to help preserve social sustainability as well as cultural and natural resources of the site as a legacy for future generations (<https://whc.unesco.org/en/list/791/>, consulted February 2023).

Insectivorous bats such as *N. laticaudatus* consume between 50 and 150% of their body weight nightly in insects, some of which are harmful to crops, thus providing important pest control as part of the many environmental services provided by bats for the region (Hutson & Mickleburgh, 2001). Their activity decreases the use of chemical pesticides in local crops, and it has proved to be a major contribution to the environmental preservation and economic savings in different regions (Ávila-Flores *et al.*, 2002; Cleveland *et al.*, 2006; Gándara *et al.*, 2006).

In general, bats have been misunderstood or negatively perceived by people, mostly based on superstitions and a lack of knowledge of their biology and activities; this threatens bats' conservation status in many regions of the world (Navarro & Arroyo-Cabral, 2011). It is important to change this scenario by changing the perceptions of the nature and ecological role of bats to strengthen social understanding of the role played within biocultural sites which will create a closer relationship or bond between humans and nature (Calixto, 2012). It is particularly important to strengthen the links between conservation and cultural aspects in WHS such as Uxmal to improve both the subsistence and maintenance of the archaeological wealth as well as the biological diversity processes, which could be transformed into attractive features for tourism (Fernández, 2008; Estrella *et al.*, 2014).

Based on the socio-environmental theoretical framework, innovative and integrated educational proposals can be designed to change environmental perceptions and decisions that do not favor key ecological species such as bats and also promote a holistic knowledge of the site (Flores &

Reyes, 2016). Socio-environmental perceptions and relational values can be defined as a set of norms, assumptions preferences, principles and values that result from by both living in a natural environment with diverse concepts that allow humans to understand, explain and appreciate the environment, or by being articulated by policies and social norms (Feijoó & Momo, 1991; Fernández, 2008; Piccolo, 2017). This concept also considers that not everything in culture is socially constructed, because direct experience is also a process that produces knowledge and experience (Durand, 2008). Therefore, research on perceptions of an ecological environment is grounded in nature-society relationships, and since perceptions are based on both individual and collective comprehension, perception is one of the dominant factors that shape the environment through human attitudes and behavior (Lazos & Paré, 2000).

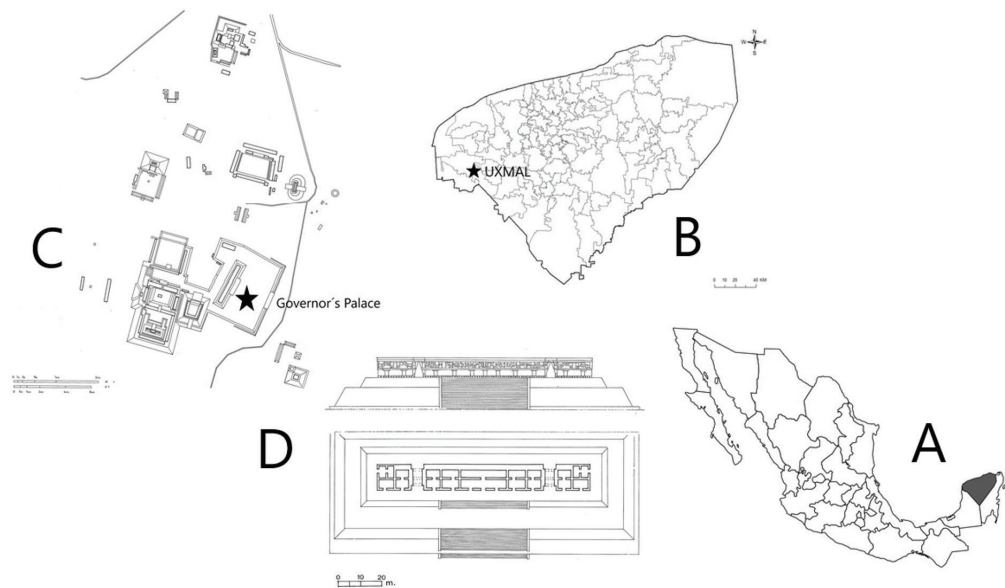
The study of socio-environmental perceptions allows us to understand how a group of humans relates with its environment, how people explain the ecological relationships among elements of that environment, and how they generate perspectives in order to identify and solve socio-environmental problems (Maneja *et al.*, 2009; López-Medellín *et al.*, 2017). Likewise, socio-environmental perceptions are critical for the conservation and cultural resignification of natural ecosystems, since customers concerned about environmental problems are more likely to purchase environmentally friendly products (Durand, 2002; Jun Song *et al.*, 2012). Furthermore, studies indicate that an increase in the public's understanding of environmental sensitive themes has proven to mobilize public complaints over local governments (Salgado-Carvalho & Fidélis, 2009; Zhe Wang, B. & Cheng, Z. 2017).

Therefore, we focused our research on the colony of *N. laticaudatus* as a sustainable key species for the Uxmal forest (Guevara & Sainoz, 2012). Our goal was to analyze the social-environmental perceptions of visitors to the archeological zone of Uxmal regarding the bats that live inside the Governor's palace. This information can help people to accept these organisms as important biological, economic and social residents of the site, thus pairing the conservation of bats with the preservation of the cultural heritage of Uxmal and help to change government attitudes that will provide a mix attraction for sustainable tourism with both historical and biological contexts and information.

Materials and methods

Study area

The study was carried out in the archaeological zone of Uxmal, Yucatan, México (20° 21'N, 89°46'O), around the Governor's Palace. This is a structure that consists of 20 chambers (9 internal and 11 external) with various cracks/gaps of approximately 30 × 30 × 70 centimeters where bats roost (figure 1). These roosting sites are completely dark, with a constant temperature of 28 °C and a relative humidity of 75%. The estimated population of the colony ranges from 2 000 to 3 000 individuals (figure 2) (Málaga & Villa-R, 1956; Ortega *et al.*, 2010).

Figure 1. Geographical location of the archaeological zone of Uxmal, Yucatan

A) Location of Yucatan in Mexico. B) Location of Uxmal in Yucatan. C) Diagram of the archaeological complex. D) Governor's Palace building. E) Bats roosting in the building.

Source: (Modified from Martínez-García & Rivera Bajo (2015) and INEGI-CONABIO, 2010).

Figure 2. *Nyctinomops laticaudatus* bats roosting inside the building

Source: Picture of Jorge Ortega.

Socio-environmental perceptions

In order to determine the socio-environmental perceptions of national and international visitors to the archaeological zone, mixed opinion polls were applied. The surveys contained open, closed and multiple-choice questions that were organized in three blocks: personal data, prior knowledge and general perception of bats (Annex 1). These questions were selected in order to know the perceptions of the tourists regarding the conservation of bats in the area: our dependent variable. Each question represented a variable that contributes to the overall perception of bats. The analysis

included the closed-ended questions, single-answer multiple choice questions and multiple-choice questions with multiple answers. Sampling was carried out from December 2015 to July 2016. An information leaflet on the ecological importance of bats in the area was also produced and offered to interviewed visitors following the survey (Annex 2).

The surveys were analyzed in two phases. The first was the descriptive analysis, in which the responses obtained for each of the items in the open-ended questions were categorized, grouped by their affinity (Fernández *et al.*, 2010). The second phase was the statistical analysis of the data using the GRET (Gnu Regression, Econometrics and Time-series Library) ordinary least squares test. This method allowed us to identify and quantify the relationship of each variable as a statistical function (Manazza *et al.*, 2014). For this work, the statistical test of ordinary least squares allowed us to distinguish in a quantitative way the variables that were related to positive or negative perceptions regarding bats and therefore identify which were important for an environmental education program aimed at conserving this species (Camúñez *et al.*, 2013).

First, a value was assigned to the answers for each question. Closed-ended questions had a value of 1 when the perception towards bat conservation was favorable and 0 when it was not; answers of the multiple-choice or open questions had values from 0 to 5 depending on the answer chosen, and the multiple-choice questions had the value of the number of options chosen by the respondent. Second, each variable was named according to the question, and models with the highest number of statistically significant variables at 90%, 95% or 99%, the highest adjusted r^2 and the lowest value of the Schwarz and Akaike criteria were chosen (Manazza *et al.*, 2014). These criteria consist on objective measures that model suitability and a relative estimate of lost information (Koehler & Murphree, 1988).

Table 1. The table shows the variables in which survey questions were categorized, the answers to be selected by respondents and the value assigned to each of these answers

Values assigned to Each Variable							
Age (years old)	Answer	Under 18	19-30	31-40	41-50	51-60	Over 61
	Score	1	2	3	4	5	6
Previous Knowledge	Answer	Yes			No		
	Score	1			0		
Feeding	Answer	Piscivorous	Insectivorous	Nectarivorous	Fruit-Eating	Hematophagous	
	Score	Sum of the options selected by the respondent.					
Diseases	Answer	Yes			No		
	Score	1			2		
Anthropogenesis	Answer	Yes			No		
	Score	1			2		
Extinction	Answer	Yes			No		
	Score	1			2		
Information	Answer	Yes			No		
	Score	1			2		

Source: own elaboration.

Conservation, the dependent variable for the model, was scored as 1 if the respondent considered that bats should be conserved in the archaeological zone, and 0 if the visitor considered bats to be harmful. The intercept, β_0 , is a constant that is automatically generated by the program, and β_1 , β_2 , β_3 , β_4 , β_5 , β_6 and β_7 are the numerical coefficients of each independent variable.

Results

A total of 323 surveys were conducted in English and Spanish. The majority of respondents were Mexican (80%), followed by Americans (4%), Spanish (3%), Germans (3%) and British (2%). Most of the national respondents reside in Mexico City and the Yucatan. Visitors' ages ranged from 31 to 60 years old (38%), 42% had bachelor's degree and 67% of them were visiting Uxmal for the first time. Proportion of sexes in the sample was equitable. The respondents' nationalities were Mexican (80%), followed by American (4%), Spanish (3%), German (3%) and British (2%). The Mexican visitors resided in Mexico City and Yucatan.

Most of the interviewed visitors (84%) recognized bats to be mammals, and 74% had previous knowledge about the fruit-eating and insect-eating feeding habits of bats. When questioned about roosting sites, 40% of the respondents allocated bats to roost in caves, 17% in cracks of rocks, and 14% in abandoned houses. The majority of the respondents (69%) mentioned that bats can be preyed on by some animals, while 10% specifically mentioned their main predators to be snakes, cats and birds. Although 90% of the respondents considered that bats are not aggressive species, only 22% of them had at least touched one while the rest said they did not like their appearance and therefore would not get close to one. The majority (87%) mentioned that bats can be vectors of diseases and 45% specifically mentioned rabies to be the most transmitted disease by bats.

In terms of the ecological importance of bats, 98% of the respondents considered that there would be negative consequences in the ecosystem if these animals were to be removed from the area. However, the ecological relevance of these mammals at the site was unknown to almost half of the visitors (44%). Some believed that habitat destruction (26%), logging of trees (13%), and pollution (12%) were the most harmful human activities to bats. Interviewed visitors mentioned that bats should be preserved in the area (91%), and 36% of the respondents considered bats to be endangered.

Half of the respondents were aware of the presence of bats roosting in the Governor's palace (90%). The majority mentioned that bats are interesting (62%), and their presence in the archaeological zone is important (45%), and even pleasant (22%). Perceptions about bats were positive for most respondents (67%), and most agreed to receive more information about the bats that inhabit the area. Respondents believed that bad perceptions of bats are mainly derived from movies, ignorance, legends and myths.

The function that resulted from the statistical analysis was as follows, where β is the coefficient that is multiplied with each variable weight value:

$$\text{Conservation} = \beta_0 + \beta_1 \text{ Age} + \beta_2 \text{ Knowledge} + \beta_3 \text{ Feeding} + \beta_4 \text{ Diseases} + \beta_5 \text{ Human threats} + \beta_6 \text{ Extinction} + \beta_7 \text{ Information} + \varepsilon$$

This function considered six statistically significant variables: the age of the respondents, previous knowledge about bats, diseases that are transmitted by bats, the negative impact of human activities on bats, perceptions that bats are in danger of extinction as a result of human activity and the need

for information on the importance of bats in the archaeological zone. The variable Feeding refers to the feeding habits of bats known to the respondent. This variable was not statistically significant in the mathematical function, but when it was eliminated, the model had a lower fit and a higher value in the Schwarz and Akaike criteria (table 2).

Table 2. *Constant, Age, Knowledge, Feeding, Diseases, Anthropogenesis, Extinction and Information* were considered as the variables that determined a positive attitude for the conservation of bats in Uxmal. The *coefficient* indicated the correlation between conservation and each of the independent variables taken into account in this model. The *typical deviation* measures the data dispersion for each of the variables in the chosen model and the *P-Value* indicate the power of each of the variables in the model (statistically significant at † 90%, ‡ 95% and § 99%).

DEPENDENT VARIABLE: CONSERVATION				
	Coefficient	Typical deviation	Statistic t	P-Value
<i>Constant</i>	0.401309	0.144799	2.771	0.0061 §
<i>Age</i>	-0.0370804	0.0183643	-2.019	0.0447 ‡
<i>Knowledge</i>	0.228074	0.113280	2.013	0.0453 ‡
<i>Feeding</i>	-0.0266848	0.0173612	-1.537	0.1257
<i>Diseases</i>	-0.0478552	0.0267214	-1.791	0.0747†
<i>Anthropogenesis</i>	0.364388	0.0734759	4.959	1.40e-06 §
<i>Extinction</i>	0.157086	0.0358304	4.385	1.78e-05 §
<i>Information</i>	0.150998	0.0376142	4.014	8.14e-05 §
R-square	0.295963	Akaike criterion		50.38865
Schwarz criterion	77.92799	Significant variables		6

Source: own elaboration.

Discussion

The total number of surveys obtained was significant at 95% (Survey System, 2006) for an approximate population of 218, 360 annual visitors (INAH, 2015). The proportion of national to foreign visitors in our surveys was approximately 80:20, likely because surveys were applied during the vacation periods in Mexico. About 30% of the respondents came from the Yucatan Peninsula, which suggests that the local community is interested in visiting this WHS.

Sixteen percent of the respondents mistakenly identified bats as birds rather than mammals. Romero and Crispin (2012) mentioned that most of the interviewed people thought bats were just animals, and did not necessarily identify them as mammals. Visitors mentioned that fruits are the main food source for bats, since the habitants of the region recognized the Jamaican fruit-eating

bat (*Artibeus jamaicensis*), a common frugivorous bat that is frequently found in tropical cities (Ortega & Castro-Arellano, 2001). These animals feed on the fruit trees located in local gardens, and this particular response coincides with the reports of Romero and Crispin (2012) that mentioned that environmental knowledge is derived from peoples' daily experiences. Nevertheless, although *Nyctinomops laticaudatus* is the most abundant species in Uxmal, it is not easily identified by local people because these bats are inconspicuous in their roosting sites and feed at night in the crops outside the city (Ortega *et al.*, 2010).

The respondents correctly mentioned the roosting sites of bats (i.e., caves, abandoned houses, etc.), which evidences the recognition and knowledge that they have with the species, as has been reported in previous articles (Reinaldo, 2008; Romero & Crispin, 2012). However, only 10% mentioned that bats were predated by birds and snakes; this contrasts with previous surveys in which cats, raptors, dogs and coyotes were identified as regular bat predators (Romero & Crispin, 2012).

Most people have had a close look at a bat but mentioned that they were afraid to touch them, and although they acknowledged their importance as an attribute of all living beings, they did not mention any direct benefit society gains from such species. The economic value of insectivorous bats as pest regulators reaches USD 882 500 per year (Gándara *et al.*, 2006). Bats regulate insect populations that are disease vectors which can affect the health of humans (Guevara & Sainoz, 2012). Mixed colonies of *Myotis velifer* and *Tadarida brasiliensis* have significantly reduced the number of cases of malaria in Texas due to insect-feeding habits of bats, and also regulate populations of the *Anopheles* mosquito that transmits several diseases (Murphy, 1989). Bioregulation provided by bats could eliminate the use of chemical pesticides, thus avoiding a series of economic and health costs for society.

It is worth to mention that bats' cultural importance in the context of the site was not mentioned, despite being one of the main deities in ancient Mayan culture and intermediaries between the worlds of the living and the dead, which is recorded in the Mayan sacred book called the Popol Vuh, which is embedded in current Mexican traditions and culture (Carvallo, 2013). Due to the biocultural importance of the area, the observation and knowledge of these bats could be exploited as an important attraction to be offered to visitors, as this type of natural-cultural tourism is currently in search of sites that integrate the natural environment with the archaeological features (García, 2012).

Fear and ignorance are important risk factors that can lead to the destruction of entire bat colonies (Molinari *et al.*, 2012; Retana-Guiascón & Navarijo-Ornelas, 2012; Soria, 2014). So a well-designed educational program to visitors is needed to enhance environmental awareness and to highlight the presence of bats as an additional attraction in the site that will in turn to promote changes in government decisions and attitudes towards the conservation of bats in Uxmal. Most of the surveyed visitors believed that the bad reputation attributed to bats originates from movies, myths and legends. Reports showed that knowledge is directly related to the low level of information that is publicly available about these mammals (Moya *et al.*, 2010). Although in some cases the answers about these organisms were erroneous, respondents were interested in learning more about these animals, which contrasts with the results obtained by Isaac-Marquéz *et al.* (2011), however, half of the respondents did not observe bats in the Governor's palace; some mentioned difficulties to reach the specific roosting site, others recalled a bad smell, while others confused them with swallows, while others mentioned to have seen them or at least heard them in the area.

The socio-environmental perceptions of the visitors of the archaeological zone of Uxmal towards bats were positive in general, however we find that the respondents lacked sufficiently accurate and objective knowledge and information to allow them to have a proper criterion about the existence and conservation of bats, which emphasizes the importance, relevance and viability of implementing an environmental educational program at the site. According to Ardoin *et al.* (2012), a well-designed environmental educational process is efficient and meaningful, and it is necessary to integrate society by directly acknowledging and valuing the large set of benefits obtained from the environmental services provided by bats. Observation of bats in their environment has proved to be a good opportunity to achieve their protection through environmental education. A substantial factor in reverting negative perceptions of bats is direct contact with them (Hoffmaster *et al.*, 2016); people who have had the opportunity to observe them closely have established an affective bond with them (Vargas-Contreras *et al.*, 2012). Therefore, we believe that if people are encouraged to visit the Governor's palace and see the bats in their roosting sites or emerging from it, coupled with concise information on their biology and the environmental services they provide to society can be a great strategy to strengthen the bond of the visitors with the roosting bats, and therefore contribute to their awareness and conservation, as well as creating a biological attraction to the archaeological zone. The inclusion of both social and environmental perspectives of the visitor in the management of this important archaeological site will, as suggested by UNESCO, strengthen the preservation of its cultural and natural resources.

The statistical analysis of the data indicated the significance of each variable (Manazza *et al.*, 2014). The function of the chosen model empirically told us how much weight each variable has regarding the positive perception towards bats and their conservation. In the case of Age, data showed that younger people seem more concerned about environmental damage than older ones (Grendstad & Wollebaek, 1998). Another significant variable of the model was Knowledge, which merges with the experiences of childhood and the acquired knowledge about nature through the years, which can explain peoples' environmental concerns (Gifford & Nilsson, 2014; Gómez-Ruiz *et al.*, 2015). In the Diseases variable, we observed that respondents considered bats as carriers of rabies and ignored their ecological role as regulators of several disease vectors. A previous report showed that the transmission of rabies from non-hematophagous bats is of lesser concern compared with that from dogs and cats (Schneider & Santos-Burgoa, 1995). On the other hand, it has been reported that the number of cases of vector-borne diseases such as dengue is 50 to 100 per 100 000 habitants higher in the state of Yucatan than cases of rabies transmitted by bats (Scheffer *et al.*, 2014; Torres-Galicia *et al.*, 2014). Human threats and Extinction showed a similar pattern in their values, since respondents showed positive attitudes towards the conservation of bats and were concerned about how human activities negatively impact bats, which can boost the presence of bats in the area as an tourism related attraction for the site. Information was a significant variable in the statistical model, confirming the Gifford and Nilsson (2014) postulate that most people with knowledge about nature are more inclined to have pro-conservation attitudes towards the solution of environmental problems.

These analyses suggest the importance of the resulting variables that determine the socio-environmental perceptions that visitors of Uxmal have about bats. Knowledge and access to Information were essential to assess the socio-environmental perceptions of bats. There is a positive perception of bat conservation when respondents are aware that human activities are negatively

affecting bat's habitats, which is derived from their prior knowledge about bats or access to this type of information. These perceptions determined the attitudes of visitors towards bat conservation and their willingness to participate in a prospective environmental educational program.

Conclusion

Spreading information about the ecological importance of *N. laticaudatus* in the area will allow people to know the benefits and the importance of bats, which is a positive step toward their preservation. The survey we conducted allowed us to understand visitors' beliefs regarding bat biology and therefore identify areas where knowledge needs to be strengthened. This work constitutes the first stage for a future design of an environmental educational program based on the ecological role of bats in the archaeological zone of Uxmal, not only because of its importance as a bat roosting site, but also as part of Mexico's biocultural heritage. It is important to consider that bats are important species that provide several economic benefits due to their different ecological roles, and their preservation can be achieved in tourist sites such as Uxmal with proper environmental education activities.

Acknowledgements

This project was financed partly by CONACyT scholarship 702279. We want to thank the authorities of Uxmal for their support and all the people that kindly contributed with their answers.

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ANNEX 1

TEST

This test aims to know the opinion that you have about bats living in the Governor's Palace, Uxmal. Participation is voluntary and anonymous, so please answer sincerely. Treatment of the information obtained here will be confidential and only for research purposes, so that not be provided to any person or organization outside of the same institute.

Instructions: Mark with an X the answer you think is correct.

PERSONAL DATA

Age	18 or less	19-30	31-40	41-50	51-60	61 or more
-----	------------	-------	-------	-------	-------	------------

Occupation	Student	Professional	Housewife	Employee	Own business	Other (Specify)
Sex	Man	Women				

How many times have you visited Uxmal?	1	2	3	4 or more
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KNOWLEDGE, IMPORTANCE AND THREATS

1. Do you know what are bats?	yes	no
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2. What kind of animals are bats?

Fish	Amphibians	Mammals	Birds	Reptiles
------	------------	---------	-------	----------

3. What do bats eat? (You can check more than one)

Fishes	Insects	Nectar	Fruit	Blood
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4. Where can we find bats? (You can check more than one)

Abandoned houses	Leaves of plants	Treeholes	Caves
Water	Cracks in rocks	Glaciers	Mines

5. Do bats have predators?

yes	no
-----	----

6. Are bats aggressive?

yes	no
-----	----

7. Have you ever seen a bat near of you?

yes	no
-----	----

8. Have you ever touched a bat?

yes	no
-----	----

9. Do you think bats has any importance?

yes	no
-----	----

10. If you answer was “yes” specify Which? _____

11. Would there be any consequences if bats didn’t exist?

yes	no
-----	----

12. If you answer was “yes” specify Which?_____

13. Do bats attack humans?

yes	no
-----	----

14. Are bats dangerous for man?	yes	no
---------------------------------	-----	----

15. If a bat bites you can die?	yes	no
---------------------------------	-----	----

16. Do bats carry diseases?	yes	no
-----------------------------	-----	----

17. What kind of diseases are transmitted by bats?

18. The human activities ¿affect bats?	yes	no
--	-----	----

19. Which? _____

20. Do you think bats must be preserved?	yes	no
--	-----	----

Why? _____

21. Are they endangered?	yes	no
--------------------------	-----	----

PERCEPTION ABOUT THE PRESENCE OF BATS IN UXMAL

22. Have you ever seen a bats in Uxmal?	yes	no
---	-----	----

23. What do you think about bats of Governor’s Palace?

Are good	Are bad	Are interesting	Are friendly	Are dirty
----------	---------	-----------------	--------------	-----------

24. What do you think about the bat’s presence in this Archaeological area?

Enjoyable	Frightening	Important	Annoyed	Risky
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25. Why do you think about the bad reputation of bats? Why is that?

If you would like to know more about bats, please provide your details:

Name:

Phone number and/or e-mail:

COMMENTS AND OBSERVATIONS

THANKS FOR YOUR HELP!

|

ANNEX 2

¿Sabías que...?

Dentro del Palacio del Gobernador en Uxmal habita una colonia de alrededor de 5,000 "murciélagos cola ancha" (*Myctinomops laticaudatus*).

Los murciélagos que aquí habitan se alimentan de insectos hecho por el que se les ha denominado controladores de plagas. En un día común de forrajeo estos animales pueden alcanzar a comer 1.3 millones de toneladas de insectos dañinos tanto para la agricultura como de los bichos que son fuente de enfermedades .



Murciélago cola ancha (*Myctinomops laticaudatus*).

Did you know...?

Inside the Governor's Palace in Uxmal lives a colony of about 5,000 "wide tail bats" (*Myctinomops laticaudatus*).

Bats that live here feed on insects for which they have been called pest controllers . On an average day foraging these animals can eat up to 1.3 million tons of insects that are harmful to both agriculture and humans since some of the bugs are a source of disease.



Murciélago cola ancha (*Myctinomops laticaudatus*).

Por otro lado las heces que producen estos mamíferos (guano) tiene efectos benéficos en el crecimiento de algunas plantas de interés comercial, por lo que la utilización de este abono evita el impacto ambiental generado por el uso de fertilizantes químicos.

Los murciélagos salen a alimentarse alrededor de las 19:20 hrs, así que si te quedas podrías observar la salida de estos animales por aproximadamente 15 minutos.

Aunque la mayoría de las veces pueden pasar desapercibido para todos nosotros, los murciélagos proporcionan una variedad de servicios ambientales que resultan importantes para el ambiente y para el hombre pues nos proporcionan beneficios económicos, sociales y de salud.

Si deseas más información ¡Contáctame!

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Moreover, feces that produce these mammals (guano) have beneficial effects on the growth of some plants of commercial interest, so the use of this fertilizer avoids the environmental impact caused by the use of chemical fertilizers.

The bats come out to feed around 19:20 pm, so if you stay you can observe these animals for about 15 minutes .

Although most of the time they go unobserved by all of us, bats provide a range of environmental services that are important for the environment and for humans providing economic, social and health benefits.

If you want more information ¡Contact me!

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