

Guidelines for Minimizing the Negative Impact to Bats and Other Cave Organisms from Guano Harvesting

INTRODUCTION

Incredibly diverse and ecologically valuable, cave bats provide billions of dollars in ecosystem services. These include seed dispersal and pollination, which help maintain plant communities, and pest control, which limits the distribution and abundance of many species responsible for spreading diseases and causing significant economic damages to crops and livestock.

In addition, cave bats also play an important role in the recycling of nutrients through the production of guano. Within caves, guano forms the basis of the cave ecosystem, as the main source of energy input from the outside world. This supports a wide range of fragile and unique species, many of which are limited to specific caves. Guano also serves as an important resource for humans, both as a fertilizer and as rock phosphate, which is an eventual product of guano deposition.

Unfortunately, poor understanding of cave ecology and bat biology and ill-defined mining/property rights for many caves has resulted in unsustainable guano harvesting practices, the loss of millions of bats, and extirpation of many local colonies. This is especially evident in caves where extraction techniques have disrupted these very sensitive animals and destroyed these geologic features that have taken thousands of years to form. Many bat conservation scientists have recognized the need for bat cave management guidelines, monitoring of their implementation, and enforcement of laws to protect caves and bats to maintain healthy cave ecosystems and support continued guano harvest.

These **working** guidelines have been drafted by the Emerging Wildlife Conservation Leaders Bat Group (EWCLBG), in collaboration with Bat Conservation International and the EWCLBG Advisory Committee, in response to the increasing occurrence of unsustainable bat guano mining practices and, consequently, the loss of millions of bats worldwide. They were developed as a first step towards addressing the need for standards for guano harvesting that can guide a wide variety of stakeholders, including cave managers, government agencies, and harvesting companies, towards

the use of practices that minimize harm to bats, colonies, and related cave flora and fauna due to guano harvesting.

Due to the vast differences in social, political, and economic situations of harvesters throughout the world, these guidelines are meant to act as a general guide to procedures that may help to minimize disturbance to bat colonies. They are not an inflexible code of conduct and are intended to be updated as new information comes to light and “best management practices” are developed. Implementation manuals, specific to countries, regions, or individual locales, can be derived from the information outlined below.

It should be noted that caves are utilized for a variety of other purposes, such as recreation and tourism, but those uses are beyond the scope of these guidelines.

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DISCLAIMER

- These guidelines were developed by the individuals of the Emerging Wildlife Conservation Leaders Bat Group and the Advisory Committee. They should not be interpreted as representing the opinions or policies of others.
- Any guano harvesting MUST follow applicable international, national and local laws and regulations.
- Compliance with these guidelines does not guarantee bats will tolerate guano harvesting and monitoring of the bats' reactions to the harvest should be completed. Note, there are some situations that may make harvesting unsustainable. For instance, the conservation status of an ecosystem or species in the cave should be considered. If systems are deemed too sensitive or rare, harvesting should be avoided.
- Every situation is unique and not all guidelines will be applicable universally. Discretion should be used.

DEFINITION OF TERMS

Sustainable – For the purposes of this document, the sustainability of bat guano harvesting is defined by its ecological impact (its conservation outcome). Guano harvesting, in this instance, is considered sustainable when it does not result in the decline or extinction of the resident bat colony responsible for the production of the guano, the loss of guano-dependent cave organisms, or the loss of cave-associated species (e.g., cave swiftlets)

Guano – the excrement produced by cave-dwelling bats. This excludes rock phosphate which develops after long periods of time (often after extended periods of deposition) and is not necessarily found in conjunction with bat colonies.

GUIDELINES

Baseline assessment of caves and cave bats

1. Whenever possible, caves should be comprehensively assessed for its biological, ecological, geological, hydrological, and cultural values prior to any consideration of caves for guano harvesting or other uses. These assessments should be conducted in accordance with government regulations, where applicable.
2. Cave bat populations in the cave and caves in the vicinity must be assessed. This assessment must include consideration of species present, population, roosting location, reproductive seasonality, and foraging area.¹
3. Cave uses (whether legal or not) must be assessed including the use of caves for recreation, harvest of bats, existing guano harvesting, spiritual or religious uses.
4. Legal or customary ownership and management of the cave must be identified and acknowledged.

¹ Methodology for these assessments can be found in: *Kunz TH, Parsons S (eds) (2009) Ecological and behavioral methods for the study of bats. Johns Hopkins University Press, Baltimore, MD*

Monitoring and Reporting

1. As part of partnerships for sustainable guano harvesting, harvesters and their government or NGO counterparts need to agree on regular monitoring and reporting protocols, and assign staff (preferably teams from at least two partners) to conduct monitoring activities.
2. Establishing a baseline population estimate of each species of cave bat and, if possible, macro invertebrate species is critical to determine whether their numbers are affected by guano harvesting.
 1. Indicators for monitoring include exit counts, assessing area of space occupied by roosting bats, and echolocation calls.
3. Sustainable harvesting will also require protocols for regular monitoring of
 1. Populations of bats and invertebrates²³
 2. Cave temperature and microclimate
4. These data need to be collected on a regular basis
5. Photographs of the cave (especially where bats are roosting and where the guano is being harvested) should be taken at regular intervals to track trends in populations and other changes within the cave.

² Kunz TH, Parsons S (eds) (2009) Ecological and behavioral methods for the study of bats. Johns Hopkins University Press, Baltimore, MD.

³ Flaquer C, Torre I, Arrizabalaga A (2007) Comparison of sampling methods for inventory of bat communities. *J Mammal* 88:526–533

Temporal Segregation – separate the timing of guano harvest from the use of the cave or mine by bats.

1. ***Migratory Bats***: For bats that are migratory and leave their caves during certain seasons, guano harvesting should be limited to the season(s) in which bats are not present in the cave.⁴ This will only work for migratory species and will not be a suitable management tool in areas where bat species spend the entire year in the same cave.
2. ***Non-Migratory Bats***: For bats that are not migratory, the feeding and roosting behavior of bats must be considered to develop appropriate schedules for potential harvesting regimes. The following points provide guidance on determining appropriate activities.
 1. In order to minimize disturbance, which can cause pup loss and other stresses, guano should be collected when the bats are not in the cave. Given the crepuscular and nocturnal behavior exhibited by most species, harvesting activity is less likely to interfere with bat colonies after dusk and end before dawn when bats are leaving or returning to their caves. This, as well as considerations for local work schedules and culture, will need to be considered by stakeholders as part of harvest planning.
 2. In caves where harvesting has been determined to be possible while bats are present in the cave, guano should only be harvested from high-ceiling areas where the bats are roosting furthest from the cave floor. This minimizes disturbance, bat-human contact and risk of disease transmission.
 1. Reducing health risks to workers can be achieved by providing respirators capable of filtering dust

⁴ Refer to: Cryan PM, Diehl R (2009) Analyzing bat migration. In: Kunz TH, Parsons S (eds) Ecological and behavioral methods for the study of bats, 2nd edn. Johns Hopkins University Press, Baltimore, MD, p 476–478

particles down to one micron in diameter and changing filters daily.⁵

3. The reproductive cycle of resident bat species should be established and included in planning. Guano should not be harvested when females are about to give birth or when babies (pups) are born and being raised; it can be harvested after the young are able to fly and feed independently.
3. The extraction period (or “harvesting season”) for a cave must take into account the seasonality of the site, suitable opportunities for low-impact activities within the cave and extraction quotas agreed upon by companies and the agencies or other organizations involved in the sustainable management of the cave.

Spatial Segregation – separate the location of guano harvest from the use of the cave or mine by bats.

1. In some situations the bats may segregate themselves within a larger cave/mine roost that would allow guano harvesting even while the bats are in the cave/mine. In these instances, when potential disturbance is unlikely and can be documented, harvesting may occur while bats are present.

⁵ Tuttle, MD and A Moreno (2005). *Cave-dwelling Bats of Northern Mexico*. Bat Conservation International

Habitat inside and outside of the cave

1. Limit extreme modifications to the habitat (e.g., excessive clearing of vegetation) surrounding the cave/mine entrance as it may change the internal cave/mine temperature and water content, negatively impacting bat use.⁶⁷
2. Avoid obstructing cave entrances or digging shafts to access guano deposits. Obstructions can limit access for bats and increase risks from predators⁸, while new shafts or changes in entrance size can change roost temperatures. Either activity can force bats to abandon the cave.
3. Disturbances inside the cave may also negatively affect other flora/fauna that in the cave ecosystem.⁹ Guano is an integral component of cave ecosystems, and this must be considered while determining the appropriate amounts of guano to extract. Surveys of cave biota (see Assessment guideline at beginning of document) will help identify target species.
4. Do not enlarge or reduce cave entrances or create new openings without first consulting an expert familiar with the ecology and geology of the cave system and the resident bat species.
5. Trim encroaching trees or other vegetation from cave entrances.¹⁰

⁶ Racey (2011), pers. comm.

⁷ Glover, AM, and JD Altringham (2008). Cave selection and use by swarming bat species. *Biological Conservation* 141(6) 1493-1504.

⁸ See Turner, MD and A Moreno (2005). *Cave-dwelling Bats of Northern Mexico*. Bat Conservation International. Although this suggestion is not based on published data, it does get at the larger point – if caves are to be managed for guano harvest, steps should also be taken to minimize other possible losses and to maintain the highest quality habitat possible.

⁹ Louis Deharveng and Anne Bedos, Diversity Patterns in the Tropics. In: William B. White and David C. Culver, editors, *Encyclopedia of Caves*. Chennai: Academic Press (2012) pp. 238-250.

¹⁰ Overgrowth of cave entrances, often by invasive alien plant species such as vines, has been a major problem in Seychelles by obstructing roosts of the Critically Endangered *Coleura seychellensis*. (**SOURCE?**)

6. Minimize use of pesticides at times and places where they are most likely to harm bats, especially in areas where bats feed. Spraying crops at dawn is least likely to contaminate insects that are eaten by bats. Organochlorine, organophosphate and carbamate insecticides can pose serious threats to bats.¹¹¹² Studies suggest that some synthetic pyrethroids (e.g., permethrin) do not result in obvious harm, but other forms may.¹³¹⁴

¹¹ Tuttle, MD and A Moreno (2005). *Cave-dwelling Bats of Northern Mexico*. Bat Conservation International

¹² Clark, Jr., DR, TH Kunz and T Kaiser (1978). Insecticides Applied to a Nursery Colony of Little Brown Bats (*Myotis lucifugus*): Lethal Concentrations in Brain Tissues. *Journal of Mammalogy*. 59(1) 84-91.

¹³ Racey, PA, Swift, SM. (1986). The residual effects of remedial timber treatments on bats. *Biological Conservation*, 35(3) 205-214

¹⁴ Clark DR Jr, Shore RF (2001) Chiroptera. In: Shore RF, Rattner BA (eds) *Ecotoxicology of wild mammals*. John Wiley & Sons, New York, p 159–214

Harvesting/Extraction Operations

1. Route heavily used road tracks away from cave entrances.¹⁵
2. Entrance gates can help protect bats from human disturbance, but different species require different parameters. For gating details contact Bat Conservation International and other professionals with technical expertise in cave management.
 1. Posted fences may be useful in some instances if they do not obstruct the bats' flight path.
3. Fire should not be permitted in caves or near cave entrances. Smoke can enter and suffocate bats and the guards can catch fire and may burn for months.¹⁶
 1. This also includes internal-combustion engines and kerosene torches. In addition to oxygen depletion, fumes can kill bats and humans in the enclosed space.
4. Because bats are sensitive to light, and disturbance by light can cause distress, lights should be used at a minimum. Do not shine directly on the bats or into the cave entrance when the bats exit at night or return in the morning. Lights that produce any kind of fumes or smoke should be avoided, as should high-candlepower spotlights that will distress bats.
 1. Headlamps and heavy-duty flashlights are potential alternatives.
5. It is understood that noise is inevitable, but all practical measures should be taken to minimize it (e.g., machinery not being used at the moment should be shut down, no radios or music players, reduce shouting).

¹⁵ Tuttle, MD and A Moreno (2005). *Cave-dwelling Bats of Northern Mexico*. Bat Conservation International

¹⁶ Tuttle, MD and A Moreno (2005). *Cave-dwelling Bats of Northern Mexico*. Bat Conservation International

Policy and Management

1. Permits can be effective at controlling the amount of guano collected, the number of harvesters allowed to harvest at a given time, and/or the time period during which harvesting is allowed. Permits should be issued by the appropriate natural resource management authority, and should initially be short-term (1-2 years with the prospect of renewal if sustainability criteria are met) to ensure that additional research and observations can be incorporated through adaptive management.
2. Enforcement through random checks or regularly scheduled audits and site visits must be part of the permitting process in order for permits to be an effective control mechanism.
3. Where possible, accredited observers should be used during mining operations to ensure adherence to sustainable management guidelines.
 1. Depending on the operation and the management scheme that is being utilized, observers may come from several different backgrounds:
 1. Government officials can represent the interests of the public as observers (similar to the role of a park ranger/enforcement officer) in areas where government regulation and financial resources permit.
 2. Industry or community representatives can serve as observers, given proper training. This is feasible in areas where property rights for the cave and guano resources are clearly established.¹⁷

¹⁷ There are several examples of this practice being successfully implemented in community forestry or marine fishery contexts. Rare Conservation (<http://www.rareconservation.org>) specializes in this type of project, and several case studies are available on their website.

3. An observer can be present on behalf of a third-party auditor in instances where a certification scheme has been established. The Forest Stewardship Council is the highest profile example of this type of auditing in the natural resources sector.¹⁸
4. Considerations must be given to the legal status of the cave system and its relationship to local communities. Sustainability is difficult to maintain where there is no clear social and legal recognition of responsibility for cave resources. Customary or legal landowners, those who use the cave and local residents are very important stakeholders, and support from those who will enforce cave management is necessary for successful management.
5. Working with a variety of stakeholders, local land managers or community members should determine appropriate collection limits.¹⁹
6. Local communities residing near the subject cave should be informed of the guano harvesting activity as well as the terms and conditions of the permit, and consulted to learn about possible infractions.

¹⁸ Forest Stewardship Council (<http://www.fsc.org>). Not also that third party certification is most successful in particular market settings, where there is a 'social license to operate' that includes sufficient public demand for certified products (see *Cashore, B., Gale, F., & Meidinger, E. (2006). Confronting Sustainability: Forest Certification in Developing and Transitioning Countries. New Haven, Connecticut: Yale School of Forestry & Environmental Studies.*)

¹⁹ Within conservation, examples of this type of community engagement are often found in marine protected areas, or in community conservation areas using CBNRM approaches, such as those in southern Africa (see *Child, B and G Barnes (2010). The conceptual evolution and practice of community-based natural resource management in southern Africa: past, present and future. Environmental Conservation 37: 283-295.*) In addition to these case studies, tools for planning, such as the *Open Standards for the Practice of Conservation* (<http://www.conservationmeasures.org/initiatives/standards-for-project-management>), or for communication, are useful.

Taking these simple precautions can help protect the bats and maintain guano harvesting!

DRAFT - FOR SEABCRU CONSIDERATION