

ORIGINAL RESEARCH ARTICLE

## Bat consumption in Thailand

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**Background:** Human consumption of bats poses an increasing public health threat globally. Communities in which bat guano is mined from caves have extensive exposure to bat excreta, often harvest bats for consumption, and are at risk for bat-borne diseases.

**Methods:** This rapid ethnographic study was conducted in four provinces of Thailand (Ratchaburi, Sakaeo, Nakorn Sawan, and Phitsanulok), where bat guano was mined and sold during the period April–August 2014. The aim of this study was to understand behaviors and risk perceptions associated with bat conservation, exposure to bats and their excreta, and bat consumption. Sixty-seven respondents playing various roles in bat guano mining, packaging, sale, and use as fertilizer participated in the study. Data were collected through interviews and/or focus group discussions.

**Results:** In spite of a bat conservation program dating back to the 1980s, the benefits of conserving bats and the risks associated with bat consumption were not clear and infrequently articulated by study respondents.

**Discussion:** Since bat consumption continues, albeit covertly, the risk of bat-borne diseases remains high. There is an opportunity to reduce the risk of bat-borne diseases in guano-mining communities by strengthening bat conservation efforts and raising awareness of the health risks of bat consumption. Further research is suggested to test behavior change strategies for reducing bat consumption.

**Keywords:** *USAID Emerging Pandemic Threats Program; PREVENT Project; Bat; Bat Consumption; Thailand*

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Zoonotic pathogens cause an estimated 70% of emerging and re-emerging infectious diseases in humans (1–3). Bats in particular are important wild animal reservoirs for zoonotic viruses, as they host more viruses per species than other mammals (4). Several emerging diseases, such as Severe Acute Respiratory Syndrome (SARS) (5), Ebola virus (6, 7), Nipah virus (8), and Middle Eastern Respiratory Syndrome (MERS-CoV) (9), have been linked to bats. There is nevertheless little research on bat and human interaction, the human perceptions about bats and the associated disease risk, and the populations that are the most at risk (10).

Globally, there are two main types of bats: megabats (Megachiroptera) and microbats (Microchiroptera). Megabats are found in the subtropics and tropics of Asia and Africa, and feed on nectar and pollen, petals, bracts, fruit, leaves, and water (11). In Thailand, where the study was undertaken, there are several species of flying foxes and fruit bats. Microbats are geographically more widespread than the megabats. They are sometimes referred to as insectivorous bats because insects are their primary food. Bats are hunted, eaten, and used for medicine and

natural insect control. Their excrement (guano) is used as fertilizer (10, 12–14).

Bat guano mining is common globally, especially in countries in Africa, Latin America, and the Caribbean and East Asian countries (including Thailand). Guano mining can be very lucrative: the guano produced by a large cave-dwelling population of bats might be worth several million dollars each year (13, 15). Bat guano is a very rich fertilizer, primarily due to its high nitrogen, potassium, and phosphorus content (16). In Thailand, guano produced by the microbat *Tadarida plicata*, the wrinkle-lipped free-tailed bat, is favored for its rich organic content. It is the most abundant bat in Thailand, lives in 17 caves across the country, and is insectivorous (12). Exposure to bats, bat guano, and bat excreta through bat consumption puts people at risk of direct contact with bat-borne viruses (14, 17).

Because of the potential for human contact with infected bats, the PREVENT Project, a part of the US Agency for International Development's (USAID) Emerging Pandemic Threats (EPT) Program, decided to conduct this exploratory, rapid ethnographic study. The goal

of the study was to understand the various ways by which people are exposed to bats and bat excreta in the context of guano mining, and its packaging and sale as fertilizer in Thailand; the perceived health risks associated with such exposure; and the measures that may be used to mitigate risk among people involved in the guano-mining business. This paper focuses on bat consumption only indirectly, given the current legal prohibitions against capturing and selling bats.

## Methods

### Study areas

The study was conducted in four sites in Thailand where bat guano is mined and sold. The sites, located in four provinces (Ratchaburi, Sakaeo, Nakorn Sawan, and Phitsanulok), were selected to represent several different ways in which bat guano mining is organized and regulated. Observing the different ways guano mining is handled was intended to capture possible variations in the age groups and numbers of people who are exposed to bats and bat excreta, the extent of their exposure, and the measures that are taken to reduce exposure. Preference was given to sites where other USAID EPT Program activities were taking place, especially other studies bat-borne and other zoonotic viruses. A map of the selected provinces is shown in Fig. 1.

### Study design and study period

A rapid ethnography approach was utilized to understand perceptions and behaviors regarding exposure to bats and bat excreta. Although the research conducted examined different aspects of exposure to bat and bat excreta, this paper reports only our findings on bat consumption. The research was implemented from April to August 2014.

### Study respondents and recruitment procedures

Six types of respondents (aged 20 years and above) were included in the study, for a total 67 interviews:

1. Mine managers. The mine manager is the person who runs day-to-day operations at the guano mine. There were only one or two managers at the selected sites. The willingness of the mine manager(s) to be interviewed was one of our criteria for site selection.
2. Male and female miners. The selection of the miners was purported to capture the range of different ages, gender, and other characteristics noted by the mine managers. The eligible miners were required to have been engaged in the guano-mining work for a minimum of 6 months. The researchers approached the miners at the cave where they worked; obtained their preliminary consent, home addresses,



Fig. 1. Map of selected areas for the study.

- and phone numbers; and made appointments to interview them at a convenient time at their homes or another location of their choice.
3. Adults who dry, package, and/or purchase the guano at the mine site. We included respondents who were willing to respond to questions and also lived near the mines.
4. Spouses or other adult family members of miners who wash miners' soiled clothing or otherwise come into direct or indirect contact with bats or their excreta. These respondents were referred by the miners.
5. Owners or managers of shops that sell guano. These respondents were referred by the guano buyers at the mine. They were interviewed in their shops or another location of their choice.
6. Users of guano for fertilizer. These respondents were referred either by shopkeepers, miners, or miners' spouses. Preference was given to users residing in the communities of the miners. They were interviewed in their homes or another location of their choice.

Table 1. Allocation of study respondents by type and province

Types of respondents	Provinces				Total
	Ratchaburi	Sakaeo	Nakorn Sawan	Phitsanulok	
Guano mine manager	2	1	1 <sup>a</sup>	2	6
Guano miners <sup>b</sup>	10	5	8	6	29
Guano miners' spouses <sup>b</sup>	7	2	6	4	19
Guano dryers or packagers	3	0	1	1	5
Owners of shops selling guano	1	0	1 <sup>a</sup>	1	3
Guano users	2	1	1	1	5
Total	25	9	17	15	67

<sup>a</sup>This respondent was the same person (the mine manager and owner of the shop); <sup>b</sup>in practice, the categories of miners and spouses were not mutually exclusive. During interviews with spouses, we learned that both husbands and wives often work in guano mines. In these cases, we interviewed the spouses both as miners and as spouses of miners, but classified them as spouses in the table above to avoid double-counting.

Numbers of respondents' by province and type are shown in Table 1.

### Data collection and analysis

The five interviewers (two male and three female) used semi-structured interview guides to conduct one-on-one, open-ended interviews in Thai with each type of respondent. The interviewers were trained to probe and spontaneously add questions based on the discussion and information provided by the respondents. A note-taker accompanied each interviewer to record observations related to body language, the presence of other individuals during the interview, and details of the environment in which the interview took place. Written informed consent was obtained prior to each interview. The interviews were audio-recorded with permission from the respondents.

In two sites, we conducted focus group discussions, inviting all respondents (except mine managers), who wished to join. In these discussions, we summarized what we learned from the individual interviews about exposure to bats and bat excreta and asked for verification and corrections, discussed risk mitigation strategies and barriers to their use, and elicited opinions about the feasibility and acceptability of potential strategies to minimize exposure to guano, such as wearing goggles and masks.

The interviews were transcribed and translated into English. The English translations were thematically coded using the qualitative research software, NVivo 10. Data on specific topics of interest were systematically compared across interviews and variations by gender and site noted.

### Ethical considerations

This study obtained approvals from FHI 360's Protection of Human Subjects Committee (PHSC) (ref. 581157, dated 25 March 2014) and Khon Kaen University Ethical Committee (ref. ST0514.11.4/236, dated 15 July 2014)

to conduct the study, with the cooperation of local staff in the study areas.

### Results

Guano miners have an appreciation and respect for bats that live in their communities or are seen existing community caves or fruit orchards. In recent years, it has become illegal to trap or eat bats. In spite of this, most respondents knew people in the community who had trapped bats, usually at the mouths of caves or in fruit orchards, and/or had eaten bats, although they said this was less common since the regulations went into effect. It is legal for community members to collect and eat the occasional bat that falls to the ground after colliding with electric power lines.

Respondents who either had eaten bats or knew people who had eaten bats said that they were usually prepared by frying or stir-frying with garlic, chili and/or basil; or boiling in curry after discarding the intestines and wings. Some people also ferment bat meat as they would pork, and serve it with rice; or prepare a spicy bat soup. In addition to cooking bats, the practice of drinking bat blood (e.g. as a health supplement or a few drops mixed with whiskey) was reported as a rumor in three of the four sites.

Below is information on the consumption of bats from respondents in each province (identified as A, B, C, and D to protect confidentiality).

#### Province A

Historically, until about 10 years ago, bats were caught in nets at the top of the mountain at the cave mouth and sold in batches of up to 100 at the food stall. Since the arrival of the governmental wildlife conservation office, however, this practice has all but stopped. The Royal Forest Department prohibits trapping bats for consumption and levies a fine of 500 Baht on those who trap or

eat bats. As in the other provinces, bats are sometimes trapped, and eaten or sold secretly. The bats that are eaten in the community are the flying fox and lotus bats, which tend to be comparatively large, fatty bats. It was also noted that Lesser Dog-faced Fruit Bat (Khang Kao Na Ma) and the Shortridge's Rousette bat (Khang Kao Bua) were occasionally consumed in the community. Some of the illegally trapped bats are sold to restaurants for 4–5 Baht per bat. The restaurants sell bats as a gourmet item that is likely not found on the published restaurant menu. Bat blood is used as a health supplement in the province. Fresh bat blood mixed with alcohol is sometimes used to relieve back, leg, and waist pain or to nourish the body and prevent 'wasting disease'. Bat blood can be purchased in the community for 5–10 Baht per bottle.

### **Province B**

The Royal Forest Department did not seem to be active in this province at the time of the study. The villagers were knowledgeable about the need to conserve bats, and there did not appear to be a fine for catching or consuming bats in this community. In the past, people in this community ate the large Lye's flying fox bats that were brought home by the miners. Reportedly, restaurants still place private orders for bats with a few people who occasionally set up nets at the mouth of the cave to catch them. The bats are purchased for 1 Baht per bat.

### **Province C**

At the time of the study, there was a 500-Baht fine for trapping and/or eating bats in this province. Bats that died a natural death could be consumed with no fine. Mid-sized bats are illegally trapped and sold in the community. Nonspecific cave bats, bats caught in nets at the mango or red cotton flower fields, and the flying fox bat were among the bat types secretly caught as an illegal food source. In addition to bat meat, respondents reported that bat blood is occasionally consumed as a health supplement in the community, as it is said to be useful for treating asthma in children (especially if the blood is taken from a bat's ear or wing), curing other unnamed illnesses, or increasing strength.

### **Province D**

Although trapping and consuming bats has been regulated for some time in this province with a fine that is rumored to be very high (50,000–60,000 Baht), numerous respondents spoke of their knowledge or experience in trapping and consuming bats. The most common bats consumed are fruit bats that become caught in nets placed over fruit trees or sugar palms. Small bats are also occasionally eaten. Bats that fall from after flying into power lines can be legally consumed and are often made

into a spicy bat soup or stir fry. Bat blood is occasionally consumed and is considered to be an aphrodisiac.

## **Discussion and conclusion**

Efforts to protect bat populations in Thailand's caves began in the 1980s and have continued until the present time. Recent legislation makes it illegal to trap or eat bats in Thailand. Currently, the Royal Forest Department discourages the trapping and eating of bats by levying steep fines. The fines were noted in all of the communities we studied. The benefits of conserving bats and the risks associated with bat consumption, however, were infrequently articulated by the study respondents, indicating that illegality was the greatest deterrent to trapping and eating bats, not concerns about animal conservation or health risk reasons.

However, several studies presented relevant evidences that bat consumption might be risky for bat-borne diseases (10, 14, 17). Aside from direct consumption, the transmission of disease from bats to people in Bangladesh is through the contamination of raw date palm sap by bats. Presumably, the transmission to humans occurs through the consumption of food contaminated with bat saliva or urine, and the infection of domestic animals (cattle, pigs, and goats) (18).

Further community-level research should be conducted on the perceived economic and other benefits related to bat catching and consumption, as well as community knowledge and perceptions of the risks associated with bats. Findings from this research may illuminate barriers to bat conservation and lead to the development of strategies and interventions for eliminating bat consumption. This has the potential to mitigate the risk of transmission of zoonotic diseases from bats to humans in Thailand, as well as in other countries where bats are eaten.

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