



## APPLICATION STORY

### FLIR cameras help to study behavior of bats living in the world's largest underground river cave system

An Italian – Philippine team of researchers has been using thermal imaging cameras from FLIR to study the behavior of bats residing in the stunning Puerto Princesa Underground River cave system in the Philippines. The researchers hope that the technology will give them more insight into the size and identity of the bat colony, and that this knowledge will help them preserve the species for many years to come.

The Puerto Princesa Underground River, located in the south-western part of the Philippine Archipelago on the mid-western coast of Palawan, is the longest underground river in the world. The site, which includes one of the world's most impressive cave systems, has been declared as a World Heritage Site by Unesco. Eco-tourists have discovered the Puerto-Princesa Subterranean River National Park, which features pristine natural beauty with distinctive wildlife. Tourists can travel by boat through the massive cave and see hundreds of bats, giant monitor lizards, monkeys, python, sea snakes and other wildlife.

#### PRESERVING BIODIVERSITY

Unfortunately, increased tourism often has an impact on the environment. Fully aware of this danger, a program called "Support for Sustainable Eco-Tourism in the Puerto Princesa Underground River (PPUR) Area" was initiated through a collaborative Philippine/Italian effort. This program is aimed at the

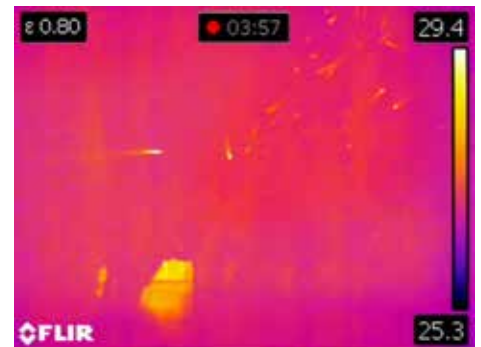
study of the fauna in the cave and ultimately has the intention to be better prepared for sustainable tourism and the preservation of the site's biodiversity.

Dr. Paolo Agnelli, an Italian zoologist and Curator of the Mammal Collection at the Natural History Museum of the Florence University (Italy), is one of the members of the PPUR research team. The doctor has already carried out several faunistic research studies and zoological collections, especially of amphibians, reptiles and mammals, all over the world. As a specialist in the field of small mammal ecology, Doctor Agnelli's main goal is to identify the bats present in the PPUR caves, in order to exactly define the present bat species and to have a correct estimate of their numbers.

#### COUNTING BATS

"The exact number of bats in a colony is very hard to determine," says Doctor Agnelli. "And yet, this information can be very valuable,

The FLIR E60bx thermal imaging camera, a 320 x 240 resolution point-and-shoot model with a fully integrated color camera.



Thermal imaging cameras make it possible to monitor bats by their thermal signature.



Doctor Agnelli: "The exact number of bats in a colony is very hard to determine. And yet, this information can be very valuable in order to discover population trends through the course of the years."



A PPUR research team member in the lagoon in front of the cave, moments before dusk, which is the ideal moment for thermal imaging to capture bats leaving the cave.

because it helps us to see population trends through the course of the years. Should we be able to assess that the number of bats is decreasing, then we should be investigating the disturbing factors and take action in order to preserve these species."

In the multiple research missions he has already been part of, Doctor Agnelli has made use of thermal imaging technology in order to help overcome the practical difficulties which are typically encountered in bat studies. Bats often select inaccessible roost sites in the daytime, and are hard to observe at night. Moreover, several species are not easy to identify in the field, so that in many cases only well-trained, experienced specialists may be able to correctly identify them.

## BAT DETECTION TECHNOLOGIES

Today, a wide array of techniques and technologies is being used to study the behavior of bats, ranging from actively searching buildings, trees and subterranean cavities, to capturing bats with mist nets, and monitoring by means of ultra-sound bat detectors, which convert the echolocation ultrasound signals of bats to audible frequencies. With thermal imaging, another important technology has been added to the professional bat researcher's toolbox.

Doctor Agnelli: "I have been using thermal imaging cameras for already three years now to study the hibernation behavior of bats in caves, especially for their deep hibernation conditions. Since 2016, I have also been using this technology to count bats while coming out of their caves."

Thermal imaging cameras make it possible to monitor bats by their thermal signature. Bats are nocturnal animals and usually leave their daytime roosts at dusk, an ideal moment to capture the bats on video while in action. As thermal cameras see heat, not light, they also allow researchers to study bats at night, at a time when they are most active. Thanks to its visual nature, thermal imaging technology can also be combined with smart software that is able to count and identify bats and perform intelligent motion tracking.

## ROBUST THERMAL IMAGER

"For the several missions to the Puerto Pricesa Underground River, I was looking for a thermal camera that is robust and able to withstand the humid conditions that are typical of underground caves," says Paolo Agnelli. "After thorough evaluation of several brands, FLIR offered the best technical characteristics and the highest reliability."

Doctor Agnelli ultimately chose the FLIR E60bx thermal imaging camera, a 320 x 240 resolution point-and-shoot model with a fully integrated color camera. "The FLIR E60bx is very easy to use, it's economical and the 60 Hz frame rate allows us to present the small-sized bats in motion in very good definition."

"The long-life battery of the FLIR E60bx, the light and compact size, and the possibility to add extra lenses: it's the total package that makes it a very

attractive camera, especially for the specific tasks that I was designated with during my research missions."

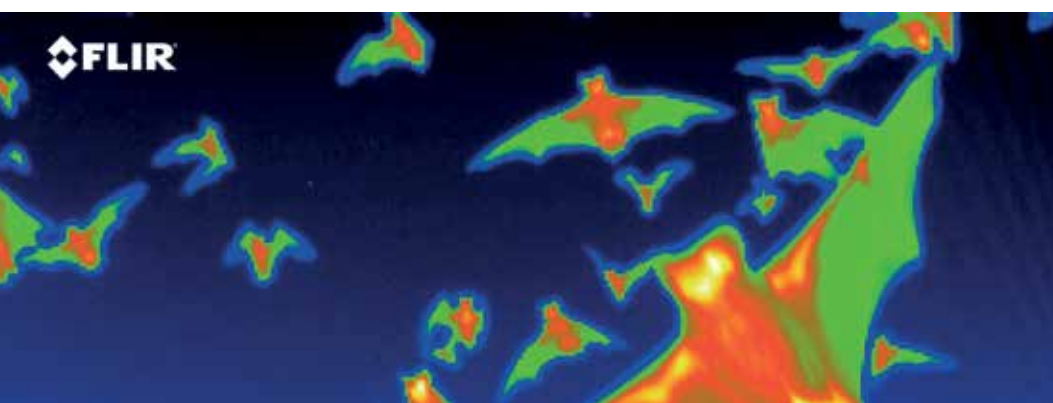
## RAISING AWARENESS

"During our first research mission in Palawan in November and December 2016, the FLIR camera has already served us really well to capture large groups of bats coming out of their cave at dusk. At the cave exit, we had to identify the best viewing point, so it was possible to capture the entire evening flow of bats leaving the cave, considering every possible route. We also had to take into account so-called "light sampling behavior", where the bats repeatedly leave the roost and return immediately if the conditions are not suitable."

Next to other established techniques, thermal imaging has proven to be another very effective technology that helps the PPUR research team to get a more comprehensive idea of the size and identity fauna in the PPUR Cave. This will allow them to evaluate the impact of the touristic activities on this complex ecosystem and to possibly select the necessary actions to mitigate this impact.



Paolo Agnelli: The total package of the E60bx makes it a very attractive camera, especially for the specific tasks that I was designated with during my research missions."



For more information about thermal imaging cameras or about this application, please visit:

[www.flir.eu/Science](http://www.flir.eu/Science)

The images displayed may not be representative of the actual resolution of the camera shown. Images for illustrative purposes only.  
Date original created: April 2017  
17-0365