Investigating the Thermal Physiology of Birds and Mammals

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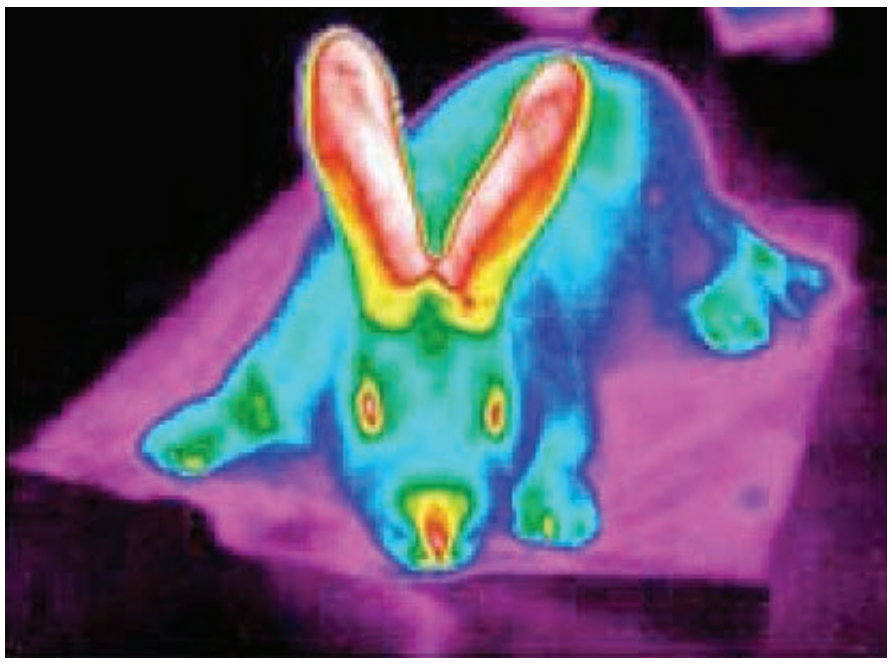
Perhaps surprisingly many details of the thermal biology of animals are still unknown. Wildlife researchers try to fill the gaps in our knowledge of these fascinating processes. One of the organisations that push the boundaries of our knowledge in this field is the Institute of Biodiversity, Animal Health and Comparative Medicine at the University of Glasgow, Scotland.

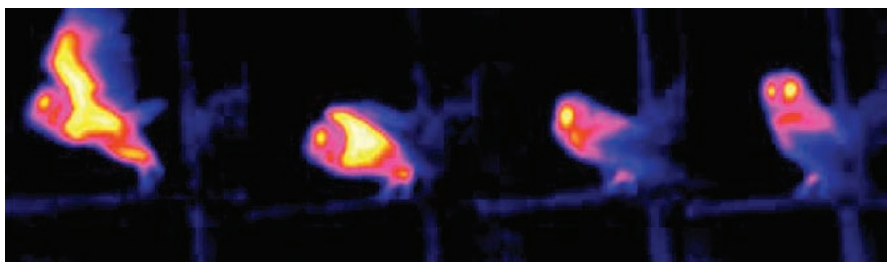


This thermal image of a rabbit reveals underlying blood circulation to the animal's ears for dissipation of excess body heat.

"FLIR thermal imaging cameras have been a great help in recent research projects. Whether they were used for fieldwork or in the laboratory, these cameras give an interesting perspective into the thermal world of animals." explained Dr Dominic McCafferty, Senior Lecturer at the University of Glasgow.

One of the first research projects McCafferty was involved in as a graduate student employed thermal imaging technology. "We wanted to study the thermal distribution of a barn owl during flight and fortunately, an engineer introduced me to infrared thermography. This was in the early 1990s and thermal imaging systems were quite large and heavy, with relatively limited capabilities by today's standards. But I immediately realised the potential this technology had for research on animals."

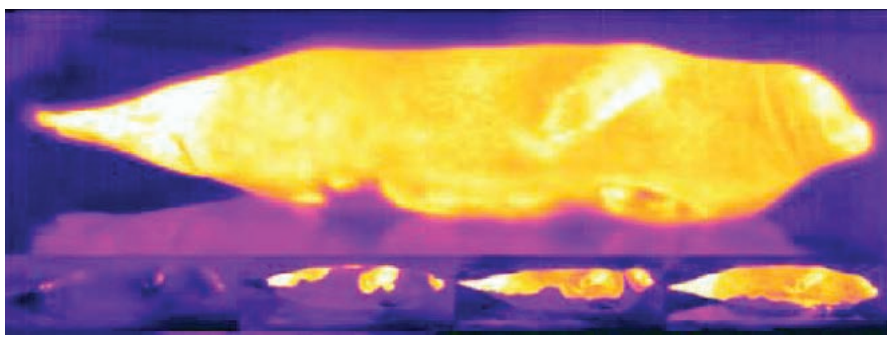
Nowadays thermal imaging cameras are quite different, according to McCafferty. "For a biologist thermal imaging technology has really 'come of age', so to speak. The new generations of thermal imaging cameras with microbolometer detectors from FLIR Systems are compact, light and very easy to use, which is especially important if you want to use the camera in the field."



Sequence of images showing barn owl during take off

Thermal images taken in captivity of a moulting female harbour seal at 5, 25, 45, 65 (bottom) and 95 minutes (top) after haul-out.

The FLIR P65 and E300 systems have most recently been used by McCafferty and colleagues at the University of St Andrews and Edinburgh Napier University to study



Thermal images taken in captivity of a moulting female harbour seal at 5, 25, 45, 65 (bottom) and 95 minutes (top) after haul-out.

the thermal physiology of marine mammals. Accurate and high spatial resolution of temperature is required for this purpose. Most species of seals need to renew their fur on a yearly basis, but skin temperature must rise in order to allow the new follicles to develop. The animals must therefore haul out onto land for longer periods of time to warm up. "With FLIR thermal imaging cameras we have been monitoring the thermal patterns and surface temperature of harbour seals throughout the process of moult. We have been able to show that the animal's surface temperature peaks at around 30ºC during this time, allowing seals to complete the moult quickly and return to the sea to feed." McCafferty believes that this data will improve our understanding of this important stage of the lifecycle when seals may be vulnerable to human disturbance.

Animal Welfare

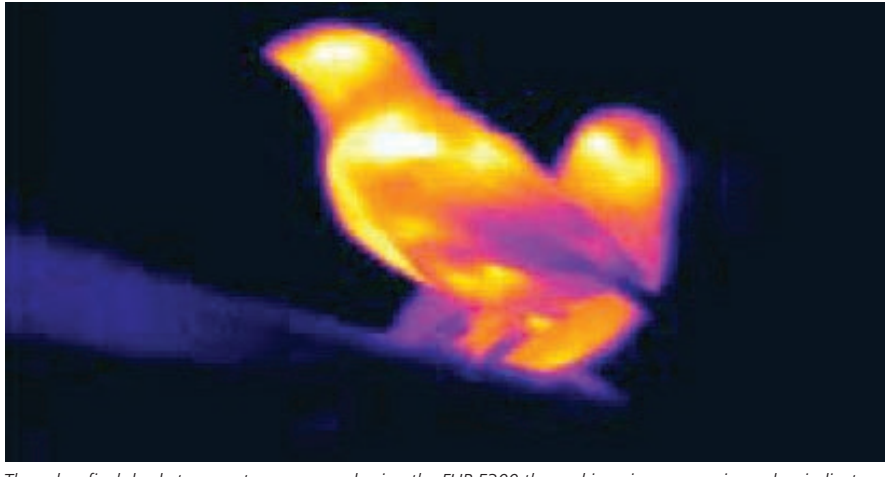
Research on the physiology of moult is not the only way in which thermal imaging cameras have proved their worth for research on marine mammals. "We have used these cameras to examine the welfare of our study animals." In scientific studies seals are normally marked with small plastic tags for long term identification. FLIR thermal imaging cameras were therefore used to monitor recovery from tagging in seal pups. "Within a few days after the animals were tagged the FLIR thermal imaging camera showed us that the area surrounding the tag was warmer than the rest of the flipper, indicating that tissue repair was underway. By the time the pups were weaned and ready to go to sea, there was no elevated temperature around the tags suggesting that much of the healing process was complete."

FLIR in the lab

The zebra finch body temperature measured using the FLIR E300 thermal imaging camera is used as indicator of its level of stress.

Although the FLIR thermal imaging camera has proven to be extremely useful in the field, it is also being used in the laboratory. "One of our students is conducting research on stress levels in captive finches. She uses the FLIR thermal imaging camera to determine the birds' body temperature, which enables her to accurately determine how quickly the birds recover from a stressful situation." The student in question is Hillary Anne Dalton. "The relation between stress and body temperature is well established in existing scientific literature," explained Dalton. "The FLIR thermal imaging camera is a great tool for this application. It allows me to determine the bird's temperature from a distance, without making the bird aware of my presence."

The goal of the research is to examine how cage design influences the ability of birds to cope with stressful situations in captivity. "To that end we keep the finches in two different types of cage. One group is kept in the standard cage used in laboratories all over the world. The other group has an improved cage, which includes a few extra features, such as



The zebra finch body temperature measured using the FLIR E300 thermal imaging camera is used as indicator of its level of stress.

a moving perching facility, a sand bath and a more natural feeding technique. We suspect that this will improve the animals' ability to deal with the stress of environmental change. There is some way to go before I can present my final conclusions, but one thing is certain: the FLIR thermal imaging camera is a great tool for this kind of research. It is easy to use and provides exactly the kind of data that I need to draw the right conclusions. It certainly fulfils my research needs."

Researchers therefore believe that thermal imaging will be a useful tool to non invasively study the thermal physiology of animals and provide many exciting insights into the world of thermal biology.

References

McCafferty, D.J. (2007). The value of infrared thermography for research on mammals: previous applications and future directions. Mammal Review, 37 (3). pp. 207-223. ISSN 0305-1838

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