'Stress and the city': Urban birds keep cool

September 1 2006

Juvenile European blackbird. Credit: Ingo Teich / Max Planck Institute for Ornithology

Animals colonizing cities are exposed to many novel and potentially stressful situations. Chronic stress, however, can cause deleterious effects. Hence, wild animals would suffer from city life unless they adjusted their stress response to the conditions in a city.

Jesko Partecke, Ingrid Schwabl and Eberhard Gwinner of the Max Planck Institute for Ornithology Andechs/Seewiesen in Germany have now shown that European blackbirds born in a city have a lower stress response than their forest counterparts. This reduced reactivity probably has a genetic basis and could be the result of the urban-specific selection pressures to which urban blackbirds are exposed (*Ecology* 87(8) 2006).

Many species have developed a symbiotic relationship with humans. For example, European blackbirds, European starlings and house sparrows thrive in concrete habitats around the globe. The sparrow is now so closely associated with man that its original niche is unknown, whereas the European blackbird was - as little as 200 years ago - a reclusive forest dweller. These species seem to profit, for instance, by the warmer microclimate and additional anthropogenic food supply in cities. However, they are also confronted with many novel and potentially stressful anthropogenic disturbances, such as the permanent presence of humans, higher densities of cats and dogs, noise and light pollution as well as traffic.

Among the physiological coping mechanisms used by vertebrates - including humans - to ensure survival under adverse environmental conditions is the acute stress response, characterised by the release of glucocorticoid steroid hormones. The acute short-term secretion of these hormones is considered beneficial in that it helps to mediate adaptive behavioural and physiological responses. In prolonged stress situations, however, chronically elevated levels of circulating glucocorticoids can impair reproductive, immune, and brain functions. Thus, wild animals would suffer from city life unless they adjusted their stress response to the conditions in a city.

Whereas changes in the behaviour of urban birds have been frequently documented - e.g. urban blackbirds are often tamer than their relatives from "natural" habitats - it was not previously known whether the physiological stress response also changes to suit the urban life style. If so, then it should be tested whether this adjustment is based on the flexibility of individuals experiencing different environmental conditions or is the result of micro-evolutionary adaptations that have evolved during the urbanisation process.

Scientists at the Max Planck Institute for Ornithology

Andechs/Seewiesen in Germany, originally under the leadership of the late Max-Planck Director Dr. Eberhard Gwinner, answered these questions in a recent experiment. They hand-raised European blackbird nestlings collected from the centre of Munich, Germany and a nearby forest area (beeline distance 40 kilometres) and kept both groups in the same bird room for one year. These two groups therefore lived under exactly the same controlled environmental conditions, both during their developmental phase and later during the experiment.

During their first autumn, winter and spring, Jesko Partecke applied a standardised capture and handling stressor protocol to all urban and forest blackbirds and simultaneously collected blood samples, to determine the concentration of corticosterone, the stress hormone in birds. Under normal conditions, i.e. undisturbed, urban and forest blackbirds did not differ in their corticosterone secretion. In addition both groups showed a similar acute hormonal stress response during their first fall. This, however, changed considerably during their first winter and spring: Then the stress response of urban blackbirds was distinctly blunted in comparison to their forest counterparts.

"These results show, for the first time, that city life changes physiological coping mechanisms in wild animals, which are necessary for survival," said Jesko Partecke. Such a reduced hormonal stress response could be ubiquitous and, presumably, necessary for all animals that thrive in ecosystems exposed to frequent anthropogenic disturbances such as those in urban areas. The scientists suggest that the difference in the hormonal stress response between urban and forest blackbirds is genetically determined and probably the result of the extreme selective forces in the city; as a result, those individuals that get along better with the "urban stressors" enhance their prospects of survival in a city.

Why the two groups of birds did not differ in their stress response during their first autumn is still an unanswered question. "One explanation is

that the reduced sensitivity of urban blackbirds to stressors occurs later in their life," speculated Partecke. Data obtained from free-ranging birds in their native urban and forest habitats are also inevitably necessary to verify the observed pattern under natural conditions. In addition, future studies are needed to assess the possible adaptive value of an attenuated stress response in urban habitats, by relating survival and fitness data to the trait variation.

Source: Max-Planck-Gesellschaft