Predators predict longevity of birds

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Water thick-knee (Burhinus vermiculatus) defending it nest against a monitor lizard. Credit: MPI for Ornithology Seewiesen/ Wolfgang Goymann

(Phys.org) —Ageing inevitably occurs both in humans and in other animals. However, life-span varies widely across species. Researchers of the Max Planck Institute for Ornithology in Seewiesen have now found a possible general mechanism explaining differences in longevity. They investigated life history data of nearly 1400 bird species and found that avian life span varies considerably across the entire Earth, and that much of this variation can be explained by the species' body mass and clutch

size and by the local diversity of predator species. With their data the researchers were able to confirm a key prediction of the classical evolutionary theory of ageing that had been proposed more than 50 years ago.

It is well-known that organisms vary widely in life-span. Whereas some fish, turtles or even invertebrates can become hundreds of years old, the neon pygmy goby – a small fish - reaches ripe old age at only 60 days. In birds, variation in life-span extends from parrots such as the Sulphur-crested cockatoo that can become more than 100 years old, to the small Allen's hummingbird with a maximum life-span of only 4 years, a 25 fold difference. How can this variation be explained?

The classical evolutionary theory of ageing, first proposed by the famous evolutionary biologist George C. Williams over 50 years ago, gives an answer. The theory predicts that high mortality rates in adult animals due to predation, exposure to parasites and other randomly occurring events will be associated with shorter maximum life-spans. This is because under high external mortality most individuals will already be dead (eaten or succumbed to disease) before natural selection can act on rare mutations that cause healthier ageing. The theory has since been further developed and tested in a number of experimental and comparative studies. Yet contradictory results have caused scientists to cast doubt on its validity.

Mihai Valcu and Bart Kempenaers from the Max Planck Institute for Ornithology in Seewiesen together with colleagues from New Zealand and Switzerland have now tested this theory using a comprehensive database on estimates of maximum life-span of 1396 bird species, 1128 from free-living species and 268 from birds kept in captivity. The researchers used a global distribution map of these species, included data on their morphology and reproductive rate, and estimated predation rate.

By means of complex statistical analysis methods they found that in the investigated bird species maximum longevity is negatively related to the number of predator species occurring within the same geographical area. This means that the more predator species are present in the same habitat and the more evenly they are distributed, the lower is the life span of the respective species. This relationship supports the classical theory of ageing, and remains valid when other life history traits known to influence longevity such as body mass and clutch size are included into the statistical model. Indeed, larger species live longer, and those that reproduce fast (lay more eggs) live shorter lives.

Remarkably, the observed pattern showing longer life-spans when fewer predators are present emerges no matter how the analysis was done: at the species level, at a finer regional scale (groups of species within a certain area) or even when comparing entire bioregions. "With our results of a negative relationship between predation pressure and longevity that is largely independent of other key life history traits we were able to confirm the universality of the 50 year old evolutionary theory of ageing on a broad geographical scale" concludes Mihai Valcu, first author of the study. At least in birds, where the necessary data are available for many species, the theory seems to hold.

More information: M. Valcu, J.Dale, M. Griesser, S. Nakagawa, B. Kempenaers. "Global gradients of avian longevity support the classic evolutionary theory of ageing." *Ecography*, article first published online: 25 April 2014 DOI: 10.1111/ecog.00929

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