ScienceWatch – Baby It's Hot Outside

"It's as if the parents are preparing the chicks for the temperature they will experience after hatching." – M. Mariette

Last month 200 countries finally agreed to reduce their use of hydrofluorocarbons (HFC's), the greenhouse gases used as coolant in refrigerators and air conditioners. Molecule for molecule HFC's are 10,000 times more active than CO_2 so the agreement to limit HFC's could reduce global temperatures by 0.5°C (0.9°F). But the average annual global temperature has already increased by 0.8° C (1.4° F) since 1880, and is expected to rise by 1.1°C to 5.4°C (2°F to 9.7°F) by 2100, depending on how aggressively we limit future greenhouse gas emissions.

This is bad news for humans. For example, melting glaciers are expected to raise sea levels 0.8 to 2.0 meters (2.5 to 6.5 feet) by 2100, enough to inundate coastal cities. But how will other organisms deal with global warming?

A report in the August 19, 2016 issue of *Science* provides an example of how some birds may cope with rising temperatures. The study by Mylene Mariette and Katherine Buchanan, behavioral ecologists at Deakin University, Geelong, Australia, suggests that parents can prepare their offspring for impending warming even before they hatch by calling to the unhatched embryos.

While studying how parent zebra finches (*Taeniopygia guttata*) communicate with each other during nesting, Dr. Mariette noticed that sometimes a parent would perform a squeaky serenade only when alone on the nest and when the ambient temperature was above 26°C (79°F). This "incubation call" was only uttered within five days of hatching, presumably when the embryos could hear it.

Suspecting that the incubation call was related to higher temperatures, she and Dr. Buchanan artificially exposed eggs to recordings of either incubation calls (treatment) or non-specific control calls (control) during the last five days of incubation. The nestlings were then placed in nest boxes in an outdoor aviary with maximum daily nesting temperatures that varied as much as 6°C (10.8°F) above ambient depending upon the amount of sunlight each nest received.

Newly hatched treatment and control nestlings showed no apparent differences. However, once they began growing the two groups sharply diverged. Treatment nestlings were always smaller than control nestlings. Moreover, higher nest temperatures caused treatment nestlings to respond in the opposite manner than control nestlings. After 13 days of growth, treatment nestlings weighed less and less with increasing nest temperatures while control nestlings got heavier. This disparity in growth rate could be seen as early as one day after hatching.

You might expect that skinnier birds would fare worse than fat ones. But the scientists found the reverse. Once they began reproducing on their own the skinnier birds that grew up in hot nests raised many more progeny than the fat ones. Thinner birds also preferred warmer nest spots.

Only one other case of birds using an incubation call is known (http://hras.org/sw/swjanfeb2013.htm). Australian superb fairy wrens (*Malurus cyaneus*), which are parasitized by Horsfield's cuckoos (*Chalcites basalis*), teach their unhatched young a unique note in the nest when the cuckoo embryo doesn't have enough time to learn it because it hatches a few days earlier. If a cuckoo chick takes over the nest by evicting the wrens born a few days later the parents stop feeding it because it hasn't learned the password.

For zebra finches it's clear that the incubation call yields skinnier birds, and as temperatures rise they do better, but why? One possibility is that thinner birds can lose heat more readily than fatter ones, so by warning their embryos that it's hot outside parents give them some adaptive advantage in dealing with higher temperatures. Maybe by losing heat more easily thinner offspring can put more energy into reproduction and less into trying to stay cool. Whether or not this is true, no one currently knows how parental signaling causes the physiological changes that yield thinner progeny.

As this example demonstrates, some organisms are preparing for a hotter planet. It's time we did the same.

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