ScienceWatch – Bigger is Better for Snail Kites

"We often assume that these large bodied animals can't keep up with changes to the system, like invasions or climate change, because their generation times are too long. And yet we are seeing this incredibly rapid change in beak size of this bird." – R. J. Fletcher Jr.

Darwin's theory of evolution says that as the environment changes, attributes enabling individuals to better withstand these changes are favored by natural selection. If the attributes are *inherited*, a new species will form over time.

However, not all adaptations are inherited. For example, at higher elevations we have trouble breathing because "thinner" air at higher altitudes means less oxygen is available to us. Over time we adapt by producing more red blood cells to bring more oxygen to our body. The change is not permanent; each time we ascend to heights we must adapt all over again. We are taller now than a century ago, not because of genetic changes but diet. A current example of the latter is the fact that South Koreans are up to three inches taller than North Koreans

These adaptations in response to environmental changes occur because of changes in gene expression, not changes in the genes themselves. Scientists call such changes phenotypic plasticity ("phenotype" is what an organism looks like, whereas "genotype" refers to its genetic constitution). Now a study published in the November 27, 2017 online version of *Nature Ecology & Evolution* says that phenotypic plasticity rather than true evolution may be helping snail kites reverse their decades-long decline.

Snail kites feed almost exclusively on apple snails (*Pomacea paludosa*) by using their curved beak and long talons to extract snail meat from shells. But apple snails have greatly declined in number due to the loss of Florida wetlands to farming and their further degradation by agricultural pollution. As a result, the Florida subspecies of snail kite (*Rostrhamus sociabilis plumbeus*) was listed as endangered in 1967.

About a decade ago a much larger exotic snail (*P. maculata*) invaded Florida waterways. Early observations indicated that snail kite fledglings had difficulty eating the much larger prey and conservationists feared it would prove to be their death knell. But according to the *Nature* study, the reverse has occurred; snail kite populations are increasing wherever the invasive snail has appeared.

To find out what was happening, a research team, which included Robert J. Fletcher Jr., an ecologist at the University of Florida, Gainesville, FL, examined whether the change to larger prey affected snail kite body mass, toe length and beak size. They analyzed 11 years of morphological data and concluded that all three parameters had increased substantially in barely

one generation. Nestlings grew faster and larger where the invasive snail was present and beak size increased even more than body mass. Larger kites with larger beaks were more likely to survive their first year so these changes have allowed snail kites to cope with the larger prey and increase in number.

Although the morphological changes were rapid, occurring over 5-8 years, or just 1-1.4 generations, the team found little, if any, variation in beak size among the parents. So it appears that natural selection had no genetic variation to act on and true genetic changes, i.e., evolution, did not occur in the next generation. Rather, the changes appear to be driven by phenotypic plasticity because the larger food source enabled chicks to grow larger.

The scientists point out that they did not look at any genes responsible for the changes they saw. However, since beaks grew even larger than expected in relation to body mass, they suspect that some change in the genetic regulation of beak growth also may have occurred, which could presage a true evolutionary change.

The good news is that, since the larger snails invaded, snail kite numbers went from a low of 700 in 2007 to well over 2,000 in 2017. "This work illustrates very clearly that these large top predators can respond to invasions at a rate much quicker than most people ever imagined," said Dr. Fletcher. This rapid adaptation by the snail kite may save it from extinction.

Saul Scheinbach