WHAT CONSTITUTES A SPECIES?

JIM RAMSEY Along Nature's Trail

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In conversations with readers over the past three years, your writer has been asked on several occasions about what is meant by species. We speak of species of birds, species of wildflowers, etc. So in this column let's have a little lesson in biology, with a special reference to genetics.

Early on, biologists considered organisms were of the same species if they appeared to match one another closely in structure and form, even to the greatest detail. About a half century or so ago, this definition was replaced by a much more basic and sound concept. The newer definition implies that members of a sexually reproducing (Mendelian) population that can interbreed and produce fertile offspring are of the same species; which is the same thing as saying that their chromosome and gene makeup is enough alike that they can share the same gene pool.

Accordingly, at present we have only one species of dogs and only one species of human beings. Although both these species are characterized by varieties or races, any of these can interbreed and produce fertile offspring.

The emphasis in our definition is on "produce fertile offspring" because there are a number of examples in nature in which two different species do interbreed upon occasion, but the offspring are sterile — a dead end.

One example would make a very challenging question on a TV quiz show. "What animal is it that could still exist if every last one of them was wiped off the face of the earth?" Answer — the mule, because mules don't come from mules. They come from crosses of horses and donkeys, two different species, whose chromosome complements are different enough that mules can't form mature sperms or eggs. They are sterile.

Two other examples familiar to your writer has to do with chickadees and oak trees.

Around here the chickadee at your bird feeder is the Carolina chickadee (see photo) which is extremely similar to a species found in northern Ohio, the Black-capped chickadee (see photo). Even Audubon did not realize that they're different until 1834. The Carolina chickadee is slightly smaller and lacks the white edges on the wing feathers of the Black- capped chickadee.

Along an imaginary east-west line across the upper one third of Ohio the ranges of the two species slightly overlap. Here hybrids are occasionally reported (see photo), one of the distinctions being their spring song or whistle. The Black-capped has a two syllable whistle while the Carolina has a four syllable whistle. Some of the birds believed to be hybrids have been reported to have three syllable whistles.

DNA (gene) studies on chickadees in the overlapped region reveal that what few hybrids there are cannot produce viable eggs that hatch, despite courtship and mating. So, as has been always thought, there are two species of chickadees in Ohio.

Two species of oaks in Ohio occasionally hybridize. In fact the hybrid, known as Quercus leana, can be found in 18 counties including Clinton County.

When the two species in question, shingle oak and black oak, are in close proximity, there is a small probability of cross pollination. Even though Q. leana is the most frequent natural oak hybrid found in Ohio, the pollen and ovule structures of its floral development tend to remain immature, greatly limiting its production of acorns, once again indicating that each of its parental lines is a distinct species.

Numerous studies and surveys of the common screech owl in Ohio have always turned up two distinct color phases, red-brown (rufous) and gray (see photo). Other minor differences also occur; for example the birds with gray plumage are slightly heavier and show some preference of mating with birds of the same color plumage.

The screech owl is the only small eastern owl with ear tufts. Indeed, with the ear tufts, and yellow eyes it resembles a very small replica of the great horned owl (see photo).

Screech owls occur in every county in Ohio, and despite the polymorphic variation in color, it has always been considered a single species. However, distribution studies and genetic investigations reveal some interesting facts. The populations of screech owls in the northern-northwestern counties are largely of the gray phase (75 percent to 90 percent), whereas in southern counties about 40 percent are of the red-brown phase.

The difference in color is determined by a pair of genes, with the gene for red-brown behaving as a dominant. The fact that there are many more gray owls in Ohio indicates that even though the gene for gray is recessive, it must have a much higher frequency throughout screech owl populations. Genes with higher frequencies usually indicate that the gene offers some advantage in survival and reproduction.

The current thinking is that the gene for gray is linked on the same chromosome with other genes that could offer some selective advantage. Therefore, even though at present there is just one species of screech owl, the two plumage varieties may be markers indicating a direction toward incipient species that could become two in the distant future.

The mating pattern in these owls is somewhat assortative (non random), meaning that although each color phase bird may mate with one of a different color, it is the exception rather than the rule. And although a clutch of eggs can hatch into nestlings of both color phases, it is much more probable that nestlings are all the same color.

If indeed screech owls are on the way of becoming two species, due to the isolation factor of mate selection along with the selective advantage that those of the gray plumage appear to have, then this would afford an excellent example of how new species come into being.