ScienceWatch-The Greater Prairie Chicken: Plucked from the Extinction Vortex
Prohibitions against incest are found in religion, legal statutes and across many cultures. Humans are not the only ones to shun inbreeding; animals and plants also tend to avoid mating with close relatives. It's easy to understand why this prohibition is so ingrained. Inbreeding is likely to result in the pairing of recessive, deleterious genes, reducing overall survival and even causing extinction by negatively affecting fertility, disease resistance and general health. When populations are large inbreeding is avoided due to the plentiful choice of mates, but what causes a small population to be finally wiped out? Is it due to inbreeding or random adverse events, such as a severe winter or a skewed sex ratio that would normally decrease but not destroy a larger population? Conservation geneticists have argued that in small populations extirpation is caused by a combination of these factors, mutually reinforcing each other, which result in what they call an "extinction vortex". While the model makes sense, no one had proved it.

Now a team of ecologists and geneticists headed by Ronald Westemeier has documented, in a recent issue of the journal *Science*, how habitat loss and inbreeding in the greater prairie chicken (*Tympauchus cupido pinnatus*) reinforced each other to create an extinction vortex. Moreover, they have shown that, once a population enters the extinction vortex, escape can only occur through habitat protection and concomitant outbreeding.

Dearly loved by birders and non-birders alike for their boisterous mating ritual, male greater prairie chickens stake out a territory in a communal mating ground (lek) where they attract females by inflating bright orange air sacs that create a loud "booming" sound. Unfortunately, their numbers throughout the Great Plains declined severely as the plow converted tall grass prairie to farmland. This has been especially true in Illinois, the easternmost edge of their range. In Illinois the native prairie habitat that originally covered over 60% of the state, is today just 0.01% of its original size. As a result the population crashed from 25,000 in 1933 to less than 50 in 1992. (In 1860 about 10 million roamed the state!) This happened despite the best efforts of conservationists to protect them.

Hunting was banned in 1931, soon after the closely related heath hen (*Tympanuchus cupido cupido*) became extinct, and in the 60's two grassland sanctuaries, 40 miles apart, were established. In 1962 only 2,000 remained, and despite efforts to control predators and enhance the quality of the remaining habitat prairie chicken numbers continued to drop. Furthermore, due to a continued decline of private grasslands, by the early70's sanctuary birds became isolated from larger populations in other states and their numbers fell below 50 in 1992. From 1962 to 1992, when the Illinois population was declining, Westemeier, who has studied the greater prairie chicken for 35 years documented a steady drop to below 80% for eggs hatched, which reached a low of 38% in 1992. During this time the neighboring, larger populations had a hatch rate of 80-100%.

Did the decrease in fertility result from inbreeding? It appears so. A direct measure of inbreeding was done through DNA analysis. Team members Ken Paige and Juan Bouzat

showed that the Illinois birds had only about two-thirds the genetic diversity of those from other mid-western states. In contrast, no loss of diversity was seen in DNA from stuffed Illinois specimens collected in the 30's. DNA from those birds was very similar to present-day prairie chickens in other states. Evidently, when the prairie chickens became isolated in the 70's, they experienced what biologists call a "genetic bottleneck-a marked drop in genetic diversity-which sucked the birds into the extinction vortex. Optimizing the environment once that happened was not enough to pull them out of the vortex. Salvation could only come by importing genetic diversity into the gene pool from the outside. This is exactly what happened. In a desperate effort to save the Illinois population, another team member, wildlife manager Scott Simpson, began bringing in prairie chickens from other states in 1992. During the next four years 518 prairie chickens were imported and hatching rates shot back up to 94%. At the same time the number of males rose from six to 70.

These results illustrate the challenge of conserving small populations. Despite successful habitat management and control of predators and parasites, population size and fitness decreased. Only increasing its genetic diversity through translocations saved the population, but it remains in danger as long as numbers are restricted by habitat size. So both factors are necessary to maintain a healthy population. In a world where habitat destruction is ongoing the establishment of preserves is laudable, but lacking sufficient biodiversity it will not prevent extinction.

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Michael R. Jeffords (New York Times)
As part of the mating ritual, a male prairie chicken inflates its esophageal pouches to woo as many hens as possible.