Genetic research reveals unique characteristics of Kenai lynx population

by Ted Bailey

Senior author Michael K. Schwartz from the University of Montana reported the results of the first genetic study comparing lynx populations in North America in recent issue of the distinguished international science journal Nature. An Anchorage Daily News article on this research also appeared in the Science section on Feb. 10.

Included in the study of 17 western North American lynx populations were 115 samples of DNA from the Kenai Peninsula lynx population.

Mike and I began corresponding several years ago. He was conducting research on the genetics of two threatened species—the Canada lynx and the San Joaquin kit fox—for his doctorate degree. Mike became aware that we had been studying lynx ecology on the Kenai National Wildlife Refuge for many years. He inquired whether we had collected any blood or tissue samples from lynx that he could use for various DNA tests. Fortunately we had frozen blood samples collected from live-captured lynx and frozen tissue samples from carcasses of trapped lynx. We provided our lynx tissue samples to Mike. As it turned out, the Kenai lynx provided the largest sample size of the 17 lynx populations that he studied.

Years before Mike and I began corresponding, I had wondered if lynx on the Kenai might be relatively isolated from lynx populations elsewhere. We had radio-collared well over a hundred lynx during 15-plus years, and we knew of only one individual that successfully escaped from the Kenai Peninsula. It was a large male that we captured near Skilak Lake in 1985; he was finally trapped near Chitna on the Copper River in 1988.

Studies in other areas have shown that individual lynx have dispersed over 600 miles. Even so, none of the numerous lynx which were radio-collared or ear-tagged in Interior Alaska or the Yukon Territory were known to have dispersed to the Kenai Peninsula. For outsiders, and indeed most locals, the Kenai Peninsula looks more like an island than a peninsula.

Considering our island-like status, I was eager to see what the genetic work would reveal, and indeed, it delivered some fascinating and unanticipated results. Mike Schwartz and his co-authors showed that there was high gene flow (interbreeding) among all their sampled lynx populations across western North America, despite some populations being separated by distances of more than 1,900 miles. They interpreted this to mean that lynx were successfully breeding after physically dispersing great distances.

They termed this finding "the lynx migration hypothesis," which states that gene flow has been ubiquitous among all the sampled lynx populations. For example, two of only three lynx known at that time in Wyoming were more genetically more similar to lynx from the Yukon Territory and Northwest Territory of Canada than they were to the closest known lynx in Montana.

In my opinion, however, the lynx DNA from the Kenai Peninsula showed the most interesting results of the study.

Lynx on the Kenai Peninsula are not listed as threatened or endangered, but Mike reported in his dissertation that Kenai lynx had the lowest genetic heterozygosity—a measure of genetic variation—of the 17 sampled lynx populations. Geneticists generally believe that populations with higher levels of genetic variation can better adapt to changes in their environment and therefore have more survival potential than do populations with little genetic variation. Genetically diverse populations have more genetic cards in their deck, so to speak, in a game where a winning hand means survival of the fittest.

Although the authors reported that the Kenai lynx were probably not biologically different from other lynx (because of the high gene flow), the Kenai lynx population as a whole was the most genetically unique of the 17 populations. In his Ph.D. dissertation, Mike Schwartz stated, "Landscape features such as islands or peninsulas can reduce genetic variation," and "Peninsulas have also been implicated as places on the landscape where genetic variability is reduced, presumably because of small population sizes and isolation."

The authors estimated that only four new indi-

viduals entering the breeding population per generation (from other populations) could explain the genetic variation observed for the Kenai lynx population. Although this estimated immigration rate is not enough to sustain an actual lynx population, it is apparently enough to maintain the observed level of genetic variation within the present population.

Kenai lynx were also genetically different in that they were the only lynx population that had more than one (three) of nine tested genetic loci that deviated from the expected genetic proportions. These data suggest that because of their relative isolation and small population size, Kenai lynx have developed some subtle genetic differences from other lynx populations. But we do not currently know what biological effects, if any, these subtle genetic differences mean for Kenai lynx.

The DNA data further indicated that Kenai lynx have a relatively low "effective population size" of 22 to 29 individuals, which is a genetic measure of a population's ideal breeding size needed to maintain the observed genetic diversity. Geneticists generally assume that this effective population size represents 10 to 20 percent of the actual population size because of unequal sex ratios, differential reproductive success, overlapping generations, and changes in population size.

The implications of the genetic research are several. Although the authors' main conclusion was that the persistence of peripheral, threatened lynx populations in the Lower-48 depends upon dispersal from core populations to the north, the Kenai Peninsula lynx population was genetically the most unique and isolated of the sampled lynx populations.

The authors emphasized that maintaining connectivity between core and peripheral populations, by way of dispersal corridors, is necessary in order for peripheral populations to be sustained. Because lynx prefer to travel in dense cover, lynx dispersing to or from the Kenai Peninsula are restricted to a few forested corridors in the eastern mountains, usually valley bottoms, most of which contain the highway, secondary roads, the railroad, and increasing development.

Lynx are reluctant to travel great distances across wide, open, treeless mountain passes or across alpine or sub-alpine mountainous areas devoid of protective trees. Lynx are forest animals. Trees provide concealment and trees can be climbed to escape from potential dangers. This genetic study and other data indicate that because of their genetic isolation and small population size relative to mainland Alaska lynx populations, lynx on the Kenai Peninsula require careful land management to maintain connectivity to mainland Alaska and more cautious population management than is required for mainland Alaska lynx populations.

Ted Bailey is a retired Kenai Refuge wildlife biologist who has worked on the Kenai Peninsula for over 25 years. He maintains a keen interest in the Kenai Peninsula's wildlife and natural history. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.