Managing and restoring carnivore populations is one of the most challenging ecological and sociological problems facing wildlife managers today. People often view predators as positive indicators of healthy ecosystems or as pests that create conflicts with livestock and other wildlife. A current species of interest by the Iowa Department of Natural Resources (DNR) is the bobcat (*Lynx rufus*), which has become increasingly common during the last 10 years. Historically, bobcats were found throughout Iowa, but they had nearly disappeared due to large-scale habitat loss and unregulated harvest that occurred during the century after settlement. Bobcats range from southern Canada into central Mexico, but until recently have been considered largely absent from the Corn Belt region of the Midwest. Although widespread in North America, bobcats were listed as Endangered in 1977 in Iowa, and harvest of the species was banned. Although bobcats are still generally thought to be sparsely distributed in the state, the species was upgraded to the current status of Protected because of increased reports of bobcats, especially during the 1990s.
Bobcats are medium-sized carnivores with males (25 pounds) being larger than females (17 pounds), with a total length of head and body of 25-35 inches. The largest bobcat we have recorded in Iowa was 35 pounds.

Bobcats get their name from the short “bobbed” tail (5-6 inches), and can be recognized by the facial ruff and short ear tufts (cover and Fig. 1).

Fur color ranges from gray to reddish brown with white on their undersides. Bobcats typically have black spots present on their undersides, although the presence and degree of spotting on the rest of their body is highly variable.

Bobcats are rarely seen because they are active between dusk and dawn, but signs such as tracks, are good indicators of their presence. Bobcat tracks are round in shape, measuring approximately 2 inches by 2 inches. Generally, bobcat tracks can be recognized by the shape of the print, the lack of claw marks (because they have retractable claws), toes arranged “in front” of the interdigital “palm” pad, and the “M” shaped palm pad (with two lobes on front and three lobes on the rear). Bobcat tracks sometimes are confused with dog tracks. Dog tracks typically are longer than they are wide, are diamond shaped (with two outside toes “below” the front toes), show claw marks, and have a triangular palm pad (with a single lobe on front and a double lobe on the rear) (Fig. 2).
Research Project

In 2003, the Iowa DNR, in cooperation with Iowa State University (ISU), initiated a study on the status and ecology of bobcats in Iowa so that population recolonization could be documented and conservation options could be defined.

Objectives

We are focusing on determining the distribution, habitat relationships, and population ecology of bobcats in Iowa. The specific objectives are (1) to solidify data about the distribution of suitable habitat and the presence of bobcats in Iowa, (2) to determine local habitat selection by bobcats, including home range characteristics and dispersal patterns in relation to the landscape, (3) to evaluate population monitoring techniques that can be reliably and efficiently used to survey bobcats in Iowa, (4) to determine recruitment and survival rates of bobcats in Iowa, and (5) to evaluate genetic similarity of the Iowa population in relation to populations in other states. We selected a study area that primarily includes Warren, Marion, Clarke, Lucas, Monroe, Decatur, Wayne, and Appanoose counties in southern Iowa where bobcats are most common.

Methods

We collect data from 3 sources in order to meet our objectives: (1) live-captured bobcats that are radio-collared and released back at the site where they were captured, (2) carcasses of dead bobcats that are the result of automobile collisions and incidental trapping, and (3) reports of bobcat sightings from bow hunters and the general public. Cooperation from trappers and landowners has been especially important to the success of the study because they contact us when a bobcat has been accidentally caught in a trap and allow us access to property. When an animal is accidentally captured it must be reported to the DNR. If the capture is located in south-central Iowa, please call the bobcat research project crew (641-203-2218). For the rest of the state, please contact your local conservation officer. For bobcat...
captures in the study area, we radio collar and gather biological information at the capture site. We briefly anesthetize the bobcat so that we can fit it with a collar and also collect information such as body measurements, age, genetic samples, and blood for disease monitoring (Fig. 3). Once released, radio-collared bobcats are tracked using vehicle-mounted antennas and sometimes an airplane.

Each animal is located at least twice per week and occasionally followed for several hours at a time to estimate habitat use and movement patterns. Since 2003, almost 100 bobcat have been radio-collared. These bobcats have been located in more than 1,400 locations. In addition to live-captured bobcats, 500 bobcat carcasses have been collected from 37 counties in Iowa (Fig. 4). Carcasses are examined to determine pregnancy rates, litter sizes, dietary preference, and age (from sectioning the teeth), and to collect tissue for genetic analyses.

Results to Date

Distribution

Although reports of sightings are increasing, the data show that bobcats are common only in southern Iowa. Postcards distributed to DNR personnel and the general public have revealed some presence in the loess hills of western Iowa and eastern Iowa but extremely sparse reports from north central Iowa. The postcard survey does not provide a means to systematically document statewide distribution, so we began a survey of bow hunters in which a sample of hunters are asked to record their observations of bobcats and other “difficult-to-survey” wildlife while they are hunting deer. Through the bow hunter survey, we can reliably estimate the presence of bobcats at regional levels throughout Iowa, and ultimately detect trends in abundance. Each year since 2004, we have received responses from about 1500 bow hunters throughout Iowa. From the 2005 survey we can clearly see that bobcats are most abundant in southern Iowa (Fig. 5). These values are the number of bobcats sighted per 1000 hours, or to visualize it another way, in southern Iowa the average person would have to sit in the woods for about 150 hours in order to see a bobcat.

Social Structure and Behavior

Similar to most cat species, bobcats are solitary, except when females have kittens with them. From our radio-tracking data we calculated
that home ranges of adult males averaged 22 square miles and it remained about that size throughout the year (Fig. 6). We estimated that adult female home ranges averaged about 7 square miles during summer when females were with kittens but increased to 9 square miles in the winter after kittens became more independent and when food resources are more widely dispersed. Male bobcat home ranges often overlapped with as many as 2-3 female home ranges. Home ranges of female bobcats generally did not overlap with other females. The social structure and behavior of the population is fairly typical of bobcats elsewhere. For example, our telemetry showed that bobcats are primarily nocturnal and their activity peaks around sunrise and sunset when they hunt by means of stalking and ambushing prey. To mark their home ranges bobcats will have numerous scent posts located along travel routes throughout the home range. Bobcats often use the same latrines and often do not cover scats.

**Reproduction**

Bobcats breed in February to March and will give birth about 60 days later (in April to May) to a litter of 3 or 4 kittens. We have estimated that it is extremely rare for yearling females to give birth, about 75% of the 2-year-old females give birth, whereas about 97% of older females give birth. By intensively monitoring 14 radio-collared female bobcats during the summers of 2004 and 2005 we found that large brush piles and areas of dense understory vegetation are typically used as den sites. Kittens will stay near their mother for up to a year.

![Photo of bobcats](image)

**Survival**

We have estimated the annual survival rate of bobcats from both the radio-collar data and also from the age structure of the carcass collections. From the radio-collar data we estimated the average annual survival of Iowa bobcats (juvenile through adult age classes) to be about 77%. The highest survival rate was among adult females whereas the lowest was among juvenile females. Mortality was caused by accidental trapping (8), illegal shooting (7), automobile collision (6), drowning (3), unknown (2), train collision (1), and other predators (1). The age structure data suggest that annual survival may be as low as 55% because we have recovered very few bobcats older than 5 years. The oldest bobcat we have aged was 9.

**Diet**

We examined the stomach contents of 100 bobcat carcasses that were collected primarily during the fall and winter. We found remains of cottontail rabbits in 60% of the stomachs (Fig. 8), mice and voles in about 20%, and fox squirrels in about 15% of stomachs. Juvenile bobcats ate proportionally more mice and voles than adults. Male and female bobcats generally ate the same prey. We found remains of deer in 12 stomachs of bobcats, primarily adult male bobcats, although the small volume of deer remains suggests...
that much of it was consumed as carrion. About 2% of the stomachs contained birds (one stomach with turkey, one with pheasant, and one with hawk feathers). We also found a few stomachs with remains of muskrat, beaver, and shrew.

**Habitat Use**

Not surprisingly, the radio-tracking data show that bobcats used forested habitat most often, although their home ranges encompassed all the other habitats in southern Iowa, including pastures and CRP grasslands. Radioed bobcats were rarely located in row crop fields although they must have crossed them frequently. A typical home range consisted of multiple patches of forest where the largest forest patch comprised about 8% of the home range. Forest patches were surrounded by grasslands and the largest row crop patch comprised less than 3% of the home range. Although home ranges were not necessarily shaped by stream corridors, the areas used contained significant amounts of streams. In the home range core area (bobcats located 50% of the time) habitat consisted of forest (20%) and grasslands (including CRP, 40%). Home range size estimates are slightly larger than previously reported in the adjacent states of Kansas, Illinois, and Wisconsin. The study supports the idea that larger home ranges are related to habitat fragmentation because suitable habitat areas on the landscape are more widely distributed. It also appears that home ranges are not packed as densely as they could be, resulting in a low population density at present where males and females have to travel farther to find mates.

**Genetics**

Genetic methods have increasingly become an integral component of efforts to research and manage wild animal populations. Examining DNA can be used to determine the sex of individuals, assign paternity, and identify and track animals non-invasively. We use these techniques to investigate whether populations in Iowa are separate and self-sustaining, or if they are linked by dispersal with populations from surrounding states. Understanding these connections at a regional scale is important in predicting how management actions in surrounding states may impact Iowa’s bobcat populations, and vice versa. On a more local scale, we are working to examine the social and population structure of bobcats within Iowa and put these findings in the context of landscape features. For example, expanses of row crop agriculture, major highways and interstates, cities, and large rivers may act as barriers, limiting the spread of bobcats in the state. In working towards these goals, we are currently using microsatellite markers to analyze DNA from bobcats in Iowa, Nebraska, Kansas, Missouri, and Minnesota.

Figure 9. Genetic methods were used to provide an unambiguous determination of the sex of bobcat #184. Bands represent regions amplified on the X and Y chromosomes. In the test shown, males (XY) produce two bands, while females (XX) produce a single band. Bobcat #184 displayed a single band, indicating it is a female.
Male bobcats disperse farther than female bobcats, which typically find vacant habitat relatively near where they were born. Typically, dispersers are young male and female bobcats (<2 years old) moving out of the area where they were born, although we have documented long distance dispersal of adult males (>2 years old) as well. Based on recorded dispersal of over 15 individual bobcats, female bobcats have dispersed an average of only about 10 miles whereas males have moved over 50 miles. The maximum straight-line dispersal distance that we know is that of a male that dispersed 154 miles. Although dispersal typically takes place in late winter and is confined to a few months, we have documented continuous roaming behavior of males for as long as 3 years. Three dispersing males have moved out of Iowa and into the adjacent states of Missouri and Nebraska (Fig. 10).

What’s Next for the Project?

When we began this project we were unsure whether we would successfully find and mark many bobcats in Iowa. But diligent work by DNR biologists and ISU technicians and graduate students (Figure 11), along with the indispensable cooperation of trappers, landowners, and interested citizens, has made the project a great success. This project is supported by the U.S. Fish and Wildlife Service State Wildlife Grant program. Funds for this program are matched with those of the DNR and ISU. While the information collected so far indicates that bobcats are doing well in southern Iowa, it is still unclear if they will be able to expand and

Figure 10. Straight-line dispersal distance and direction of 17 male and female bobcats.

Figure 11. Juvenile male bobcat (No. 215) with the 2006-2007 field crew (listed from left to right) Scott Williams, Chad Tucker, Jim Coffey, Stephanie Koehler, and Sara Hansen.
persist in substantial numbers in the more highly agricultural areas of Iowa. Genetic data that we are now analyzing will explain how kinship is related to the landscape and whether the Iowa bobcat population is closely linked to bobcats from surrounding states. Continued research will help to explain the ecological mechanisms enabling bobcats to populate the Iowa landscape.

**How Can the Public Help?**

The general public can help by reporting sightings or auto-killed bobcats that they see by calling the bobcat hotline at 641-203-2218. When you call be sure you can give a clear description of the location, for example by noting the closest 911 address or mile marker. We especially appreciate trappers in south-central Iowa who call the hotline when they accidentally catch a live bobcat during the fall because those are animals to which we attach a radio collar. Bow hunters, you may be selected to participate in the sighting survey. If you have questions, contact Dr. Clark or Dr. Gosselink, whose addresses appear below.

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