

THE RED FOX IN IOWA

by

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Edward J Bierly, who painted the red fox shown above, is a wildlife artist of long-standing whose work has been published both nationally and internationally. He confesses that among American animals the red fox is his favorite subject, and he has often watched them in the woods around his studio in Lorton, Virginia.

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Foreward

The Wildlife Section of the Iowa Conservation Commission has the responsibility to monitor wildlife population trends, manage state-owned lands for wildlife production and diversity and conduct research projects to provide a scientific basis for management of Iowa's wildlife. This bulletin is the culmination of a 10-year study of red foxes in the Midwest. It is a popularized version of a scientific publication published by the Wildlife Society entitled, MORPHOLOGY, REPRODUCTION, DISPERSAL AND MORTALITY OF MIDWESTERN RED FOX POPULATIONS, (Wildlife Monograph No. 49), written by Gerald L Storm, Ronald D Andrews, Robert L Phillips, Richard A Bishop, Donald B Siniff, and John R Tester. The monograph received national recognition in 1978 when the National Wildlife Society designated it as the outstanding publication of the year.

This popularized publication is one which all citizens of Iowa can read and gain a greater understanding of the red fox and its role in Iowa's wildlife community. The entire fox study, including the monograph and this publication, was financed through the sale of hunting, fishing and trapping licenses and a federal excise tax on hunting and fishing equipment (Pittman-Robertson Project W-115-R-1). While wildlife belongs to all the people of Iowa, it has been sportsmen who have been responsible for funding most wildlife management and research and for acquiring most of the state wildlife areas we have today.

Preface

This book is written in a manner that will hopefully be easily read, informative, and interesting. While I feel this study is one of the most important and comprehensive studies of red foxes in the world, I realize that to be complete it must relay the results and information to the public. The study, the Wildlife Monograph, and this publication are very timely because during the past decade and a half, the image of the red fox changed from a villain to a valuable fur animal and sporting resource. Wildlife Professionals have had to reassess and reconsider their views on the role of predators in the field of wildlife management.

This study is the result of a research effort made possible through cooperation by many different disciplines. It would not have been possible without the cooperation of numerous Iowa Conservation Commission Wildlife Section Personnel and Conservation Officers, sportsmen, farmers and other people interested in the red fox. I hope the results of this effort will bring about a better understanding of Ol' Red's role in the wildlife community, as well as why foxes behave the way they do and why fox populations fluctuate annually. Hopefully, Iowa sportsmen, and others who read this book, will more clearly understand the considerations necessary to properly manage this important species.

Ronald D. Andrews
Clear Lake, Iowa

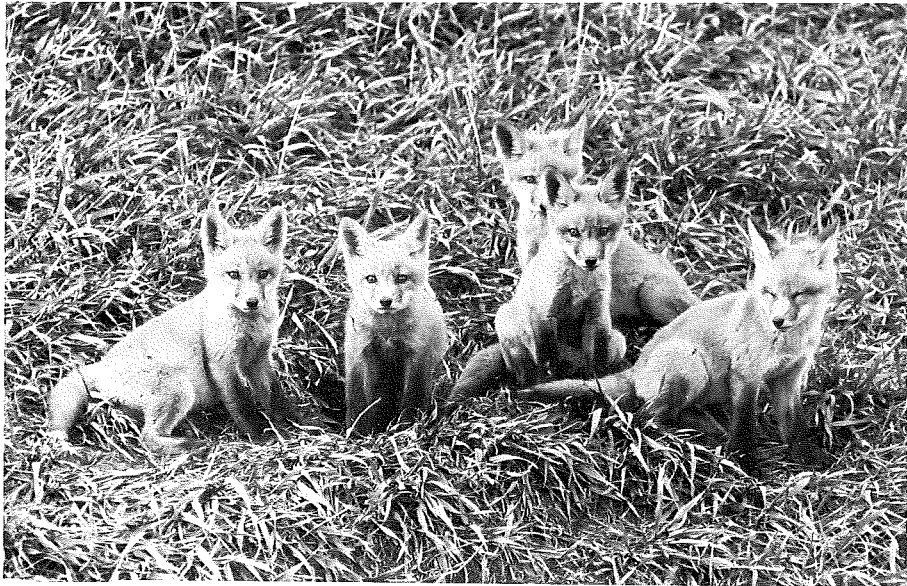
Acknowledgements

Cooperation from many people was necessary to make this fox study successful. I wish to thank all the Wildlife Biologists, Conservation Officers, Wildlife Technicians and other Commission personnel who took time from their busy schedules to locate fox dens and assist with fox tagging. I am indebted to the sportsmen, farmers and others interested in wildlife who helped locate active fox dens and assisted in capturing pups. The trapping expertise, energy and effort of George Good who provided enthusiastic help and encouragement in capturing, ear-tagging and radio-tracking foxes was particularly appreciated. The field assistance of Richard Bishop and Robert Phillips was essential to the success of the project. Dr. GL Storm was instrumental in supplying the Conservation Commission with radio equipment for monitoring fox dispersal. I am grateful for his time, efforts, enthusiasm, and assistance in orientating me towards the use of radio telemetry equipment and his vast knowledge of red fox ecology. Dale Humburg was very helpful in assisting with the radio telemetry portion of the study. The editing of this book by Richard Bishop, Terry Little, Allen Farris and Kenneth Reynolds was very much appreciated. Larry Pool did an excellent job drafting figures. I am indebted to Robert Alsbury, Wildlife Artist from Ventura, Iowa, for the original cartoons which adequately depict the diversity and behavior of the red fox. The photos used in this book were taken by numerous individuals. I appreciate their generosity in allowing me to use them in this publication. Roger Sparks was very helpful in editing and getting the final draft to the publisher. A big thanks to Effie Humburg who typed and edited several drafts of the manuscript. Most of all I would like to thank my wife Martha, son Tony and daughter Tracy, who on many occasions had to play second fiddle to Ol' Red while I was in the field capturing, tagging and radio-tracking red foxes.

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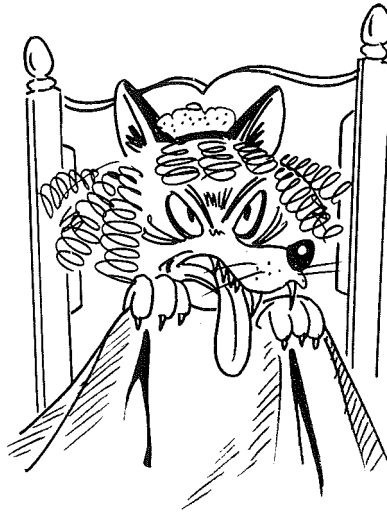
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Introduction

People who become acquainted with the red fox are seldom able to maintain a neutral attitude toward this animal. Clayton B. Seagers aptly described Ol' Red back in 1944 as follows: "The red fox is the best-loved and most hated, praised, berated, wisest, dumbest, smelliest, daintiest, thinnest, sleekest, most flea-bitten and most controversial creature ever to occupy the ardent attention of hound, hunter, trapper and hennery owner in this nation¹." He has been slandered by many as a culprit, a villain, a chicken thief, and a pheasant murderer. He has also been under indictment for defacing property because of the holes in which he lives. The fox has been the inspiration of more animal folklore than Aesop could ever have dreamed. Childhood nursery stories stereotype the red fox as nothing but a sly and crafty "bad guy".



Fortunately for even the worst "villains" there are a few sympathizers. The gardener and fruit grower welcome the fox when cottontails are chewing lettuce or girdling fruit trees. Small grain farmers welcome Ol' Red on their property when the rodent populations begin to soar. The image of the red fox has fluctuated at both extremes since the 1900's.

During the depression years of the 1920's and 1930's, red fox fur, as well as that from other fur animals, provided many people with enough economic livelihoods to barely eke out a living. While the value of fox fur was relatively low by the 1970's standard, it was still an important source of income for those lucky enough to capture Ol' Red by trap or take him by gun.



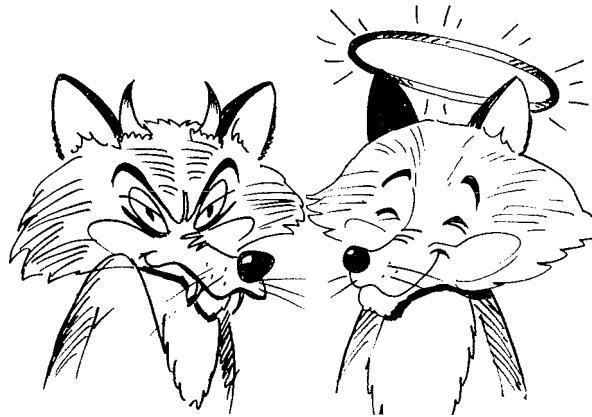
During the 1940's and 1950's, the fox's image was at a low ebb. Many a poultry farmer woke up to find that Ol' Red had been in the chicken house during the night and on occasion, over 100 chickens had been killed. The upland bird and rabbit hunter thought that Reynard Fox was killing more than his fair share of game. It was during this period that the sport of fox hunting began to grow. Hounds were still being utilized, but a new group of houndless gang hunters was evolving. "Circle hunts" involved several hunters surrounding a section and walking toward its center, hoping to take any foxes that were flushed. The one-on-one hunting method was also evolving where a single hunter tracked a fox in the snow until he could get close enough for a shot. The latter was interested in the animal mostly for its sporting qualities and believed they were helping out the poultry farmer and small game hunter by taking some of those "nasty pheasant, rabbit and chicken eating critters". Even conservation agencies were beginning to believe that the only good fox was a dead one. They thought the impact of fox predation on certain small game populations might be too severe.



In fact, anyone could legally shoot fox pups at a den site in Iowa. It was not uncommon for some people to scan hilltops on sunny spring afternoons for playing fox pups. They would kill the pups for the bounty, gas them in the den with carbon monoxide or anhydrous ammonia or sell the live pups. Despite the fact that year-round war was declared on Ol' Red, he managed to survive in fairly large numbers.



During the 1960's and 1970's, a new image of Reynard Fox was being etched. More hunters and trappers were becoming interested in pursuing Ol' Red for both his fur value and sporting qualities. The high-powered rifle and spotting scope became important tools for these sporting enthusiasts. Hunters would scan the snow covered landscape, looking for a red ball of fur sleeping in the sun on the leeward side of a hill. They would then stalk the fox in hopes of getting a successful shot.



Unfortunately, the high fox pelt values of the 1970's has tarnished the image of fox hunters and trappers. Many people were hunting Reynard Fox for the almighty dollar. They were losing sight of the value of chasing foxes in a more sportsmanlike manner and instead were getting caught up in the use of their modern gimmicks and gadgetry. Using such modern day mechanical means such as 4 wheelers, snowmobiles and CB's to take their quarry is illegal and is not condoned by the Iowa Conservation Commission.

Trappers throughout the 1900's were learning more about fox movements and crossings and became more successful at taking their quarry. Conservation agencies were beginning to realize that the fox played an important role in the wildlife community and given adequate habitat, the fox was not the limiting factor on small game populations.

Even Iowa lawmakers were changing their conception of Ol' Red, but it was not until the 1969 Legislature that something other than a continuous year-round hunting and trapping season was allowed. A liberal hunting season was established in 1970. More restrictive seasons were instituted as wildlife habitat was reduced and as fox pelt prices soared. To gain a better understanding of this important wildlife resource, the Conservation Commission initiated the red fox ecology study in 1966.





Leonard Lee Rue III

Chapter 1 The Red Fox's Roots

ORIGIN IN THE UNITED STATES

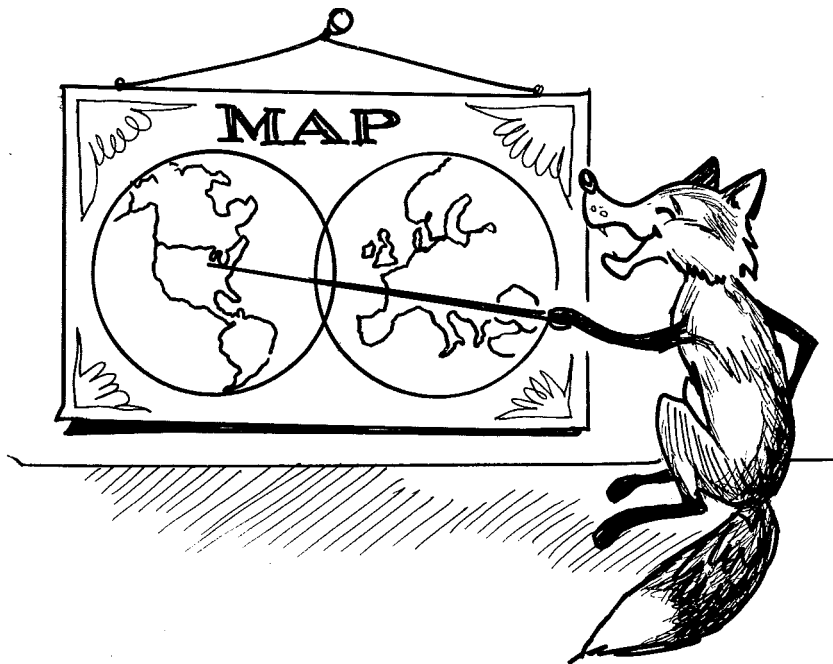
The red fox currently is widely distributed over much of North America and perhaps has a two-fold origin. It was once believed that English colonists brought this wildlife asset to North America because the most commonly seen fox at the time the pilgrims landed at Plymouth Rock in 1620 was the gray fox. The confusion was further compounded by Colonial gentlemen who, between 1650 and 1750, introduced red foxes from France and England to the central Atlantic coastal areas for the purpose of hunting on horseback with hounds. The introductions were undertaken because the gray fox climbed trees and would run along the tops of walls and fences when chased, while the red fox would stay on the ground and could be more readily harried by hounds.



Jim Cash

Gray fox in tree.

The red fox is, however, a native of North America. Remains have been found by archaeologists in Indian middens (or refuse heaps) dating back to 2,000 B.C. and by paleontologists from the still further past. Thus the roots of the Iowa red fox run deep. Ol' Red may be a hybrid from interbreeding of native and introduced stock or a descendant of either. Modern day scientists classify 12 different subspecies of red fox which have resulted from these descendants.





Chapter 2 The Red Fox's Make

PHYSICAL CHARACTERISTICS

The red fox is dog-like in appearance with an elongated pointed muzzle and large pointed ears which are usually erect and forward. It has moderately long legs and long, thick, soft, body fur with a heavily furred, bushy tail. Typically, Iowa foxes are colored with an orange-red coat, black legs, lighter colored underfur and a white-tipped tail. Red foxes occur in many other color phases, including silver, cross, and melanistic, but the red color phase dominates. Only on a few occasions has the cross color phase been seen in Iowa. This animal closely resembles the red phase, but the outer guard hairs are tipped with black. The silver phase and other color variations that occasionally occur in the western United States are probably survivors that escaped from early fox ranchers. Fox ranchers developed a variety of color mutations including amber, glacier, golden glory, pearl, and silver.



Color phases of Red fox. Top to bottom: typical red, cross, Samson.

The Samson fox is a genetic variation of the red fox. This fox, named after the Biblical character Samson who had his locks trimmed by Delilah, is a rather woolly looking animal that lacks most or all of the long guard hairs, thus exposing the underfur. Several Samson foxes were identified during the course of this study, but overall their incidence of occurrence is less than 2 percent according to Iowa fur buyers. The fur of Samson foxes is of no commercial value and they likely encounter problems of survival during the extreme cold in the more northern latitudes.



Red Fox (Photo by: Minnesota DNR)

RED FOX VERSUS GRAY FOX

All the color and genetic variations mentioned previously belong to one species, the red fox. The red fox's scientific name is *Vulpes vulpes*. The gray fox, a cousin to the red fox, is scientifically dubbed *Urocyon cinereoargenteus*. Unlike the more prairie dwelling red fox, the gray fox prefers to inhabit timbered areas. The tree loving gray is a stockier animal with a coarse, grizzly-gray, black body coat, with rusty red hairs in a narrow band along the side. At close range these foxes are very easily distinguishable. A close examination of their skulls reveals a distinct difference in shape (Figure 1).



Gray Fox (Photo by: F Robert Henderson)

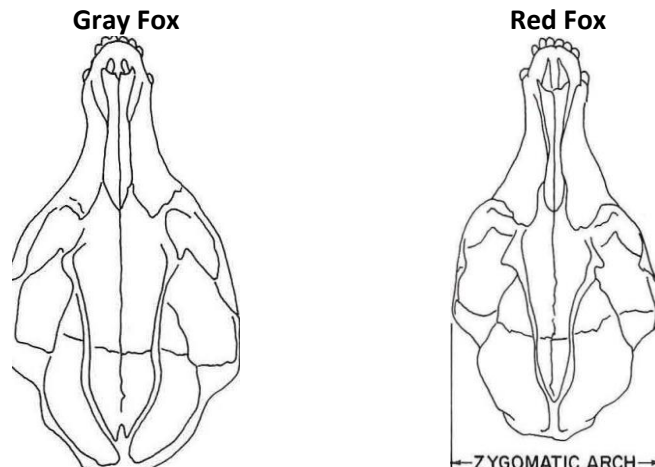


Figure 1. Red and gray fox skulls. The red fox skull has a longer snout and narrow, less distinct crown than the gray fox.

Despite the fact that red and gray fox ranges overlap, no one has recorded interbreeding of these two species in the wild. As far as other relatives are concerned, scientists have found evidence that Ol' Red will, on rare occasion, breed with two of its country cousins; the more northern Arctic fox and the more western swift fox, neither of which are found in Iowa.



Arctic fox



F. Robert Henderson

Swift fox



Measuring skull

FOX WEIGHTS

Foxes born in captivity range in weight from 2.4 to 4.5 ounces at birth². The zygomatic arch (the widest part of the fox's skull) was measured on several fox pups. These measurements were compared with those of ranch fox pups and helped us to backdate wild pups to date of birth. Considerable effort was also put forth in weighing and measuring various parts of red fox anatomy to compare Midwest foxes with foxes in other parts of the world. Juvenile male fox pups tended to be heavier than juvenile females but there was not a statistically significant difference until they were nearly 6-months old. Adult male foxes weighed during this study ranged from 9.2 pounds to 12.6 pounds with an average of 10.7 pounds. Adult females ranged in weight from 6.6 pounds to 10.2 pounds with an average of 8.8 pounds.



Other body measurements were taken, including total length, tail, hind foot and ear length. Total length (tip of nose to

tip of tail) of full-grown Iowa red foxes range from 36 to 46 inches with the average being 40 inches and tail length ranges from 11 ½ to 16 inches. Full-grown Iowa Reds stand about 14-15 inches at the top of the shoulder. All of these measurements were utilized to compare foxes in various regions of the world. With some rather sophisticated skull measurements and statistical calculations, one can randomly choose a fox skull from a "bone pile" and later determine, over 90 percent of the time, whether the fox was born in Iowa, Minnesota, Illinois, or elsewhere.

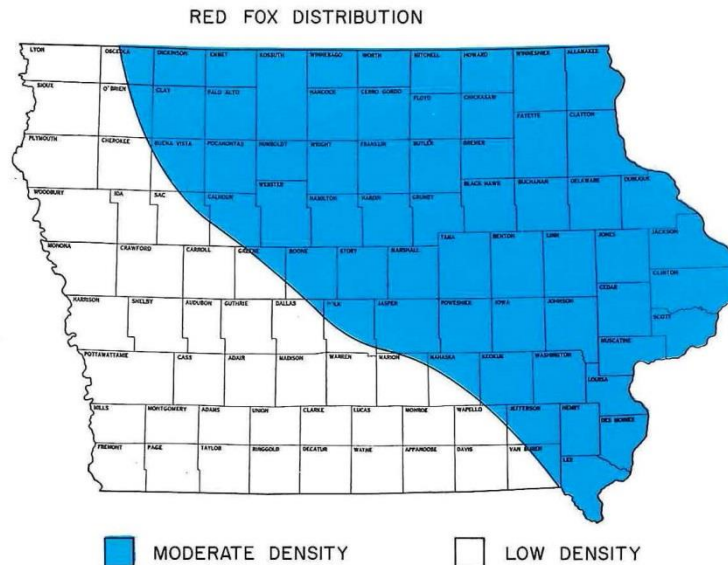


Figure 2. Current red fox distribution and density in Iowa.

CHAPTER 3

Iowa Red Fox Range and Distribution

HISTORICAL RANGE AND DISTRIBUTION

Reports indicate that red foxes occurred in wooded areas along the Missouri River in the early 1900's and probably in similar habitat in eastern Iowa along the Mississippi River and its tributaries³. It apparently was a rather uncommon resident prior to pioneer settlement in Iowa. Up until the time Iowa became a state, fox numbers seemed to be closely correlated with the activities of white man⁴. As pioneers advanced westward and set up homesteads they reduced the number of large predators and small tracts of timber making the habitat more suitable for foxes.

It was not until the beginning of the 20th century that Ol' Red was "all over the state"⁵. During the 1930's, "despite persistent hunting and year-round open season, the red fox continued to maintain its population throughout the state"⁶.

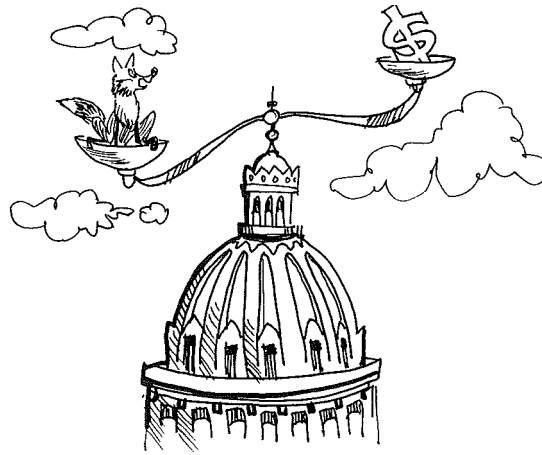
Ol' Red maintained a rather stable or increasing population throughout the 1940's and early 1950's. Southern Iowa sustained the highest population and old-timers who remember the 1950's say there was at least one fox litter in every section prior to the outbreak of mange in the middle of that decade.

The disease, mange, drastically reduced the foxes in southern Iowa by 1960. At the same time the fox population appeared to be steadily increasing in the northern half of the state. Mange and other fox diseases will be discussed in Chapter 12.

CURRENT RANGE AND DISTRIBUTION

Northern Iowa's red fox population increased to a recent all-time high in 1968 when fox litters could be found in every suitable piece of habitat. Southern Iowa's fox populations have remained relatively low since the mid 1950's because of the persistence of mange and perhaps competition from the increasing coyote population. The general Iowa red fox distribution and density for the late 1960's and early 1970's is shown in Figure 2.

Since 1968, increasing pelt prices which stimulated hunting and trapping, deteriorating habitat caused by intensive row cropping, and increasing incidence of mange in northeast Iowa have all contributed to a statewide decline in fox numbers. Although few people would have expected it, the increased production of corn and soybeans in northern Iowa not only contributed to the demise of the ring-necked pheasant, but has hastened the decline of the red fox. The relationship of the fox to the farmer and farming practices will be discussed in Chapter 14.



CHAPTER 4

Fox Bounties and Ol' Red's Legal Status

HISTORY

The bounty system has been present in America almost since the pilgrims landed at Plymouth Rock. The bounty system is so old it has the status of tradition, and to resist this tradition has practically resulted in rebellion. The Commonwealth of Pennsylvania has paid bounties since 1763 on one type of animal or another. As pioneers pushed westward the bounty system followed. Practically every state has had some type of bounty system.

Iowa's bounty laws date back to 1817, nearly 30 years prior to our statehood, when the territory adopted its first bounty system. Since that time, state bounty laws have been amended, altered, or changed at least 38 different times⁷. When county government was initiated in the early 1800's, the counties became responsible for bounty payments. Most of the bounty payments have been optional to the counties. As early as 1844, the legislature enacted a bill making bounty payments mandatory, but the financial burden on county budgets was more than they could stand, so optional bounty payments were reenacted the following year.

It was not until 1860 that the legislature actually added "swifts" (red and gray fox) to the bounty list and established a \$1 rate of payment. When the Code of Iowa was recast in 1897, the \$1 bounty on "swifts" was deleted. For the next 54 years, bounties on foxes were not required statewide. In the 1940's and 1950's, emphasis on predator control to protect game animals and domestic livestock led to the renewal of bounty on foxes. Unsuccessful agitation for this began as early as 1919. Strong pressures resulted in the passage of a bill providing a statewide bounty of \$2 for red and gray foxes at the 1951 General Assembly, despite the fact it was optional on a county-by-county basis. From 1951 to 1959, all 99 Iowa counties paid fox bounties.

By the mid 1960's, over one-third of the counties had discontinued bounty payments on foxes. In 1974, Woodbury County was the only county to pay bounty on some 38 foxes. During 1975 and 1976 no fox bounties were paid in Iowa. In 1977, Lee County was the only county to pay bounty on fox. A graph showing trends in the fox bounties since 1940 is given in Figure 3. The 1978 Legislature removed foxes from the list of species on which bounty payments could legally be made. Bounties are still being paid in some comities for coyotes, pocket gophers, and ground hogs, although it is probably only a matter of time before all bounties are removed.

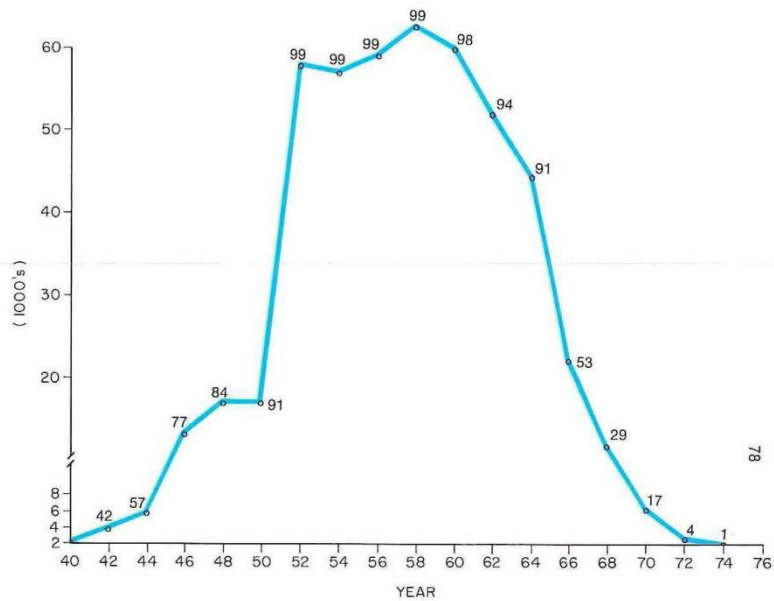


Figure 3. Foxes bountied from 1940 through 1974. Numbers above the line represent the number of counties paying bounties.

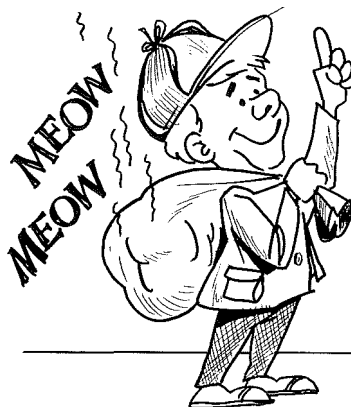
BOUNTY PAYMENT FUNDING

Since the bounty laws first came into effect in Iowa, the funding source has been county property taxes. In some states this is not the case. Their sources of funding include state taxes, dog license fees and monies from the sale of hunting and fishing licenses. Fortunately, this has not been the case in Iowa. Another special source of funds for fox bounties has been the Iowa Turkey Producer Associations. In areas where turkey growers were abundant, special assessments were placed on each producer. When foxes were taken within their area of production the individual taking the foxes was paid an additional bounty besides that collected from the county bounty fund.

ARE BOUNTIES BUNK?

The original intent of the bounty system was to reduce animal populations that were thought to be undesirable or nuisance varmints. It has been ineffective and very costly. The image of these animals, once considered nuisances, has changed and most are no longer considered undesirable. This is especially true of the fox but it applies to other predators as well. Over \$2 million in fox bounties have been paid since 1937, yet fox populations were at record highs in the 1950's and 1960's. It was indeed unfortunate that this money was not channeled into wildlife habitat management and acquisition programs.

One of the biggest problems associated with the bounty system is fraud. Because pursuits of animals for bounty reward are unwitnessed acts, it is difficult to know if a claim is lawful or fraudulent. The most common type of fraud is to collect payment in one county on "varmint" taken in another county or even from a bordering state. On occasion, animals have been bountied in more than one county. Also, dogs and cats have been killed, accidentally or intentionally, because they resemble foxes or coyotes. On several occasions, bounties were collected on these animals.



Because the bounty system is archaic, wasteful and has no scientific wildlife management benefits, the Iowa Conservation Commission is opposed to bounty payments. In fact, bounties are a slap in the face of good game management. Because the current bounty law allows counties to decide whether payments will be made or not, it eventually will lead to the entire self-destruction of the system. Hopefully the bounty system will not be revived. Revenue for bounties should never be derived from fish and game trust funds since these monies should be spent for worthwhile conservation programs such as habitat conservation and management.



CURRENT LEGAL STATUS OF OL' RED

Up until 1970, both the red and gray fox were considered nuisance and pest animals from a legal point. Iowa law would not allow any- thing other than a continuous open season. The 1969 Legislature, however, enacted new legislation to give the Conservation Commission the authority to set a fox season as long as the “biological balance” was maintained. The law defines biological balance as that condition when all losses to the population are compensated by natural reproductive activity or artificial replenishment, replacement or stocking. Although some legislators did not realize they had voted to allow the Conservation Commission to set a restricted season on foxes, for the most part, the season was readily accepted. The season was very liberal, opening September 1 and closing the end of February. With increasing hunting and trapping pressure, high fox pelt prices and deteriorating wildlife habitat, more restrictive fox seasons have been instituted. The reason for this will be discussed in Chapter 17.



CHAPTER 5 Fox Reproduction

A female fox is monestrous, meaning that she is reproductively active only once during the year. By comparison, dogs and cats may be reproductively active more than once during a year. The female fox or “vixen” potentially may breed at 10 months of age, although the proportion of vixens breeding during the first year varies in different regions. Our Iowa studies indicate that at least 95 percent of the male and female foxes breed during their first year.

BREEDING BEHAVIOR AND SEASON

The presence of two parallel fox trails in early winter snows, indicating that foxes are traveling together, signifies the approach of the mating season. Although typically a breeding group of foxes consists of a single pair, occasionally one male and two females or vice versa, are observed engaged in breeding activity.

Red foxes in the United States may breed from December through April^{8,9,10,11,12}. From our studies of fox reproductive tracts and fetuses, it appears that in Iowa the initial breeding begins about the last 2 weeks of December and peaks about the third week of January (Figure 4). Less than 1 percent breed after mid-February. Gestation is 51 to 53 days.

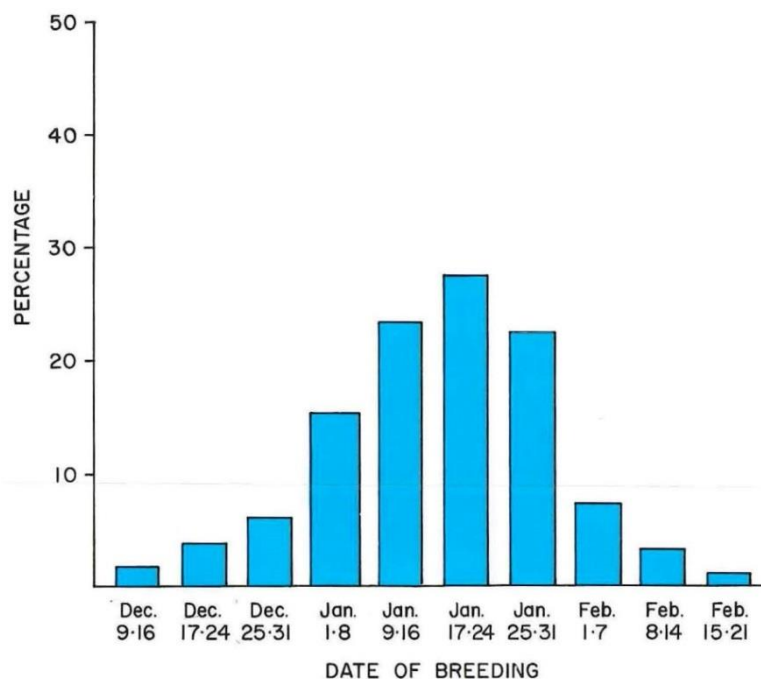


Figure 4. Breeding season dates for female fox.

Although more study is needed, researchers believe that the changing photoperiod (meaning the length of day-time hours) is the major factor influencing the onset of breeding. Temperature and precipitation may be less influential factors. Our studies indicated that during the mild and nearly snowless winter of 1968, fox pups were born about 10 to 14 days earlier than in winters with heavier snowfall. Also, when there are greater numbers of adults in the population because of reduced mortality the previous year, conception and whelping dates are earlier, on the average, than in other years. Adult foxes tend to breed 1 to 2 weeks earlier than yearlings.

The majority of foxes are born between March 20 and April 1. Sextuplets are common in most Iowa fox families; however, the number of fox pups per litter ranges from 1 to 12. During the first 10 days or until the fox pups' eyes open the female seldom leaves the den. Her mate brings food to her. The vixen's milk is much richer than cow's milk and she nurses her offspring for about 2 months. Early in the pups' life their diet consists of regurgitated flesh; however, by the time they are 1 month old the adults begin bringing small dead animals, then live ones for them to eat. Usually only one family group of foxes will occupy a den site. Of the 345 active den sites where we captured foxes, two fox families were present in the same den in only seven instances. This was noted by two distinct size differences in the fox pups.



SEX RATIOS

Sex ratios of foxes have been estimated from samples of fetuses (the embryonic stages of fox pups in the female reproductive tract), pups captured at dens and adult-sized foxes taken by hunters and trappers. Fetus counts taken from reproductive tracts of foxes collected in Iowa showed a 50:50 ratio of males to females.

Of the approximately 1,500 fox pups tagged at den sites during the study, 54 percent were males and 46 percent were females. This preponderance of males can perhaps be attributed to greater mortality of female pups during late gestation, parturition (birth) or the first few days of life. Males, which are generally larger and, more aggressive, are more competitive for the mother's milk and food which she brings to the den. This behavior may cause mortality to the young females by out competing them for food. In addition, males are bolder, utilizing the den entrances and main tunnel-ways more, perhaps making them easier to capture than their more shy counterparts.

The sample of adult foxes taken at fur buyer businesses and from hunters and trappers showed a sex ratio of 56 percent males to 44 percent females. The higher proportion of males either reflects differential pup mortality or greater male vulnerability to hunting and trapping. This may reflect the tendency of males to travel greater distances, encountering more traps and hunters in unknown territory. Vixens may be less vulnerable because of less movement and the tendency to remain near den sites especially when heavy with young.



CHAPTER 6

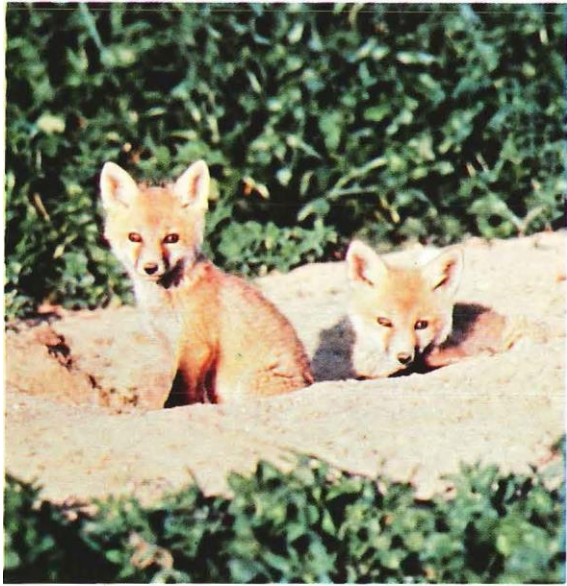
O' Red's Home Sweet Home

DENNING AND DEN SITES

During five field study seasons, foxes were captured from April through July in 345 different dens. The distribution of den sites indicated that red foxes rear offspring in a wide variety of habitats and topographies. Typically, foxes will remodel a den that has been abandoned by a badger, woodchuck or occasionally a muskrat. Seldom do foxes dig their own dens. Abandoned gravel pits, pond banks and the banks of drainage ditches and streams are common denning sites. Abandoned farm buildings, rock and brush piles, stacked hay bales, road culverts and dry tiles are also used as den sites. Many foxes prefer to den near a relatively open site on a hilltop or knoll associated with grasslands or legume fields. Foxes will den in row crop fields, but usually not until after the major tillage and planting has occurred.

Generally, dens have more than one entrance and one particular den had sixteen active openings. Usually there is a chamber in O' Red's home containing a grass bed for the young and sometimes there are additional rooms for food storage. Den tunnel-ways vary considerably in length. Many of them are dead ends but some of them are quite extensive. On at least one occasion the complete length of a 60-foot wire ferret was snaked through the tunnels of a fox den without reaching an end point. Sometimes several temporary dens are located within a few hundred yards to a quarter of a mile from the main den. Pups can be moved into these temporary dens in case of danger or sometimes the pups are separated as they get older. This separation of pups into two or three nearby den sites is probably one of Mother Nature's ways of keeping the entire litter from being destroyed by man and his activities or by some other predator such as badgers, coyotes, or dogs.

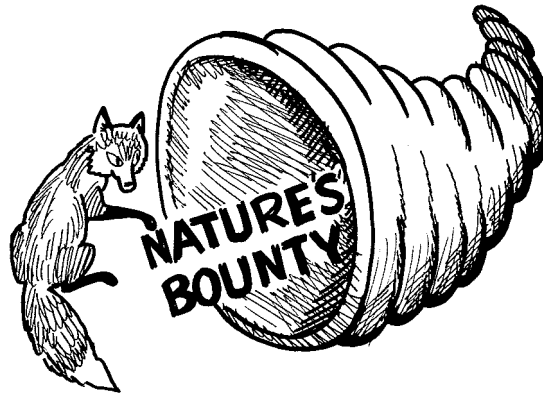
The abandonment of the soil bank and diverted acres program, combined with an all-out push for maximum crop production, reduced the number of secure den sites (Chapter 14).



Ted LaGrange



Jack Coffey



Chapter 7

Fox Menus (Food Habits)

The menu of the red fox is several pages long, contains a variety of delicacies and generally is *a la carte*. Scientifically speaking, this animal is a carnivore because it prefers to eat animal matter. Technically, however, foxes should probably be called omnivores or “every- thing eaters”. It is the fox’s diet that has given him his bad reputation. Farmers, teachers, fur buyers, trappers, hunters, game officials, and nature lovers, have all taken sides in the issue.

Foxes, like many predators, are opportunistic animals and eat what- ever they can get. Contrary to popular opinion, the diet of a fox contains considerably more than mice, rabbits, pheasants and other meat. Foxes eat whatever they can find or get, without apology for doing so.

During the course of a year they may eat such entrees as house mice, meadow mice, deer mice, meadow voles, shrews, moles, cottontails, woodchucks, gray squirrels, fox squirrels, thirteen-lined ground squirrels, chipmunks, gophers, barn rats, chickens, ducks, partridge, pheasant, quail, starlings, robins, shorebirds, sparrows, meadowlarks, eggs of all kinds, grasshoppers, beetles, crickets, carp, bass, suckers, minnows, other fish, apples, plums, mulberries, grapes, cherries, grass, corn shucks, weasels, muskrats, horses, cows, pigs, turkeys, guineas, other foxes, snakes, wheat, oats, barley, raccoons, opossum, flickers, and other items too numerous to list. Most of the menu does not necessarily need to be eaten fresh and many times foxes will use these foods in the form of carrion. Sometimes, the more rotten it is, the more mouthwatering to the fox.

SEASONAL DIET CHANGES

The bare list of what a fox eats can be misleading unless supplemented with several other facts. Time of year, stage of the hunting season, proximity to poultry flocks, and a host of other factors can determine what a fox’s diet will be. The menu changes with the season and the locality.

During the late spring and early summer, the fox menu includes such delicacies as pheasant, duck and bird eggs of all kinds, with crickets, grasshoppers and June bugs as the main entrees. Ol’ Red also capitalizes on such farming practices as hay mowing or oat harvest by feeding on the “spoils” of eggs, bird and rabbit remains left in the wake of such activities.

From summer to early fall, fruits such as strawberries, mulberries, plums, and others rank high on the menu. As young wildlife in broods and litters begin to venture further from the safety of their natal areas, some of them fall direct prey to Ol’ Red. Others are indirectly utilized as food after they become a victim of a vehicle on a roadway and are later picked up by a passing opportunistic fox. As fall turns to winter, the fox’s diet shifts more to meat. This is not necessarily all fresh meat since they also capitalize on “cripples” left from the hunting season. Foxes living in the vicinity of specialized livestock and poultry operations generally clean up on whatever the farmer leaves. Dead animals, especially pigs, disposed in the back forty are attractive to a hungry fox. Most certainly, foxes living in the vicinity of poultry pens have occasionally invaded the chicken coop and scattered feathers and blood all over. When this happens, Ol’ Red’s image sinks to a low ebb in the eyes of the poultry raiser.

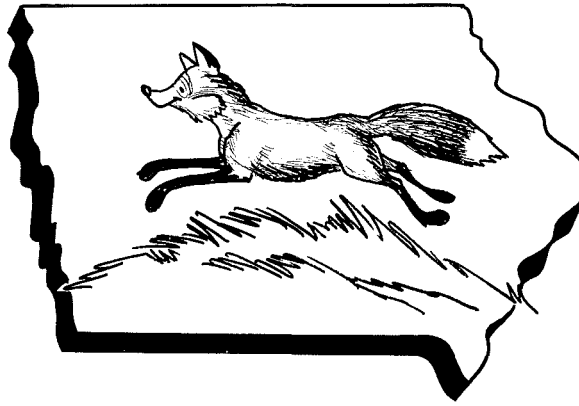
Our study did not emphasize food habits of the fox except with gross measurements. We counted and tallied food item

remains at den sites. Mice, rabbits, pheasants, a variety of songbirds, poultry and small pig remains were most numerous. Occasionally we found an unbroken pheasant egg at a den site. Interestingly, we found a number of den sites with at least one dead but uneaten weasel. It appeared that the weasels were used strictly as a play item for the fox pups, rather than something to savor. Although not noted during our studies, many researchers have found evidence of foxes actually establishing food caches to store food items for later use.



Food remains at den.

Generally speaking, it appeared that as wildlife habitat became more restricted, more pheasants and other game were found at den sites. This supports, in part, the wildlife management principle that given adequate wildlife cover, foxes, pheasants and other small game can live compatibly without the fox having much impact, but when habitat becomes restricted, predators will have a greater impact.



Chapter 8 Fox Movements

SPACING

By the time fox pups are 8 to 10 weeks old, the litter may become separated into two or more groups at different den sites. This spacing is probably initiated by the vixen, but as the pups get older they begin to space themselves at different den sites or above ground bedding sites. This spacing mechanism is probably one of Mother Nature's schemes to protect a fox litter from being completely destroyed by man or other predators. The older fox pups become, the greater the tendency to pick out their own mini-territory within the adult's overall home range. Once this spacing occurs, contact between individual littermates is reduced.

HOME RANGE

Home ranges of foxes are generally defined as the area within which a pair of adult foxes den and raise young prior to fall dispersal. Home ranges seldom exceed 5 square miles and most of the time are considerably smaller. Territorial boundaries between different pairs of foxes are established by scent marking, squalling and other types of communication.

DISPERSAL

Foxes, like other meat-eating creatures, move greater distances and more often than their vegetable eating associates. They must move more because their meat supply is not as readily available as the vegetable supply. However, by late September and early October, something more significant than food causes foxes' behavior to change.

At this time, many full-grown, young-of-the-year foxes leave their familiar territory and disperse through foreign country looking for a new home. Not only do foxes disperse in the fall but coyotes, raccoons, pheasants, grouse, rabbits and practically the entire animal world seems to go through the motions of what biologists refer to as the "fall shuffle".

METHODS OF STUDYING FOX MOVEMENTS

Several methods of prying into the secretive travels of Ol' Red have been tried with considerable success. These included the capturing and ear-tagging of fox pups at den sites. Foxes were roused from dens with the use of a mechanical wire ferret (13), a long piece of smooth spring steel wire with a spring and wooden plug at one end and a handle at the other. This wire was snaked and twisted through den passageways, chasing foxes out other den openings to be captured in dip nets. Occasionally their fur became entangled in the wire ferret and they were fished back out the original den opening. **IT IS NOT LEGAL FOR THE PUBLIC TO USE A WIRE FERRET AT ANY DEN SITE.**

The ear-tagging of foxes utilizes the same principles as leg banding waterfowl to determine waterfowl migration patterns. Both ears of the fox were pierced and identifying numbered tags were placed in them so each fox could be individually recognized. When a hunter, trapper or other individual found one of the animals, they could report the number as well as the location and date when the animal was taken. The straight-line distance (as the crow flies) from the area where the animal was born and tagged to where it was recovered could be measured from a map. The other method of pursuing Ol' Red on his travels was one of the new space age innovations. Foxes were captured in their home ranges prior to dispersal and tiny beeper transmitters (radios) were placed in collars around the animals'

necks. The private life, trails, travels, and foot prints of the “bugged” animal were then plotted directly on a map.

TIME OF DISPERSAL AND FACTORS INFLUENCING ONSET

Of nearly 600 juvenile red foxes tagged and recovered during this study, only two showed indications of beginning dispersal movements prior to late September. A juvenile male fox was recovered in July, 7.9 miles from where it was tagged, and a juvenile female was recovered in early September, 5.8 miles from where it was tagged. The earliest dispersal of 57 radio-tracked foxes occurred on October 1. By mid-October, several sub-adult males had moved further than 20 miles from their natal denning area. Sub-adults refer to young-of-the-year animals that are physically full grown but not yet one-year-old. Table 1 shows the number of foxes recovered, the average distance moved and the minimum and maximum distance moved for each month during the study. These foxes were tagged during March, April and May.



Fox capturing and tagging

Age of the fox may be one factor affecting the initiation of dispersal. It appears that Iowa foxes initiated dispersal two or three weeks earlier than Minnesota foxes¹⁴. Since Iowa foxes tend to whelp earlier than those in Minnesota, the onset of dispersal may partially be related to the fox’s stage of development and maturation. Although our observations were

not conclusive, circumstantial evidence indicated the larger, presumably older fox pups, dispersed earlier than the smaller and younger foxes.

Our radio-tracking results indicated that males left home earlier than their female counterparts. Researchers believe this is related to changes in reproductive activity. Male foxes are sexually mature in late November and December and females in January and February¹⁴. In male foxes, internal reproductive changes begin in early October, or 3 months earlier than the beginning of breeding in late January (Figure 4). For females the gonadal changes occur about 2 months prior to the height of the breeding season, making November the time one can anticipate female fox dispersal. The correlation of dispersal and changes in the internal reproductive organs supports the idea that physiological state influences the onset of dispersal. It also explains the differential and somewhat later dispersal period of vixens compared to buck foxes.

It is difficult to say from this study whether social behavior such as littermate squabbles or parent-young feuds initiated dispersal. The radio-tracking data indicated this was not likely the case, because the animals spaced themselves within the overall home range of the parent foxes and contact between individuals was minimal, thus reducing the potential donnybrooks.

It is not likely that limited food supply initiates dispersal because in the Midwest both animal and plant food material should be at their peak in the late summer and early fall when fox dispersal begins. Probably a combination of age, internal reproductive changes and photoperiod, initiates dispersal in foxes.

PROPORTION DISPERSING

Figure 5 shows the proportion of tagged foxes known to have dispersed more than 5 miles during this study. From the graph it is apparent that males are by far the biggest roamers in all three age categories. For sub-adult foxes, 80 percent of the males, but only 37 percent of the females were recovered more than 5 miles from their natal ranges the first year. The proportion increased to 96 percent of the males and 58 percent of the females if they were recovered a year later. The tendency for adults to disperse was less pronounced; 30 percent of 22 males and 21 percent of 49 males were recovered more than 5 miles from their release points. These data support the contention that few foxes disperse as adults (15). Of the 26 adults that dispersed, only two were recovered more than 14 miles from where they were tagged, suggesting that most "old-timers" did not travel long distances. In some cases the extensive movements of adults may have resulted from courtship and mating behavior rather than dispersal. It was not known whether these adults had dispersed their first year like most sub-adult foxes. In either case it is evident that not all red foxes set up permanent residence during the first year of life and remain there until they die.

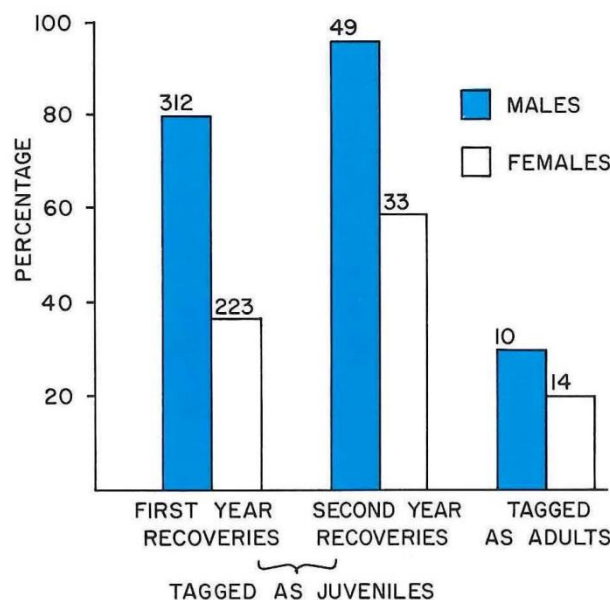


Figure 5. The percentage of red foxes recovered more than 5 miles from the point of release; one group was tagged as juveniles and the other as adults. The number above each bar is the total number of recoveries during October through March.

DISPERSAL DISTANCE

Straight-line distances between points of first and last captures for each ear-tagged fox varied by sex, month of recovery and age at last capture (Table 1). These animals were all marked at natal dens. Twice as many females were recovered less than 10 miles from their natal range and more males traveled distances greater than 10 miles in their first year. The recovery distances for juvenile and sub-adult females ranged from 0.0 miles to 67.0 miles with an average of 6.7 miles. The majority of the longer movements occurred from October through March.

Table 1. Straight-line distances, in miles, between first and last captures of red foxes tagged and released at point of capture and recovered during their first year of life.

Month Recovered	Male			Female		
	Number of Foxes	Distance		Number of Foxes	Distance	
		Average (Miles)	Range (Miles)		Average (Miles)	Range (Miles)
April	2	0.0	0.0- 0.0	5	0.0	0.0- 0.0
May	16	0.5	0.0- 1.9	5	0.1	0.0- 0.3
June	16	0.6	0.0- 1.4	12	0.9	0.0- 2.8
July	11	1.2	0.0- 7.9	8	1.0	0.0- 4.4
August	6	1.9	0.4- 4.5	7	0.8	0.0- 2.1
September	2	0.8	0.4- 1.1	7	1.6	0.0- 5.8
October	21	11.8	0.0- 45.4	11	5.2	0.0-25.4
November	60	19.3	0.0- 98.5	48	5.8	0.0-45.1
December	89	22.1	0.0- 94.1	48	6.5	0.0-49.2
January	102	27.3	0.4-130.6	69	9.2	0.0-54.3
February	25	22.7	0.0- 85.3	28	11.9	0.0-67.0
March		51.5	51.5- 51.5	2	10.8	3.6-17.9
TOTAL	351			250		
AVERAGE		19.4 miles			6.7 miles	
RANGE			0.0-130.6 miles			0.0-67.0 miles

Recoveries of sub-adults from October through March showed fewer foxes taken within 10 miles of their home den. These recoveries did not include young foxes that died or were killed on their natal area as did the April through September recoveries. Of the animals tagged as juveniles and recovered as adults (after 1 year), 96 percent of the males and 58 percent of the females were recovered more than 5 miles from their natal ranges (Figure 5). Nearly 71 percent of the males and 32 percent of the females were recovered beyond 20 miles.

The female fox's tendency to be more of a homebody is still apparent, since 64 percent of the dispersing females were recovered 5 to 35 miles from their birthplace and only males moved farther than 70 miles. The percentage of males recovered decreased as the distance from the natal range increased from 5 to 75 miles, but increased slightly beyond 75 miles.

The maximum straight-line movements recorded for Iowa foxes tagged as juveniles and recovered at various ages were: 76 miles for a sub-adult female, 159 miles for a 5-year-old female; 130 miles for a sub-adult male and 215 miles for a 2-year-old male. The maximum distances for foxes tagged as adults were 36 miles for a male and 104 miles for a vixen, both were recovered within a year after being tagged.

DISPERSAL DIRECTION

The recovery locations of 418 foxes that moved more than 5 miles from the capture point showed that more were recovered north than south of the release sites. This directional tendency was also evident in data reported for foxes

tagged in Michigan¹⁷. The number of foxes recovered north of release points increased as the dispersal distance increased beyond 5 miles; those recovered within 5 miles showed no such directional movements.

The higher proportion of tagged foxes killed north of the release site does not necessarily mean more foxes moved north from natal areas. There may be more hunters and trappers in the northern areas, and because snow is more frequent north of release points in Iowa, fox hunting conditions may be better. The latter view is supported by the yearly variation in recovery data. In January 1971, snow-covered broad areas of both southern and northern Iowa. This presumably provided better fox hunting conditions over a wider area than was experienced from 1967 through 1969. Although recoveries in the winter of 1971 were higher north of the release sites, the ratio of north to south recoveries was 54:46, the lowest recorded during this study. First year recovery data for all years showed 64 percent of the males and 59 percent of the females were recovered north of their natal ranges, versus 36 percent of the males and 41 percent of the females recovered south. Whether or not there is more snow and hunters and trappers north of release sites, I believe there is a tendency for more foxes to move northward.

The history of fox range expansion in the United States shows there has been a tendency for the fox to expand its range northward and westward. In Iowa there was a tendency for this northward expansion. Although speculative, I believe that more foxes travel northward up the natural drainages of the country. Some people conjecture that more foxes like to travel against the prevailing winds. From October through February when peak dispersal occurs, the prevailing winds are from the northwest. Traveling into the wind may give foxes a sense of security as they disperse into unknown territory because their senses of smell and hearing, aided by the prevailing winds, give them some indication of what unknowns lie beyond.

DISPERSAL BARRIERS

There were no reports of ear-tagged foxes fording or swimming the Mississippi River along the Iowa-Illinois-Wisconsin boundary. The river is usually not frozen during October and November, but in some years it is covered with ice and snow by late December or early January. Nevertheless it does appear to be at least a partial barrier to dispersing foxes. Figure 6 shows the percentage of fox dispersing in four directional quadrants. Of the foxes recovered within 10 miles of the Mississippi River in Iowa, only 11 percent were recovered to the northeast of the release site. In north-central Iowa, nearly 30 percent of the foxes moved to the northeast, providing further evidence that the Mississippi River was a barrier to foxes residing nearby.

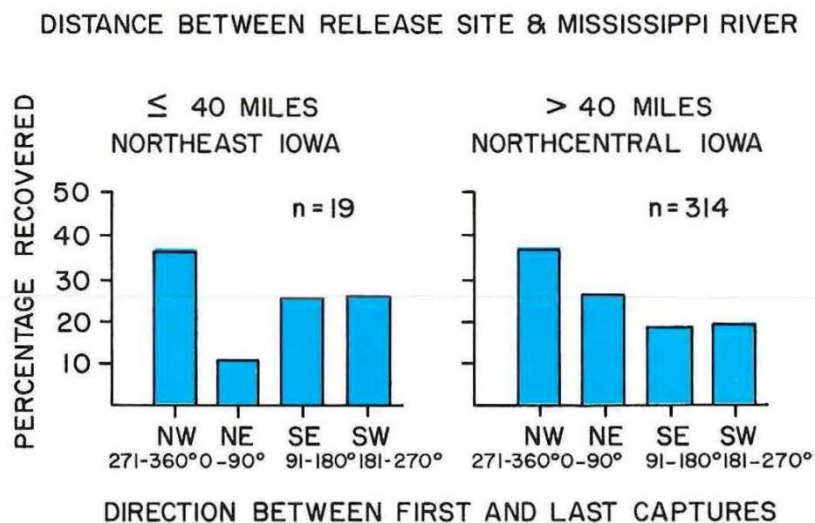


Figure 6. The proportion of foxes recovered in four directional quadrants (NW, NE, SE, and SW) from the point of release indicating the influence of a major river on movements of red foxes. Graph on the left represents data for foxes captured and released in northeast Iowa, less than 40 miles from the Mississippi River. Graph on the right represents data on foxes captured and released in north-central Iowa, more than 40 miles from the Mississippi River.



Jerry Leonard



Jerry Leonard



Radio collared fox.

Chapter 9

Dispersal Route of Individual Radio-Tagged Foxes

Tiny beeper radios placed around Ol' Red's neck provided us with the ultimate method of monitoring the actual paths of foxes during their dispersal. Receiving equipment placed on a vehicle allowed us to trace these movements. Antenna equipped planes were also used to locate animals after the first night of dispersal. Except for occasional brief movements shortly after sunrise, radio-tagged foxes traveled exclusively at night and remained within 1 square mile or less during the day. Telemetry (radio-tagging and monitoring) information indicated that foxes began directional movement in a particular direction within 2.5 hours after sunset. This is similar to the onset of daily movements of resident foxes. Other researchers have found that their movements occur at night, with peak activity around sunset and another less pronounced peak near sunrise. When foxes were dispersing, tracking data indicated that very little rest occurred. In 303 nighttime hours of continuous monitoring of dispersing foxes, 85 percent of that time was spent in actual dispersal and 15 percent was spent at rest. Foxes tended to rest when they confronted major physical barriers such as rivers, lakes, and cities.

DISTANCE AND DIRECTION

Researchers have found that monthly home ranges of resident foxes during September, October, and November are no larger than 6 square miles^{14,17,18,19,20,21}. In contrast, dispersal took foxes well beyond these limits during the first night. The average nightly distance moved by five radio-collared male foxes during 33 nights of dispersal was 9.0 miles, compared to 5.6 miles for three females during 14 nights of dispersal. This supports the tag return information showing longer dispersal distances for males. This dispersal was not an erratic wandering that resulted in gradual shifts into new territory but a directional movement to new country. Dispersing foxes are capable of moving long distances in a few days and the potential for rapid colonization of suitable habitat is much greater than is suggested by the small size of an established fox's home range.

Mobility of the fox-probably is important in scattering genes (blood-line) throughout the population. In other words, foxes that survive the pressures of man and nature in one area have the opportunity to disperse to a new area and breed with foxes that were able to survive the elements there. Their offspring may have the best characteristics of both parents, potentially making them better than either parent. Also, if foxes did not undergo some sort of dispersal, some areas would become overpopulated with foxes and disease and starvation might cause the demise of the fox population.

BARRIERS DURING DISPERSAL

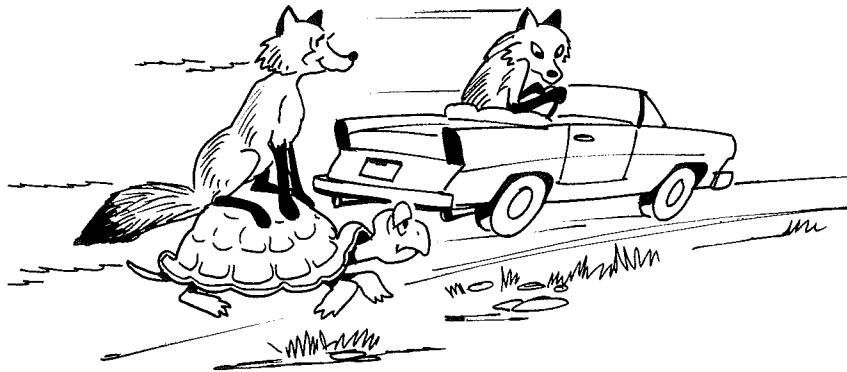
Although the dispersal of foxes was often oriented in one direction, the overall travel routes of some foxes showed marked deviations from a single direction. The irregularities in directional movements were often associated with physical barriers, especially cities and lakes. Creeks and rivers, except for the Mississippi River in northeast Iowa, did not appear to be major deterrents to dispersal, but changes in movements occurred when foxes encountered some rivers. Their travel slowed and became more erratic until they swam the rivers. The size of the water-way and characteristics of the rivers such as the presence of islands or ice, influenced the dispersal patterns.



TRAVEL RATES

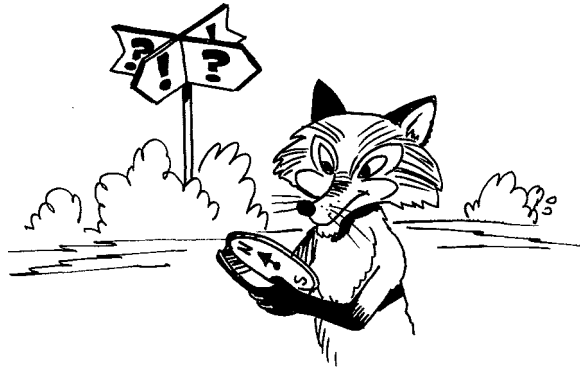
Buck foxes travel at a faster rate than vixens. The average rate for five males was 1.1 mph and for three females was 0.8 mph. Although our radio-tracking was not intensive enough to study habitats and physiographic features along travel routes, it appeared that there was no tendency to select any particular cover to disperse through. Ol' Red apparently felt secure in the darkness of the night in all types of terrain, whether or not cover was present. Travel rates appeared to be the same in open fields, croplands or timbered woodlots. Tracks in the snow and some visual observations of moving foxes indicated that dispersing foxes usually traveled alone.

Some foxes appeared to settle into new territories successfully after dispersing for up to 6 days. Others appeared to settle in for a few days and then move on, establishing a territory after a second period of dispersal.



ORIENTATION

The directed travel during dispersal suggests a well-developed mechanism for orientation in red foxes. This raises questions about what environmental cues are involved, and how Reynard Fox senses them. Salmon, certain amphibians and turtles and waterfowl apparently orient toward areas or at least directions where they had been previously or where others are going. Orientation, based on previous experience, is a considerably different problem from the orientation of dispersing red foxes who travel alone through areas they have never visited.



If dispersing foxes oriented to topographic features, they did so only generally without recognizing specific landmarks because they traveled in unfamiliar terrain. Neither does orientation by celestial cues seem likely because foxes maintained a general course in one direction during 7 nights with overcast skies as well as during 24 nights with clear skies. The only time they veered from their chosen course was when they encountered physical barriers such as lakes or towns, or when they were about to settle in new territory. Explanations on how foxes orient themselves are inadequate at this time and there is opportunity for further research.



INDIVIDUAL TRAVEL RATES

Of the 23 foxes radio-collared in Iowa, four were closely monitored and their dispersal routes mapped. A brief discussion on each of these four follows:

Fox #1, Ol' Three Legs

The first fox monitored was a juvenile male captured and radio collared in Hancock County on September 30. At the time of capture this animal had one non-functional hind leg (this animal was dubbed Ol' Three Legs). Although the leg was present it hung loose at the hip joint and a small portion of the tail was also broken off. We speculated that the injury may have been caused by being hit by a vehicle. The animal was located daily until October 12, when it could not be found with the mobile receiving equipment. Figure 7 shows the complete travel route of Ol' Three Legs.

On October 12, an aerial search pinpointed this fox about 5 miles northwest of his natal area. That night my constant vigil with him began. He continued north-northwest until he came to the town of Crystal Lake. After spending

considerable time at the south edge of the lake, he veered around the west side and settled northwest of Crystal Lake. Ol' Three Legs had moved about 9 miles that evening.

He continued northerly to a point about 2 miles northwest of Thompson, Iowa, where he spent half of one night and the next day within the same section (1 square mile) of land. Although I speculated he might be going to settle in that area, I decided to monitor him one more night to be sure. He did not settle but continued northerly to a point about 3 miles north of the Iowa-Minnesota border. A return trip to that point on the fourth night indicated he was still traveling northward and continued to about 3 miles north of Bricelyn, Minnesota. Then he began to swing back southeasterly.

On the fifth night, Ol' Three Legs continued moving south in what appeared to be a homeward direction and he settled near the same section he had been in 2 days previously, northwest of Thompson, Iowa. It was interesting to note that his movements hastened considerably as he neared this familiar section of ground. For the next 12 weeks Ol' Three Legs remained in this section. The total distance tracked and mapped for this fox was 57 miles. On three separate occasions, the animal was visually checked to observe the condition of its hind leg which continued to swing loosely at the hip.

The radio collar did not allow Ol' Three Legs the opportunity for any secret hiding places. On two separate occasions, the signal from his radio traced his hiding place to a road culvert under Highway 9. On December 27 the saga of Ol' Three Legs ended when he was shot 4 miles west of what had been his home base for the previous 12 weeks. Although purely speculation, the reason he was shot 4 miles away from where he appeared to settle was probably because of hunter pursuit.

Fox #2, Fertile to Rudd, Iowa

The second fox radio-tracked was an adult male radioed near Fertile, Iowa, on September 9. This was the only adult male monitored during this study; his travel path is shown in Figure 8. The animal apparently began dispersing on October 14 but he was not located until October 16. He was located about 10 miles southeast of his natal range near the northwest edge of Mason City. The next night the fox appeared to be frustrated with the barrier created by the town of Mason City. Finally it moved 4 miles northeast to near Highway 65. After crossing Highway 65 the fox moved easterly for the next 2 nights; and southward on the fifth night where it appeared to settle in. Like Ol' Three Legs, this animal also made a large balloon shaped loop before settling. This fox was followed about 54 miles on its travels. Contact with this fox was lost during the next two days. On January 16, the animal was shot 5 miles southeast of Rudd, Iowa approximately 9 miles from where it settled in. It is interesting to speculate that if Mason City was not in its path, would it have continued southeast and ended up near where it was shot? There seemed to be a tendency for animals encountering barriers to eventually make their way around them. Once around the barrier, animals would resume their original course.

Fox #3, The Short Distance Mover

Fox #3 was a juvenile female radioed on September 12. Six months earlier this animal was captured at a den site less than a quarter mile from where caught and radioed. This fox began dispersing on October 18 and moved 12 miles northward when for some unknown reason I lost contact with it on October 20. On February 10 this animal was shot 5 miles north of the original capture site indicating the fox had either made a loop or backtracked on the original route it had taken when dispersing. Because of the short distance moved and the limited radio contact with this animal during dispersal, I did not draft an individual figure showing the route. I speculate that the radio or battery malfunctioned.

Fox #4, The Slow Moving Female

Fox #4 was a juvenile female and littermate to Fox #3. Her route is shown on Figure 9. She was captured and radio-collared north of Clear Lake in Cerro Gordo County on September 12. On October 21 this animal began dispersing and moved 6 miles westward parallel to Highway 18. She remained at that point until October 24 when she began a very slow, almost laborious, movement towards Forest City. Thwarted by the town of Forest City, this fox moved very slowly back southward to the area in which it had spent considerable time in 8 days previously. The animal apparently had an aversion to highways since only once did she cross the heavily traveled Highways 18 and 69. Ironically, this fox was hit by a car on a gravel road 11 days after she appeared to settle.

Fox #5, Thwarted by Barriers

Fox #5 was a juvenile male ear-tagged on May 14 and recaptured and radioed September 11. The radio collar quit working but he was recaptured and re-radioed October 13. Figure 10 shows the travel route of this animal. On November 2 the animal was found 6 miles south of the release point. It remained in this area for 1.5 days and then moved eastward to the Mason City residential area. After some confusion, the animal returned westward on the same route to the area it had been the night before. On November 5 the animal moved westward paralleling Clear Lake. He continued into McIntosh State Park and spent considerable time in the area of the sandbar, which is the narrowest portion of Clear Lake. I had the impression this animal was considering swimming the lake. If so, it apparently had second thoughts, since it veered back northwestward and finally turned south around Ventura Marsh, moving another 15 miles southward before contact was lost. Nearly 90 miles of this animal's travels were placed on a map.

Besides these five animals, partial movement data was gathered on 4 other foxes. All travel routes showed certain similarities. All animals, dispersed at night. They maintained one general direction, moving around obstacles and then continuing in the same general direction. Twelve miles was the longest single-night movement. Looping patterns appear to be a big part of the fox travel. Three miles per hour was the highest dispersal speed of foxes that were closely monitored. The routes of the females tended to be a considerably more aimless and wandering type movement and they dispersed at a much slower rate. Figure 11 shows the relationship of the travel patterns of all five foxes that were closely monitored. It is interesting to note that 10 of the foxes radioed in September were trapped and radioed within a stone's throw of their original capture site. This supports the ear-tagging information and the fact most foxes remain within a relatively small area until dispersal begins in October.

Of the 23 foxes radioed, only 5 (4 females and 1 male) were not accounted for. The remaining 18 were recovered in the same fall and winter they were radioed. Three were hit by automobiles, two were trapped, four were found dead from unknown reasons, eight were shot by hunters and one met an inglorious death when it came in contact with a high voltage electric fence.

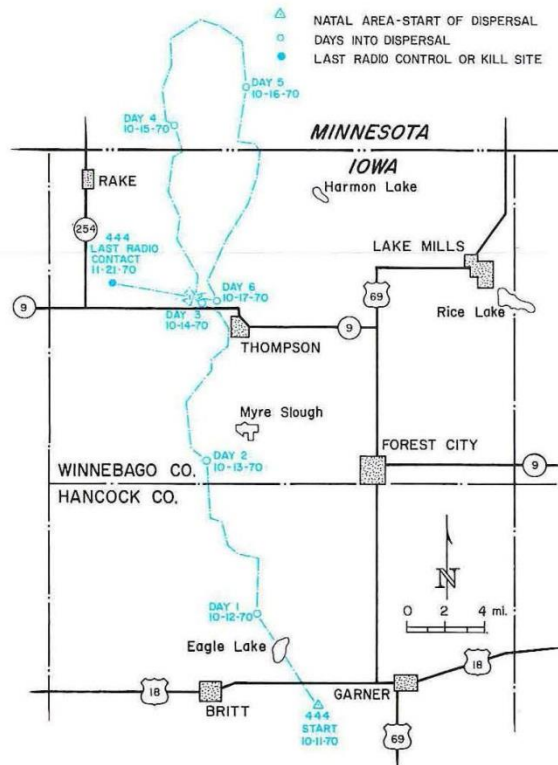


Figure 7. Dispersal path of Fox #1, Ol' Three Legs, juvenile male.

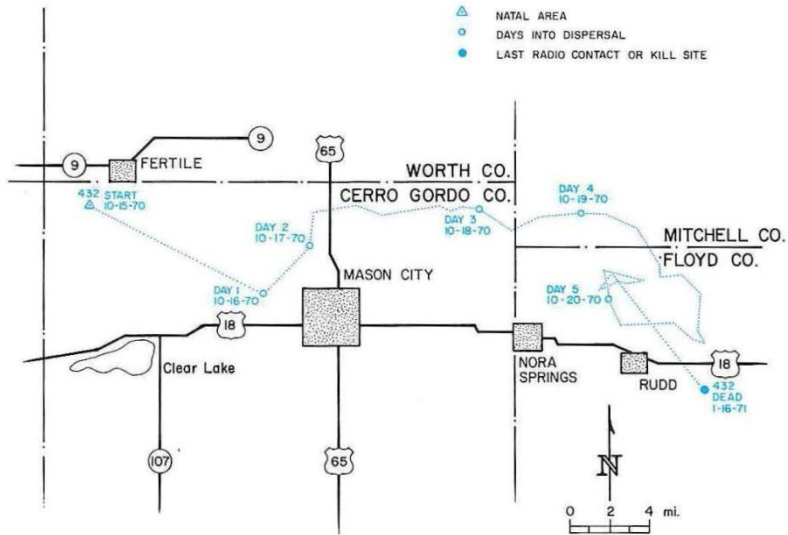


Figure 8. Dispersal path of Fox #2, Fertile to Rudd, adult male.

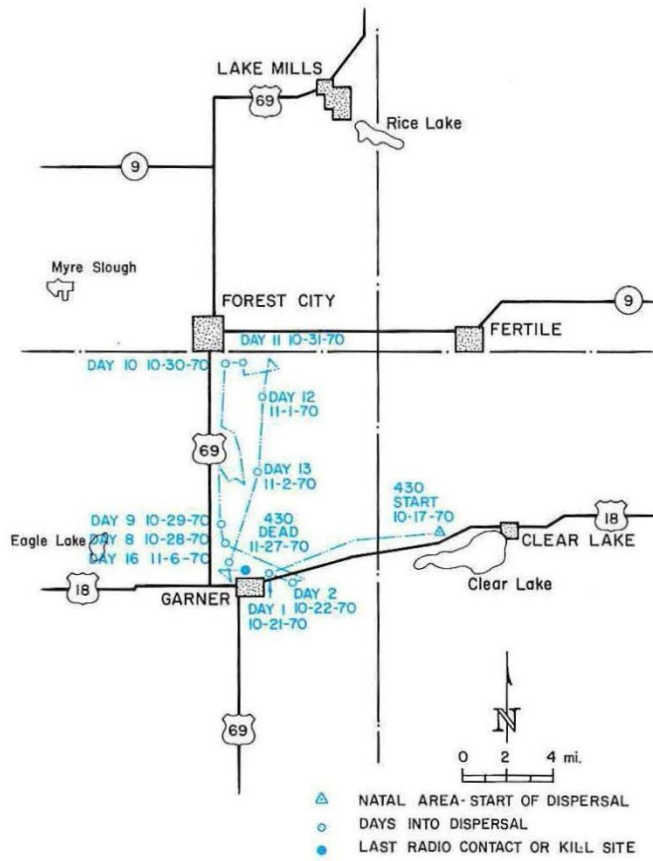


Figure 9. Dispersal path of Fox #4, The Slow Moving Female, juvenile female.

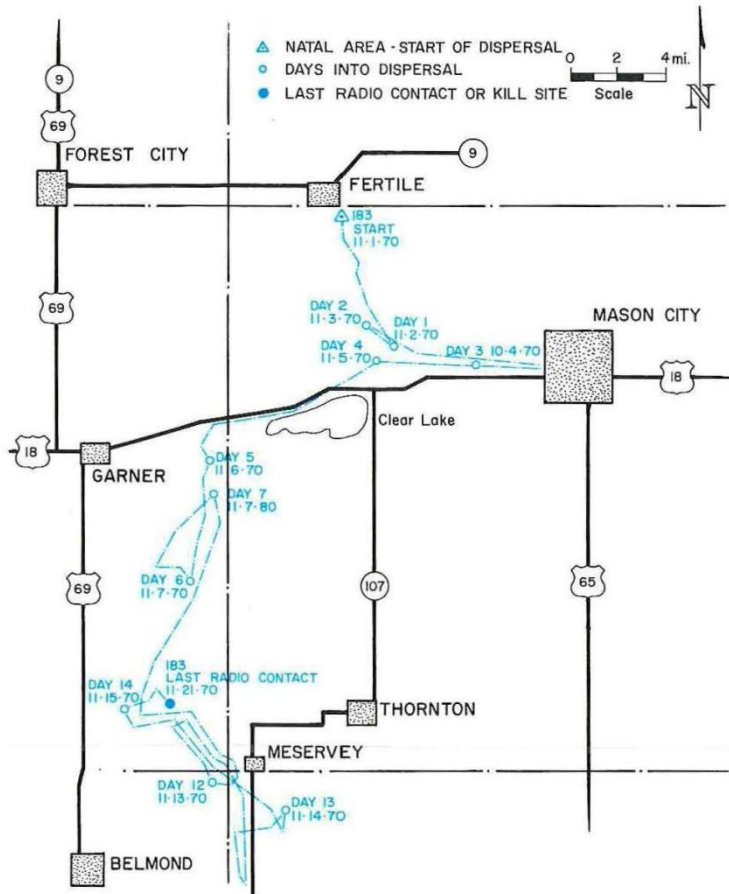


Figure 10. Dispersal path of Fox #5, Thwarted by Barriers, juvenile male.

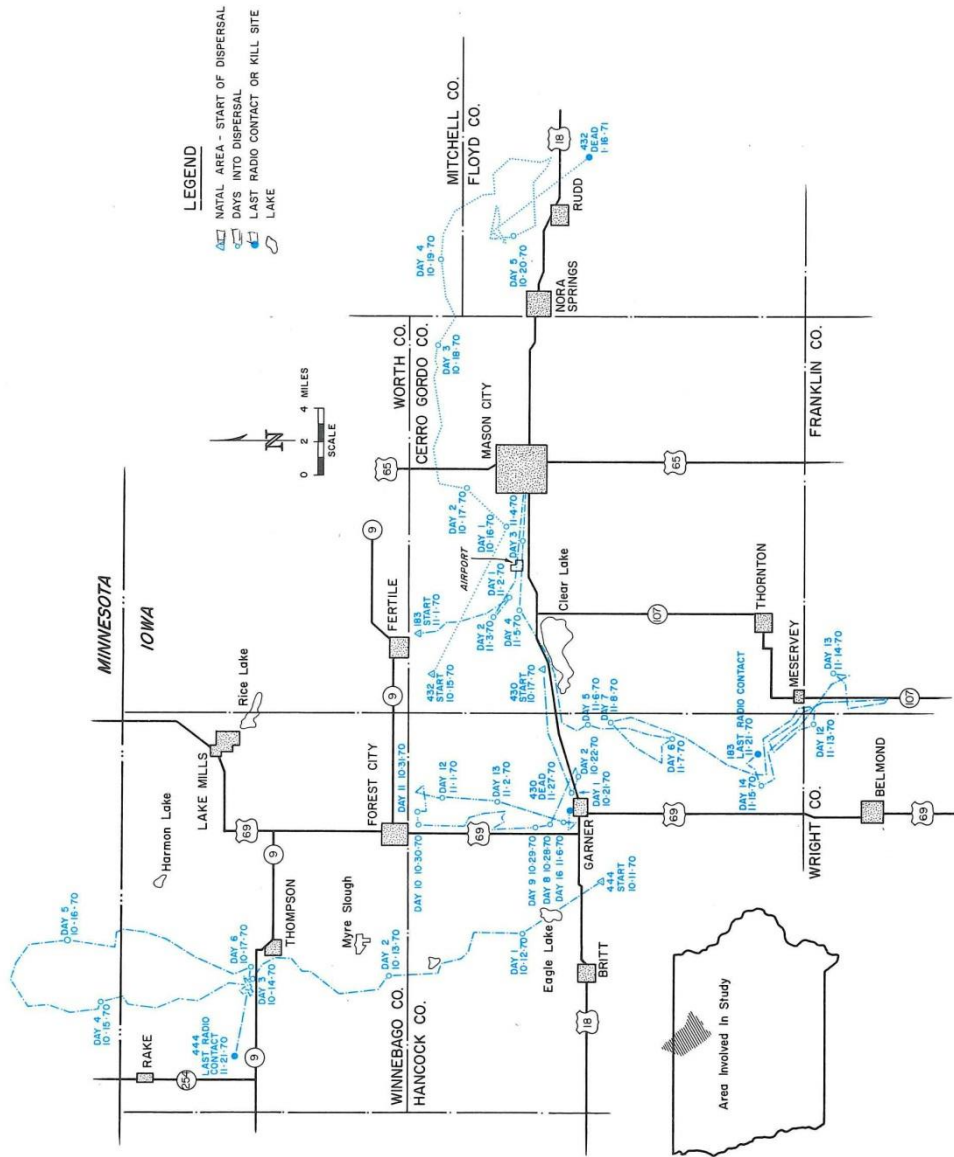
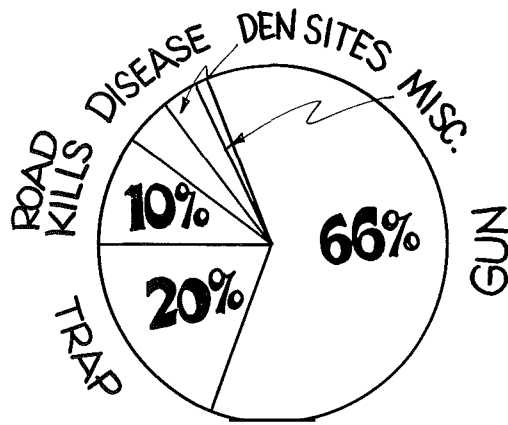


Figure 11. A map showing movements of all 5 radio-tracked foxes in north-central Iowa.



Chapter 10 Mortality Factors

Reynard’s life is not all a bed of roses. During his many travels and while raising a family, he often faces death. Table 2 and Figure 12 show the cause of death for 610 tagged foxes recovered during this study. Eighty-three percent of the reported mortality occurred from October through February when most foxes are hunted and trapped. The three most frequent causes of mortality to tagged foxes were shooting, trapping, and being struck by vehicles.

Table 2. Cause of death for red foxes recovered during this study.

Age	Juvenile and Sub-adult		Adult ⁴		Age Unknown ⁵		Total
No. Tagged	1335		56		0		1391
Sex	M	F	M	F	M	F	
Shot by Hunters	166	113	41	27	3	7	357
Trap	58	41	7	8	3	3	120
Road Kill	34	27	2	2	--	2	67
Dead at Den ¹	3	5	--	--	--	1	9
Killed at Den ²	14	9	--	--	--	--	23
Farm Machines	--	2	--	--	--	--	2
Killed at Farm Bldgs	2	3	--	--	--	1	6
Electrocuted	1	--	--	--	--	--	1
Dog	1	--	--	--	--	--	1
Unk ³	6	7	1	1	--	--	15
Fur Dealer Report	4	2	3	--	--	--	9
Total	289	209	54	38	6	14	610

¹Found at den but cause of death not known.

²Killed by man at den (nonhunted).

³Reported killed but method of kill not reported.

⁴Foxes initially tagged as juveniles and sub-adults that survived at least one year were classified as adults when death occurred.

⁵All foxes initially tagged were classified by age. Unknown age categories occurred when tags were reported or found after being lost for two or more years.

Most tagged foxes were reportedly shot during December and January when foxes are hunted for fur and recreation. A few were shot during October and November before fox hunting normally occurs. These were taken incidentally during hunting of other species, primarily pheasants. Foxes were trapped from October through January and virtually all of the recoveries by trappers were reported then. Hunting and trapping of foxes accounted for 76 and 14 percent, respectively, of the total adult mortality and 56 and 22 percent of the juvenile and sub-adult mortality. More males than females

were shot but more females than males were trapped. The difference was true for adults and juveniles but neither was statistically significant.

Only four (0.7%) tagged adults were killed by motor vehicles versus 61 (10%) juvenile and sub-adults (34 males and 27 females). Each year, mortality of young foxes on roadways began in June when pups were about 3 months old and began crossing roads. Roadkills increased during summer as juveniles extended their range. A study in Wisconsin found that the average home range increased 10 times between June and early September (slightly over 100 acres to over 1,000 acres)²⁰.

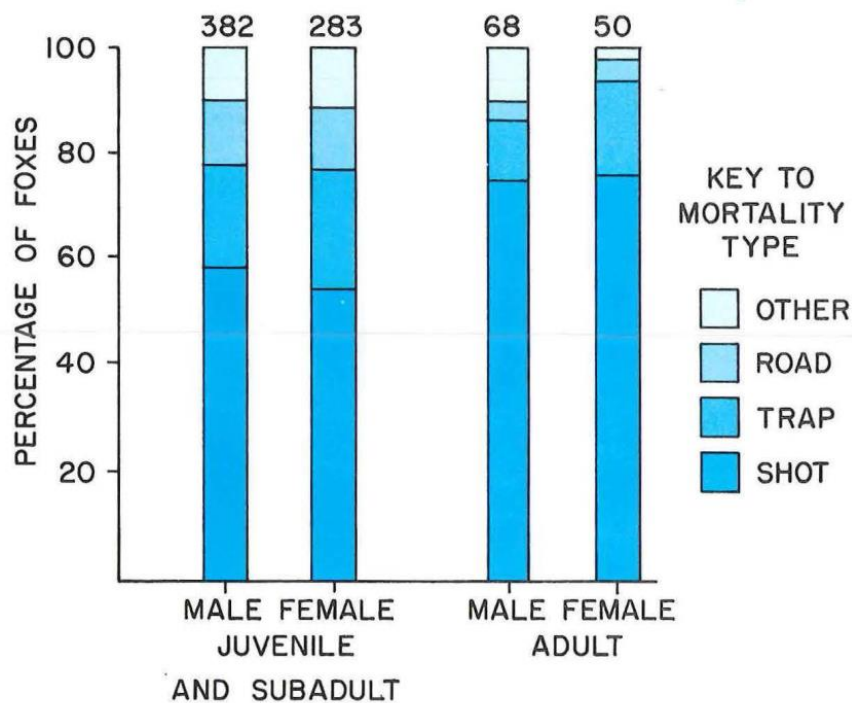
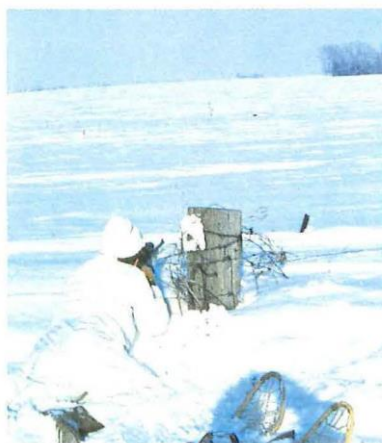


Figure 12. The proportion of 4 types of mortality associated with ear-tagged foxes recovered as either juveniles and sub-adults or adults. The number above each bar represents the number of foxes recovered in each category.

The overall proportion of roadkills (11 percent) probably is an underestimate. Undoubtedly some road-killed foxes were not picked up or reported because summer fox fur is of no commercial value. Also, some foxes hit by cars may have landed in ditches out-of-view.



The proportion killed by shooting increased with recovery distance. Of the foxes recovered within 5 miles of their natal ranges, 48 percent were shot. This percentage increased for longer recovery distances with a peak of 87 percent recovered by shooting in the 50- and 65-mile category. In contrast, the proportion of foxes trapped showed no particular relation to recovery distance. The ratio of hunter:trapper kills was about the same for foxes killed as residents or as

dispersers. Mortality on roadways was more prevalent in the resident group, although a few travelers “met their Waterloo” as the result of highway mortality.

The proportion of resident foxes shot, trapped or killed by cars was about the same (50 percent) regardless of whether they were recovered north or south of where released. This percentage was not true for dispersing foxes, over 59 percent of them recovered by shooting, trapping or roadkills were taken north of where released. The reasons are not clear, but they may reflect more hunting and trapping pressure in northern regions, better snow conditions for hunting further north, or the apparent tendency for more foxes to move north.

MORTALITY OTHER THAN HUNTING, TRAPPING AND ROADKILLS

Only 2.8 percent of the tagged juvenile foxes were reported killed at dens, and all of them were killed by man. This is a conservative estimate of the actual kill at dens for at least two reasons. First, it was obvious from local residents that indiscriminate killing of young fox pups is probably not reported because conservation agencies frown on this practice. Secondly, farmers reported that entire litters (not tagged) were killed by shooting or by intentionally spraying ammonia into dens during the spring when ammonia is applied to croplands.

Since the conclusion of our field tagging in 1970, we believe that the indiscriminate killing of fox pups has become less common. Landowners are actually becoming more protective and sometimes even possessive of fox litters found on their property.

The proportion of foxes reportedly killed by farm machines or in farmyards was small, but this kind of mortality probably was also higher than indicated by our data. Pups bedding above ground in alfalfa fields were occasionally killed by mowers and hay crimpers.

Mortality from parasites and disease was difficult to detect and only one death was assigned to this cause (Chapter 12).

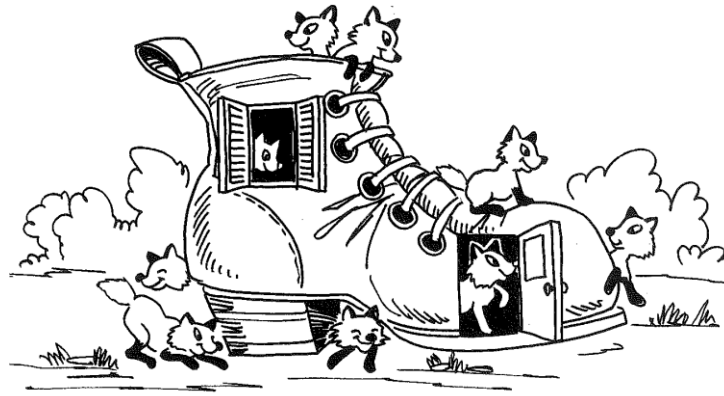
RESIDENT VERSUS TRANSIENT MORTALITY

Much speculation has centered on the possibility of differential mortality between resident and transient (dispersing) mammals. Many biologists believe that transient animals encounter a higher mortality rate than residents in species such as deer, mice and muskrats. As mentioned earlier, pups increased their mini-territory in June, July and August and this was when recoveries from roadkills were the highest. As pups explored new territory, they apparently became more vulnerable to cars.

Surprisingly, our tag return data indicated that dispersing foxes were not more vulnerable to mortality factors than residents. Our data suggests that foxes are most vulnerable right after they settle into new territories. At this time Ol' Red is busy searching and exploring his new, unfamiliar environment.

LITTER SIZE AND MORTALITY

Our data indicated that larger litters (six or more pups) tended to have recovery rates below the overall 37 percent average. Individuals from larger litters were possibly less vulnerable to hunting and trapping; however, we believe that higher summer mortality in large litters is a more likely explanation. Larger litters are more conspicuous and require more food. Adults make more feeding trips to the den leaving more sign. Many of these litters could have been destroyed by man and not reported. Increased energy demands on the adults and competition among the pups would perhaps result in lower survival. Higher pup mortality in large litters during the summer could result in fewer of these pups being taken by hunters and trappers.





Chapter 11 How Old do Foxes Get?

The recovery data for 1,335 tagged foxes is shown in Table 3. Altogether, 45 percent of the Iowa foxes tagged as juveniles and 34 percent of those tagged as adults were recovered. Of those tagged as juveniles, 97 percent were recovered during their first or second year, with only 3 percent recovered 3 to 6 years after tagging. From this we see, it is only the lucky fox that survives longer than 2 years. Only 1 of 62 foxes tagged as adults was recaptured 5 years after marking; a female at least 6 years old. This vixen, plus a male marked as a juvenile in 1966, were the only two foxes known to survive 6 years. All other adults were recovered within 2 years after marking. A very few foxes in captivity have been known to live over 15 years.

Table 3. Recovery data for red foxes tagged as juveniles in Iowa.

Year Tagged	Number Tagged	Recoveries ¹						Number	Total Percent
		Age of Recovery							
		1	2	3	4	5	6		
1966	84	45	5	2	--	--	1	53	63
1967	241	53	44	3	1	1	--	102	42
1968	365	145	22	5	1	--	--	173	47
1969	252	91	10	3	--	--	--	104	41
1970	393	153	10	--	--	--	--	163	42
TOTALS	1,335	487	91	13	2	1	1	595	45

¹The number of recoveries through March 20, 1972.

Just as the old timers say, our tag returns indicated that juvenile foxes are more vulnerable than adult foxes. A fox that survives its first year is an experienced animal and thus better able to cope with its environment. However, the complete turnover rate of the fox population is so high that few foxes live beyond three years of age. Also, as one would suspect, foxes that inhabit more hilly and wooded environments survive at a higher rate than those in the intensively cultivated areas where presumably they are more vulnerable to man.

Vulnerability to humans might be especially important during the period of intensive farm work when 2- and 3-month-old juveniles are commonly seen near dens. During this period they may be shot, gassed with ammonia or the dens may be disturbed by farm machines. The number of juveniles killed directly by farm equipment is low, but foxes tend to move to new sites when their dens are disturbed and moving could increase the exposure of both juveniles and adults to man. In some cases, new dens, such as road culverts, might be less favorable and perhaps more vulnerable sites.

Hunting pressure on foxes is also greater during winter in the intensively farmed areas where they are more conspicuous in open fields. Mortality due to hunting and trapping is influenced by snow conditions and fluctuates markedly from year to year.



Mangy fox.

Chapter 12 Fox Diseases and Parasites

Ol' Red, like most other wildlife species, encounters a variety of maladies, diseases and parasites. The number one disease problem of the fox is mange. This is an intense itching of the skin caused by a mite. Mange often results in loss of fur and causes other external and internal physiological stresses. Foxes infested with mange in advanced stages appear partly naked with very little fur on the tail and legs. A closer look would also indicate that the legs, head and ears generally are covered with flakes of skin and occasionally the eyes are swollen and matted nearly shut. Foxes heavily infested with mange generally die from the internal physiological stress created by the disease and from exposure to the weather because of loss of fur. This disease thrives when fox populations are high and thus it is often referred to as a density dependent disease. Foxes in mangy condition are "sad looking" creatures when compared to healthy fellow foxes.

Mange resulted in a reduction of the fox population in southern Iowa in the early and mid-1950's. The continued persistence of this disease is one of the factors that still suppresses the fox population in the southern part of the state. The northeast Iowa fox population had been increasing since the early 1960's. The rolling topography and timber habitat provided foxes with ample escape cover making them less vulnerable to hunting pressure. This factor plus the two relative open winters of 1966-67 and 1967-68 allowed fox numbers to increase substantially. As mentioned earlier, mange conditions occur when fox densities are high. During this study, mange was increasing and became prevalent in northeast Iowa from 1968 thru 1970 when fox densities in that corner of the state were at a recent all-time high. Many people reported seeing scroungy looking foxes near farmsteads and other unusual places. Hunters, trappers and fur buyers found more mangy foxes than usual.



Mangy pup.

In 1968 fox prices began to increase and snow conditions provided hunters with good conditions to hunt foxes. Pressure was high and record numbers of foxes were taken. Many people believed that the resulting decline in fox numbers occurred because of high hunting mortality when actually a major portion of the decline resulted from the increasing mange problems of previous years. In fact, the increased hunting pressure and thus the higher fox harvest was

probably beneficial in slowing the spread of this high fox density- dependent disease.

EAR-TAGGING DATA FROM MANGY FOX

Twenty ear-tagged foxes had mange when recovered by hunters or trappers although none of them appeared infested when marked. Of these 20 mangy juvenile foxes, only 4 (20%) were recovered more than 5 miles from their natal range. This compares to 45 percent of the "normal" juvenile foxes which were recovered more than 5 miles from their natal range, suggesting that foxes with mange were less likely to disperse.

Interestingly, four mangy fox pups were captured on April 26, 1968, at the same den site. Three of these were recovered. The animal with the heaviest infestation at capture was killed 49 miles from the capture site on December 27, 1968; a second animal was shot January 12, 1970, 76 miles away and the third was shot January 18, 1971, 47 miles away. The hunters reported that all the pelts were in good condition. The fact that these animals survived at least 8 months and dispersed at least 45 miles shows that some foxes recover from mange. However, overall information indicates that a high incidence of mange can have a detrimental effect on Ol' Red's population.

DISTEMPER

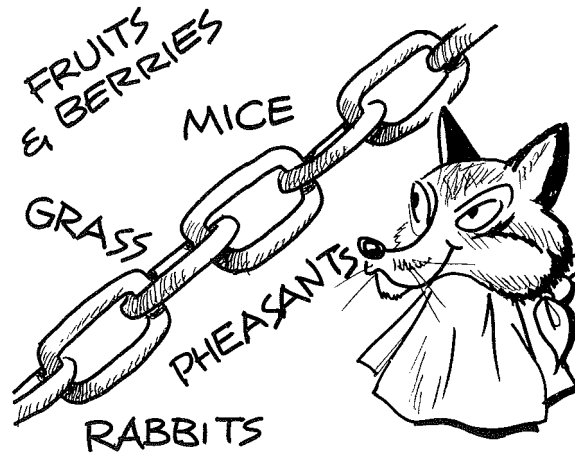
Distemper is the next major disease affecting Iowa foxes. This disease is a virus and the symptoms include high fever, matted eyes, clogged lungs and labored respiration. Distemper symptoms are sometimes variable and some animals show little or no outward signs of the disease. The disease is prevalent in dogs and cats and can be contacted readily from interactions with these animals and other wildlife or by being in the area where these animals have been. Mortality can be high; however, more research needs to be done to determine the impact of this disease.

RABIES AND PSUEDORABIES

Rabies has never been a major mortality problem among Iowa foxes. During the last 10 years, one to three rabies-positive foxes were reported annually by the Iowa State Department of Health. The striped-skunk is the major wildlife species that carries rabies in Iowa. Rabies is, however, frequently reported in foxes in the eastern United States and Canada. A relatively new disease known as pseudorabies or false-rabies likely occurs in foxes. The symptoms are similar to rabies except it doesn't affect humans hence that is how it received the name pseudorabies. Little is known about the extent or ramifications of this disease on wildlife populations; however, dogs and cats are very susceptible to this disease and in most instances it is fatal to these domestic species.

PARASITES

A variety of internal and external parasites utilize the fox as a host. Tapeworms, hookworms, round worms, heartworms and lung flukes occur in foxes in different degrees. Fleas and ticks are also present. This study did not investigate the status of these creatures within the fox population.



Chapter 13 The Fox and Other Wildlife

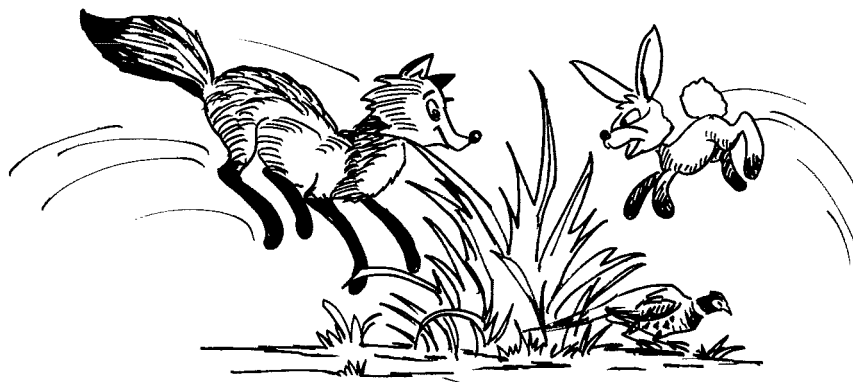
In nature's scheme there are relationships that we call food chains. One animal feeds upon another and that animal on another and so on up to the top of the food chain, which in many cases is man. The fox is at the top of a lot of food chains in Iowa.

Ol' Red's association with other wildlife species is primarily that of using them as food items. Mice and other rodents provide the largest meat base for foxes to feed upon. Rabbits rank second and a variety of birds, including ring-necked pheasants rank third. Most of the common food items of foxes was described in Chapter 7. The big question that remains is *-is the fox having an impact on other wildlife populations when utilizing them as food?*

As far as the mice, rabbits and other rodents are concerned, the answer is no. These animals have such a high reproductive potential that the fox has no detrimental impact on the population. It is beneficial that Ol' Red consumes a good portion of these critters because they soon would become a nuisance and overpopulated, leading to either disease or starvation problems.

When habitat is adequate, the fox has little impact on pheasant numbers. As habitat deterioration occurs and cover becomes more limited, Ol' Red can indeed have some impact on waterfowl, pheasants and other upland game. Upland game species and the fox congregate in the remaining limited cover, and in most cases, Ol' Red comes out the victor. In one instance in North Dakota, researchers found that a vixen fox, her mate and her family consumed over half of the breeding mallard hens on a National Wildlife Refuge.

Between land-use changes and intense agricultural practices, many wildlife species are declining in number. As predators and prey congregate in the remaining available habitat, increased predation on individual animals as well as increasing nest destruction, may reduce the prey population. The result could be fewer pheasants, ducks and rabbits for sportsmen to pursue.



IS THE FOX REALLY TOP DOG?

Many people believe the coyote can and occasionally does kill a fox, perhaps utilizing the kill for food. We did not study foxes in prime coyote range, but it would seem likely that coyotes could out compete foxes for food and living space. A snowmobiler in southern Iowa recently recovered a dead tagged fox and the only marks on the animal were teeth marks on the neck. Several southern Iowa sportsmen also tell stories of seeing red foxes being pursued by coyotes. While a few foxes are probably killed by coyotes we believe the majority of the fox population reduction is one of competition and not direct killing.

Coyote numbers began to increase in southern Iowa after the fox population crash in the 1950's; by the mid-1960's the coyote population was increasing by leaps and bounds. The red fox population has remained low in southern Iowa for two speculated reasons -the persistence of mange and competition from the coyote for food and space.



Chapter 14 The Fox and the Farmer

The image of Reynard Fox, in the eyes of the farmer, has been very changeable since the 1940's. Different types of farmers sketch different pictures when it comes to depicting the good and bad features of Ol' Red. Beef cattle raisers, dairy producers, truck farmers and grain farmers maintain a fairly "non-com" attitude towards Mr. Fox, since he is not competitive with their business enterprises. For poultry farmers, the fox can and has been a thorn in their side. In the 1940's and 1950's most farmers raised a few chickens, and foxes feeding families, found chickens to be easy "pickings". After all, chickens can't fly like pheasants and are not as alert. The same was true for young turkeys. Farming styles have changed, however, and fewer people raise chickens and turkeys. Those that do have fairly elaborate confinement set-ups so their poultry are not as readily available to foxes as they used to be.



Given the opportunity, foxes have been known to kill suckling pigs and new born lambs but this occurs only rarely. Like chickens, new born lambs and suckling pigs do not have the speed, agility and alertness of squirrels and rabbits. The fox is not malicious but rather it is only natural for him to take what comes easiest. Changing livestock husbandry practices as well as a gradual shift from livestock production to grain production has greatly improved the modern day image of Ol' Red. Admittedly though, there are still a few old timers who believe the only good fox is a dead one.

As fox pelt prices increased in the 1970's, farmers became more protective of the fox. Many of them became interested in pursuing Ol' Red for his sporting as well as economic value. These changing attitudes have aided greatly the change in status from vermin to game animal that the red fox has recently acquired.

Despite farmers' more protective attitude toward Ol' Red, they still seem to deny him a suitable place to live in the highly agriculturalized portion of Iowa. As sloughs and marshes are drained, additional cover is removed from the landscape and more row cropping occurs. It is more and more difficult for foxes to find adequate denning sites. Foxes being pursued by man no longer find the abundance of sloughs and weed patches they once used for escape. Extensive land tillage has destroyed the rodent food crop the fox once found in the pasture meadows and sloughs. It was once thought that intensive row crop farming effected only upland game birds such as pheasants, but it is obvious that all wild

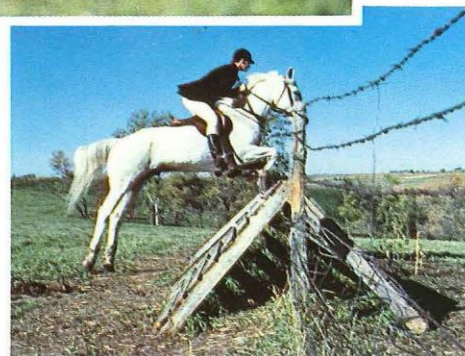
creatures are being stressed by the pressures of intensive agriculture.



Harvey Fagenbaum



Warren Taylor, Des Moines Register



Warren Taylor, Des Moines Register

Chapter 15

The Fox and the Sportsman

HUNTING

With the possible exception of the coyote, commonly referred to as a wolf, the fox has provided more hours of predator and sport punting than any other predator in the U.S. Many people think of hunting today as the kind that involves carrying a gun or it isn't hunting. As indicated in the fox mortality chapter, the gun hunter does indeed account for the biggest proportion of fox mortality in Iowa but fox hunting takes on many forms and modes.

The earliest type of fox pursuit was a tradition brought across the Atlantic from England by the pilgrims. This involved releasing a pack of hounds to locate and chase Ol' Red while riders on horseback pursue the hounds and fox. It is one merry chase and the most important part of the hunt is that no person ever kills a fox. Only the hounds are permitted to do this. There are one or two hunting clubs that continue this type of fox hunting in Iowa. In most cases, hunters dress up in fancy look alike hats and duds and pursue Ol' Red dressed as if they were heading to a church meeting. People indulging in this type of hunting explain the appeal of this age-old sport as follows: "The chase is the most thrilling part, of course. But it also is the pleasure of being outdoors, brisk rides in the fall air, and doing something physical. It's the communication between rider and horse; the challenge of improving riding skills jumping fences, crossing streams and maneuvering through the brush. It's also the camaraderie -the good feeling between hunters in the group that provides pleasure." Part of the beauty of this type of fox hunting is the tradition. It is easy for these types of hunters to daydream back 200 years when this sport first occurred in North America.

In southern Iowa a version of this type of hunt continues. This is where hunters release their dogs and pursue them on foot, listening to the sweet music of the barking dogs in hot pursuit of Ol' Red. The use of horses is almost prohibited because of the frequency of fences. Occasionally, jumping mules are used to clear these fences, but they are not used as frequently for fox hunting as for raccoon hunting.

Another kind of non-killing fox hunting is often called "jug hunting". The foxes are neither shot nor otherwise killed. The

hunting is done at night and the dogs and the fox put on the show. The men sit around a fire with a jug and listen to the race, and the warmth of the companionship makes the sport. To these men the fox is the second most noble creature that breathes air. This type of hunting continues today but on a small scale.



Fox hunting with guns, dogs, and people has many variations, all of which offer quantities of sport, and each has different forms of excitement. Fox hunting dogs come in two varieties -cold trail hounds and "sight" dogs. Most dog hunters use cold trail hounds. There are a few hunters who utilize greyhounds. Once the fox is spotted the greyhounds begin the chase utilizing their keen sight rather than sense of smell like their cousins, the trail hounds. Greyhounds generally capture the fox because of their swift agility, whereas trail hounds pursue Ol' Red in a manner that the hunter will likely have an opportunity to bag him with a gun.

Fox hunting with guns and dogs brings the thrill of the chase, and the excitement builds as the dogs approach, driving the fox before them. The long chase, which travels over hills, along ridges and across fields, is more a part of the sport than the actual kill. Maneuvering for position, the attempts to anticipate the fox's route, and the sense of accomplishment at the end of the hunt are rich rewards. This type of hunting has been practiced primarily in southern Iowa, and, with lower fox populations, the sport has declined considerably since 1960. In the 1940's and early 1950's when foxes became more abundant, a new type of houndless gang hunt evolved. A shotgun was the primary weapon involved and hunters claimed their objective was to get rid of those "*!#!*!@φΩΨ!#!*" foxes because they were raiding too many chicken houses and eating too many pheasants, rabbits and other game. Again, the companionship of the hunt was an important aspect. The principle of gang or circle hunting was simple, but the practice required some leadership and coordination. A block of land was encircled and the hunters moved toward the center hoping to drive foxes out into view of other hunters. A great many hours of recreation were afforded those hunters and many participants saw foxes. Contrary to popular belief, foxes were not wiped out since a few foxes usually "outfoxed" the hunters and escaped.

Unfortunately, with the popularity of the CB radio and 4-wheeled drive vehicles, mechanized sportsmen are abusing the sport and pursuing the fox with a relentless attitude, damaging the image of the legitimate sport hunter.



P. L. Parsons, L. L. Bean, Inc.

A common form of hunting in northern Iowa involves one or two hunters and adequate snow cover. Hunters drive the roads viewing the leeward side of hills looking for a sleeping fox. Once sighted, plans are made and the hunters, dressed in white coveralls and armed with high-power rifles, begin stalking this animal. Once positioned the hunter takes aim and attempts to either shoot the fox or scare it to provide a running target. Many times the animal escapes, but the excitement and stories remain long afterwards.

A form of fox hunting which really tests your ability and skill as an outdoorsman is to go out on your own after a fresh snowfall and track down a fox. This method of hunting is the ultimate in quality and sportsmanship and you will not have to worry about over-shooting. This type of fox hunting will teach you the most about foxes and other wildlife. One thing it may teach you is 1,001 things that will keep you from bagging the fox. Reading the sign left by the fox and observing other wildlife can be the most rewarding aspect of this type of hunting.



Jerry Leonard

Another form of this one-on-one hunting involves trying to coax a fox into gun range by using a mouth call that imitates the sound of a dying cottontail or jack rabbit. This sound supposedly attracts any hungry fox that might be in the area, and, if the hunter is properly concealed, the fox might come close enough to be bagged. Calling in the early morning or late afternoon hours will provide the best opportunity to attract a fox. Calling under a full moon during fresh sparkling snow cover can be very rewarding and refreshing. Interesting things often happen. The fox may approach from behind or in a direction you are not watching, and, about the time you give up on the fox, he shows up unexpectedly. Exasperating things can also happen; your gun may be wrapped around your neck, your mitten won't pull off or you are answering the call of Mother Nature.

Many times other critters, such as great horned owls, hawks and roaming house cats, approach the call expecting to capitalize on a squawling rabbit. In fact, some hunters caution that occasionally owls will swoop down with talons open. Inquisitive raccoons and curious deer sometimes respond to the call. All of these unexpected happenings make predator calling an interesting way to hunt.

All in all, fox hunting can be as varied as your imagination will allow and any good fox hunting experience will provide you with many hours of storytelling after the hunt is over.



TRAPPING

Probably one of the oldest methods of harvesting any animal is that of trapping. Although there are not as many variations to fox trapping as fox hunting, it still requires a lot of knowledge, skill and sometimes luck to trap a fox. Trapping provided the economic livelihood for many a pioneer as he moved westward across this nation. While there have been several booklets written by trappers on the secrets of fox trapping, basically the secret is having the trap set at the proper location commonly referred to as a fox crossing. Fox trappers use all kinds of different sets for their endeavor. Of all the fox sets used, perhaps the most effective of all and the one that takes as many animals as all other sets put together, is the "dirt hole set". The "scentpost set" is probably the next most used technique. Other trap sets include "trail set," "blind set," "mound set," "chicken manure sets," "campfire sets," and a variety of variations of these sets. Good fox trappers can catch 15, 20 or more foxes at one location if the population is relatively high, if traps are placed properly, and if fox dispersal is occurring. Methods for making typical fox trapping sets and when and where to set them can be found in the Iowa Conservation bulletin entitled TRAPPING IOWA FURBEARERS by Thomas Berkley. Variations in fox trapping are also depicted by the many varieties of fox lures on the market. Some of the more common varieties are: Widow Maker Fox Lure #800; Wily Red Special Lure #500; Red Fox Gland Lure #100; Long Distance Call Lure #600; Red Fox in Heat Matrix; Red Reynard #700 and many others. According to their labels they are guaranteed to attract and catch foxes from miles around. Data from the returns of ear-tagged animals indicate that trappers were the second major cause of fox mortality. Trappers accounted for about 18 percent of our recovered ear-tagged foxes.



Dirt hole bait set



George Good

One season's catch



Captured fox



THE NON-CONSUMPTIVE USER

Like most wildlife species, there are people interested in red foxes other than for hunting or trapping. People who are lucky enough to locate an active fox den can enjoy many hours of recreation, observing fox pups playfully frolicking on a green hillside on sunny afternoons. Generally, one must maintain some distance because human scent left in the vicinity of a den may cause the vixen to move her young to a new den site which is not as readily observable. Binoculars or a spotting scope and a long-distance lens camera are the proper gear utilized by people interested in observing foxes for pleasure.

Probably one of the most important aspects that consumptive as well as non-consumptive users value is the occasional encounter with Ol' Red. How does one place a value on seeing a fox while walking or snowshoeing through a timber or cross-country skiing across the hill-sides? The thrill of these encounters with foxes and other wildlife cannot be measured in dollars and cents.



\$8,000 fox coat (courtesy Cownie Furs)



Chapter 16 Fox Fur Fancies

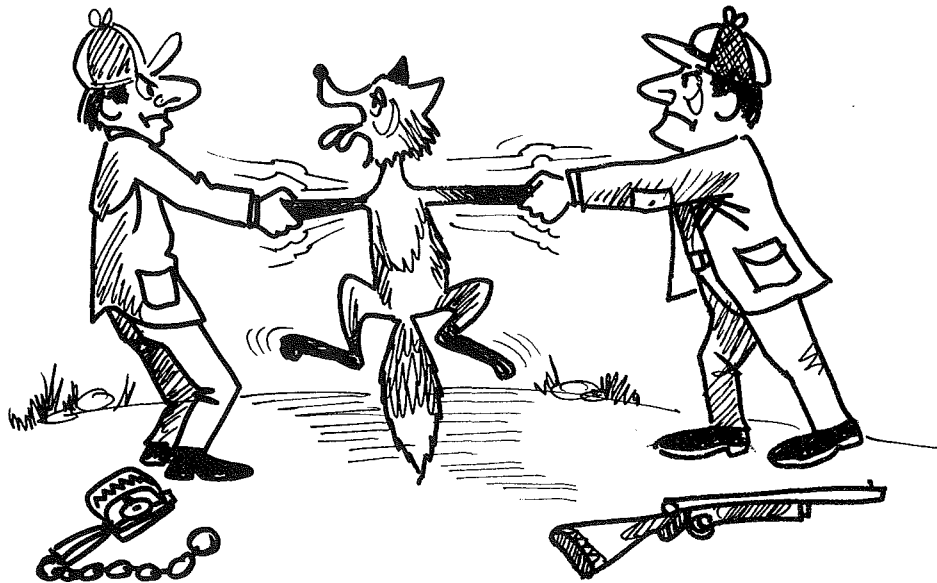
Fox fur is, of course, most important to the fox itself. It is also important to people, although its importance fluctuates considerably with fashion demands. Why the fluctuations? Trends are determined by fashion designers who try to create fashions that will catch the whims of women. Long-haired furs are currently the “in thing” and as long as it lasts, fox pelts will bring a premium. European countries and particularly Paris, which is the fashion capitol of the world, determine what the price of fur will be in the United States. Most fox fur is used for trimming on ladies coats, jackets and muffs. Quite often it is left in its natural red color, but for variety, some fox fur is dyed other colors. On occasion one can find a coat made entirely from fox fur. With the recent high value of fox pelts, this coat may cost well over \$1,000. The ultimate in fox fur fashion found by the author was a fox fur lined water bed priced at about \$300 in 1970.

To the sportsman, a fox is a fox, but to the fur trade there are many different kinds. Different localities produce different pelt qualities even though they are all red fox. Climatic conditions are thought to make the difference. The measure of quality is in the length and silkiness of the outer guard hairs. Also the texture of the fur is important or in other words the way underfur supports the outer hair.

The finest fox in North America comes from the northern states and the Canadian Provinces. The pelts are larger with lustrous flowing, lengthy guard hairs. Even within the 200 mile distance between the north and south borders of the state, northern Iowa fox pelts are larger and of much better quality than southern Iowa pelts. A good fur buyer can readily pick out foxes taken in different parts of the state. While fox fur, as well as that of other long-haired critters, is in fashion right now, it is likely that the pendulum will swing back. Milady’s mind will change and she will choose short-haired furs again.



Robert Stewart



Chapter 17

Fox Season Controversies

It was not until 1969 that the Legislature changed the Iowa code to allow the Conservation Commission to set something other than a continuous open season on foxes. Fur seasons are set within broad biological parameters, with considerable emphasis placed on biopolitical ramifications, commonly referred to as people management. The people management aspect of setting fur seasons is a complicating factor, especially during this era of high pelt prices, increasing hunting and trapping pressure and deteriorating wildlife habitat. As long as forbearer seasons are set on a statewide basis, sportsmen must view the seasons with a broad understanding and realize the need to consider sportsmen in all portions of the state. Tunnel vision by self-centered sportsmen groups often cause problems. Season dates are set to provide the greatest recreational opportunities for the majority of the sporting enthusiasts without endangering future populations of the resource. In recent years, with high pelt prices, it seems fewer sportsmen are satisfied with season dates.

The first consideration in setting any season must be the wildlife resource. Next is the recreational interests of the sporting factions involved. Attempting to set seasons that will provide maximum hours of recreation while still sustaining the resource is not always a popular business. With foxes and other furbearers, pelt primeness must be considered, particularly during this period of record high pelt prices. Consideration must also be given to weather variations across the state, as well as differences in forbearer populations.

The hunter-trapper conflict is as old as the invention of the tools of their trades. It is something that we have lived with almost since man first settled this nation. Not only is there a gun hunter-trapper conflict, but there are also hunters who are in conflict with both the gun hunter and trapper because they do not want to see the fox killed.

Many people think the heyday of the fur business occurred when pioneers first arrived in Iowa. While it is true that many settlers eked out a living in the fur trade during those pioneering years, record breaking fur value years occurred in the 1970's. These high pelt prices have only added fuel to the fire of the hunter-trapper-dogrunner feud. Not only that, high pelt prices have also caused hunters to square off against other hunters, each fighting to maintain their own hunting territories. Another problem created by high pelt values and increased hunting pressure is that landowners are less tolerant of hunters and trappers. Unethical behavior by both groups in pursuing their quarry has badly tarnished the image of the sportsman. People become very selfish and greedy when money is involved. High pelt prices make fur seasons more difficult to establish.

FOX POPULATION TRENDS AND IMPRESSIONS

Fur seasons are set each year about the middle of the summer nearly 6 months prior to the season opening. Fur harvest records based on fur buyer reports provide a retrospective view of forbearer populations. Figure 13 shows an upward trend in harvest and value of red fox since the 1959-60 season. A record value of fox pelts of slightly over \$1 million

occurred in 1976-77 and in 1977-78. Since 1969, with the exception of 1974-75, record fur values were increased with each successive year.

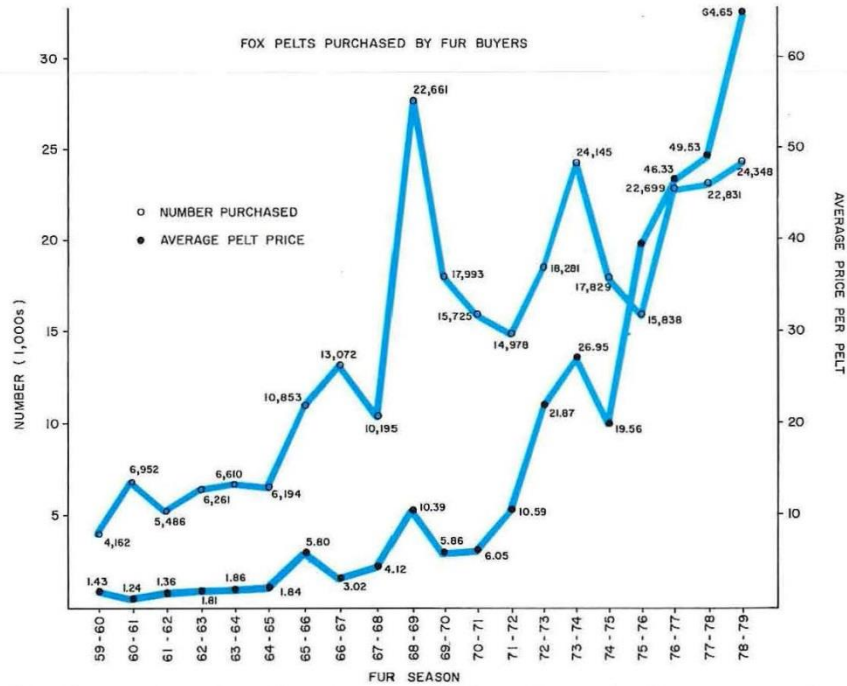


Figure 13. Fox harvest and pelt price trends based on fur buyer reports, 1959-60 through 1979-80.

Besides the fur buyer harvest reports, Conservation Commission personnel assemble annual impressions of populations. These impressions are based on field signs such as tracks, scats, active dens, and visual sightings.

As State Furbearer Biologist, I initially make season recommendations based upon the harvest data and the impressions I receive while attending such meetings as The Iowa Trappers Association and the Fur Takers of America as well as visiting with fur pursuing enthusiasts from across the state.

In January each year, I draft an initial season framework which includes dates, length, and limits. The framework dates are broad outside guidelines with the exact seasons generally set within these dates. These recommendations are then taken to the Conservation Commission as notices of intended action. This allows the entire public the opportunity to contact the Conservation Commission and provide their thoughts and comments on the proposed seasons. Near the first of April a public hearing is held allowing the public additional oral comment on the proposed season guidelines. In June, final season dates for the upcoming fall and winter are drafted. These dates are based on my assessments of the public comments received, the previous year's harvest figures, and impressions and inputs received while attending fur organization meetings. These recommendations are then distributed statewide to all wildlife and enforcement personnel for their comments. A wildlife staff meeting is held in Des Moines where district officer supervisors, district wildlife management supervisors, research biologists, and the administrative staff review, discuss and occasionally overhaul the final fur recommendations. They are then presented to the 7-member Conservation Commission for its approval. The track record has been good and most of the time the recommendations are accepted by the Commissioners. Three species of furbearers (fox, raccoon and coyote) create most of the conflicts that occur and understandably so because these are the species being pursued by both hunter and trapper. These species, in recent years, have also experienced record high fur values.

REASONS FOR FOX SEASONS SINCE 1970

Iowa law allowed nothing other than a continuous year around season until 1970. Season dates and lengths since the first Iowa season are shown in In 1974-75, the fox hunting season opened 2 months later and closed 2 weeks earlier (January 31). Fox trapping was allowed only during the months of November and December thus shortening it by 1 week at the beginning and 1 month at the end. This eliminated the aspect of allowing the early small game hunter to legally shoot an Ol' Red, but, the pheasant hunter still had the opportunity. It is unfortunate that this early part of the season

had to be eliminated, but biopolitical pressures prompted shorter seasons with much later openings. Again, with the earlier closing of the season a few more bred foxes were saved.

Table 4. Earlier chapters discussed how the image of Ol' Red vacillated from nothing but a sly and crafty bad guy to a stately game animal. Foxes were being persecuted year-round, with many pups being destroyed at den sites until their image changed in the late 1960's.

In the late 1960's and 1970's, this study, as well as others in the country, indicated that foxes play an important role in the wildlife community. Given "adequate" habitat, it was learned that predators and prey can live compatibly without reducing the prey population significantly. The new image led to our first restricted season during 1970-71, which was liberal and set primarily to protect fox pups during the spring and summer months. Hunting and trapping seasons opened concurrently on September 1 and closed the end of February. While the Conservation Commission realized that foxes were not prime on September 1, the early opening did allow the squirrel, rabbit and other small game hunters to legally bag a fox. The trophy value of allowing a young squirrel hunter the opportunity to bag a fox with his .22 rifle was an important consideration. Only a handful of foxes were taken during the first 6 to 8 weeks of the season, and this had an insignificant impact on the total fox population.



In 1972, fox pelt prices began to increase considerably and the result was increased fox hunting and trapping pressure. Accelerated drain- age of wetlands, row cropping and fall tillage made the fox more vulnerable because needed escape cover was removed, many denning sites were destroyed and food resource reduced. All these factors together contributed to the decline in fox numbers.

In the 1972-73 season, the first differential fox hunting and trapping seasons were initiated. The fox hunting season opened with the first small game seasons (squirrels and rabbits) in early September and closed 2 weeks earlier (mid-February) than the previous 2 fox seasons. The trapping season opened the last weekend of October and closed the end of January. Those seasons still allowed the early small game hunter to legally shoot a fox and allowed the trapper to trap prior to the onslaught of winter in fairly decent weather and when pelts were prime. The reduced length of the season at the end helped protect a few vixens heavy with young. The 1973-74 season was essentially the same as 1972-73.

Pelt prices continued to skyrocket. Concern for the fox and the policy of our Commission to provide maximum hours of recreation while sustaining the resource, led to further restrictions of fox hunting and trapping season. An attempt was made to ration and more equitably distribute the fox harvest on a per sportsman basis. Fox hunters outnumber trappers perhaps 10:1, however, fox hunters require and expend considerably more hours to take a fox than do trappers. Also, hunters tend to pursue their quarry on a one-on-one basis, where trappers have their tools in place 24 hours a day whether they are out or not.

In 1974-75, the fox hunting season opened 2 months later and closed 2 weeks earlier (January 31). Fox trapping was allowed only during the months of November and December thus shortening it by 1 week at the beginning and 1 month at the end. This eliminated the aspect of allowing the early small game hunter to legally shoot an Ol' Red, but, the pheasant hunter still had the opportunity. It is unfortunate that this early part of the season had to be eliminated, but biopolitical pressures prompted shorter seasons with much later openings. Again, with the earlier closing of the season a few more bred foxes were saved.

Table 4. Fox hunting and trapping season lengths, harvest, and pelt values.

Fur Season	Year	Dates	Number of Days	FUR BUYER HARVEST DATA	AVG. PELT PRICE	TOTAL VALUE
Hunting and Trapping	1970-71	09/01 to 02/28	181	15.725	\$ 6.05	\$ 95,136.25
Hunting and Trapping	1971-72	09/11 to 02/29	172	14.978	10.59	158.617.02
Hunting Trapping	1972-73	09/09 to 02/15 10/28 to 01/31	160 96	18.281	21.87	:399.805.47
Hunting Trapping	1973-74	09/01 to 02/15 10/27 to 01/31	168 97	24.145	26.95	650.707.75
Hunting Trapping	1974-75	11/02 to 01/31 11/02 to 12/31	91 60	17,829	19.56	348.735.25
Hunting Trapping	1975-76	11/08 to 01/31 11/08 to 11/30	85 23	15.838	39.88	631.619.44
Hunting Trapping	1976-77	11/20 to 01/30 11/20 to 12/19	72 30	22.699	46.33	1.051.644.7 0
Hunting and Trapping	1977-78	11/26 to 01/22	58	22.831	49.53	1,130,819.4 0
Hunting and Trapping	1978-79	11/25 to 01/14	51	24.348	64.65	1.574.098.2 0
Hunting and Trapping	1979-80	11/17 to 01/13	58	17.629	48.71	858.708.59

Trapping season began at 6:00 am opening day and ended at 12:00 midnight on closing day from 1970-71 thru 1978-79.

Season began at 8:00 am opening day and ended at 12:00 midnight on closing day in 1979-80.

Regardless of whether a female is taken in November or January she is potentially a productive animal, however, females that survive to January and become bred tend to be more vulnerable as they remain close to den sites. Because harvest and fur values remained relatively high, additional season restrictions were placed on the fox trapper in 1975-76. Almost unbelievably, the fox trapping season was reduced to the first 3 weeks of November. This was, however, the best time for fox trapping, since this was when most of the fox dispersal occurs and pelts were prime. The fox hunting season remained the same as the previous year.

Hunters, trappers and resource people were still concerned about their sport, and 1976-1977 brought about additional changes. Because the take per trapper was several times greater than the hunter take, seasons were readjusted in an effort to somewhat equalize harvest opportunity. Both hunting and trapping seasons started 2 weeks later in November and fox trapping was allowed for 1 month only. This created potential weather problems that could make trapping more difficult, plus many foxes had already dispersed, thus reducing the potential trapper success. Although trappers were very disgruntled, it appeared to be a partial solution to distributing the fox take more equitably between the two sporting factions.

One difficult problem was still occurring. Some trappers were still taking foxes in traps that were supposedly set for coyote, raccoon, skunks, or badgers. These foxes were being released and bagged as hunted foxes because the hunting season was still open. Conservation officers found that the differential hunting and trapping season dates made the illegal take of foxes by trapping after the closed season nearly unenforceable.

Prosecution of illegal fox cases was difficult because of the differential season dates, and some magistrate judges dismissed such cases. Upon close scrutiny of their legal authority, the Conservation Commission ruled that only

concurrent fox hunting and trapping could take place. Hopefully, legislation to allow these differential season adjustments will occur in the future.

The 1977-78 season began in late November and continued through the third week of January. This late opening raised the ire of the fox trapper. Then why so late? Again, the intent was and is to more equally distribute the harvest between hunter and trapper. Fur buyer reports indicate that even though the hunter outnumbered the trapper 10:1, the trapper took one-half to two-thirds of the fox during the past two seasons. The late fox trapping opening of November 25 was designed to reduce the take by trappers, particularly during "normal" inclement weather of this period. The fox trapper gained about a 1-month longer season, but conditions were more difficult.

THE 1978-79 SEASON CONTROVERSY

The 1978-79 season recommendations of November 25 through January 21 were initially adopted by the Commission. This would have been essentially the same as the previous year. As mentioned earlier, trappers were indeed unhappy with the late trapping season opening date especially since it was the second year for a late opening. They also felt that the Commission was entirely too generous with the hunter allowing him to hunt into late January.

In an effort to get what they wanted, some trappers contacted legislators, and specifically members of the Legislative Rules Committee. The Legislative Rules Committee has to approve all seasons passed by the Commission. Trappers wanted the season to open earlier and close earlier. Apparently enough pressure was exerted on the seven Commissioners that they shortened the season, closing it one week earlier on January 14. I believe the precedent of altering the previously established season dates was unfortunate. Not only was it unfortunate from a Commission vantage point but maybe also for the trapper who may be the victim of future changes. While I believe that sportsmen must be involved with the legislative process, I believe they should address much bigger issues, such as habitat loss and deterioration rather than season dates. Hopefully, when and if fox pelt prices decline, season dates can be liberalized and biopolitical considerations lessened. In the meantime, tempers between fox hunters and trappers will likely remain hot. Regardless of when the Commission sets the season, someone will be unhappy.

The concurrent hunting and trapping season should resolve enforcement problems, because any fox in possession before or 10 days after the season dates without a permit will be illegal. Trappers must remember that foxes taken in land sets prior to and after the season must be released. A red fox can be readily released from a trap by placing a hog choker around its neck or covering the animal tightly with a heavy coat or blanket and spreading the jaws of the trap. The hunting season has been shortened at both ends. While shortening the early part of the hunting season does not necessarily affect the overall take by the fox hunter, the 10-day reduction at the end should curtail the hunter take and protect more bred female foxes.

Some fox hunters are causing additional conflicts and controversy because of the unethical manner by which they pursue the fox. The use of 4-wheel-drive vehicles driving through fields and CB radios to zero in on and chase foxes has reduced the sportsman-like pursuit of this animal. The Conservation Commission does not condone this activity. In fact, people using these devices are violating the law. The Iowa Code specifically says that electronic devices cannot be used in the pursuit or harvest of wildlife. The 1979 Legislature attempted to pass legislation to make it illegal to pursue any wildlife with the use of CB's. Unfortunately the legislation was poorly worded making it nearly impossible to prosecute violators using CB's to take foxes or other furbearers. Even when the wording is improved, because of the extensive use of CB's for all kinds of activities such a law will be difficult for conservation officers to enforce. Landowner attitudes are near the breaking point because of these deplorable and unethical actions. Amazingly, in many instances it is nearby landowners that are causing the problems but the tendency is to blame all hunters rather than create ill feelings with neighbors. Both the hunter and trapper need to improve their image since the adverse publicity they create should eventually become the rope that hangs them. Unsportsmanlike conduct is inexcusable and intolerable.



Chapter 18

Red Fox Management

The biopolitical aspects of the fox season are very difficult problems to deal with when it comes to management of this often sought after resource. We have considered bag limits on foxes, but indications are that they are unenforceable. A season bag limit per sportsman with a system of tagging fox pelts might be helpful to law enforcement, but in eras of tight fish and game budgets, tagging programs are too costly to administer. Given adequate funds we will continue to explore avenues to regulate the fox take per sportsman. Hunting and trapping season dates will continue to be a major aspect of fox management in Iowa.

Sound management programs for other wildlife species will usually include Ol' Red as a benefactor. Land use practices will continue to be the major factor affecting long-term population trends. Long-term diversion of land and properly managed annual, set-aside acres programs, help provide important denning sites and much needed escape cover during the hunting season. Discontinuation of timber removal and wetland drainage would be of benefit to the fox and all other wildlife. Most types of wildlife habitat acquisition will be a bonus to the fox. Soil conservation programs such as minimum tillage, strip farming, shelterbelt plantings, etc., help the fox, not only making it less vulnerable but also increasing the food base available to it.

Hunters and trappers, themselves, can become fox managers by learning the behavior and habits of the vixen. They can be careful to avoid pursuing bred females as a part of the quarry, particularly in January. Most importantly, they can practice ethical and sporty techniques of pursuing Ol' Red. They should condemn so called sportsmen who pursue foxes with 4-wheel-drive vehicles and CB radios and should cooperate with conservation officers whenever they observe game violations. Sound management of Reynard Fox will occur only with the cooperation of everyone.

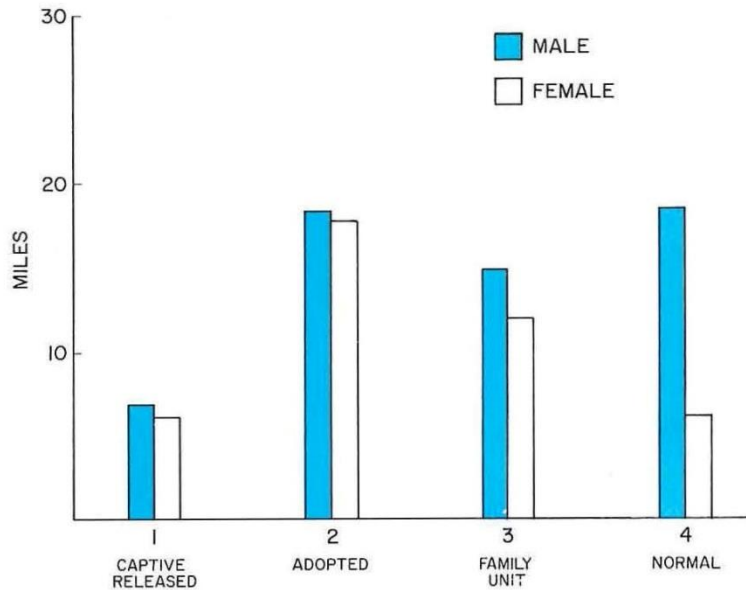


Figure 14. Comparative mean movements of the four categories of juvenile male and female fox.

MANAGEMENT OF UNWANTED FOXES

Fox litters found on wildlife production areas may pose serious threats to production of waterfowl and upland species. This is particularly true on certain state wildlife management areas. These foxes could be captured alive and transplanted to other den sites where they would not be in direct competition with other species. During our fox tagging studies we encountered several landowners that did not want foxes released back to their property. In most cases these were turkey or chicken producers, or perhaps a person who raised a few tame ducks, guineas or other fowl for a hobby.

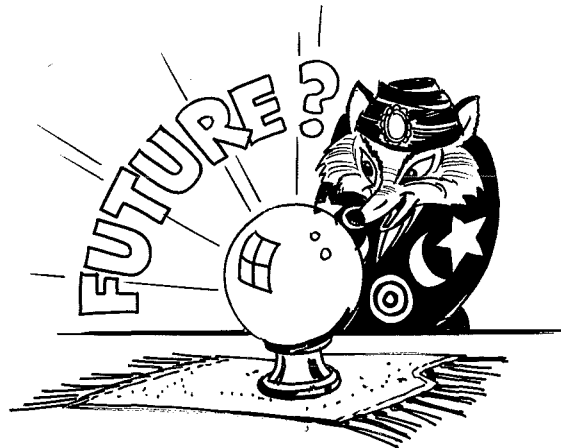
Rather than killing these unwanted foxes or trying to raise them in captivity to be released later, we transplanted adult females and pups to new territories. When only the pups were captured they were adopted out, a few at a time, to other active dens away from the poultry areas²². We found that these transplanted foxes survived very well (Figure 14). Consequently we accomplished two goals - reducing the farmer's problems and saving the fox. This type of fox transplant program could be a worthwhile management practice on areas intensively managed for waterfowl and upland game production or private land with unique problems.



Chapter 19 Economic Importance of Ol' Red

The economic importance of Ol' Red is measured in more than just fur value. Figure 13 shows the history of fox fur values and harvests based on fur buyer reports. Besides the record \$1 million worth of fox pelts harvested in 1976-77 and 1977-78, additional thousands and perhaps over a million dollars were pumped into the economy by the costs of other paraphernalia needed to pursue Reynard Fox. Money spent on food, gas, vehicle maintenance, guns, ammunition, traps, lures, hounds, dog food, snowshoes, predator calls, camouflage and winter clothing and many other items means dollars pumped into local economies. Fur houses, trap supply businesses and the fashion industry provide full and part-time employment for many individuals.

Besides the monetary return of pursuing Ol' Red, the intangible benefits can be far more rewarding. The outdoor exercise and challenge can be very stimulating. The solitude, peacefulness and independence of learning the ways of the wild, strengthen the character of people. Walking a slough or timber area, reading signs, not seeing your quarry but knowing its presence and the sense that man is part of this very important natural system can leave refreshing memories for the rest of one's life. This and the opportunity of experiencing the "pioneer spirit" of the past cannot be valued in dollars and cents.



OL' RED'S FUTURE

What does the future hold for the red fox in Iowa and North America? Is this once very abundant and renewable resource beginning to show signs of exhaustion?

Although the stocks of wild foxes are reduced, they are not in immediate danger of extinction. Wildlife habitat deterioration, due to man's influence, has greatly contributed to the demise of some fur populations. Synthetic furs are

replacing the use of wild furs in the garment industry. This has far ranging consequences and the petroleum products and energy consumed in producing synthetic furs is non-renewable. This alone may have considerable economic impact on the entire world. Wild furs, including the fox, under proper management can be renewable resources.

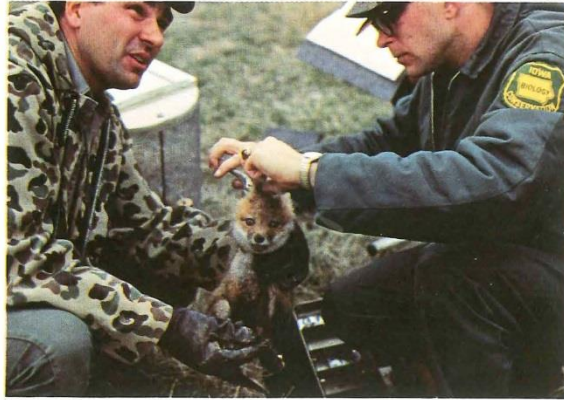
Regardless of how the American public may treasure the fox resource for fur garments and the comforts they afford, the recreational and monetary rewards, or the non-consumptive value of just seeing Ms. Fox and her pups playing on the hillside, it shows little concern for the future supply. Because of the dollars associated with the current fur value and the all-out push for food production, wildlife habitat is being destroyed, invaded, polluted and raped by man.

Fur trappers, hunters, and dealers are not contributing enough in license fees to sufficiently finance required habitat restoration and management of fox and other fur species. They are reaping much more than they are returning. These sportsmen, as well as the non-consumptive public, must be willing to sacrifice more of their own personal gain either by increased license fees, fur stamps or a small percentage of these fur sales or general tax appropriations, if they expect to see foxes and other fur species continue to thrive.

The year 1976 marked the beginning of the third century of this nation of ours. It seems only appropriate that we should stop and consider ways of maintaining all wildlife in good numbers for the consumptive as well as the non-consumptive user.

It would be a sad day if Ol' Red becomes anything but commonplace in the countryside and no one could see the sudden flash of red fur running across a hillside or the tell-tail sign of where the fox had eaten a rabbit. The red fox has indeed been the inspiration of much fact and fable, and while many of the habits of Ol' Red have been revealed in research studies such as these, many remain to be unveiled. Because the fox is adaptable and changeable, it is only right that he keeps a few secrets to himself.





Don Pfeiffer



Jerry Leonard

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