

**J**ust above the meadow bordered by tall trees and wrapped in darkness, the barn owl flies in hunt, its wing movements beating in gentle cadence to the summer night's many sounds. Suddenly the bird swoops in one resolute glide toward a target in the shadows no human observer can see or hear. Head forward, this hunter of the night lifts its wings to full spread and at the last moment thrusts its feet forward. A mouse is irrevocably trapped in the barn owl's razor-sharp talons."

"Portrait of a Common Barn Owl is an excellent publication. ICI Americas has gone far beyond the required amount of research necessary for their purpose. It is hoped more industries will follow their lead."

Sincerely,  
Alexander Sprunt IV  
Vice President and Director of Research  
National Audubon Society

## PORTRAIT OF THE COMMON BARN OWL

**F**or centuries mankind has been fascinated and sometimes fearful of these silent raptors which hunt primarily by night and whose screeching call chills the listener with its almost human-like quality. Until now their secrets have been primarily their own.

Prior to the initiation of the Barn Owl Research Program in 1980, classical research observations provided only general information on this species of owl, *Tyto alba*, even though for centuries they have lived closely to man, frequenting areas near farms and small towns and choosing man-made structures for roosting and nesting. These remarkable birds of prey actually help to keep down populations of rodents, their primary food source.

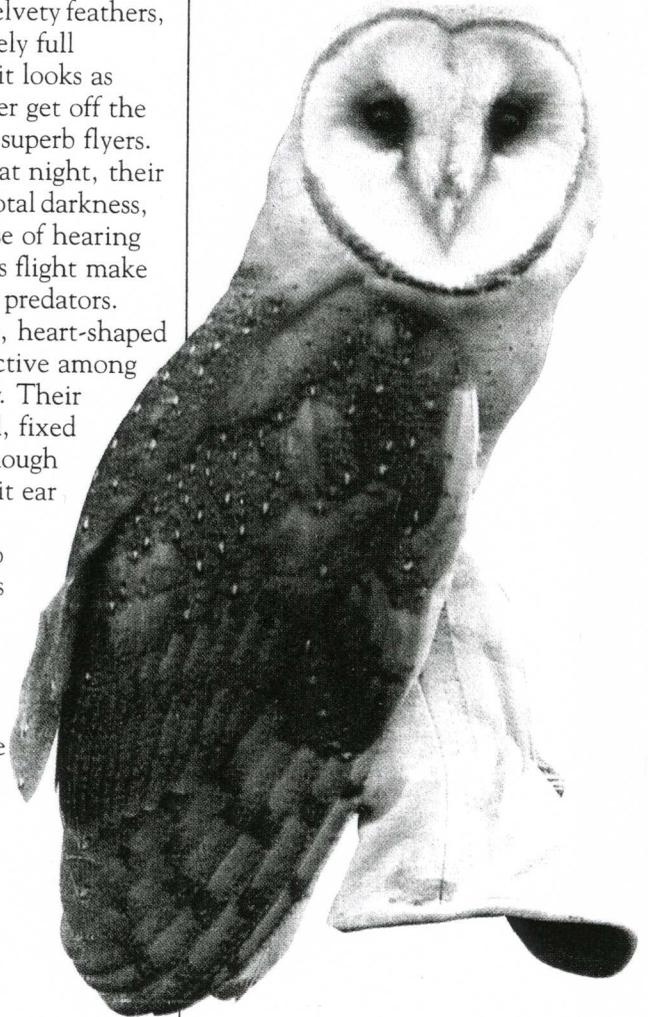
The slender bodies of barn owls are disguised in a cover of velvety feathers, giving them a deceptively full appearance. Although it looks as though they might never get off the ground, these birds are superb flyers. Well-equipped to hunt at night, their ability to see in almost total darkness, their extraordinary sense of hearing and their near soundless flight make them perfect nocturnal predators.

The barn owl's white, heart-shaped face makes them distinctive among others in the owl family. Their eyes are dark and round, fixed and forward-looking. Though many owl species exhibit ear tufts, this one does not. Their hearing is tuned to the high-pitched sounds emitted by their rodent prey. Asymmetric ear openings in this bird's facial disc are thought to aid them in detecting the faintest sounds.

Weighing 17-25 ounces, females are larger than males, and they exhibit a buff-colored breast with black spots. Males weigh 14-19 ounces and have a whiter breast with fewer and smaller spots. Ranging in body length from 13-15 inches, their tail is squared rather than rounded. Wing-spread averages 41-45 inches.

Contrary to popular opinion, barn owls do not hoot. They make conversational shrieking sounds differing from other owls, with distinctive alarm and defense calls. A series of rapid squeaking noises is associated with mating.

*Tyto alba* — the common barn owl can be distinguished from other owls by its heart-shaped face.



## The Habitat of the Barn Owl

**B**arn owls populate most of the United States except for areas of the extreme north. Because they are particularly sensitive to cold and damp weather, these birds are more common to the temperate and subtropical areas worldwide. The life span is relatively short; few adults live beyond 3-4 years.

Barn owls live in open country and around farms and small towns. They have the ability to make homes in a variety of nesting sites though they do not build nests. They choose tree cavities, holes in earthen banks and man-made structures such as church steeples and barns. These cavities fill up with brownish-black pellets which are the regurgitated indigestible fragments of each meal — fur and bones. Pellets of the barn owl average 2 inches in length and are produced about twice a day.

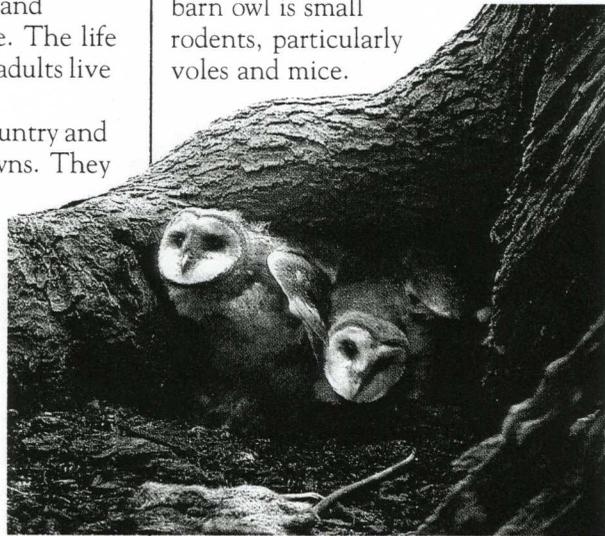
## Why Study Barn Owls

**M**any facts about these illusive but important predators are not known. Before this barn owl study, most knowledge of barn owls was garnered from the patient work of dedicated bird-watchers and researchers through occasional observations during long evening and early morning vigils near the barn owl's favorite haunts. What factors affect barn owl populations? What accounts for the changes in North American barn owl populations during the past 30 years? Why is this species now considered threatened or endangered in some states?

Like all raptors (predatory birds), the barn owl is federally protected; it is illegal to kill or capture them. Yet

in recent years in some places in the United States there has been a decline in populations. This concerned environmentalists, bird-watchers and ornithologists (bird scientists) because they did not know the cause.

Sharing this concern was a chemical company which manufactures rodenticides. The favored prey of the barn owl is small rodents, particularly voles and mice.



*Typical barn owl nest in a tree cavity.*

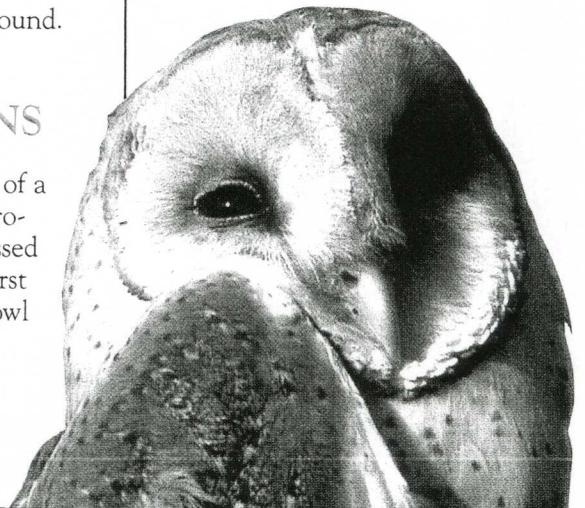
No one knew if the rodenticides could affect the decline through indirect involvement of the new active ingredient brodifacoum, which was rapidly replacing the old standard, warfarin. With the introduction of these new-generation anticoagulant rodenticides, it became apparent that extensive research was necessary to learn more about barn owl ecology since survivability of the species was at risk. Was the barn owl being affected indirectly through the food chain? It was important to know the answer before introducing the compound.

## A FORMAL STUDY BEGINS

**T**his was the beginning of a Barn Owl Research Program which encompassed four major objectives. The first was to determine why barn owl populations were apparently

declining in some areas of the United States, yet in other areas they remained stable or even increased. The second objective was to find out whether new rodenticides containing the active ingredient brodifacoum used to combat rodent problems around homes and farms would contribute to the population decline. The third objective was to investigate and document aspects of barn owl life which could further the understanding of owl ecology and population management. Discovering techniques which could protect and enhance barn owl populations along with fostering greater public awareness was the fourth.

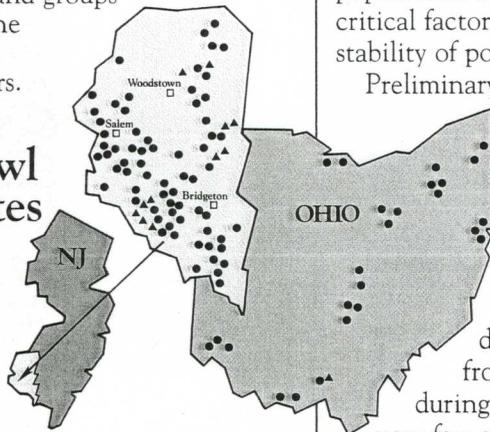
To establish guidelines for the research program, advice was sought from the U.S. Fish and Wildlife Service, the U.S. Environmental Protection Agency and other authorities. It was concluded that only a multistate study carried out over several years and involving dozens of birds over hundreds of square miles could adequately serve the aims of the project.



## Assembling The Team

No research group had ever attempted such a large-scale evaluation which involved first finding the barn owls, then documenting and analyzing their habits and movements to discover what factors affect their population or improve their survival. The expertise, coordination and financial resources needed to accomplish the study could come only from a team of dedicated individuals and groups from both the private and public sectors.

### Barn Owl Nest Sites



Public interest and cooperation were of paramount importance to the success of this project. A network of landowners, environmental groups, bird-watchers and many others who supported the effort was established through individual contact with more than 500 residences and farmsteads. Public lectures by research participants and media coverage served to promote interest and enlist volunteers.

University researchers, bioacoustical engineers, agricultural extension agents and wildlife specialists joined the team. From the private sector, farmers, agricultural chemical company employees and media representatives offered to take part. Licensed bird banders, wildlife biologists, electronic specialists and communication and mapping technologists were among the many experts from government, universities and industry who participated.

## Overview

During the course of this study one of the largest bodies of scientific information of its kind in the world was amassed. This study today serves as a model of approaches and techniques for various state and federal authorities interested in starting barn owl research or management programs. Data was collected on habitat and behavior leading to explanations for decreasing populations and an understanding of critical factors that influence the stability of populations.

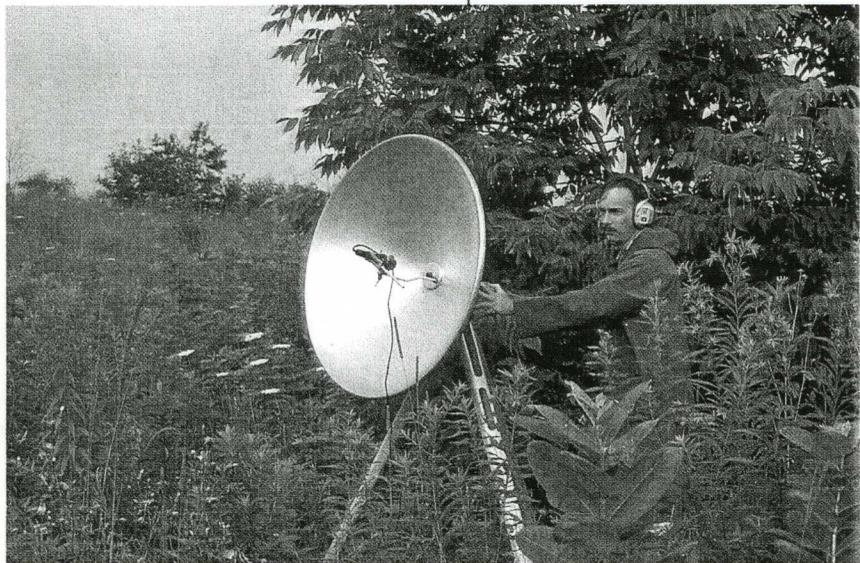
Preliminary surveys in selected parts of the United States and contact with various owl authorities narrowed the study to two areas: New Jersey and Ohio. In Ohio barn owls had dramatically declined from frequent sightings during the period 1925-55 to very few sightings in recent years.

In New Jersey, however, barn owls were apparently still common. It was believed that a comparison of habitat, prey, nesting and other factors

combined with a detailed study of barn owl behavior, could lead to a greater understanding of the reasons for differences between populations in these two areas.

Having chosen the geographic region for the field study, the researchers' next step was to find the barn owls in each area. Detection by sound seemed the best way to locate and document the presence of owls over more than 450 square miles of New Jersey farmland. Anticipating that hissing sounds and begging calls of the nesting young and the screeching cries of the adult would lead researchers to nests and roosting locations, bioacoustical experts brought in sound detection and recording equipment, not only to locate the owls, but then to record their nightly "conversations."

*Bioacoustical equipment used to detect and record barn owl sounds.*



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## Capture

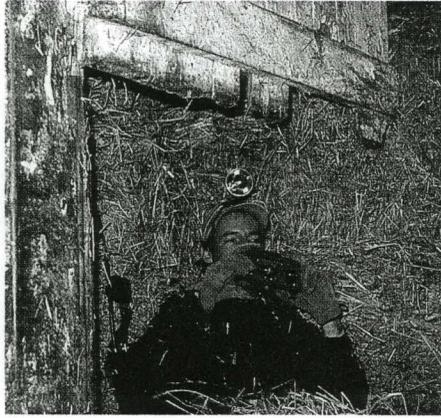
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**A**ctual capture was necessary in order to take measurements and band or tag the birds. It had to be done in ways so as not to injure them. Special equipment was required. Barn owls were banded at roosts and nests during the day for which climbing gear was required to reach cavities high in trees. Devices were developed to give remote indications of owls in nests. Remotely triggered trap doors were then used to detain birds for banding and inspection. When startled, barn owls hiss or snap their bills, lower their heads and weave from side to side.

For nighttime capture, difficult-to-see netting known as mist nets were erected, much like a volleyball net, across owl fly-ways. Scientists were equipped with special electronic night-vision goggles which amplified low light to near-daylight levels for easier viewing and quick attention to captures. Each capture required absolute silence, which necessitated the development and use of two-way radio code communication between team members.

Once captured, owls were weighed, measured and body characteristics recorded. This information was fed into a computer to help develop

the best way to externally determine the sex of adult owls, a difficult task at best, but critical to the study. Learning mating habits and determining differences between the male and female in movement, behavior and care of young were essential to understanding species survival.



*Electronic goggles turned night into day for observing owls.*

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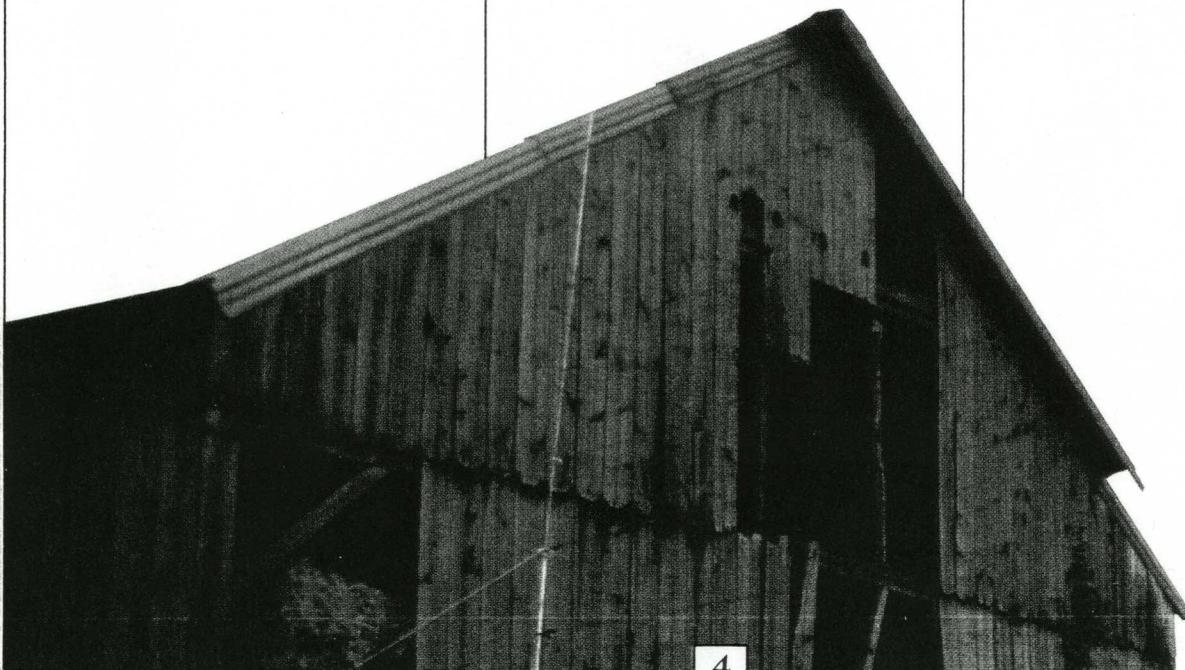
## Identification and Banding

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**A**ll owls were fitted with U.S. Fish and Wildlife Service legbands to identify each one individually if found or captured again. Over the six years of the study, records were maintained and regular research conducted at 223 sites in New Jersey,

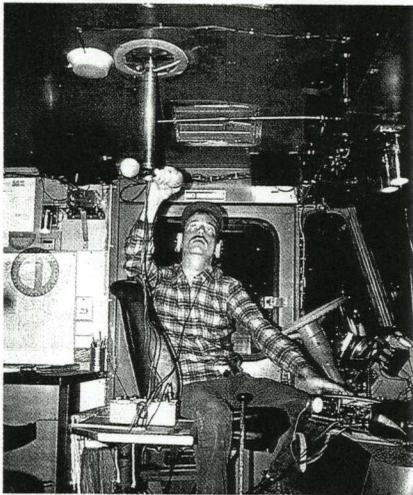
107 of which have had barn owl nests. Through the cooperation of local property owners, sites were checked for owl activity several times a year.

More than 800 individual barn owls were captured and banded within this study area. Recapture of previously banded birds produced valuable data concerning movement, life history and survival. Information of this type has not usually been collectible from most banding studies in the past because adult owls are difficult to capture. Fledgling (older chicks) survival and age at maturity are two of the many areas on which data was collected.



## Space Age Techniques

In addition, more than 50 adult barn owls were fitted with tiny radio-transmitters having special frequencies and weighing less than a half ounce. These could broadcast a signal to specially equipped ground vehicles and aircraft which could then monitor owl locations by day and movements by night, even if the birds ranged several miles away. Radios were attached to the owl's tail feathers so that transmitters would fall off with the next molting of feathers. Thus they posed no lasting effect on the owls.



Owl movements monitored by ground and air vehicles required complex instrumentation.

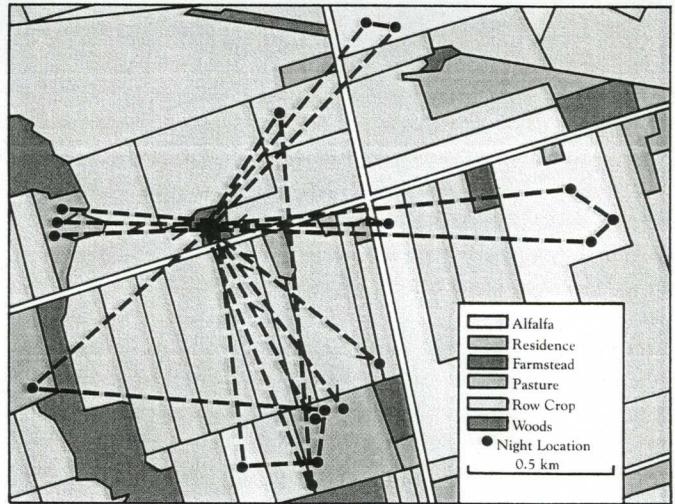
Detailed maps produced from high-altitude aerial photographs were used to plot bird locations. Habitats of each owl were analyzed as to number, locations in woods, grassland, marsh, or farms, and movements were tracked.

## Home Range and Territory Covered

Band-recovery data and radio-tracking information gathered from regular monitoring during nighttime feeding and daytime roosting indicated barn owls move more widely than originally thought. Documentation of hunting activity revealed a number of new findings, some contrary to what might have been expected.

## Movement of Adult Barn Owl

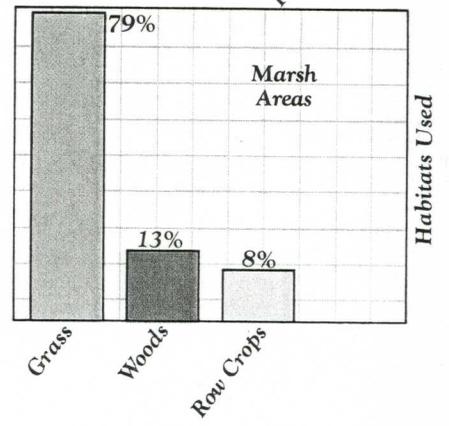
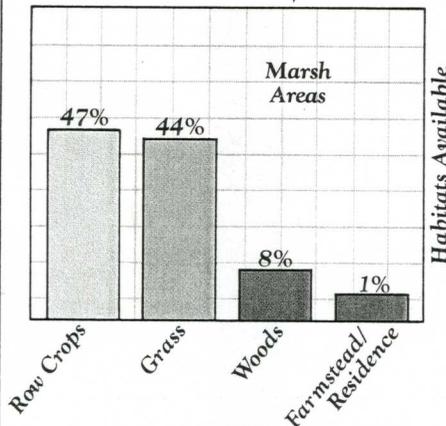
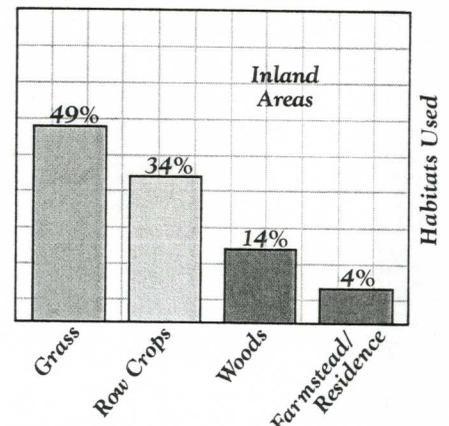
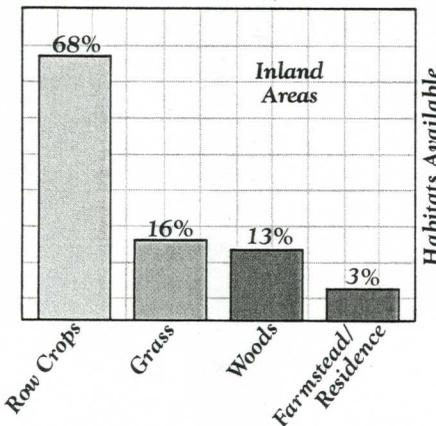
Movements of adult male barn owl were directed away from the nest at the farmstead.



In New Jersey these birds of prey frequently had distinctive hunting and nesting locations, sometime spaced 2-3 miles apart. Daytime roosts or resting places were up to 5 miles from the nest. Many owls hunted as far as 2 miles from the nest, though not necessarily around the roosts. The average home range encompassed 1700 acres (2.7 square miles) and, at times, it was much larger.

The owls arrived at the day roost before dawn and did not leave until after sunset when hunting and feeding began. Most hunting was usually before midnight, but another period of hunting 1-2 hours before sunrise was observed. The owls seldom moved erratically, but usually flew directly to favored hunting areas.

## Habitats In Barn Owl Range



These hunting locations were classified by habitat types. Both inland-nesting and coastal-nesting (marsh) owls spent hunting time largely in grassland areas. Farmsteads, residences and woods served as nesting locations and were rarely used for hunting. This was not expected.

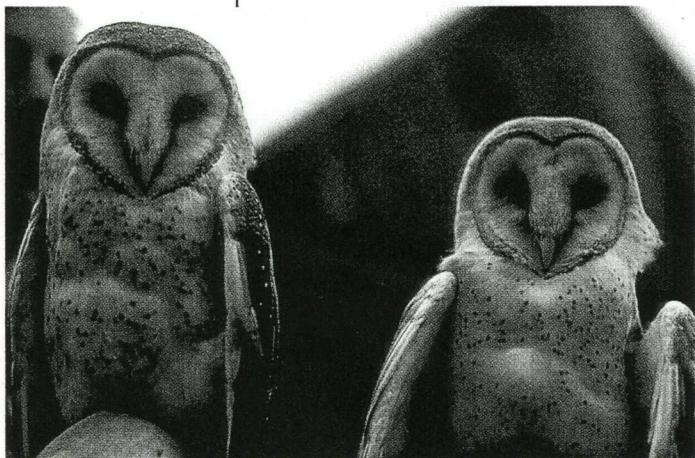
Although nest sites may be used each year, it frequently is not occupied by the same pair of adults. Nest site change between years sometimes occurred over 10 miles or more. Few birds that hatched in the study area returned there as adults. There were several instances of barn owls migrating from the study area in the fall.

### Pair Bonding and Nesting

Generally the barn owl has one mate at a time (monogamous). They can breed in the U.S. in any season, but like most birds, they show a preference for spring nesting; for example, April to July in the East and Midwest. They can, however, hatch a second brood later in the year.

No nest is built. Regurgitated pellets serve to cradle the white-colored eggs which are laid in 2-3 day intervals. The incubation period is about 30-34 days, and the average clutch in Ohio is 6 eggs. Incubation, however, begins immediately, thus staggering the time of hatching and the ages of the chicks.

Mortality is extremely high among owl young. As with many wildlife species, high productivity of eggs or young compensates for mortality of offspring. Because they often lack secure nests, eggs and young frequently fall to the ground, especially from ledges in barns, abandoned buildings and silos.



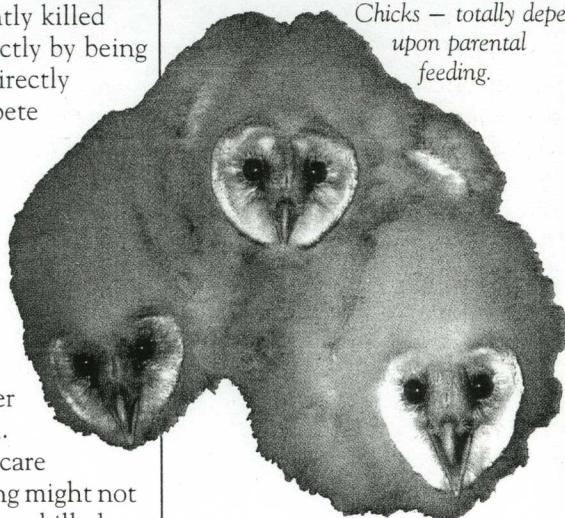
Barn owls – Female (left); Male (right).

Observations indicate that later-hatching owls are frequently killed by nest mates, either directly by being eaten or trampled, or indirectly through inability to compete with nest mates for food.

Chicks are totally dependent upon parental feeding by both adults for more than 2 months. Males spent more time taking prey to feed the young, especially during the latter part of the nesting period. This division of parental care suggests that a nest of young might not survive if the male owl were killed. Chicks are covered with down at birth, but within 8-10 weeks, adult-like plumage replaces it.

Examination of almost 300 barn owl nestings in New Jersey revealed that production of young is prolific. The average brood size in New Jersey was 3-4 young per nest, but brood size could range up to 7. Nests with eggs or young were documented for every month of the year except January. Most New Jersey broods hatched in mid-May.

Some male owls appeared to have more than one mate and nest site. The high density of nests in the New Jersey area, many less than one-half mile apart, combined with the wide-ranging flights of the barn owl, suggests the barn owl is not aggressive toward its own kind and that such habits and behaviors are not factors which limit owl populations.



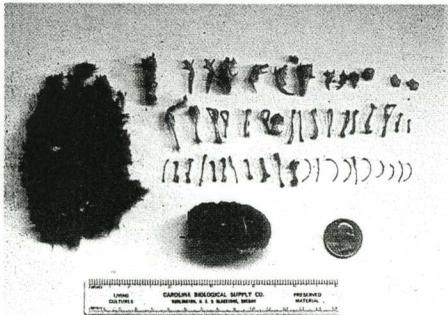
Chicks – totally dependent upon parental feeding.

### Concurrent Study of Rodent Prey

While owl monitoring was in progress, rodent studies were also under way. Ear-tagging, infrared-heat and motion detectors and rodent tracking were techniques used to determine the activity and species of rodents within the home range of the barn owl. Rodent baits placed around farmsteads contained anticoagulant rodenticides or a nontoxic dye tracer or both. Once ingested by rodents the dye settles in their bones, making it easy to identify them later when examined under an ultraviolet light. In this way, regurgitated owl pellets containing rodent bone fragments collected from nests would disclose, among other facts, a possible link in the food chain to toxic chemicals.

Pellet analyses enabled scientists to discover what rodent prey makes up the diet of the owl. Pellets were carefully dissected to look for dyed bone fragments as well as to reveal the owls' food preference. A comparison of rodent species available in a particular area along with the findings in the owl pellets showed a strong selection by barn owls for the meadow vole, a rodent common to grasslands.

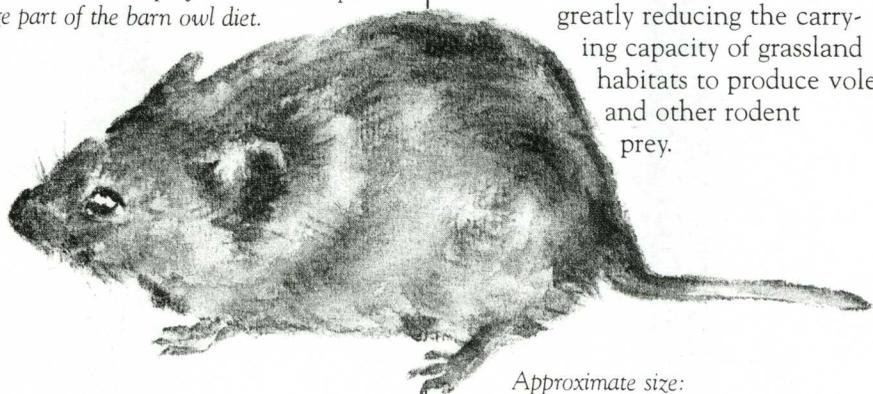
Bone fragments from smaller prey, such as house mice, white-footed mice and the larger Norway rat were found less frequently in the pellets. Less than 2% of the barn owl prey typically consists of birds. This finding suggests that availability and size of the meadow vole serve as the basis for the most energy-efficient choice of food that can sustain barn owls and their young. A family of two adults and six young owls may consume over 1,000 rodents during their three-month nesting period.



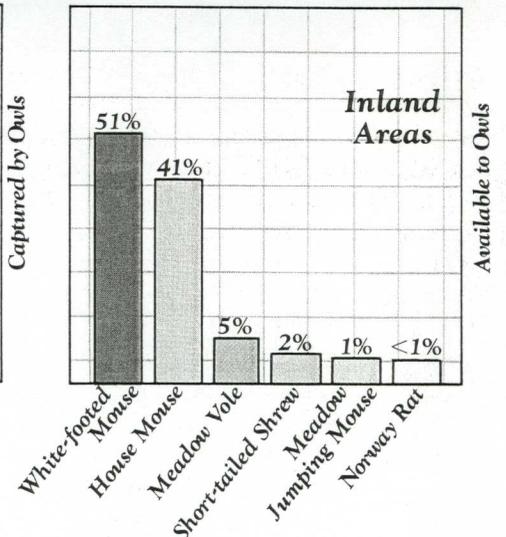
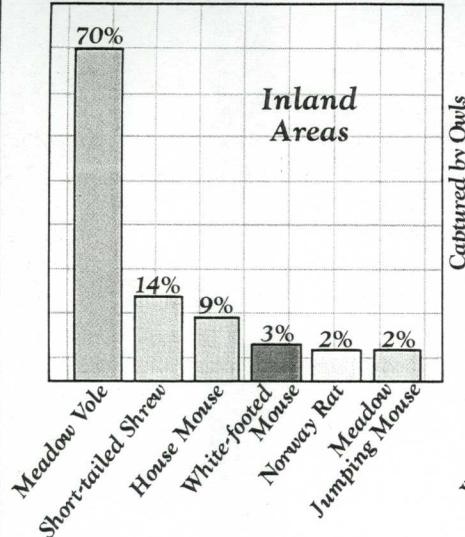
Pellet analysis used to determine owl's diet.

Through examination of rodent bones for the dye marker and analyses for anticoagulant residues in tissues recovered from owls, wildlife biologists and the Environmental Protection Agency concluded that farm rodent control using brodifacoum bait posed no danger to barn owl populations.

Meadow vole — the prey which makes up a large part of the barn owl diet.



### Barn Owl Prey



## THE FINDINGS: WHAT AFFECTS OWL POPULATIONS?

### Natural Causes

**D**uring their 3-4 year lifetime, barn owls encounter a host of physical hazards. Nest collapse, starvation, exposure to harsh weather, electrocution by power lines, predation by dogs, raccoons and great-horned owls and disturbances by man were among many reasons for the high mortality of both chicks and adults. Severe winters and extreme rain storms interfered with the barn owls' hearing and hunting success. Harsh conditions directly affected the poorly insulated barn owls at critical times in their life cycle. Lack of rainfall also indirectly affected barn owl populations by greatly reducing the carrying capacity of grassland habitats to produce voles and other rodent prey.

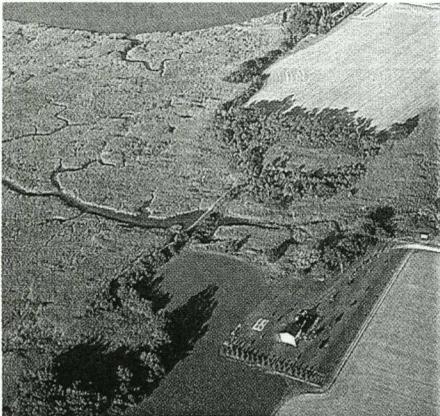
### Changes in Agricultural Practices

**I**n Ohio declining populations of barn owls may well stem from changes in agricultural practices. Barn owl populations were at high levels in the 1930's. However, since then agriculture in Ohio has gradually moved away from sheep and milk industries, and mechanized farming replaced the need for mules and horses. Corn and particularly soybean production increased, and thus grass previously associated with pasture-type farming was replaced by row-crop agriculture. Crop rotations no longer included one or two years of meadow. The loss of grassland habitats and disappearance of the voles and other rodents dependent upon the grasslands have made not only Ohio, but vast areas of our country, uninhabitable to barn owls. Barn owls do not breed and multiply when their source of food is diminished.

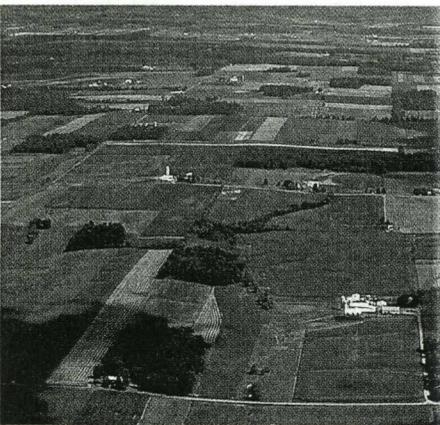
In New Jersey where barn owls thrive, the dairy industry is still strong and vast areas of salt-marsh grassland remain intact; together, these serve to support large numbers of voles.

In the entire state of Ohio during a 4-year period (1979-1982) only 33 nestings among 15 nest sites were documented. In comparison, the New Jersey study area had almost 300 nestings by adult barn owls during a 6-year period (1980-1985).

One factor in maintaining stable owl populations revealed in the study was the availability of good nesting sites. Although in some areas voles still may be available to owls, secure nest sites may be lacking. Many of the nests in New Jersey were in hollow trees and over 30% of these nest sites were lost after tree collapse or removal. Loss of these larger, older trees in villages and on farms can pose a serious threat to owls if other acceptable nest sites are not available.

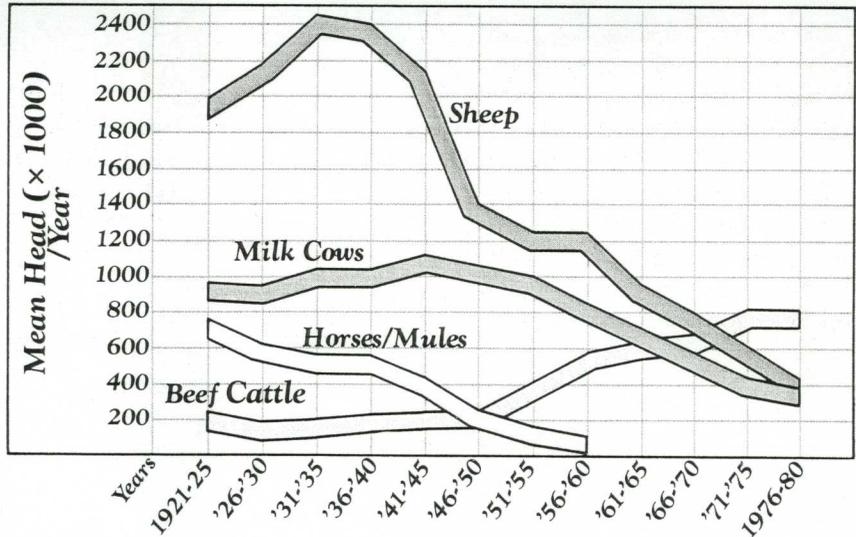


*In New Jersey, where vast areas of pasture and grassy areas still exist, meadow voles and other similarly-sized rodents serve as an abundant food source for thriving barn owl populations.*



*Changing land use and agricultural practices in Ohio, resulting in loss of grassland habitats, have led to declining barn owl populations.*

### Sheep, Milk Cows, Beef Cattle in Ohio 1921-1980



During the owl-monitoring study, nearly 100 wooden, artificial nest boxes were constructed and installed in barns and other structures. Many of these were constructed by local groups and individuals. Nest-box use in New Jersey made up 75% of annual nesting locations by 1985 as owls increasingly accepted these new, more secure lodgings.

### THE FUTURE OF THE BARN OWL

Land-use patterns and changes in agricultural practices have been too great to expect barn owls to roam over territory traditionally frequented by them in the past. The prey resources (voles or similarly sized prey) needed to maintain the high productivity in the barn owl no longer exist as they did 50 years ago. Grassland habitats appear to dwindle a little more each year.

Schemes for captive rearing and release or transport from high density owl areas to scarcely populated areas cannot succeed if nesting and hunting habitats are not suitable. Enriching habitats with wooden nest boxes or maintaining open grassy areas for hunting by raptors can stabilize and even increase local populations.

Protection and encouragement of the barn owl where grassland habitats exist will ensure that this owl remains in parts of our country for all to enjoy.

According to ancient legend of early American Indian tribes, the sorrowful cry of the barn owl is a lament to the distant, idyllic time when mankind and animals lived in perfect harmony. And today? Through this ongoing study a clearer picture of the barn owl slowly emerges along with a firm basis for management. Modern farm practices for the control of rats and mice do not threaten barn owl populations. Given nest sites and the appropriate foraging habitat where vole populations are continually regenerated, this predator with its superb hunting skills and stubborn drive to produce its young can successfully survive in today's world.

For more detailed information contact:

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