

# FOX AND QUAIL STUDIES IN WEST TENNESSEE

AL MARSH, Game Management, Division of Game and Fish, Nashville, Tennessee

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A concerted effort to learn the answers to a multitude of questions, which have been debated pro and con for years without satisfactory conclusions, relative to the releasing of hatchery-raised bobwhite quail and the long-standing and heated controversy between the fox and quail enthusiast, is being made in West Tennessee by the Division of Game and Fish, Department of Conservation in cooperation with the Fish and Wildlife Service, United States Department of the Interior.

Seventy-five percent of the \$35,000.00 extensive Federal aid research project is made possible by funds derived from Pittman-Robertson Act, known as the Federal Aid in Wildlife Restoration Act and designed to restore natural conditions for our wild birds and animals. The Division of Game and Fish is matching the Federal grant with twenty-five percent of the total fund.

## SUMMARY — IN PART

Because of the nature of this research work, particularly the latter problem, I feel it is imperative that this presentation not conform with conventional procedures. At the very beginning I am going to give you information that has taken three years of hard field work and thirty-five thousand dollars of your money to learn, although my remarks should not be interpreted as complete and conclusive at this time.

First. It would be just as senseless to contend that foxes will not take quail and rabbits, if they can get them, as it would be to contend without reservation that the foxes' diet consists of nothing else but quail and rabbits, and that they are solely responsible for seasonal fluctuations in game populations, and that the control or elimination of foxes in itself would solve the game shortage problem.

Second. Foxes do eat quail and rabbits. The percentage of quail is very small. However, in comparison, the percentage of rabbits taken is great.

Third. Relative availability of acceptable foods determines the foxes' seasonal diet.

Fourth. Fruits, berries and insects constitute the major summer foods, while rabbits, small rodents and birds constitute their chief winter foods.

Fifth. Quail populations will not increase beyond the carrying capacity of any given area regardless of the amount of stocking and predator control done and protection afforded.

## DISCUSSION

This is by no means an attempt to cram you full of objectional information against your will. There is little doubt that I could emerge from this meeting a very popular man if it were possible to meet with the fox and quail hunters in separate sessions and tell each group the things they would like to hear. I prefer to give you facts concerning our findings.

For about fifteen years Tennessee has raised bobwhite quail (*Colinus virginianus*) artificially and released them in many cases at random and indiscriminately over the entire state with little concern about their outcome or value. Sportsmen at one time were highly elated and completely satisfied to learn from press and radio announcements that several thousands of hatchery quail were liberated in Tennessee. Their value was an accepted and foregone conclusion. Not until recently have these sportsmen begun to wonder about the fate of hatchery quail and to what degree, if any, they helped the hunting situation.

For the past few years farmers and sportsmen have become acutely concerned, disturbed and alarmed over the apparent disappearance of large numbers of quail. As a result, one often hears numerous and varied theories, mostly based on a few casual and incomplete observations, or on pure hear-say or perhaps prejudice having to deal with the scarcity of quail. Even though the population of upland game birds is never static during any one year, for various and sundry reasons, we hear it said emphatically and authoritatively, "The fox got 'em" or "The hawks and owls got 'em." Consequently, this research project was born in March, 1946, the first of its kind to be carried on in Tennessee, in order to get unbiased and positive information on the problem applicable to Tennessee conditions.

Likewise, the present concern over the advisability of stocking our fields with artificially grown quail was inevitable, and the present trend is in complete reverse to a few years ago. Many aspects of game management work through the years have developed in cycles. For example, either an all-out effort was made to propagate quail artificially without regard for environments, or just the opposite was advocated.

In too many of the fancy and attractive "over-night" or "shot-in-the-arm" game restoration practices, the cart was placed before the horse for reasons too varied and numerous to mention.

It may be of interest to inject a recent compilation of hatchery quail banding records for the period 1936 to 1947 inclusive. During this ten year period a total of 214,822 hatchery quail was released from the Buffalo Springs Game Farm throughout Tennessee. This data shows that from a total of 65,671 or 29.7 percent, of the hatchery-raised quail banded and released there were only 143 returns — less than one-half of one percent.

The need for conclusive, positive information is paramount in order to put into effect a sound quail management program, as well as to find out whether Tennessee sportsmen are getting value-received for the thousands of dollars spent annually propagating bobwhite quail at the state game farm near Knoxville, where the average annual production has been approximately 30,000 birds at a cost of that many dollars or more.

### Aim of the Project

The aim of the project is to get valid information on many of the questions now confronting sportsmen and game administrators alike, and to find out other things that might help the thousands of hatchery-raised bobwhite quail "take root" in Tennessee, thus coming to the rescue of a diminishing sport long held in high favor in this part of the country and one for which much distinction can be claimed.

## Major and Minor Problems

Listed in our work plan are two major phases: 1) the value of hatchery-raised quail for restocking, and 2) the fox-quail relationship. Although closely related, these are in reality two projects in one.

The overall objective under Phase I is to liberate pen-raised bobwhite quail (native strain) on intensive study areas under various field conditions where survival counts can be made and their reactions observed.

The related problems under Phase I, the value of hatchery-raised quail for restocking are:

1. Ability of hatchery-raised quail to adjust themselves to the wild.
2. Spring release vs. fall release.
3. The most desirable release age groups of immature quail.
4. Extent of hatchery quail associations with native quail.
5. Their living range, longevity, and migration.
6. Reactions to gun and dog pressure, and the amount and quality of sport they provide.
7. Predation by foxes and birds-of-prey.
8. Behavior, food habits, etc.
9. Environmental influences.
10. Success or failure of bringing off broods. An intricate time consuming study in itself. Therefore, little information was accumulated.

The overall objective under Phase II, the fox-quail relationship, is to study trends in the foxes' seasonal feeding habits.

Related problems under Phase II are:

1. The amount of predation by red foxes (*Vulpes fulva*) and grey foxes (*Urocyon cinereoargenteus cinereoargenteus*) on both native and hatchery quail.
2. Comparison of fox predation on quail under "high" and "low" small rodent (buffer) populations.
3. The influence of other predators such as birds-of-prey, opossum and house cats upon quail populations.

## STUDY AREAS

In order to get this information on a scientific basis, four definite study areas have been set up, two primarily for quail and two for the fox-quail relationship investigation. One quail area is located near Denmark, consisting of 1,500 acres; the other is located near Humboldt, containing 2,000 acres. They consist of privately owned and typical farm lands, although these areas differ somewhat in topography and agricultural practices. The fox areas consist of portions of the Chickasaw State Park and the Milan Arsenal. The latter abounds with both quail and foxes, which makes it an ideal working field laboratory for this purpose.

West Tennessee was selected for this work because it contains some of the best natural quail territory in the entire state, and it was felt that studies of this nature should be made on areas capable of supporting quail.

Cooperative agreements have been signed between landowners and the Division of Game and Fish for a period of three to four years. The state is paying landowners five cents per acre per year for the complete control of hunting and trapping rights on these study areas. The exterior boundaries of each quail area are well posted.

Uncontrolled hunting of any kind is unlawful on the study areas except the Milan Arsenal. Removal of quail, both native and hatchery, when necessary, by shooting is accomplished by cooperators and cooperative sportsmen under the direction and supervision of project personnel. Pertinent information, which otherwise would be lost, is recorded for each quail taken from the areas. Such information consists mainly of the sex, maturity, covey location, weight, band numbers, if any, behavior, disease, and general physical condition of both native and hatchery-raised quail. Of course, many more detailed particulars are recorded.

## HATCHERY-RAISED QUAIL

Only the best strain of native bobwhite quail is raised and released in Tennessee. Some sportsmen have erroneously thought that Mexican quail were being released, basing their beliefs upon what was, instead, the bobwhite quail's ability to cope with fast changing conditions of increased gun and dog pressure by running on the ground, flushing far ahead of dogs and hunter, and flying into trees for escape protection. The last Mexican quail were released in Tennessee more than ten years ago, and if they did crossbreed with the native birds, present indications of such are negligible if not completely nil.

We have been exceptionally reluctant to make any definite comment on the results of our investigation thus far because of the danger of jeopardizing the real intent of this program. The problem is of such magnitude and importance that mere half-baked notions, circumstantial evidence, rumors or hear-say cannot be taken into consideration in formulating an equation to its solution.

We are after "hard" and "cold" facts free from dictation and coercion in any way in the pursuit of this specialized work which is influenced by professional standards and ethics. The work will be terminated in about six months.

The facts as we found them will not be distorted or misrepresented. They will be published without showing favoritism.

We have been and will continue to remain neutral on this question — there is no alternative. We are approaching the problem with open minds. We are not opinionated or biased. We are not laboring to prove a preconceived theory about the behavior of foxes and their relationship with quail.

Although we have accumulated plenty of unmistakable, time-tested and repeated year-in and year-out evidence from our relentless observations of field conditions, we do not feel fully qualified as yet to speak as authorities on this momentous matter.

We are thoroughly familiar with all the important conditions of each study area, for without a knowledge of existing factors of the whole picture, it would be virtually impossible to make accurate measurements.

There is nothing mysterious or secretive about the work we are doing. It is relatively simple. Careful and critical analysis of field "sign," fox trails and dens, the contents of foxes' stomachs and hundreds of fox scats over a period of several years from the same territory where both quail and foxes are abundant, and where we are familiar with the physical features and characteristics of the area, is providing us with much positive data.

It is relatively easy to analyze most of the food contents of a fox's stomach or scat, as you will be shown at the exhibit if you wish. In both, fur, feathers, bones, insects, fruits and berry seeds remain intact or in large enough fragments to be easily

recognized with the naked eye. However, the dissecting microscope is sometimes necessary to identify fur and skulls or teeth of small rodents and other items. A knowledge of and familiarity with available seasonal foods makes the job of food analysis even simpler for the trained field biologist.

We can't help being amused and equally provoked over the bickering and childish arguments presented in behalf of the fox or quail by well-meaning and supposedly intelligent sportsmen. Some of our worse offenders in the advancement of "crack-pot" game restoration theories are the learned professional men. Yet in the application of their profession both are ever-careful they have all the correct facts of the case before any definite action is taken. The country store and barber shop biologist play a misleading role in solving all of our game management ills with simple and fool-proof means.

We are in the field every day, and yet our greatest fear is that we may learn something that just "ain't" so.

Fussing with each other over selfish interests and differences is a total waste of time and energy. There are too many problems of great importance confronting us which we need the cooperation of all sporting groups to overcome.

## METHODS AND TECHNIQUES

Briefly I want to discuss the methods and techniques used in executing the research work, and to relate some of the information we have accumulated and extracted from masses of data and figures.

We will begin with the work done on hatchery-raised bobwhite quail. Keeping in mind that the research work is designed to throw light upon three questions: 1) advisability of using pen-raised quail for restocking, 2) the extent of predation by foxes and quail, and 3) future course of the quail and fox management program.

A thorough quail census with good dogs was made of each study area prior to releasing hatchery quail. Seasonal average of acres per quail are listed: In 1946 - 47 — 5.9; 1947 - 48 — 4.6; 1948 - 49 — 6.9. The number of quail per covey per season varied little: In 1946 — 11.5; 1947 — 10.6; 1948 — 10.2.

Each area is divided into equal parts, sections A and B. Native quail were removed from section A to cut down competition with hatchery quail, and to check the effect of over-shooting against accumulative quail releases and no shooting on section B. This procedure was followed the first two years. In 1949 shooting was done in sections A and B.

Approximately 25 percent of the total quail taken by shooting were hatchery stock. The percentage of kill is in direct proportion to the condition of hatchery quail when released. The percentage of cocks killed was higher in native quail, while slightly more hatchery hens were killed than cocks. These do not include birds released in the spring — only those released the same fall.

Hatchery quail are "processed" before loading in the following way: Either leg is banded; toe web punched; tail and wing tips painted with aluminum paint; and the average weights of eight quail per box is taken. Aluminum paint has little value in identifying living birds in flight or on the ground. It is a great aid in the identification of hatchery quail from quail remains. Matting of feathers and producing an unnatural coloration on quail may be undesirable features.

Spring releases (adult birds) were made in pairs and covey of eight to sixteen per release point. Eight and sixteen immature (10, 12 and 14 week old) birds per covey

were released in the fall at each release point. Cock foster mothers were tried with a few coveys of ten week old quail. Success was impossible to measure.

All handling, "processing," loading, transporting, and release of quail were done by project personnel, or supervised by them. The quail used for our studies came from the Division of Game and Fish Buffalo Springs Game Farm. They were taken at random from holding pens with no attempt to separate sexes or pairing young, and transported by automotive equipment in cardboard boxes.

As a rule, most quail when released utilized good cover, fed immediately, mostly upon greens, appeared alert and were capable of normal flights. The adults released in spring appeared to be a bit tamer than the immature released in the fall.

Of the 776 hatchery quail released on our study areas, only 10.5 percent survived up until one year after release. This figure was derived from positive identifications in the field, removal of shooting and live-trapping. At least 85 percent of the quail killed by hunters are yearlings, which indicates that the average life span of quail is very short, not more than three or four years. This must be recognized as an important factor in the percentage of survival of hatchery quail.

Periodic follow-ups of quail released were made with and without dogs, as conditions would permit, primarily for the purpose of looking for "sign" and positive identification of living quail. We were able to identify only 24 living hatchery quail. All appeared in good physical condition. Four hatchery quail were taken by birds-of-prey soon after release.

To further augment survival data we used covey and cock and hen traps (Stoddard). A total of 61 quail were trapped — 48 native and 13 hatchery, or 21 percent hatchery birds.

## PREDATION

Contrary to common belief, the extent of predation of foxes on quail is comparatively low. Hatchery quail are subject to heaviest predation during the first week after release. Hatchery and native quail and rabbits suffer most from ground and aerial predators during the end of winter when cover and food are at a minimum and the nesting season is on. At this time both quail and rabbits apparently do not have good sense.

In answer to the common question, "To what extent do foxes eat quail and rabbits?" we have accumulated this data:

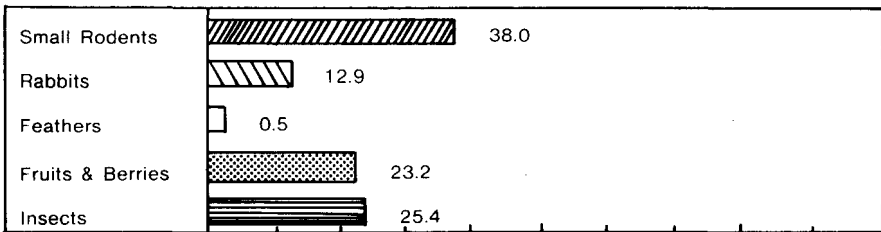
Out of 544 fox scats only 6.5 percent contained feathers of all kinds, most of which were identified as field lark and field sparrow. Quail feathers and remains amounted to less than one percent. Thirty-two percent contained fur, one fourth of which was identified as rabbit (Fig. 1, 2).

From a management standpoint the value of proving or disproving the theory that rodents act as "buffer" foods for foxes is questionable. If it were proven that foxes did not exert much pressure upon quail when the rodent population is "high," we still could not advocate a larger rodent population. However, if the reverse were true then some steps for the control of foxes might be advocated.

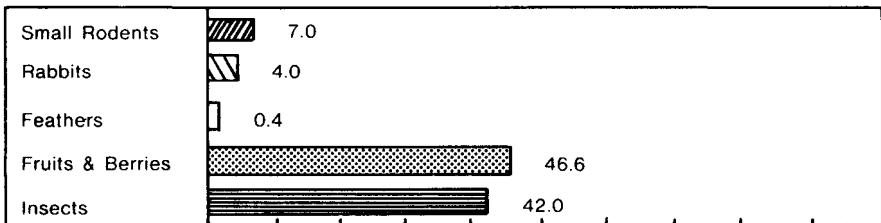
The Chickasaw plum (wild plum) and persimmon could just as well be classified as "buffer" foods. We have found no difference in the amount of predation by foxes on quail during seasons when these fruits were scarce or abundant. Foxes merely adjusted themselves to changing conditions of food scarcities by ranging further, eating more of the available foods and substituting others.

MILAN ARSENAL AREA

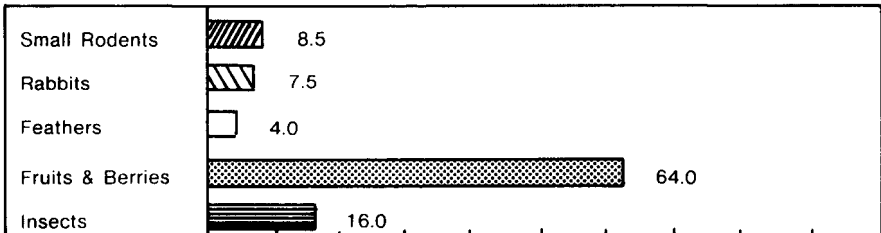
Spring (April, May and June 1948) Analysis of 208 fox scats.



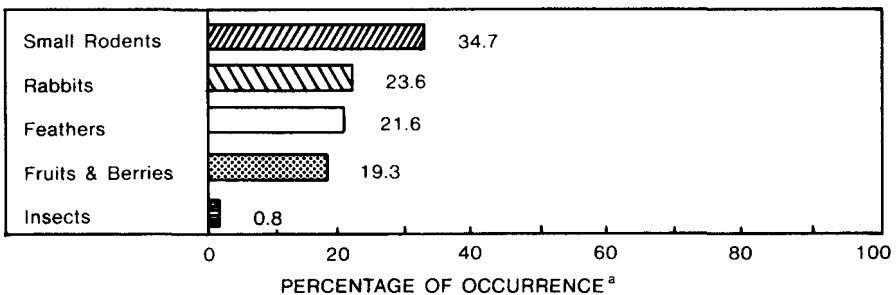
Summer (July, August and September 1948) Analysis of 102 fox scats.



Fall (October, November and December 1948) Analysis of 146 fox scats.



Winter (January, February and March 1949) Analysis of 88 fox scats.

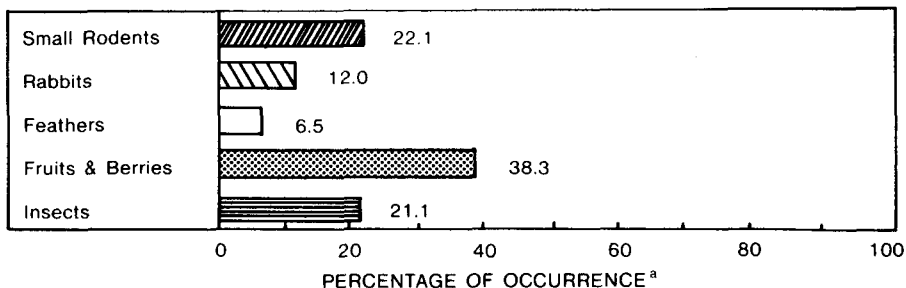


<sup>a</sup>Volume does not vary over 5%.

Fig. 1. A comparison of the seasonal representations of major food groups in the fecal passages of foxes.

## MILAN ARSENAL AREA

Annual (April 1, 1948 - March 31, 1949)



<sup>a</sup> Volume does not vary over 5%

**Fig. 2.** Annual representations of major food groups in the fox diet based on the analysis of 544 fox scats (fecal passages) taken from the Milan Arsenal study area.

In an attempt to accumulate data on this problem, four one-half acre quadrants of upland sedge and sedge-lespedeza types of cover were trapped with approximately 200 common mouse snap traps spaced about 15 feet apart and baited with peanut butter and rolled oats. Traps were run for three consecutive nights. The result was an average population of 12 small rodents per acre for this type of cover.

### Collection of Materials for Food Habit Studies

Information gathered pertaining to foxes' food habits has been from three sources, namely, 1) observations of fox dens to check food remains, 2) fox stomachs, and 3) collection of fox scats (fecal passages).

Eleven foxes' dens on and off study areas have been observed systematically during periods of heavy utilization — usually between February and July. We have found that dens are not "stuffed full" of quail and rabbit remains as it is often reported by the casual observer. At any rate, to draw a conclusion of the fox's diet based upon observations of remaining food items at foxes' dens would be about 90 percent wrong for two reasons: 1) Foxes use their dens only a few months of each year, and 2) Usually there are no remains left of small and soft foods eaten in their entirety.

Listed are some of the important food remains found at the dens we have under observation for the past three years: 12 rabbits, 8 chickens, 11 cotton rats, and 3 quail.

An attempt was made to take a representative number of foxes' stomachs to provide a list of food items eaten in volume. Animals were taken by trapping and shooting after dark from autos in the Milan Arsenal area. We did not change the ecological pattern on our areas by taking too many foxes. To date we have approximately thirty stomachs. Not a single one contained quail feathers. Main foods taken were small rodents, fruits, berries and insects.

Our best means of getting a fairly accurate index of the fox's diet is through the collection of hundreds of scats, although the volume of foods eaten cannot be



ascertained from this source of material. Scats are taken at random from the quail areas and Chickasaw Park, but are picked up bi-monthly from edges of three miles of black-top roads surrounding Zone "D" in the Milan area. These represent food items taken by the same animals monthly, seasonally, and yearly in percentage of occurrence. We have averaged collecting approximately 75 scats per month and as many as 40 per mile of road per month from the Milan area. Our total collection contains approximately 3,000 fox scats.

Carrion cannot be identified in a scat, whereas it is possible to do so in the analysis of foods contained in a fox's stomach.

The fact remains that feathers from one bird could show up in several scats, however, occurrences are recorded as representing a separate, normal and healthy quail. The possibility of quail taken by foxes as being cripples, diseased or victims of some other natural cause must be discarded.

The same holds true with occurrences of rabbit fur and bones in scats. The size of rabbit taken would have some effect upon the number of occurrences. In the case of a small rabbit it could be devoured in one meal and the fur and bones could show up in more than one scat. In the case of a large rabbit more than one meal could be made up from it by one or more foxes, thus further complicating data representing percentage of occurrences. Quail and other small birds in all probability would be eaten in one sitting.

Next to foxes, the house cat is blamed most for heavy predation on quail by persons, who, in most cases, have nothing concrete upon which to base their belief. The project personnel, motivated partly by a strong desire to satisfy a personal curiosity, collected and examined fifty cat stomachs. These constituted tame and semi-wild cats taken from study areas and along highways after dark in quail territory when found far from dwellings. They are not to be construed with backyard pets. This activity has been bloody and cruel, and no doubt many valuable mousers and children's pets, including several suckling and pregnant females, have been slaughtered.

The remorse suffered is so great in contrast with before the study, when we felt that cats were detrimental to game, that now only very few cats are killed. We are relieved somewhat by feeling justified in making a few cats martyrs to a worthy cause.

The main food items taken by the cats in our collection are listed in the order of their importance: 1) Rodents (field mice and cotton rats), 2) Insect (grasshoppers and ground beetles), 3) Toads, 4) Snakes, 5) Persimmons, 6) Birds (single nestling field lark), 7) Table scraps.

If this be a fair sample of their normal feeding habits, they have been at least 95 percent beneficial.

## CONCLUSIONS

In conclusion, I will relate some results and things learned about native and hatchery quail and the fox.

1. The method of handling, transporting, and releasing hatchery quail, plus the quality of birds raised and type of environment in which they are released, has a marked effect upon their success or failure immediately after release.

2. Adult hatchery birds released in the spring apparently vanish in thin air. Six months after releases not a single bird has been recorded. Young, 10, 12, and 14 weeks old, released in the fall survive and remain in limited numbers for about one year. They too, seem to vanish the following fall. We have only one record from one of our first fall releases taken the second fall.
3. The most desirable release age groups in immature quail are directly associated with their physical condition when released.
4. Quail released in good environments were inclined to stay put while those planted in poor environments soon migrated elsewhere. Kills varied from 0 to 2 mile from release points.
5. Hatchery quail differ very little from native wild quail in their appearance, behavior, reaction to gun and dog pressure, their flight and covey formation, and utilization of foods. They mix with native and/or other hatchery quail. Bird dogs have difficulty in scenting them and they hold to point and flush in a manner similar to native quail. Hatchery quail are inclined to weigh approximately 1 ounce more than native quail.
6. Hatchery quail suffer various degrees of ill effects from being hauled several hundred miles by automotive equipment.
7. The present quail population on our study area is just about the same as three years ago in spite of protection, controlled hunting and accumulative quail releases. Also sections A and B are harboring approximately the same quail population although they were managed differently. Quail are removed by shooting from section A and protected on section B, Although the same number of hatchery quail were released on both sections.
8. At best, survival of hatchery quail after the first year is comparatively small, and it is questionable if continued customary releases are of value in increasing the quail population on a state-wide or local basis. Limited numbers of hatchery quail properly handled and released on areas capable of supporting them — areas depleted or below the carrying capacity — will no doubt be of some value. The exact place for this type of release must be determined. In the final analysis, the value of stocking hatchery quail boils down to whether we continue to release them at \$1.50 each to be killed the same fall or protected from shooting and loose them the following fall. In view of the results of this work, quail should not be released in the spring, and random and indiscriminate releases should be terminated.
9. The difficulty of completely eliminating native quail from a covey or reducing them to a few is in direct proportion to the type and distribution of cover and hunting conditions. Ground and air predators are confronted with the same problem. And even under ideal conditions it is difficult to eliminate completely every quail from a covey.
10. Native quail will survive in apparently good condition and remain by themselves in singles, doubles and up to coveys of 4 and 5 during critical winter weather without joining other coveys until late winter.
11. It would be safe to harvest at least 60 percent of a normal quail population and still have enough left for seed.
12. Native quail mate with hatchery quail, to what extent we do not know.
13. Heavily shot-over areas do not respond to a normal quail population the first year even with supplemental plantings of hatchery quail. Infiltration of native quail is also a slow process.

14. Areas desirable for quail and rabbits are usually used by predators and small rodents alike.
15. Controlled burning of monotonous and unproductive areas such as old stands of broom sedge in winter has proven beneficial to quail.
16. The small percentage of predation on quail by foxes can be attributed to a man's poor manipulation of their environment making exposure inevitable.
17. Quail live in harmony around active foxes' dens, using den mounds for dusting and grit without being preyed upon.
18. The amount of predation by foxes on quail nests and young during the nesting and hunting season is negligible. We have only one record of white egg shells in a fox scat. No young have been found. Occurrence of these food items was no greater than in other seasons.
19. Some areas maintaining a small rabbit and quail population or void of them are not inhabited by foxes. Obviously, the limiting factors must be something else. The reverse situation is also true. Environment, climatic conditions, and over-shooting are probably the greatest factors influencing fluctuations in quail populations.
20. Foxes are decidedly omnivorous. Most people think of them as being solely carnivorous.
21. With development and practice of better poultry husbandry, losses of chickens and other domestic fowl will be practically eliminated.
22. Because of the large amount of insects and rodents and some snakes consumed by foxes, they could be classed as beneficial to both man and quail. Damage by insects to man is great, and snakes and cotton rats are capable of destroying quail eggs and nests. The cotton rat, a seed eater, competes with the quail for food during winter shortages.
23. The fox population in Tennessee is no doubt at its peak. Return of high prices for long-fur pelts would automatically make the fox very popular and within a short while scarce. An open year-round season on both red and grey foxes until their numbers are reduced to a level that will provide good fox hunting and less predation on domestic fowl and animals appears to be in order.
24. A simple and fair test, which consisted of the remains of birds and animals found in the field, was given to various groups of select and experienced quail hunters from sporting clubs for identification. The results proved without a shadow of a doubt that 95 percent of the sportsmen are unable to identify correctly the remains of birds and animals found in the field, wood, or at fox dens.

In closing I want to leave one thought with you. If Tennessee as a whole, or a given section, is suffering from a game shortage, there undoubtedly is a reason or reasons for this condition. Unless those reasons are learned and corrected, trial and error methods designed to restore game cannot be too successful. A seemingly perplexing and complicated problem becomes as simple as that.