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DAVIS COOPERATIVE WILDLIFE  
RESEARCH UNIT  
MELBOURN, QUEENSLAND 5843

THE DAVISON RANCH, ELLIS COUNTY OKLAHOMA

GAME BIRD PROJECT

FROM FEBRUARY 1, 1932 to JUNE 1, 1935

SUBMITTED BY

VERNE E. DAVISON

U.S. DEPARTMENT OF AGRICULTURE  
FOREST SERVICE  
DANIEL BOONE NATIONAL FOREST  
1700 BYPASS ROAD  
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## INTRODUCTION - PURPOSE - ESTABLISHMENT

There is an increasing demand for the conservation of game birds, by sportsmen and out-door lovers, and of song birds by agriculturalists and nature lovers. It seems to increase at about the same rate as the numbers of the birds decrease except the decrease preceded the increased interest by a few years. The value of the birds affects all rural activities in business by their destruction of insect hordes, by providing recreation and pleasure of hunting and sight-seeing for the city and town dweller.

One class of these birds has been neglected above others, have been destroyed in the name of sport, and now present a serious problem of rehabilitation and continuation. This is the class of upland game birds, nesting on the ground and because of their fast flight, edibility, and bird-dog training qualities are most pursued by the hunting sportsmen.

In northwestern Oklahoma, where the Davison Ranch Project has been carried on, two of these upland game birds, the bob-white quail (*Colinus virginianus*) and the lesser prairie chicken (*Tympanuchus pallidicinctus*), are more abundant and more valuable than any other birds for hunting pleasures. In the case of bob-white quail, while there is much knowledge now obtainable concerning the birds, their habits, preservation and increase, generally, there are several specific facts that need to be known in order to establish successful game management practices. Some of these facts were controversial, a few being reasonably expected different from other areas. For thorough information on the bob-white quail, Stoddard's

"The Bob-white quail, Its Habits, Preservation and Increase" is authentic and instructive for that part of the country on which it was prepared - the Southeastern States. The birds are the same but climatic and food conditions are very different and therefore does not apply to Oklahoma's problems entirely.

In the case of the lesser prairie chicken, no authentic information has been gathered, no attempts had been made to learn their life habits and requirements. The northern prairie chicken (*Tympanuchus americanus*) some of the grouse and similar upland birds had been studied in the Northern States, but each was quite different and such conditions were of little value in the propagation of the southern bird. The similarity of the several species is but partial and opportunities for study here were in no way comparable to the North.

From this situation it is easily understood why leading conservationists found a thorough study of the birds advisable. The American Game Association, and the Bureau of Biological Survey, a division of the U.S. Department of Agriculture, having completed a survey of the country, studied the problem of upland game requirements and having access to the foremost thought of national and state wildlife specialists, cooperated to establish several areas for the purpose of demonstrating game management. The Oklahoma State Game and Fish Commission, whose officials were familiar with the Davisons and their 100,000 acre ranch game refuge, was interested in this project as a game production unit.

Henry F. Davis, Regional Director in the Southwest for the American Game Association, Wallace E. Grange, cooperative agent for the Biological Survey, and H. S. McMurtrey, Superintendent of Propagation

for the State game Department, accompanied Verne Davison on an inspection of the Davison ranch holdings in Ellis County, Oklahoma, January 21 and 22, 1932. Having found the area suitable and promising worthwhile results, a three year contract was entered into between the Biological Survey and the State Game and Fish Commission for the immediate establishment of a demonstration project on a portion of the ranch. Further cooperative agreements were made with Verne E. Davison, as the project manager to complete the set-up.

The contract called for an annual expenditure of \$3,500.00 or more of which \$1,000.00 might be deducted for rental of the project area, leaving a minimum expenditure of \$2,500.00 each year for improvements, wages, and equipment. However, no charge was ever made for the use of the area, and the total expenditure for the three year period was only \$5,688.57, an average yearly expenditure of \$1,896.19 which included considerable ranger patrol duty and expenses for transplanting prairie chickens to other state areas from other portions of the Davison ranch. Occasional labor was furnished in addition to the project manager's services, the agents of the Biological Survey made periodical inspection, aiding in planning the program, examining and reporting stomach collection data. The American Game Association was represented on most of the subsequent inspections by Harry C. Shuttee, Kansas City, Mo.

The reports of the Biological Survey Agents are on file in the offices of the interested cooperators, and will not be covered by this report. Mr. Herbert L. Stoddard, Thomasville, Georgia, nationally known quail expert, made these inspections toward the latter period of the project.



The specific purposes of the project were soon changed from a demonstrational to an experimental position because of the lack of the authentic information of the prairie chicken, and the migratory habits of the quail, a very peculiar condition unknown generally. This change was agreed upon by all the parties and a fact finding research inaugurated during the first year.

To gather together, briefly, the desirable aims, and the methods used to accomplish them, will give an idea of the magnitude of the work and the detail that becomes necessary in a study of the complex life habits of wild birds. It will give an insight, too, to the obvious retardment of success occasioned by the shortage of funds, and the need for a longer period of research into the many problems. The writer's greatest desire is to see this study carried out to completion because of its basic necessity and unquestionable value in the future management of lands that may produce these game birds. With that purpose in mind, the report recognizes those important facts that are not definitely ascertained and makes specific recommendations for their continuance.

The reader will find it most interesting to consider the management of game production in the same careful manner of any other business. The writer, being in the business of producing livestock under range conditions, which has undergone many changes of late years, is struck, primarily, with the meager facts that are known about the birds under observation. A careful reading of the full report will doubtless convince the reader, too, of the futility of managing the business of

game production until most of the major contributing factors governing the welfare of the birds is understood.

The production of game in the field is generally secondary to some agricultural endeavor and must therefore be pursued with the least possible interference with that business. Likewise, the practices of the primary industry that are detrimental to the birds' environment must be learned and modified where possible. As often as not, the improvement for the one is also an improvement for the other.

One must remember the chief purposes of saving game birds (having a sufficient brood stock from which to produce a surplus for shooting, saving a beautiful species from annihilation, and their economical value in insect control) and provide methods of increase at a reasonable cost, in fact at the least possible cost compatible with numbers.

It is first necessary to know how many birds are on a certain area and observe and record the increase and decrease over a period of years, keeping records of all the factors that might influence the change in population. It is a lamentable fact that estimates of bird numbers, even by people who wish to be helpful, are so varied and generally exaggerated as to be a menace to sensible game planning. For example, the prairie chicken population on this area was variously estimated at 10,000 to 100,000 with 25,000 generally considered conservative. Yet, by methods that are about 95 percent perfect (explained in detail later) it has now been determined that 3,000 would have been liberal. No count has been made of the entire ranch, but the 10,000 acres under close observation, the best of the chicken territory, proved to contain 850 chickens in the spring of 1932. Such estimates as those are the regular information upon which seasons are opened, bag limits regulated, and hunters tempted to the field. It naturally results in an

excessive kill, considerable disappointment and a definite step backward in game rehabilitation.

Most game increase estimates are made upon the theory that each 200 birds are equally divided male and female, that each hen raises a brood of about 15 which produces 1,500 birds a year the first year, 11,250 the second and 84,375 the third, and so on--an annual increase of 750 percent. Yet an actual increase of 100 percent is exceptionally good, and 50 percent is not disappointing. All of this adds up to the results of over killing and a division of sportsmen into camps of argument, each with a "pet" idea of the single reason for failure of the 750 percent increase. Some say "game hogs" others "predators" "bad winters" "bad laws", etc. no end. Of course it is somewhat a combination off all these factors, and more, but it is now easily understood why it is necessary to learn what actually does happen to the 650 percent that doesn't materialize, how to prevent this loss, and having learned, to teach producer and hunter that they may appreciate the value of each single bird and the provision that must be made for its welfare.

Most of the steps will appear simple and natural, each leading to another, but some paths prove false while fewer are good. To establish each fact authentically (and everything less than that would be almost criminal) it must be proven by many repetitions, every fact checked against itself, for the facts must be correct before being offered for the guidance of people who desire to conserve the State's WILDLIFE at their own expense. It is the opinion of the writer that it is the duty of the Game Department administration to perfect and teach the methods of game production to the occupants of lands that sustain the game supply for sportsmen who contribute funds for the department's upkeep. No other agency is capable of or designated to accomplish this mission.



This then, if admitted, demands the knowledge of the birds' entire life habits, this separation of actual facts from fireside lore--in short a continuous study in the field, keeping records, to establish methods of game production, and improve them. It requires the determination of numbers, number of hens and cocks, nesting data, number of eggs, number of nests destroyed, and by what, and all that happens while the bird is growing to maturity. Even that is only part of the story since there are 365 days in the year, each of which must provide food and protection from any enemy. It all leads to the finding of many nests, daily observation, following the brood throughout about 14 weeks of growth, and the ravages of hunting season and winter weather. It is generally known that insects and seeds are the chief foods, but the pertinent question is "what insects and what seeds" the many species of each reaching into hundreds--but the valuable ones being far less.

The methods of determining food requirements are by taking the birds' and examining the contents of the crop and gizzard--what they have eaten. Quail eat seeds so small that it requires several hundred for one meal, yet find it in abundance. All the plants that are common which make up the environment should be known and their uses determined. To do this a collection of seeds were made for reference, the species determined, and the general characters studied.

To follow an individual bird through life, one must be marked unmistakably. For this, metal bird bands are consecutively numbered and all possible data kept of each particular bird, each covey formation. Appropriate records include such facts as age, sex, movements, mating, covey numbers, dates etc. This necessitated the preparation of a detailed map of the whole area under study, improvement of the then primitive methods of capture, holding and releasing, studies of the sexual differences and the varying ratios. weights, measurements,

coleration, courtship and mating and the care of the young were all necessary.

Several years are required to learn the life span of birds that are banded, of which the age is known at banding time, and later recovered. So too, the development of foods and methods of their control for better or worse take a series of seasonal experiments and observations to complete. The value of water, in this rather arid region, certain nesting cover and the balance between the upland game and other birds and animals must be determined.

The use of fire and plow is a common aid in most agricultural practices and to raise birds with it is a study that is worthy. These factors once understood provide a way to improve both businesses with the least detriment to the other.

One of the commonest attempts to promote game welfare is by artificial feeding and planting small patches of domestic grains, such of which has proven inadequate for the late winter and spring months when it is most needed. Yet, there are methods that can be employed which can be determined by well directed efforts of research.

To study these several phases, feed and nesting areas were fenced against grazing stock, birds were taken each month for food examinations, limited nesting studies pursued and field observations carried on. More than 2,500 individual birds, mostly prairie chickens, were captured, banded and released with full records made of interesting facts. Native foods were collected, new foods introduced, weather conditions recorded and burning and discing experiments commenced. Heavy and light pasturing were observed, parasitic growths noted, predator species collected and their influence studied. A careful census was

taken each year and comparisons made. Methods of netting were improved and many details relative to these few problems were undertaken and are taken up in detail in appropriate places.

The facts as recorded were compared, summarized, regrouped, and reports submitted the cooperating parties on several phases of the work. An individual record was prepared for each of some 2,500 birds that were banded, several of which were recaptured and killed. Inquiries from several states were answered and information from experts was secured and studied. A few articles for public information were prepared and published. As many studies as time permitted were made of areas other than the one project.

Most of these studies, and their methods, together with their results are detailed in appropriate paragraphs. Several problems were satisfactorily completed, many more but partially completed, and some almost untouched because of the limits of one man's ability to accomplish more on the available funds. Intersingled with this report will be found frequent mention of the writer's desire to see the work continued and expanded where specific problems need attention. An apology is offered for this liberty because the work is of paramount importance and by its completion, only, can the full value of this preliminary study be realized. Through that completion, only, can any satisfactory game restoration program in northwestern Oklahoma be planned and accomplished.

#### PRIOR HISTORY OF THE DAVISON RANCH

The history of the Davison ranch as it is applied to prairie to chicken and quail is interesting up to the time of the project's establishment. It will demonstrate some of the vital things that need to be considered. Could the present method of ascertaining accurate

numbers have been used throughout the ten years from 1922 to 1932, the effects of lighter grazing, burning and protection could now be thoroughly understood. Also the effects of two open seasons under normal circumstances, in 1929 and 1931, might have been calculated.

Contrary to the previous history, the three years of the investigation were record drought years for this area, and, while offering a splendid opportunity to study adverse conditions, were not conclusive for average years.

The ranch is almost entirely grass land of rolling prairie, no material farming operations having been carried on for many years. Its use as a state game preserve was given by George Davison in 1921 in an effort to protect the game that was still living there and increase it to higher numbers. Buffalo, deer, and elk were started and have been successfully increased. Wild turkey were added with less favorable results. Pheasants and partridge were introduced at different times but with no success. In those, days, 1921, and previously, inadequate laws and less adequate enforcement permitted the game hogs to almost exterminate the prairie chicken. All the deer were gone. Lack of good roads had saved the quail in good numbers. Early in the settlement of Oklahoma, market hunters had devastated this area by wholesale slaughter of both quail and prairie chicken by car loads.

Under the protection of the state, prairie chicken rapidly increased from only an occasional covey to several hundred, quail held their position. The operation of the ranch doubtless had much bearing on the increases of chickens, and again some practices probably retarded even better success. An abundance of cover was provided as a result of very light grazing, several thousand acres being untouched by stock for several months. Fires were very severe over these ungrazed areas



and frequently occurred at bad times of year for food, cover and nesting of birds. Much controversy was raised on the effects of fire, as is the case elsewhere, as related to birds. But fire is a valuable weapon to the cattlemen of large areas for cleaning his lands of disease, insects, and excessive brush. A pasture, to insure early fattened cattle, must have a minimum of old grass and a maximum of new. The welfare of both birds and stock can be adequately served without detriment to the other as the investigation will show.

But large areas of land no longer will be left for the total benefit of birds, except public lands set aside for the purpose. Grazing areas are now cut up by farms, and these smaller units present the chief type of habitation for the future game crop. Many thousand acres of western Oklahoma lands are similar to and used for the same purposes of the Davison ranch. Its large acreage under single management offers the better opportunity for an extended research of such large scope, the results of which will be applicable to those other areas. Hundreds of birds may be studied here by handling, where smaller areas would not permit sufficient spread.

Predators are numerous, offering information for research. wide variety of foods and protective covering, and a variation of grazing operations in different pastures, offer excellent observation and experimental records.

The following pages discuss the ranch and its operation from 1932 to the spring of 1935, the initial period of the study on the project. It takes up detailed findings of the many problems encountered in the production of the prairie chicken and bob-white quail. Methods of procedure, facts that are proven, theories that are mistaken, and recognition of its shortcomings are intermingled to present a composite picture of a problem half-solved. It is a foundation



upon which an authentic program of game management can be perfected at a small expense, applicable to practically all the state. Its continuance for a short while will provide an authority in written pamphlet for the guidance of land occupants, interested sportsmen, and officials whose duties are dedicated to the public welfare of conservation of game.

#### TYPE OF COUNTRY - ENVIRONMENT

Most of the country in Western Oklahoma that produces the lesser prairie chicken is covered with a low growing oak beneath which grows a wide variety of grasses, weeds, flowers and other shrubs. The small oak is referred to as "shinnery" because of its low growth. Yet, it may be somewhat misleading if it were not explained that "shin high" growth is a result of frequent burning. It will grow from knee high to 20 feet or more in a few years, depending on the particular species of which there are several.

The soil is very sandy, the sod thinly scattered, and beneath the sand at a depth of 12 to 30 inches lies a light red clay containing the submoisture that provides an even distribution of moisture for plant life over a much longer period of drouth than is the case with harder surfaced lands.

Among the species of oaks, are some that grow in almost round clumps of variable size from about 20 feet in diameter to possibly 150 feet. The species grow more rapidly and to greater height than surrounding species. The name of "motts" is used to designate this type of clump from the usual terrain. "Motts" are a most important factor in the habits of the birds, and in the success of netting live birds in summer. Most of them are rounded up into cone-like hills as a result of blowing sand drifting into them since they hold their leaves throughout winter when the oaks drop theirs at frost.

The general lay of the "sandhills" is rolling, rather high in its relation to the surrounding country, made up of hills and swails (many of which have no drainage outlet). The appearance, at first is of a country completely overrun by oaks, but better observation discloses underlying grasses and weeds which produce abundant grazing for cattle and excellent cover for nesting and protection of upland game. Food for them is supplied by oaks, grass and many species of plants. At the edges of the sandhills, where soil changes from sand to hard soils, draws begin to form and drain into deep cut canyons. As the sand changes to clay, so the flora changes from oaks and thinly sodded grasses to heavily sodded grass on the hills and trees and brush on the creeks. Likewise most of the other plants of the sandhills give way to a new set of plant life on heavier soils.

All of this land was homesteaded in 100 acre tracts over a period of years from 1907 to 1920. Perhaps half of the quarter-sections were partially farmed for one year or more. Those fields that were replowed several years in succession completely eradicated the oak growth, others farmed for shorter periods leaving only the larger species. Returning to pasture, new kinds of grass sprang up but there is still no sign of the oak on these "old fields". These old fields are most heavily sodded and kept grazed close in summer, offering no nesting grounds for the birds, but providing open areas upon which the prairie chicken feed considerably. An old field that was improperly cared for has often started blowing, the sand being driven from the top down to the clay subsoil. These are bare of any vegetation and are referred to as "blowout".

Within the ranch practically no farming is done, but it is

surrounded by farming operations in varying degrees. Within the ranch are only half a dozen residences, the ranch itself having but four sets of home improvement.

The sandhills embraced by the ranch are about five miles across from east to west, and 14 miles from north to south. The sandhills continue to the northeast for about 20 miles but end to the south, east, and west in canyons draining into the South Canadian River.

The elevation above sea level is between 2,300 and 2,400 feet. Average rainfall is 23 inches. However, the three years covered by this report were record years of drought dropping to 12 inches which resulted in complete failure of farming operations in most instances and grazing ability of the land to less than half.

Several of the homestead sites are still marked by trees that were planted and survived well until this drought. Included in these successful plantings were black locust, cottonwood, catalpa, mulberry and many fruits. About 75 percent of these died during the investigation, even a small percentage of the native oaks dying, too.

Dew is commonly absent for periods of several days in June, July, and August but such lengths as 30 to 60 days, common these three years, were extreme. Only a small portion of the plant life was able to produce the seed that is usually so abundant. Of course the mean temperature rose. The lessened supply of forage, of course, resulted in overstocking of grazing lands, which left a depleted protective covering for birds--in many places practically none at all.

One factor makes the sandhills most adaptable to successful nesting and rearing of upland game, that is the rapid drainage of water by absorption that carries surplus rainfall into the ground in a few minutes protecting nests and young from destruction. It also

explains the stubbornness with which dry spells are resisted and evenness of humidity for hatching. Another factor is the ability of the low oak to reduce the extreme heat of summer by shading and transpiration. Most nests are partially shaded at all times of day, protecting the bird and eggs while incubating. The mottling of the ground by the leaves of the shinners camouflages both bird and nest admirably. It makes nest finding most difficult.

An abundant crop of acorns is produced about four out of five years on the smaller species of oaks. No year is a complete failure. The acorn sizes are from the end of the little finger to the end joint of the thumb. Upon them the chickens do well keeping fat the entire winter and spring, in fully as good condition as ones that go to grainfields. The summer foods are just as plentiful consisting chiefly of grasshoppers which are probably more abundant here than any other Oklahoma locality. There are many other insects and these are supplemented by constantly maturing seeds of other plants.

Winter cold reaches zero but seldom, recordings as low as 16 degrees below being exceptional. These cold extremes are short lived, a continuous freezing temperature of three or four days being common. Snow covers the ground four or five times each winter, sometimes remaining on for two or three weeks, but none having been severe enough during the investigation to harm either quail or prairie chickens except the indirect cause of an occasional flocking to the fields when a law violator can easily slaughter many prairie chickens. Some green leaves are available throughout the winter and are taken by the chickens,

The summer range of prairie chickens is confined almost entirely to the sandhills of the Davison ranch in Ellis County. The best



of the bird range is the higher portion of the sandhills where it is the "sandiest". No nesting, evidently occurs on the fringe of the area where the top soil hardens, and no young are ever observed on these edges. Quail make use of this area of transformation more readily, though not so successfully as the heart of the sandhills. The 10,000 acres selected for concentrated study are in the heart of this best country.

Fall and winter find many chickens on the surrounding fields and hard lands, occasionally on creeks. Quail migrate to the valleys and canyons at the approach of fall, leaving less than 10 percent on the summer range. Late February brings the chickens back to their breeding grounds, over a period of 10 days or 15. Quail return in April and May. Banding records, returns of which are still meager, accurately check with these observations.

It will be noted that the propagation and increase of these upland game birds are more dependent on proper care and use of pasture lands than on the cultivated lands. Since burning these areas is a major control method for ranching, results of fire are detailed later.

#### FED AND NESTING AREAS

As has been explained in the introduction, the original plans called for a demonstration project to show means of improvement of cover and feed, but were afterward changed to an experimental basis. The original plans called for the building of small food patches (about 5 acres each) to be fenced from stock and used to plant grains and trees. These were to be placed on each 160 acre tract or possibly each 40 acre tract by the end of the three years.

Sixteen such feed patches were fenced in the spring of 1932,



one for each 640 acres, with three wire fences and native oak posts of a temporary nature. The size ranged from 2-1/2 to 13 acres embracing 1 to 5 acres of land level enough to cultivate and one or more oak motts. The average size was 5-1/2 acres, the average cost of fencing including labor and materials \$2.77.

Cultivation failed by virtue of the drouth that prevented regular agricultural operations to mature but established some interesting information on natural weed growth and some drouth resistant shrubs that were planted. The three wire fences were not satisfactory in some pastures where roughish cattle bothered. Other areas were unmolested.

In 1933 nine additional areas were fenced with four wires and permanent posts. They averaged 5-1/2 acres from 4 to 9, costing \$33.35 and were entirely stock-proof.

Cowpeas and mong beans made some successful seedings. Under normal conditions maize will mature good yields of grain but as will be pointed out in the following paragraphs, such small fields offer little hope of success.

The meager production of grain developed the fact that two acres or less of feed for each 640 acres was inadequate for prairie chickens and the rodents and other birds. During the summer, many rabbits and mice are making use of the whole 640 acres, rearing their families and living off the natural foods. But the first frosts stop the growths of vegetation and cause the overhead leaf covering to become thin. Consequently an exodus begins that usually ends in a concentration on the protected area. The heads of grain beckon to winged species and as a result hordes of black birds, crows, hawks, sparrows and songbirds devastate the fields as insects disappear. This destruction occurs late in the fall or early winter, leaving nothing for

the more severe storms of mid-winter and spring. More specific attention is given these species under the heading "predators". Blackbirds commonly eat up 40 acres or more of grain in the field if left alone. Crows are much less numerous here than in southern Oklahoma but eat much grain.

Damage to young trees and shrubs by rabbits is great and can be avoided by screen wire or poultry netting surrounding the trunk for two or three years.

The value of the feed and nesting areas appears much more valuable to quail than to prairie chicken. Seven prairie chicken nests were found in the patches in 1932 and 1933, only one being left undestroyed to hatch. Three quail nests that were found hatched well, none being molested. It was further observed that almost every patch contained a rearing covey of quail each year, reared with success. The observations further indicated that the value is probably more in the nesting cover than in the breeding use as it was more commonly found to be the case that the birds preferred a nearby mott for their daily sanctuary.

Those patches containing the most cover, several oak motts or trees, and largest in area, were used by the quail till later in the winter each year than the smaller ones of less protection. Two patches that contained 10 and 13 acres of which much was locust trees, held quail each winter of 1932-33 and 1933-34. On January 1, 1933 at least 98 quail were still in feed patch areas but by spring even part of those had left. In the winter of 1934-35 none remained except at headquarters where 14 were wintered, compared to an average of about 50.

Had normal weather conditions prevailed, less concentration of rodents would likely have resulted, better cover would have developed, and many times more seeds matured for sustenance. Finances for this part of the study were withdrawn before the second winter so that no final conclusions can be drawn. It is worthy of further study, however, on the basis of facts already known since larger patches are impractical for small farms. It may be that a patch for each 40 acres, by lessening the rodent concentration to one sixteen-th, would be successful. Several species of plants were developed at headquarters that can withstand such drouths, that rabbits will not bother, and offer excellent cover from bird enemies. These plants have a good chance of turning failure into success when supplementing native conditions.

Some experiments were conducted to increase cover by cutting the oaks over by partially severing the trunk three or four feet above the ground, permitting the tree to live. There is much promise in this method, even the severe drouth failing to kill but little of it. This should be continued.

#### METHODS OF OBSERVATION

Field observations have been carried on, chiefly, from automobiles which are less disturbing than any other way found. Most people have the natural thought that one on horseback could more nearly observe wild birds in their natural feeding maneuvers. But this is no more satisfactory than on foot.

A closed car is better for year round work but not necessary for purposes for observation. One may drive a car onto the gathering grounds of the prairie chicken with but slight disturbance.

Or, having disturbed them by too abrupt an entrance, wait a few minutes in which they will return and carry on as usual. At feed they may also be watched by stopping the car and motor when they will go about their feeding with little more notice than their ordinary watchfulness employs.

Window glasses may be rolled down and limited conversation permitted. Movements of the body are distracting somewhat unless very slow. A gun report without movement is peculiarly unnoticed, generally, but the opening of a door and appearance of a person will immediately cause all the birds to fly.

During the feeding period of morning and evening, observations are not so easily made as during the resting period of mid-day or the courting time of mornings in spring. During the resting period, in the heat of summer, when the young are with their mothers (or parents in the case of quail) the cover is taken to the protection of shade from sun where they dust and enjoy rest. They are located here by driving cars near the shady motts and here, too, are successful netting and banding operations consummated. A net is carried in the car, and when set, the car is again used to drive the birds into it.

Prairie chickens are usually found on the shady side of the molt at the outer edge and may be observed from a few feet distance from the car. Quail are sometimes in the edge, but as often in the center, and will remain in plain sight for several minutes, feeding, dusting, playing and even sometimes fighting, but more often hurrying away to the protection of a screen of rushes. This tendency is minimized by quietness. The chickens are less apt to stay close to the car but are also less apt to leave the molt entirely, being content to place a weeper amount of brush as a screen between themselves and an intrusion.



## PRAIRIE CHICKEN LIFE CYCLE FROM HATCHING TO FALL MOURNING

The young chickens show juvenile feathers of the wing primaries and the tail when first hatched. Natal down is more yellowish than the quail.. To be able to determine the exact age of the young birds when it can first fly, when it can fly 100 yards, and when each change of feathers occurs, will, of course require rearing in captivity. Weights, sizes, and other items of importance will wait for the same sources of information. The ages and changes referred to in this report are therefore only approximate but will be found sufficient for this general report.

A few birds have been hatched from eggs gathered in the field, none having survived longer than a few days. Then the studies have been taken up when the birds were four or five weeks old and carried on until practically full grown which is about 14 weeks, very similar to the period of growth of quail.

At the time the young are old enough to capture and band, four or five weeks, determination of sex is possible. The most noticeable difference is in all stages, in the color of the tail feathers. At first the juvenile tail feathers are barred, a brown bar enclosed between two narrow black bars, this series in treble. The inner half of the outer feathers show a decided tendency to lose these bars, in the cocks, but are nearly uniform in the hens. As the feathers grow larger and older, the bars become less as stated above and practically disappear in the cocks, still little change in the young female. Different covies differ considerably, some being easily distinguishable and others almost impossible to ascertain though this case is infrequent.



One of the interesting tendencies noted in two instances of second generations was the continuance of those difficult colorations that prevented the ready separation of male and female by the tail feathers. The lower tail coverts, coming in at six or seven weeks, are additional distinguishing marks between male and female but do not become so pronounced until ten or twelve weeks of age, when the female has bars alternately arranged on either side of the quill, but the male has a white feather with a black eye near the outer end. At about 13 weeks of age, the entire set of tail feathers are shed, when these under-tail coverts must be depended on for sex determination. The tail feathers then growing in, adult, contain no brown bars in the cock, but are almost black except for a white bar at the end. The female adult tail feather is barred across both sides of each tail feather. This change of tail feathers occurs in early September.

The eyebrow, that in the mature cock is quite distinctive, is of little value in determining sex during the first ten weeks since the female has the same bare space over the eye at that time. In the hen, no brilliant orange feathers appear in this space when grown, but at about ten weeks of age the cock develops these beautiful color additions. Then, too, the heads of the male begin to square on top as the muscles that control these eyebrows develop beneath the skin, and the neck becomes heavier with the growth of more muscles that will control the pinnae on the sides of the neck in courting time. Yet these pinnae do not develop until early winter. The female is growing a thinner more graceful head and neck during these latter days of maturity.

Each covey starts, generally, by itself while the birds are immature. The few times when two (and once four) covies have been found together, it was apparent that each had been separated a little until netting progressed to force them together. Occasional singles from one covey are recaptured with another brood, but are traceable to banding disturbances and are rare. As often as one such bird joins another covey, they are found alone day after day or join a flock of old birds that are little more than singles using the same shade each day.

The brood consists of only the mother hen and the young since prairie chickens do not pair off and the cock performs no part of the brooding duties. Their movements are covered under the heading "migration", but it is generally over a small area each day, though they do not locate in a certain range as quail do. They may move a mile in two or three weeks but are apt to remain on an area of about 160 acres most of the summer. When their adult tail feathers have grown in and frost has changed their habitat, they then begin to go into flocks of 25 to 50. This in October and November. By December and January, sometimes two or three hundred will be seen in a single field which gives rise to the opinion that they stay in such large flocks. Further observation will disclose, however, that they come to the fields in 10, 15, or 25 to the bunch, and though all fly when frightened, disintegrate into small portions when some distance from the field. If left to depart under their wishes they leave, as they came, in small flocks.

The pinnae become fully developed by January, the outer feathers of the male being about 2 inches long and black, the lower set white. The hen has a less noticeable set of short brown and gray feathers giving her the appearance of none at all.

To complete the cycle of feathering and growth, the adults begin their molt in June and from then until the pinnae grow back in fall the sex is not so easily told in the field, though experienced observers have no difficulty in making certain, a necessary fact in netting operations. The old cocks are brownish, grizzled about the head and neck, bare sacs showing on the neck where the molted pinnae have been. The hen is gray, head and neck more smooth and much more slender than the males. The action of the old cocks and spinster hens is evidence enough that they are not young or the mothers of young. Netting of these birds is very different from the covey and must be handled faster and over a larger area.

The activity of the mother hen at different periods of covey growth is interesting and very important in netting. Until the young birds are about grown which will cover approximately the time until July 25th (varying in covies of later hatch) the hen is hard to flush and returns immediately to the brood which has waited for her or her call. The hen can be caught at most settings under these circumstances and proper care will catch the young. The later period finds the hen ready to flush at the least excuse and is a signal to be careful for a minute or the young will go to. Then the young can be maneuvered into the net without the hen and without the loss of any of the young. To have tried to get the hen, as was once done, is to have failed to catch more than one or two.

## THE GOBBLING SEASON (PRAIRIE CHICKEN) -CENSUS-MATING-SIZE

Approximately three and a half months during the spring from March to mid-June, afford an excellent opportunity to observe the courtship of the cock prairie chickens, and to ascertain the exact number on any area with unbelievable accuracy.

The cocks' usual habits are so regular that few variations occur and therefore the observations and census records from the very start have proven generally acceptable for a continuous record during the four years covered to date. This affords the most useful comparison of increase or decrease and insight into the probable future, of any method known to the writer.

The manner in which the birds behave and their every day gatherings on the same place are very interesting and of particular importance. They will be covered in detail.

Beginning in late February the cocks gather in bunches ranging in number from one to forty on what we have termed "gobbling grounds" which are apparently selected for their visibility over surrounding areas. Therefore, they usually occur on the higher ridges, not on sharp hill tops, but the broad level portions. Occasionally they are on a slight rise in the center of a large swail. The activities of the birds soon thin the vegetation on the ground. On the 16 section (10,240 acre) under four years of study, there have been as few as 28 and as many as 40 "gobbling grounds" averaging from 11 to 16 each -- though they were by no means in uniform numbers.

Constant observation and keeping of records have demonstrated the fact that each individual bird uses the same ground every morning and evening. In fact they establish themselves on the same portion of the ground, maintaining their individual positions by fighting the



adjoining cocks on all sides. Since these facts are easily observed, it is evident that a thorough census is available on the male population of the lesser prairie chicken with an accuracy that is practically 100 percent. The value of this knowledge and its pursuit is great because a successive record for a term of years established the rise and fall of the abundance of this game bird beyond the guesswork that proves so inadequate and misleading. It affords a check on the ravages of drouths, severe winters, open seasons, feed crops, overgrazing and predators.

The gobbling season gets under way about March 1st, (Feb. 25, 1932) the first six weeks being spent in jockeying for choice positions on the ground. During this period no hens are observed on the ground and the males not yet a year old find great difficulty in establishing themselves against the heavier old birds. There is evidence to indicate that the same cocks use the same ground succeeding years but the writer is unable to state that it is true of any number. During these first six weeks period the same antics are performed as later but with less enthusiasm and color.

About the 10th of April the females commence to visit the grounds and the courtship becomes highly animated. The body is in a horizontal position the head forward but slightly higher than the back, wings dropped forward and downward showing about six primaries spread almost touching the ground. The tail is spread fan-wise in turkey-gobbler-fashion. The Primaries on the neck are raised perpendicularly and parallel or thrown still farther forward bringing them together just over the head. The whole position has the appearance of rigid strain. Over the eyes the orange colored eyebrow, not noticeable at other times of the year, becomes brilliant as it is spread over the top of



the head, the two almost meeting, leaving a very narrow strip of the barred feathers showing.

Fighting continues as before, often vicious, though never severe enough to cripple or kill. Two cocks will approach each other to within a few inches then settle down, heads together, making a "cackling" "fussing" noise. Perhaps several minutes will pass when suddenly they will jump at each other off the ground in combat with feet, wings, and bills. A feather or two may come from one and should one be fortunate in coming down on or directly behind his adversary he will likely catch hold of feathers of the back and drag along behind the other as he fights to get away. That usually ends that combat for a few minutes both birds turning to an adjoining bird on another side, soon however returning to the original adversary. There seems a strong tendency to pick a scrap with a single neighbor all one morning though of course all the adjoining cocks, generally three, must be kept in place. Much noise of cackling and fussing accompanies the fighting over a ground throughout.

The actual "gobbling" or "drumming" is a courtship display for the benefit of the females and a paragraph of theory as to its application will be found a little farther on. The position of the male is the same as described two paragraphs above except the head is lowered a bit and action is preceded by a rapid treading of the feet that is plainly heard as a drumming noise. Then at the end of the treading, a sound resembling a "gobble" is made, accompanied by the inflation of an air sac on each side of the neck beneath the pinnate, and the rapid opening and closing of the fan-shaped tail that makes a noise as of rustling silk. The gobble is given but a single time when the bird

is alone with more often a second cock is nearby which will join in when each may gobble six or eight times, alternately, in perfect cadence that sounds like the rapid gobbling of a single bird. When two do their "song and dance" together, they invariably face the same direction or exactly opposite, having heads together or facing parallel. Their performance is so accurately matched and times as to create jealousy in the heart of a "follies chorus Director".

The air sacs which are inflated as the "gobble" is sounded, are bare of feathers, and have a tinge of orange with the pink color of the skin. They are inflated to the size of the round end of a small hen egg, and as it deflates, makes a soft "mewing" noise ("cooing" might be better). The sacs are really but a single enlargement of the esophagus which, when inflated stretches the bare outer skin into the two pouches on either side of the neck. It is evident that considerable effort is required to inflate the sac.

A ground having 25 or 30 cocks provides much activity at almost every minute, though there are occasional spells when no movement or sound is made, and others when only the fussing is heard. Again every bird will be noisy and active in a frenzy of excitement as a hen approaches. Then, a few cocks will fly up on the low bushes amid much flapping of wings to get a better view or attract attention to himself. Courtship display is always more animated close to the hen, though only the two or three cocks belonging to that particular portion of the ground are able to court her as they strut beside her or around her. It is the habit of the hens to transverse the ground, the cocks giving way to others as she goes into the other cocks' domain. When a cock attempts to come into forbidden territory, the native cocks pounce upon him without ceremony or loss of time.

The actual mating is seldom seen, though it is evidently done on the gobbling grounds. Dr. Arthur A. Allen, Professor of ornithology of Cornell University, an expert on the ruffed grouse of New York, presents a theory that shows promise of fitting the mating habits of the lesser prairie chicken closely. It is, briefly, that the males are subject to "cycles" during the mating season through which there will be few days<sup>a</sup> when the cock pays little attention to the hen, will not mate with her, and even in the case of the grouse fights her. Considerable observation indicates this may be true. Dr. Allen's theory further presents the thought that the hen walks through the ground searching for a male that is in proper "rhythm" and again studies indicate the likeliness of its application to the lesser prairie chicken. After several days of study and observation on the same ground in the spring of 1935 with Dr. Allen in which a stuffed bird was used for part of the information, much data was collected that is not incontrovertible but further study should prove. The stuffed bird was a cock chicken, Placed in the same location each morning, the nearby birds paid no attention to it at first though they would be within four or five feet of it at times. Then one morning, one of the birds that had passed it many times the days before, with little ceremony attempted to mate with the "dummy". The following morning the same performance was repeated. Other birds still paid no attention to it.

Actual mating studies were rewarded in company with Dr. Allen, also. It is very advantageous to have two persons together since the movements of the several birds involved in the study may be watched and accurately recorded. One morning, on a ground of 26 males, hen No. 1 appeared slowly picking her way among the males, transversing the entire ground in about a half hour's time, returning to male A near our car. Meanwhile hen No. 2 had entered the ground and was

making like rounds except not so extensively as she appeared to have selected her mate as male B. Both the cock chickens were, from their bands, two years old or older. Hen no. 1 stayed close to male A each watching the other closely, the hen indicating willingness to mate twice several minutes before the male did mate with her. Hen No. 2 was likewise close to cock bird B but at this time two more hens arrived, each of them stopping in the vicinity of males A and B. Hen No. 3 stayed near male A, hen No. 1 having left the ground. Male B showed no preference for one or the other of hen No. 2 or 4, strutting beside either one that came closer. After some 15 minutes, he mated with No. 2. Male A then mated with hen No. 3. In less than 2 minutes male B mated with hen No. 4. Other mating has been observed on the grounds but not with the opportunity of knowing the individual birds and watching their courtship for such time.

The cock chickens gather on their grounds every morning until about mid-June, a period of about 15 weeks, at the first sign of dawn, even earlier on bright moonlight nights. They stay for two hours or more, then feed, and through mating period of April, May, and June, are usually near the ground all day. At evening they are generally gobbling again though all will not be there, generally, and a census would be inaccurate at that time. At dark they will leave to roost in heavier cover, flying away, and returning on wing at dawn. Data on their roosting habits are all too meager as it may throw light on predator operations, and might afford new opportunities for capture.



CENSUS. The census records have been kept in daily records and on blue-print maps of the area, one each year for 1932, 1933, 1934, 1935. Then a composite map covering all four years was prepared to compare the variations and to establish all the information available respecting successive years. Some of these facts are of interest at this time, others require more years to understand.

The 1932 records show 31 gobbling grounds with a total cock population of 499, grounds containing from 2 to 35 birds each.

1933 records show 40 grounds with 611 cocks with 3 to 38 per ground.

1934 had 28 grounds with 353 cocks from 1 to 36 per ground

1935 shows 31 grounds with 362 cocks from 1 to 30 each .

There are 53 grounds on the map for the four year period of which 17 have been used every year, 7 three years of four, 13 two years, and 16 but once. However, the grounds are more stable than these figures indicate because most of the one and two year grounds are near ones that were vacated. Too, there may have been two or three grounds more the first year than were recorded which would have raised the four year number. The increase in 1933 over the number in 1932 accounted for 9 new grounds, most of which were abandoned the following year of drastic loss.

Very heavy burning of the area was done in 1932. The season, though dry was good enough to provide good cover. Moderate burning was done in the spring of 1933, the season was dry, cover becoming short in late, followed by an open season on prairie chicken in October. 1934 was extremely dry, no burning at all, very little cover. 1935 was still drier with practically no cover until last May.

Banding records, supplementing these factors, shed light on the situation, but the total information is not conclusive on so few years records, and therefore, the writer makes no attempts to point out the reasons for the variations or their corrections. True, the indications are clear but until normal conditions are encountered, no authentic program can be safely followed.

There is a theory, having much foundation of fact, supposedly, from the northern prairie chicken and grouse areas, that there are definite cycles of high and low numbers of these game birds, due to reasons other than management of the lands. Of course, to prove this thing requires a continuous record for several years, and if it is so, a cause can be found and the numbers anticipated on a long range game program.

The gobbling ground census in 1935 was extended over additional areas.

SIZE: Twenty grown cock chickens weighed from 23-1/2 to 31-1/2 oz. each, averaging 27.66 oz. 5 hens, grown, weighed from 23-3/4 to 27-1/2 oz. each, at an average of 24.55 oz. The heavier males were evidently birds in their second or third winters, the lighter ones apparently birds just maturing whose measurements were full but body light. The dates taken cover October and November, mostly, though, some are later toward spring.

The length of the mature birds from bill to tail is 16-1/2 to 17 inches, the wingspread from tip to tip 26-1/2 to 27-1/4 inches, and the folded wing length from 8-1/4 to 8-1/2 inches. The measurements, as seen, are quite uniform, there being no material difference according to sex or age (after maturity).

The physical condition of the prairie chickens have been found very good during the entire year. But one bird, a young 1933 hatched bird caught in August, has been found light in weight or other evidence

of weakness from parasites, inbreeding, or any cause. More than 1900 of these birds have been handled and carefully observed, with only accident cripples noted. A few operations were performed for minor disturbances, such as acorns that had worked through the crop beneath the skin on the breast, split throat through which the tongue had dropped, etc. Several one-legged birds were found the first year, 1932, most of which were taken for stomach collections, but no such cripples were observed in 1933 or 1934, or early in 1935.

An interesting fact relative to predators and losses of birds from other sources is that only twice have cocks been known to disappear from a gobbling ground during March, April and early May. This does not mean that no other loss has occurred, but possibly one-third of the birds have been under close observation each year, and from this proportion only two seemed to have been killed. One was taken by the ordinarily harmless swainson hawk, the other from undetermined cause. To sum it up more generally, predators from the air or on the ground are negligible as pertaining to the cock chickens through the gobbling season. Old age would take a percentage no larger than this.

#### NESTING - SEX RATIO - PRAIRIE CHICKENS -

Nesting studies are very limited and are of use at this time only as proof of the necessity of intensive study for three or four seasons. Here, likely lies the most important losses of increase, the most damaging work of predators, the most opportunity for improvement of environment, all at a small expense. The difference between the "increase that should be" and the "increase that is" probably is made at this stage of the life history.

Prior to this period of study, for several years, there was no lack of cover or control of predators, yet prairie chickens surely increased, no one knows by what degree since recording methods were unknown.

During the prior period fires were the rule, not the exception, and offer in the nesting period a serious problem. But with proper knowledge of nesting dates fires can be controlled to do no harm.

The facts disclosed by the few nests that were observed indicate the following facts. The earliest nest found was April 29 with nine eggs. If the clutch is filled by one each day this would back up to actual laying date of April 20. A few days should be properly expected in most locating. This would place the earliest nesting date at about April 15, though the records of courtship on the gobbling ground indicate possible mating as early as the 10th. At the present time, then it is established that all agencies that would harm nesting, chiefly fire, should be confined to a period before April 10.

The usual information from records is that the hen lays an egg each day until the clutch is completed, beginning incubation the last day. It may be that there is some variation which more extensive study would show. The eggs are almost plain, almost white when first laid, darkening each day to a light buff or tan. The changing color is so plainly marked that a clutch, just completed, can be separated into the order in which they were laid by the shades. 13 eggs will probably near the average, 12 being as common as 14. 16 have been found in one nest (this nest was full of rotten eggs). Length of incubation is 22 to 23 days. Several of the nests were destroyed, no cause being determined. Those nests that hatched without interference include 3 of 13 eggs each of which 12 hatched in each case, the last egg (probably the first laid) being rotten. The fourth nest had 14 eggs and hatched all of them, June 4. The other three hatched May 23, May 31, and May 27. The latest day laying was started in nests studied was May 7, after which 12 were laid each day and then the nest was destroyed. Later observations, however, indicate that several nests are laid later than this date.



Observations and banding records indicate that about 80 percent of the prairie chickens are hatched during about a three weeks PERIOD from May 20 to June 15, probably another 10 percent the following week and the balance until as late as July 15. Nothing later than this date has apparently been raised. It maybe well to compare these figures with some information regarding the grazing practices of cattle.

Burning of pastures is practiced in all areas in northwestern Oklahoma where prairie chicken are surviving, and for the best results for cattle should be done prior to April 10. Nesting would not then be harmed, but it is often burned later than this. Another practice that is advisable but not often used, is the resting of certain lands from grazing until July which provides almost double the grazing the same lands and would prove a boon to the nesting of the chickens. This form of aid to upland game will become widely used as the value to both businesses is taught and understood. These are two outstanding problems that can be worked out to the advantage of both basis industry and wildlife restoration, which is the ideal situation that must be approached until such time as areas are set aside for the sole benefit of birds.

Studies of the birds for the first four or five weeks after hatching is almost impossible except in captivity as they live in the growth of grass and shrubs that is abundant protection from observation.

Most of the covey observations from which SEX RATIO has been recorded have been made from late June, through July, August, and early September. The birds are then found in mid-day when the temperature is above 100 degrees in the shade, using the oak motts for dusting and relief from the heat. Feeding is done in the morning hours, usually until the sun is three or four hours high, and again in the evening

beginning about two hours before sunset. Cool cloudy days permit feeding the whole day.

Under average conditions these days of extreme heat are likely to occur between July 15 and August 20, but an intervening rain makes the following period too unsatisfactory for netting operations. Again, the work is set aside by cloudy days, and days of high winds both of which cool the ground under the lower cover, too. 1933 heat was so extreme that banding was carried on from June 30 to September 4. 1934 banding period was from July 9 to August 21. 1932 included July 15 to September 5 but the first ten and last ten days were not worth the effort except that we were then determining what factors governed the success of capturing operations.

A total of 291 prairie chickens were banded in 1932 and released at the same place where caught. In addition, 235 birds were netted and shipped to other state areas for propagation purposes. Records were in the making to establish methods of netting, banding, and handling. Information about covey formations, covey numbers, covey movements, individual ages, colors, health, ratio of male and females, and in short everything that could be learned about them, was sought and proper records made for further reference. So little was known about them that most of the season was gone before a tangible set of records, and much information were worked out. The 15 coveys that were recorded, accurately for numbers, averaged 7.5 young per covey in 1932. Principal value of records in this year was a study of netting methods, losses in netting, and correction of mistakes.

Banding in 1932 was largely a loss, as the bands used were very light aluminum that had been purchased for quail but were too large for them. Care was taken to place the bands on well, but a large percentage

doubtless came off, though a few were recovered in 1934. These bands bore numbers and the return of the Oklahoma State Game and Fish Commission.

1933 banding operations were more successful, Biological Survey bands being used of sufficient strength to stay on the leg. The bands that were furnished were the "new No. 5 size"  $3/8$  by  $5/16$  which had to cut down to  $5/16$ . 384 chickens were banded and released on the management area in 1933, bearing Biological Survey returns numbered from A573601 to A573984 inclusive, 230 birds were netted, banded and shipped to other state areas. The 51 covies on which accurate numbers could be recorded showed a per covey average of 6.47 young. The sex ratio on the young birds, taken in two series, one from July 12 to August 10, the other from August 11 to September 4, showed exactly the same ratio in each series - 140 cocks to 100 hens. This accounts for a shortage of  $1/5$  of the brood stock that is ordinarily expected and the reduction of increase 100 percent as explained in the introduction. Bands in 1932 and 1933 were placed on the left leg.

For banding in 1934 the proper size band was purchased bearing Okla. Game Dept. return and numbered from 1 to 610 inclusively. This band is a  $5/16$  by  $5/16$  Biological Survey specification. 245 of these 610 chickens were transferred to other state areas late July, the remaining chickens-367- were released where caught on the management area. Of the total, 412 were young on which sex records were available, making sex ratio of 146 cocks to each 100 hens. 75 covies were caught on which accurate records of total number were noted, a total of 410 or averaging 5.46 each. The first 37 covies included 212 young, the last 37 covies 192. The latter series were caught in different localities from the first ones and may account for the 10 percent lesser number. On the other hand it might represent a loss by death, not quite so

likely as the other theory and certainly not a very welcome thought. More records of this sort will bring out the true happenings and show whether a study in normal times will be more favorable than this one carried on under adverse conditions. The above information is a foundation upon which a comprehensive program can be planned and thorough information be had at a minimum expense, and increase the value of the work already accomplished.

When perfected methods are employed in the netting and banding of prairie chicken, a census of old cocks on the gobbling ground, a census of young per covey in July, and a sex ratio of hens and cocks, will give good prophecy for abundance at open season time. There is so far one item that is very important that has not been investigated in this relation. That is the percentage of hens that successfully hatch and those that are broken up. That problem would shed much light, if solved, on the rate of increase that might be expected and the rate that materializes under varying circumstances. It can be solved to a high degree of accuracy.

- Nesting studies would provide a percentage of loss by destroyed nests, but would not include the number that were broken up before nesting had progressed far enough to be found, while the successful ones would be offering many more chances of discovery. This however can be supplemented by a netting of old cocks and spinster hens, which run together and can be caught through July and August. This method, alone might give the best information on the subject by providing a ratio of old cocks and spinster hens which would compare the ordinary sex ratio as found by young bird banding. A combination of these methods would surely provide a lot more accurate authority on how to increase prairie chickens than the haphazard reports of single-day investigators.



## METHODS OF NETTING AND TRANSFERRING PRAIRIE CHICKEN

Tracing but briefly the evolution of prairie chicken capturing until the writer came in charge of these activities in Oklahoma, the refinements and improvements that have brought the art to its present stage are most important for the guidance of others who may be interested in such efforts.

I am told that the first netting was done by carrying a fish seine between two men on horseback, who found the young birds feeding in the open and dropped the net on them from above. This plan evolved to carrying the seine between two cars. Of course the birds generally got away beneath the edges unless caught in netting while attempting to fly. The next major step was the finding the birds in the shade of the oak motts in the heat of day and the staking of the net around nearby bushes into which birds were driven. The catch was small and expensive but the chief purpose was to provide birds for display at the Game Department's bureau at the State Fair.

At this point in 1929 the writer got his first experience, principally as a guide to the rangers who had developed the netting possibilities. As is the case today, certain rules were set that must not be overlooked. The birds were not "disturbed" by placing the net on the mott in which the birds were found but on the nearest one about, which often happened to be 100 yards or more away. In short, 32 days of work by 4 men and three cars were rewarded by 72 chickens. So little was known of the birds that young and old, male or female, could not be distinguished in the field by late August and the handling of the three classes is quite different--their maneuvers being widely divergent.

In 1931 two crews were started in August to catch more than 100 chickens for transplanting purposes. The first yielded 19, the next, a tremendously hot, still day, yielded 62. With one net in the writer's car and but one helper, three covies were located close together, but

the other netters were nowhere to be found. As a result, 26 birds were netted, and crated with one car and two men in about 2 hours.

From these accidents and necessities, and since 1932 by careful study, a technique has been developed that captures about 90 percent of the birds found in motts on the hotter days of July and August. An average good catch is 35 to 40 a day in fairly well stocked territory, 70 to 80 being rare. The necessary equipment is one car, two or three men, handling equipment, and a net, which will be described further on. If the birds are to be transplanted, a small truck to carry crate and an extra man are convenient additions though not a necessity.

The nets we have used have been made-over fish seines. The mesh should be one inch, at least for the first three or four feet high. The entire height should be eight or ten feet, the length forty to sixty feet, a half inch rope on the bottom and a quarter inch rope on top. To the bottom rope iron stakes are attached, by loop, the eye over the rope, and wiring to prevent slipping to one side. Stakes should be long enough to hold the net firmly to the ground when driven in but short enough to handle quickly, about 8 inches in the sand prevailing here. At the bottom and about the center, a round hoop some 30 inches in diameter is placed in the net and netting cut out to form an opening. A "barrell" is made about eight feet long of one inch mesh fastened to hoops the forward one matching the hoop in the net, the backward ones getting smaller. The rear end is puckered together with a draw string that may be opened when loose but which in position is pulled out taut and staked behind. The front of the barrel slips through the opening in the net, making a detachable barrel that saves time and punishment to the birds.

The net is set over the oak motts with the two halves at right angles, or nearly so, with the barrel as the angle. The net slopes upward and over to form a "lean-to" and roof. The bottom should be

staked in a straight line leaving an unobstructed runway on the inner side, and the end reaching over the open pathway that usually rounds the mott and is used by the birds as they return. When taken down, the net is a small compact wad of netting 30 inches across and carried on the hoops of the barrel. Dead sticks will interfere somewhat and must be kept out as much as possible. Grasshoppers will eat holes in the netting while it is set, cords will be broken by sticks and pull loose from the bottom, all of which requires constant watching and frequent patching. The net is gone over carefully each morning before the day's work begins, and repaired.

The birds may be found by driving the car from mott to mott, around each one, watching for the birds or their tracks. They are usually to be seen in the edge of the mott where they dust and find cool shade in the breeze. The best place to set the net is right over the holes that have been dusted out as the birds readily return to them. Wherever the set is made, the birds must be driven to the other side of the mott where, if hot, they will remain hidden by the screening of bushes while the net is put up. Care must be taken that a person on foot does not show himself except through the screen of vegetation or all will flush. Speed and quietness are the essential requisites, other than a well planned set, for the birds must be driven between the out wing ends as they are caught.

Having completed the set, the car is used to circumvent the covey which should be in the opposite side of the mott but are often several yards out in the low "shinnery". Care is taken to drive the birds back to the mott on foot as the flushing of one usually spells failure to catch any. Sometimes the birds will stand panting in the sun, and should they appear to be "eyeing" the sky, it may be taken for granted that their minds are on the verge of carrying them skyward.

The tooting of the horn, movement of the car a little distance, whistling or most any other noise may be employed to move them. When all have returned to the protection of the larger oaks, the men not driving the car can be dropped off on one side and the middle and work afoot while the driver can stay along the other side and maneuver the car and direct the others from his more visible position. Those on foot, and often on hands and knees or stomach, can follow the draggy birds that linger behind at a distance of only six or eight feet if they will keep th head and body mottled behind the bushes, even they be scarce. The shaking of the bushes are sufficient scare but are not startling to the chickens. When the whole covey is under the netting roof which is against the netting at the bottom, one man must be at each end and the third man, if any, in between. The birds are crowded to the center and into the backstretched barrel. When all are in, no time should be lost in picking them up in the moveable barrel and placing them in the shade as they will die quickly in the sun's hot rays reflected from unshaded sand.

Until the covey is half grown, the mother hen will lead and return to her chicks without often flying, but after that she is more likely to fly and the young may scatter if not rounded up carefully. The hen can be caught at these later periods but unless there is particular reason for so doing, much time will be lost, and probably several young escape.

The principal bane to successful netting is the failure to recognize the old cocks which are difficult to handle because of their speed and wariness. There are often 20 or 30 of them, sometimes 40. A set made for



old cocks must be wide, the top drawn over as far as possible, and when set, must be filled by quick work as they will hit the net and run out or fly. Spinster hens are not so wary but are just as fast, that is they will not run so far ahead of the netters but will keep right on at good speed when pushed closely. Young birds are inquisitive and in no hurry to get away. Sometimes they cannot be driven, sitting a few feet away just watching the operations until exasperation causes closer work to flush them. A trick in the capture of old birds, sometimes successful, is to flush them to another mott once or twice when they will get warm enough to take advantage of the shade and tired enough to cut down on their maneuvers. A good net is required to hold 23 old cocks weighing almost two pounds each that are flopping and fighting to free themselves of the net.

Handling and transplanting the birds requires the least frightening, and handling and time possible. A crate two feet high with burlap buffer top and smooth slats for ventilation does very well. Of course the birds will live many days without food or water, can be fed in about 24 hours and watered within less time, but they are accustomed to feeding on insects, not grain or water, twice a day. The starving of the birds beyond the digestion of the naturally gathered food should be avoided as much as possible where they are to be released in the open again. Moving has generally been done by truck to the railroad and by express from there to other destinations where they were again picked up by car or truck and taken to the place of release. In 1934 the birds were moved by truck at night the same day they were caught, released near daylight 300 miles away, and though no follow up information was obtainable in this or other instances of handling, the birds themselves were in much better condition than other methods of handling permitted. The floor of the crate is covered with

dirt, two or three inches deep.

The actual hours of netting are usually from 10 A.M. to 5 P.M., varying according to wind and heat of the sun. From 11 to 3 the work is most easily accomplished as the sun's rays are nearest straight overhead offering fewer shaded resting places for the birds to retire to as they are disturbed by the spreading net. Lunch is a necessary evil but can be swallowed hurriedly to avoid loss of precious time. Drinking water is a welcome addition for the work in the brush is extra hot, and the hotter the day, the better to catch and the easier handled are the birds.

The color of the net is no difference, white, green or brown. It is well hidden by the brush over which it is spread, anyway. Three or four flat tires a day may reasonably be expected as the burned over oak leave a multitude of hard sharp stobs that readily go through heavy duty tires.

The most successful method we have employed in improving our catch is to record why each bird got away, how many, and who was to blame. It is then easy to sum it up and correct the faults, whether it be the net, the set of the net, or the maneuvers of the trappers. Experience by trial and error is the final secret to success. The trapper will find it well to study the birds that old and young can be noted readily.

#### BANDING OPERATIONS AND RECORDS OF PRAIRIE CHICKENS

The movement of individual birds and covies were carefully studied by two methods, principally by capturing the birds as described in the preceding chapter when an aluminum numbered band was placed on the leg and the birds released at the same place immediately. A detailed map of the 10,000 acre management area, showing roads, fences, windmills, trees, blowouts, old fields, and every sizable oak mott, drawn to the scale of 8 inches to the mile, was used to record the

stations by number. The second method was by daily observation of covies through the summer months when some covies of chickens were known by peculiar marking or certain combinations of bands.

Covey observations of quail are entirely authentic throughout the summer months when supplemented by moderate banding activities as the quail covey locates in a certain range and may be found there each day.

169 banding stations were established on the 16 section area. The first 96 stations established were recorded in individual fields and the birds caught there from time to time were entered on these separate station records in an effort to determine the type of oak most best suited to netting and most desired by the covies. A thorough study showed there was no preference to this burden of duplicate records was eliminated, though daily records are complete and could be carried up to date if it were deemed advisable. Of course, banding at a station was always carried under the original station number.

In keeping banding records, the number of the band, station number, section location, date, sex, age and covey information is kept on each. The covey information included number of young escaping, those caught, information concerning the mother (or parents in case of quail) whether other covies were present, the approximate age in weeks judged from size and feathering, and any peculiar thing that was noticed about the actions or appearance of the birds.

From the band number any individual bird is readily recognized when taken again; the station number shows exactly where he has come from since the date recorded. An additional record is made of a bird when caught a second time giving every detail that is known about him and his covey. From the records of sex came the astonishing information

that of the young birds in 1933 there were 140 males to each 100 females hatched, in 1934 146 males to 100 females.

The age record is kept primarily as to whether old or young, indicating a current year's bird or an older one. Bands were changed to different legs to aid field observations, some being doubled on recaptured hens in 1934.

From the covey information came the fact that the average young per covey in 1932 was 7.5; in 1933 it had dropped to 6.46; and in 1934 an exact lowering of one more young to 5.46. These may not be normal hatches but they are quite different from the usual estimates made by reporters. Covey information in 1932 was kept as to reasons for failure in catching the whole covey, which resulted in a 40 percent catch being increased to about 90 percent by improving methods of netting and the net itself.

Returns from bands the second and third years are comparatively small for several reasons. Mainly, the old birds are more difficult to catch than the young, and the banding of young offered the most accurate information that was desired - sex ratios, ages, covey numbers, etc. The bands became more valuable with age since it denotes life long habits, etc. Therefore, each succeeding year will make the capturing of old banded birds more desirable and more interesting. Yet, several have been recovered in the one open season, a few from out-of-season violations, others from stomach collections, and quite a few by renetting. Sufficient information has been gathered to determine the covey movements in the brooding season, but much is yet to be wanted in following the birds from year to year.

Migration of quail from this summer range to winter quarters was clearly established by these banding activities though insufficient returns have been secured to learn much of their second year's



activities because the research with quail was no longer supported by the Game and Fish Commission after the first year, and the writer was able to carry it on but meagerly the second and third years for lack of funds and added personnel.

Regarding covey movements during the brooding season, many bands have indicated a composite picture of them. No specific covey will be followed, though several have been redorded--rather, a general summary seems more appropriate for this report. They wander about in somewhat the same locality with seemingly little homing instinct--more a matter of feeding on the plentiful grasshopper diet, resting, and feeding again. Sometimes caught in the same place a few days later, more often a hundred yards away, and then still days later a little farther in the same direction or sidewise. A half mile is a good range for a month, though many traverse in a week. A full mile up until mid-September is an extreme for the covey, though a single bird separated from the covey may go even farther. One such bird was 918 a young cock banded at Station 18, August 4, 1932 with four other young and some old birds. The other four were renetted at the same station August 9 but 918 was not with them, evidently having separated from the covey in the excitement that the old birds often cause in being released. No. 918 was renetted with four unbanded young, September 18, two miles northwest of Station 18. This is the longest movement of a single bird so early in the fall. The most interesting recoveries of prairie chicken banded and released on the management area follow:

969, a young 1932 hatched bird, sex unknown, was banded at Sta. 13, August 6, 1932, when 22 other chickens, of two covies, were banded in one netting. 969 was reported killed October 1, 1932 two miles northeast of Geary, Oklahoma, a distance of 80 miles, airline, southeast

of the project location. About 20 chickens were reported to have been seen in the locality, one other being with 969 on this particular day. The band was returned and the explanation offered that the hunter was hunting ducks as the birds came into a pond. There is some chance that the report was faked but it is not likely, since the band was returned by a resident of Geary and no logical reason can be imagined for misleading the investigation. Only one of the 23 was ever recovered-- No. 977, killed by the writer for stomach collection the following spring, a mile north of Sta. 13.

1135, 1932 hatched female, was first banded at Sta. 66, September 5, 1932, and two years later was renelted at Sta. 102, July 17, 1934, the mother of 8 young. This is 3-1/2 miles southeast of Sta. 66.

A573792, the mother of eight young was caught July 12, 1933, at Sta. 108 was recaptured July 11, 1934 at Sta. 150, the mother of five young. The two stations are less than 100 yards apart. The hen was observed several times in the following days of 1934 in the same locality, in fact in Sta. 108, the very place she had been caught with her young the year before.

Two 1933 hatched birds of the same covey banded July 10, 1933, at Sta. 105 were recaptured in 1934. One A573757, a cock, was caught July 15 at Sta. 110 which is 1/2 mile southwest of Sta. 105. The other a hen, A 573759, was renelted July 31, 1934 three miles south and one east of Sta. 105, with several young and ~~old~~ birds so mixed up that no covey facts could be known.

A573976, the mother of two chicks caught September 8, 1933 at Sta. 109, was renelted July 15, 1934 at Sta. 159, with only two chicks that year. Sta. 169 is but 1/2 mile west of 109. This covey was seen several times, here.

A573974, an old hen, caught September 9, 1933, at Sta. 139 and

probably the mother of several young that escaped, was recaptured 1-3/4 miles east, at Sta. 98, July 13, 1934, with the 1934 record number of 13 young.

A573911, a young female of the 1933 hatch, was banded at Sta. 105, August 7. She was renested July 25, 1934, the mother of nine young, about 4-1/2 miles north and one mile east of Sta. 105.

An old cock chicken, A573652, banded July 1, 1933, at Sta. 91, was recaptured August 20, 1934, less than a mile west.

A573904, the mother of ten young, was banded August 2, 1933 at Sta. 90. She was difficult to catch the entire covey of young having been banded the day before. On August 30, 1934, the same hen, using the same cunning methods, made her capture quite difficult at Sta. 93, 1/2 miles south of 90. She had four chicks this time, but part escaped as she was the most desirable prize.

A573904, a 1933 hatched hen, was banded August 7, at Sta. 82. She was the mother of two chicks in 1934 when recaptured at Sta. 6, August 10, which is 1-1/2 miles southeast of Sta. 82.

The field studies are more comprehensive by different bandings. 1932 bands were but 1-4 inch wide and were placed on the left leg. 1933 bands were 5/16 inch wide and placed on the left leg. 1934 bandings were with 5/16 inch wide and placed on the right leg for 1934 hatched birds and on the left for all birds over that age, except previously banded hens which were given an additional band on the right leg making them one on each. These are the most sought after bands in 1935 or later because they produce history.

By these different markings, much observation in the field is made certain. For future nettings, these with left leg bands are more important to the study than those with right bands.

Chickens transplanted in other state areas in 1933 carried bands on the left leg, those of 1934 were on the right. This would have permitted observations in the field by glasses, of great information, but it has not been accepted by the officials of the Game Department as advisable, as yet. It seems to the writer a great shame to transplant birds to new areas at considerable expense, with records kept, and experiments tried in finding better methods of transplanting, and then failing to benefit by the knowledge that could be gained at relatively small expense. Until a follow-up has been made, the writer will continue to recommend that procedure.

#### PRAIRIE CHICKEN AND QUAIL INCREASE IN THE FIELD

The problem of increasing bob-white quail numbers on quail preserves has been studied by Mr. H. L. Stoddard whose "The Bob-white Quail, Its Habits, Preservation and Increase" has been used extensively in reference which has aided this investigation many fold. From Mr. Stoddard's information such as been learned with only a minor check necessary on conditions here. Other important facts that thorough investigation demands, have had insufficient study to warrant a report on. However, the liberty is now taken to make some observations on the "probable" indicated facts that must be considered in a continuation of this project. Those facts that are determined definitely will be so stated.

Since almost universal belief has it that quail and prairie chickens increase each year by multiple of five, six or seven, that phase has been studied closely. This erroneous calculation is hampering the serious business of game production because it prevents the sportsmen and producer from realizing the true basic needs of the game he must leave for propagation.



From Mr. Stoddard's investigations, the results of which are beyond question authentic, we learn that the best quail preserves of the Southeast do not maintain their numbers if the kill exceeds 50 percent, turned about, it means that 100 percent increase is considered good on well managed quail preserves. It is an average of little more than two young per pair. Then his calculations of covey numbers averages a bit under 14 including the old paid and all additions from other coveys which might leave 10 young. This, then would tend to indicate that about 25 percent of the pairs were successful in rearing a covey of ten. Stoddard's nesting percentages showed 34 percent successfully hatching an average of about 13 chicks each. However, this does not consider the many nests that were doubtless broken up before observation.

Compared to these conclusions in the Southeastern States, we have no figures of such accuracy, though conditions for study here are much more favorable, apparently, for study than there. It is the opinion of the writer that the Davison ranch area will show a more favorable increase when studies are made of the situation, which however does not take into consideration the winter losses. Regarding the increase of prairie chickens, information each spring is proof thereof of increases over the twelve months period if carried on over a large enough area to avoid local concentrations or such fallacies.

The causes of nest failures are a very important set of records that need to be determined for a comprehensive game restoration program. Rains, drouths and lack of cover for nesting are major factors and need to be understood more clearly. Farming operation, grazing of stock and predators should be studied with their relation to the nests. The predator problem as generally considered is probably overestimated while

while destruction by other means is completely overlooked. Control of predators by extermination is both expensive and inadequate, the more valuable way possibly being the development of better protective covering.

Rather satisfactory observations have been made here on the loss of the bob-white quail after hatching until maturity. While actual counts and figures were not recorded in all cases, the younger covies (to about 3 weeks) being most difficult to count accurately, many covies were observed through late July, August, and the first part of September. No serious loss occurred in any covey in 1932, about 40 covies being under observation every few days in the above period. The few that were closely watched and the count was known to be accurate on, showed no loss at all. 1933 and 1934 were accompanied by such reverses that no information is available on the subject since those covies that were handled invariable contained more than the one pair of old birds, this joining together of unsuccessful pairs and singles, of course affecting the covey number beyond accurate comparison. It should be repeated however, that the area under investigation is probably much better summer range than the average of quail areas of northwestern Oklahoma because of the shinnery cover, even temperature, and a abundance of food. But one problem of agricultural interferences is present, that of stock grazing which is not heavily done, ordinarily.

Losses of prairie chickens after hatching have not been determined until about 4 weeks have elapsed. Before this time, the only method to pursue is the observation of nests, comparing the known average hatch to the average number of young during the season they can be netted. The few nests that were studied were insufficient to settle this problem but the indications are that something like an average of

11 are successfully hatched under the better conditions prevailing in 1932. The average netting of young was 7.5 for that season making a possible loss of 3.5 per covey, most of which occurred in the first stages of brooding. Let's repeat, the estimate of 11 average hatch is not authentic and more likely too high than too low. If that loss could be reduced by one-third or one-half, by proper management of the bird's environment, game production would be increased 20 percent or more than that one item alone.

Losses of prairie chickens after five or six weeks of age to maturity are indicated by two series of records in 1934, the first covering the dates July 9 to 21, the second from July 25 to August 18. The first 38 covies included 218 young, an average of 5.74 per covey. The second series covered 37 covies including 192 young, averaging 5.20 per covey. This would indicate a loss of about 9-1/2 percent in approximately a 30 day period. However, there is strong possibility that the different locations of netting operations had something to do with this variation. Should further investigations disclose that 9-1/2 percent loss does occur at this period of the covey life, it is a problem that deserves a solution, for it is a large loss in so short a time.

It may be well to repeat here that the meeting of the chickens and quail is probably the most hazardous period of the reproduction cycle. It presents a problem of investigation that requires a concentration of several men's help for about a 60 day period from April 15 to June 15. It is of particular interest that the people who ride the prairie chicken country almost daily, will tell you that one or two prairie chicken nests is all they have ever seen, and most of them were destroyed by their horses stepping on the nest, often on the hen herself. The discoveries of the nests of this bird are often very difficult because of their habit of staying on until one can almost touch the

hen. No case of a cock being interested in the nesting or hatching of the prairie chickens have been revealed--natural, of course, following in the information of gobbling grounds, and covey formations.

Quail nesting studies were not at all conclusive because of their small number and inadequate opportunities to follow them out daily. Two nests were being set by the cocks, an indication that Stoddard's findings are applicable here in that respect. Young covies of quail are hatched throughout the entire summer, one covey of 4 young being found November 2, 1932 that were only hatched a day or two before. During the mating period of 1932, a new covey of young were found practically each week until mid-September. It is further evident that these late hatched birds, are not well feathered by frost, have little chance of maturing. Only one covey of young (perhaps 8 weeks old) found Thanksgiving day, 1933, were observed by the investigation as late in the season. This would figure a hatching date of late September and from it is reasonable to expect that birds hatched later than, and indeed during any of the month of September, would have little chance of surviving in the field. Other reports are occasionally had of "peepers" during the open season between November 20 and January 1, but they are not common enough to indicate a survival in sufficient numbers of these late hatched quail to be of value.

#### PREDATORS

The problem of predators, as related to upland game, is large, and must include an acknowledgement of their economic value to agriculture by keeping the balance of nature more suitable to the whole agricultural problem. To destroy all animals and birds that occasionally prey on game birds, is a miscarriage of conservation, and in many instances a definite hinderance to that very cause.



It may generally be stated that the chief destructive effects of animals and birds, commonly referred to as predators, are upon the nesting activities. It may be found of serious consequence on the mother bird herself, or in the removal and eating of the eggs, or by the destruction of the birds at hatching time. True, there are other periods of destruction that are probably more familiar to the sportsmen and farmer, but investigation reveals that it is a minor affair compared to nest destruction. In a general way, it may also be stated that the provision of abundant natural cover is the best method of coping with the predator problem. Yet, it is also evident that many control measures are desirable, not a complete eradication but proper balance.

No attempt will be made to list the predators in order of their damage because that would invite argument, and in truth, would not be reliable since the studies here have not been carried on as intensively as it would be advisable during the nesting period. Yet, the following list of birds, animals, and insects, cover most of the predators (enemies of upland game in Northwest Oklahoma). One or two may be added as study is carried on, and doubtless some will be found as of little damaging effects, but each deserves mention and further study. Here they are: hawks, crows, ravens, owls, coyotes, badgers, skunks, opossums, snakes, terrapins, rats, mice, ants, gophers, prairie dogs, ground squirrels, cottontail and jack rabbits, and eagles in winter. Separately, and very briefly, each will be mentioned, intermingling observances here, with reliable information from other sources, to present a composite picture of the problem and its method of solution.

HAWKS. There are several species of hawks in Oklahoma, but two of which are sufficient enemies of upland game birds to dictate their killing. Since both these hawks are the most difficult to get a shot at, it follows that many times more beneficial hawks are killed than the ones that are destructive. Therefore, blanket warfare on hawks is

most deplorable, and should be abandoned, because they have a high value to the agriculturist and game breeder in the destruction of rodents that are far more damaging to feed and game crops than the benefit could be. The two hawks that are no doubt enemies of quail and prairie chickens are the Cooper's (*Accipiter cooperii*) and Sharp-shinned (*Accipiter velox*). They are comparatively small, that is to be distinguished from the large hawks, often referred to as "chicken hawks". Both live in the brush and trees, are fast fliers, do not soar about as the other hawks, and are only rarely caught in range of a gun. They are wary beyond any comparison with crows. Their habit of catching quail in mid-air or pursuing into the underbrush, where it is devoured, confused the average person with other predator destruction. Three or four quail remains may be found in the same brush thick\_et where skunks or other ground animals are blamed, but where these hawks have carried their prey. A campaign against "blue darter" has resulted in the destruction of two other hawks, similar in size, "blue" appearing, but which are gentle, fearless valuable friends of the countrymen. These, the Mississippi kite (*Elanoides forsteri*) and the sparrow hawk (*Falco sp.*) are feeders on insects. They are common in the open, on posts, in dead tree tops, and in the air are low sailing, beautiful birds. The Mississippi kite will entertain the observer by swooping down with uncanny accuracy, picking up a flying cicada, (flying locusts) and eating part of the insect in mid-air, dropping the unwanted portion. They will follow a herd of cattle for hours, a dozen or more at one time, and have made friends of nature observers everywhere. The sparrow hawk, with head slaty gray, reddish back and tail, and gray under feathers is the prettiest colored of our native hawks, and the smallest, though the sharp-shinned hawk is almost the same size. They may

be easily distinguished by their manners, the predacious pair being wary, fast low fliers, long bodied and short winged, tails long. The beneficial pair are fearless, slow circling, short tailed, and wide winged.

The marsh hawk (*Circus hudsonius*) is an intermediate hawk that is sometimes classed as a predator but generally as beneficial. They are the most abundant of hawks in this region, the male light gray, the female, larger, brown, each with a white bar at the base of the tail. The wings are wide, more pointed than the larger hawks. It is this hawk that is so often exasperating to the hunter as he observes a bird gliding over the cover, frequently flushing quail or chicken. There is no doubt that some of each are killed by the marsh hawk, but there is still grave doubt if the numbers are sufficient to offset the destruction of snakes, etc., that make up the major food of this hawk.

The larger hawks, such as the red-tail, Swainson, and rough-legged hawks, are, according to most authorities, feeders on small mammals, insects, and carrion, also snakes. There is no reason to destroy these birds in the name of game bird conservation, yet, because of their easy mark with gun, this type of hawk bears the brunt of "hawk killing" efforts.

The genuine conservationist will enjoy studying and learning the hawks according to their habits. It is a badge of intelligence in game management and the beneficial hawks will repay this thoughtfulness many times in holding rodents, insects, and reptiles to smaller numbers, game birds benefitting from this source, and the naturalist receiving pleasure in the aerial display of these masters of the art.

CROWS AND RAVENS are classed together because of their similarity in appearance and habits. The common American Crow (*Corvus americanus*) is numerous over all of Oklahoma but in lesser number in Northwest than in central, eastern, and southern Oklahoma.

The white-necked raven (Corvus corax sinuatus) is only common in western Oklahoma. This bird is slightly larger, heavier billed, soars where crows flap the wings, and has a more raucous call. Because of the soaring ability of the raven, it is likely they offer more menace to the nesting of game birds than any other bird, the crow being a close second.

The crow nests very early in the spring, often hatching in early April. The ravens nest a little later, usually hatching after May 10. Crows' and ravens' nests are almost invariably rebuilt over nests of previous years, and this fact opens the possibilities of control at low cost. Each old nest can be located on a map during the winter when leaves are off the trees, and a systematic killing on the nest planned for the following spring and summer. It may present a method of discouragement to nesting on an area by removal of the old nests.

The food studies show their principal foods as insects, grains, carrion, and small lizards. Eggs are very difficult to determine by stomach collections though the investigation disclosed the eggs of prairie chicken in the stomachs of three young birds in the nest (crow or raven). The efforts in 1932 were directed toward taking as many as possible for study and destruction of most of the nests.

Sixteen nests were studied in 1932, 3 of which were destroyed by predators. Two were permitted to hatch, others were destroyed by the study. Several other nests were destroyed by riders of the pastures without cooperation with the study. No destruction of prairie chicken or quail was evident from the stomach studies of 31 birds. A few instances of empty egg-shells were noted near the nestings of crows and ravens. In 1935, cover being almost nil, many eggs were found



destroyed by them--and strangely, a higher percent of their own nests were destroyed by other birds.

In conclusion may it be estimated that loss of quail nests by crows is not very serious in this region. Losses of prairie chicken nests can be minimized by good nesting cover, destruction of old nests may be a deterrent, and control can be made highly effective during April, May, and June, the principal nesting months, by inexpensive methods of killing the nesting birds. The gun has afforded the means to destroy this bird, but there should be a better way, possibly a method of poisoning at or near the nest, by eggs or carrion. Some experiments would be worth while along this thought.

OWLS are not numerous in this area and no opportunities were offered to study them as predators. However, it may be well to quote Mr. Stoddard "all owls should be regarded as beneficial on quail preserves" because of their destructing of mice and rats. The prairie-dog owl is the most numerous on the project, homing in the towns of the dogs. (Burrowing owls) (Speotyto unicularia hypugaea).

COYOTES are quite numerous on the Davison ranch and information is lacking on their depredations respecting quail and prairie chickens. It is readily admitted that the raising of wild turkey, and domestic fowls, demands their control to minimum numbers. The worst feature onto the project is probably in nesting activities when they may run on the hens or the eggs. Second in importance would likely be the disturbance of covies at night as they prowl for food. However, much of this latter objection must be overridden in favor of the many rabbits that they devour. At headquarters, where the several quail have been watched each day, each winter, coyotes feed almost every day, but no loss occurred from any cause any year of the three. Rabbits increase as coyotes are decreased, and inversely. Without complete investigation, an important problem cannot be solved definitely, but in general it is

indicated that control to reasonable numbers should be exercised but that complete extermination is unnecessary, inadvisable, and too expensive.

Badgers, SKUNKS, AND OPOSSUMS are fairly numerous on and surrounding the project area. The badger is doubtless a value because of the destruction of gophers, mice, rats, and prairie dogs. No information is available from the study relative to game directly. Skunks, civet cats, and 'possums are doubtless destroyers of ground nesting birds and their eggs. Some nest destruction was evidently the work of these animals, but more extensive nest information will be required for facts and figures. It may also be noted that no quail were taken at headquarters from fall until spring though a few skunks were permitted to remain in the vicinity all the time. They did not become numerous at any time, however. The proper procedure to determine the actual damage to nests, is probably to confine these predators with nesting birds, and from the methods of destruction, a pattern to use in the observation of nests in the field, obtained. Then a series of nest studies will give an idea of the proper control necessary and the proportionate expense allowed in the control for quail and prairie chicken preserve management. The value of these animals as fur bearers must be taken into consideration, too.

SNAKES appear a serious menace to nests and young of ground nesting birds. The commoner snakes of the area are sand-rattlers, the slender whip snake, and the bull snake. The first is a small poisonous snake that likely bothers little. The second is a killer of small birds, animals and reptiles. The latter is a master egg eater, known to take any egg to the size of turkey eggs. The bull snake is a feeder

of live quail to practical maturity. This was demonstrated by an unfortunate incident when 15 quail were left in a crate that had spaces wide enough for an medium sized bull snake to enter. Three were swallowed whole, two almost grown, the other half-grown, two others were killed, the remaining 10 dying during the next 5 days. The snake having swallowed the birds head first, could no longer get through the opening, so was caught while the destruction was in progress. Nothing in the field has been observed that so excites the parent quail as a snake, several instances being observed in netting. The larger snakes are more feared evidently, as the old quail dances about at a safe distance with a great fuss and warning to the brood. The whip-snake is very fast, and has been observed with birds, and small animals. The sand lizard, whose food is seeds and insects, is largely found in the stomach of the whip-snake. The bull-snake, however, has a value in the destruction of rats--almost exterminating them.

TERRAPINS are egg eaters, as shown by experiments conducted with several individuals. Songbird eggs were used, and in every case the eggs that had started incubation were broken and eaten first, the fresh ones soon afterward. The terrapins break the eggs with the hard beak on the nose, eating the shells and embryo. There was little hesitation in crossing the wooden boxes to the eggs on the other side. As to their ability to locate and destroy quail nests, nothing is known, but could easily be determined by placing them in pens where quail were nesting. The amount of ground covered each day is astonishing, and the effect of a brooding hen efforts at protection would amount to little, probably. Prairie fires kill many terrapins as they are unable to escape, and should it be found that their destruction amounts to a high percent,

as indicated, it would add to the values of fir as now understood. Mr. Stoddard found the terrapin of the southeast no menace, but it is not armed with the beak at the nose, a useful weapon these find use for in breaking the eggs.

RATS, MICE, GOPHERS, ground squirrels, and prairie dogs should be classed somewhat together as destroyers of game bird environments and foods. Of course the rat is a small bird eater, but probably does not exist in nesting and rearing areas to any great extent. But these numbers must be kept low for agricultural purposes and the hawks, and owls are their principal natural enemies. Snakes are doubtless of some value in this case but probably not to repay the direct destruction of nests and young. Their numbers may be reduced by poisoning and trapping, particularly where landscaping and forestry is to be considered. Pocket gophers (Geomys) are particularly damaging to newly planted trees and shrubs, and contribute to no small extent toward soil erosion by wind and water.

RABBITS are considered valuable as game animals in many localities, but not very highly in western Oklahoma. Jack rabbits are so great a menace to agriculture, particularly winter grains, that only their damage to young trees and shrubs (that offer cover for game birds) need be mentioned here.

The cottontail rabbit is not protected by seasons in Oklahoma as is the case with game birds and fur-bearers. The principal damage comes from the destruction of shrubs and the consummation of food that has been raised for birds. As soon as the frost causes the leaves to drop from the oaks, a heavy concentration of rabbits is noted in the small feed patches. They are invited into these better cover areas for protection and food. As many as 28 cottontails and 17 jack rabbits



have been taken from one feed patch in two weeks time by shooting. It represents the summer population of about 640 acres crowded into 5 acres for winter. Should a feed patch for each 40 acres be provided, a lessening by 16 times might change the picture to a desirable one, but this was not tried. It has been noted that but 2 or 3 acres of a grain left for an area of 640 acres is insufficient to provide food for birds, rats, rabbits, etc., throughout the entire winter, and it is well known that birds must eat in March the same as in November, though little consideration is given the needs of the birds after open season dates by most people. Many "game management" practices advocated in the past are fine rabbit increasers but not much for game birds. The reference is to the theory of leaving an acre or two of domestic grain, no burning, and the destruction of hawks, owls, and coyotes.

Rabbit destruction of trees may be prevented by placing poultry netting about the trees before the green vegetation is killed by frost. Eradication, or rather control, can be managed by several kinds of inexpensive traps or poison, but these measures where advisable should be taken in early winter before their damage is done. Some observations must be made frequently as a new migration from the surrounding country may happen any time, and many of the rabbits that frequent the area at night will be found as much as a quarter of a mile away in the day time.

Ants of unknown species are predators that need attention. Mr. Stoddard has made a very extensive study of "fire-ants" in the Georgia district and has made great headway in their control. Too, he has recorded nest destruction of quail in no uncertain terms. The Davison investigation of nests has so far been meager, and no ant infestation

has been observed in quail and prairie chicken. However, both turkey nests and some song birds' nests were observed with many ants, and the killing of the young as they opened the eggshell to emerge, was performed by the ants swarming into the shell and literally eating the birds alive. One nest of the scissor-tailed flycatcher was noticed to have been infested after hatching, several days, and the young killed when perhaps four or five days old. This was by the small black ant, Whether these are "fire-ants" or other species, the writer is unable to say, but there is room for study of nests and the ants.

The Eagle, migrating into northwest Oklahoma, in late fall and staying until early spring, preys on prairie chicken to some extent, and ducks to considerable. They doubtless kill a good many prairie chicken but good cover will likely prevent a severe amount, and where jack rabbits are not otherwise controlled, the eagle will prove a benefactor. It is the eagle's chief food in this region.

Wild dogs and wild house cats are so well known as predators and undesirable that no mention need be made of them except in defense against any criticism that might be directed at the report for its absence.

To sum up the total predator problem, the facts of their destruction are most closely associated with nesting studies. This information is most desirable because misleading efforts have done great harm instead of good. It would be more sensible to learn which are true predators, and concentrate on those than to exterminate all of them on suspicion. As has been shown, many of these so-called predators are necessary to keep down larger destruction by others. And it may be repeated that cover will protect many birds and their nests at less cost than predator control.

## NETTING AND BANDING OF BOB-WHITE QUAIL MIGRATION

There is no need to take up the life habits of the bob-white quail in detail as the subject has been well covered by Herbert L. Stoddard in his "The Bobwhite quail etc." There was need, however, to check the application of his findings to the habits of the birds in Oklahoma. There is such difference in climatic conditions and food and cover that these subjects deserved particular attention. It was thought by the writer that the quail made a habit of using the high sand hills as a summer production range and the surrounding creeks and canyons for a protective winter range. To find beyond question what really was happening, banding operations were inaugurated for quail as had been done with chickens.

A few facts that are equally true here that were reported by Stoddard will be repeated for emphasis because of the widespread belief in other theories. To emphasize, also, the need for the continuance of this work on a broader scale, the writer would like to take the liberty of pointing out a few fallacies that have likely prevented the enormous past expenditures for quail restoration programs from being the success they might have been.

Several thousand quail have been purchased in the past 14 years from Old Mexico and Mississippi and released on refuges over the state. The policy of establishing those refuges was based on theory without foundation of fact. Most of the areas were already depleted and it was evident that the agricultural practices had been the chief factor in that devastation. The remedy was soon advocated as planting a little feed, leaving an acre or two for the quail, and inadequate amount for the crows, rabbits, rats, and other birds, animals, and rodents after early winter. This policy invites disaster by bringing covies into an area in fall when grain is plentiful,

generally throughout the entire hunting season, and then permitting them to starve to at best a weakened condition for lack of the same food in late winter. It was also true that most of the refuges embraced lands about the farms and meadows which were overgrazed in cover destruction, oftentimes in the name of water requirements. The refuge having been depleted of its natural stock was restocked with southern birds, without any change in the environment that natives could not stand, except no hunting. Laws protecting fur-bearers were made without knowledge of their nest robberies, and while the value of fur-bearers is recognized, the game crop value is being retarded. One of the principal features retarding game crops, providing sufficient facts were in hand, is the attitude of many officials and sportsmen demanding "free" hunting.

The discussion of "free hunting" may seem, at first, out of line with the fact finding study carried on at the Davison Ranch but a further thought will show it is one of the principal ideas that will follow such an investigation. The quail and prairie chickens are not produced for nothing, were never produced for nothing, the harvest that appeared to be "free" was merely the reaping of a crop which took many years and thousands of acres of land, now used otherwise, to produce. Until a policy is followed that permits the recovery of the cost of game production, that production will be meager and unsatisfactory. Its relation to this investigation, is the possibilities of game production at a reasonable cost by employment of standard methods that are not guess-work, which will provide food in November, March, July, etc., nesting cover in early summer, and proper understanding of the kill that can be permitted under varying circumstances. Let us see what the migration of quail has to do with a program of this sort.



MIGRATION of bob-white quail was definitely determined by Stoddard in the Southeastern States to be so small as to establish a covey's year round range at approximately 1/4 mile. The banding operations on the Davison Ranch project just as definitely established the fact that thousands of birds are raised on one area in summer and are wintered on another area several miles away. In summer the range was found to be small covering no more than 40 acres, and it is about the same size in winter but between the two there is quite a movement. This then gives an insight into the possibilities of community hunting preserves that will provide nesting areas for summer, and wintering quarters for hunting by which the producers may share in the cost and the reward. Several areas of farm lands were found to produce no quail at all but to provide excellent shooting in season (Nov. 20 to Jan. 1).

To explore a bit farther into the community hunting preserve, if all the needed facts were available, certain nesting areas could be protected that would produce say double the birds each year. This area would be used in winter to some extent as the birds moved to winter feeding places which would be left with proper foods, principally native weed seeds. Then, a plain shooting program followed that permitted a certain kill on the known numbers so that numbers could be increased instead of decreased as is now prevalent.

NETTING of bob-white quail is accomplished with a modified "fyke net", built of inch mesh cotton netting. The "barrel" is about 14 feet long, round, tapering from 12 inch diameter to about 7 inches at the rear, and held in shape by wire hoops about 30 inches apart. From the opening in the "barrel" a "sing" is run each way about 30 feet, making a 90 degree angle V. These wings are made

of 1 inch netting about 3 inches high with a heavy cord at top and bottom, stakes being fastened about 3 feet apart which hold the net up. The wings are set up, taught, in a straight line with a clear pathway along the inner side for the quail to run down into the barrel.

To this net, the investigation added a feature that has proved quite valuable in this territory by making catches more complete. A "hood" was designed that attached to the mouth of the barrel spreading to about 4 feet wide at the front, some 6 feet from the barrel. Iron stakes were attached to the bottom rope that hold it to the ground. This "hood" type net is used to catch where a small clump of bushes or weeds can be covered with the hood, the wings directing the covey into the clump. Then even though the birds attempt to fly instead of going into the barrel, few escape. Without the hood a set is made in the "open" attempting to place the barrel in cover. In the capture of young covies the hood is very desirable, but for the matured birds, the hoodless net is quite satisfactory.

Quail are located in the oak motts by care in mid-day where they spend their time resting, playing, and in safety. Larger oak motts demand work on foot to locate their tracks and finally the covey. The net is then set at a likely angle to catch as the birds are driven by car in the open and by hands and knees crawling in the brush. Should the quail covey be flushed, as often happens, they may be gathered together and a second, third, or fourth attempt made to drive them into the net.

One of the bane of netting quail is the easy cottontail rabbits that frequent the same places. They are often caught in the net, and their sharp teeth soon open up the barrel for their escape. Not infrequently have they gone into the net without the men knowing it, and the covey driven right on through the holes cut by the rabbits,

an exasperating experience.

These summer netting and banding operations have proven, together with daily observations, that the covey lives within the confines of a few acres, seldom more than 10, never exceeding 40, often no more than 5. They may be found every day at one, two, or three favorite resting places. Water has no place in their daily routine, though they will drink some if available in heavy cover, but their use of insects invites playing and feeding around a covered watering place as the insects are numerous and sometime stupid as they drink.

It is the understanding of the writer that several states have found no migratory habits in the bob-white quail by banding experiments. The records already obtained here reveal the necessity of further study and correction of this habit, if possible, at least determination of the causes.

The banding of 200 quail in 1932, comprising part or all of 24 covies, covered approximately 35 percent of the 590 birds known to be on the area. There were others, doubtless in a portion of the area on which little work was done but these numbers were under close observation and many attempts were made to band them as improvement of the net was under way. This year's banding was the major quail banding year, and from its information comes most of the conclusions.

The covies were not completely recorded, though they could and should have been. Almost daily observations were made from July 1 to September 15, and the netting and banding was carried out on the days that proved too cool for the netting of chickens, or too early in the morning.

Of particular interest are the general facts. The covies did not migrate

during this period, always being found in the one, two, or three favorite nesting places in the same small range. Each covey range was found to cover no more than 20 acres, often much less, during this 2-1/2 month period. Two or even three covies were sometimes found in the same range, though they were no often found in the same group.

The number of young, and total number, in each covey were often counted when observed in the shady motts or when flushed, and no material loss was recorded in any instance, most of the covies remaining intact to 100 percent.

It seems improbable that the frequent disturbances of netting had any ill effect causing the bird's migration since many attempts were made to catch two of the largest covies, and no movement occurred until after mid-September when most of the covies moved away from their usual places, alike, other quail quail were handled late at Headquarters without their moving.

After frost, when some covies had moved into the feed patches, or those already there still remained, observations were more intermittent. In six of the eighteen feed patches, the remains of quail there were evidently killed by Cooper's or Sharp-shinned Hawks were found. These covies all moved out before January, and with the exception of one covey in each of the two best cover protected feed patches, all left during early January. Cover in the feed patches was not heavy but the following two years of extreme drouth offered nothing better for comparison.

154 quail were banded on the area in 1933, from August 2 to September 20, in a partial effort to cover the territory. Covies were much smaller than in 1932 and about equal in number of covies.



Improved netting permitted the better success, relatively, than the previous year. Banding operations in 1931 were abandoned because support for this work was withdrawn the previous year, and the writer was unable to provide the needed funds for expense and labor.

The hatch in 1932 was good, that is probably averaged above 10 young per covey, but it was not uniform in age, some being early, other hatching the 1st of November. The 1933 hatch was very poor, only four or five young in the average covey, and few coveys. In most instances, there would be two pair with each covey of young and then odd males in addition. Many old pairs were by themselves throughout the season. In 1934, the hatch was quite uniform, neither early or late, the young appearing to average about 8. Fewer unsuccessful pairs were observed, but the total brood stock was less than the two previous years, so the hatch was doubtless considerably smaller than 1932 and a little better than 1933. At the time this report is written, it appears that a still smaller stock of brooder will raise an excellent hatch in young, both a high percent successful in hatching, and coveys high in number (August 20), 1935.

Total production in the four years might have run in the following numbers (this is a rough estimate, though based on close observation and some actual counts--the value of the estimate being in proportions). 1932 production on the 16 section management area was about 750; 1933 about 300; 1934 about 350; and 1935 probably 450. It is hoped these estimates will be of advantage in determining the relative damage of conditions unfavorable to quail, and check the amount of kill that is advisable. The hunting ~~season~~

season bore out these estimates in 1932, 1933, and 1934, except the latter when more severe cover shortage occurred in surrounding areas which was reflected in the season being worse than 1933.

Individual banded birds that showed long migration from the management area as a summer range, and surrounding creek and river country as a winter range, are quite indicative of the general trend.

No. 660, an early hatched quail in 1932 was banded at Sta. 26, Aug. 5, 1932, and killed Nov. 25, 1932 along the Canadian River, 8 miles south and 2 miles east of the banding station.

No. 676, a 1932 hatched quail, was banded at Sta. 37, Aug. 10, 1932, and was killed late in November along the Canadian River at a point about 5-1/2 miles south and 2 miles west of the banding station.

No. 1217, an early hatched quail of 1932, was banded at Sta. 55, Aug. 20, 1932, and was killed Nov. 30, 1932, at a point on Hackberry Creek 10-1/2 miles east and 2-1/2 miles south of banding station.

No. 1247, a 1932 hatched cock quail, was banded September 6, 1932, at Sta. 50, and was killed on Mosquito Creek, 5-3/4 miles north west. No. 1335, a later hatched quail in 1932, ranging in the same area near Sta. 50, but of a different covey than 1247, was killed at the same time on Mosquito Creek by the same party (December 2, 1932).

No. 1286, a mother hen of 7 rather late hatched quail in 1932, was banded at Sta. 16, September 20, 1932, and was killed November 23, 1932, on Hackberry Creek about 10 miles east and 3-1/2 miles south of the banding station.

From 1933 bandings and recoveries, the following records are interesting.

No. A454670, a young quail, was banded September 8, 1933, at Station 22, and was killed, December 2, 1933, in the county south of Ellis, a distance of 26 miles almost due south. This is the longest migration recorded here and embodied the travel to the Canadian River, as several other records show, thence across the mile width of sand, and on across adequate food, water, and protective covering some 15 miles.

No. A454626, a 1933 hatched cock quail, was banded at Sta. 118, August 7, 1933, and was killed, November 25, 1933, 2 miles and 1 mile north of Station.

No. A454732, the mother of 9 young in 1933, was banded at Station 19, September 2, 1933, and was killed on Packsaddle Creek, December, 4, 1933, a distance of 5 miles south from banding station.

Nos. A-454678, A454683, and A454680 were banded, with others at Sta. 72, September 8, 1933. The birds comprised two small covies with two old pairs of quail and were killed on adjoining farms about 3 miles west and 1 mile south. The first numbered was killed November 30, 1933 on the West Farm. The other two were killed from the same covey, November 20, 1933, on the East Farm.

No. A454704, banded September 9, 1933, at Sta. 137, was killed the last day of the season, January 1, 1934, on Hackberry Creek, 2-1/2 miles east and 3 miles north of the banding station.

Five banded birds were killed on a farm 3-1/2 miles southwest of banding Station 2, where they were banded September 8, 1933 from the same covey Thanksgiving Day, 1933. The exact numbers were not obtainable except that they were nearly successive numbers in the 190s, which permitted the assurance of the proper covey migration being known.

Nos. A454633 and A454636, both young quail of the same covey banded at Station 72, August 8, 1933, were killed November 20, 1933, on a tributary of Hackberry Creek, about 8 miles east of banding station (and a little north). It will be noted that these birds were banded at the same station exactly a month earlier than Nos. A454678, etc., which went in the opposite direction.

To summarize a bit and advise concerning the needs of future work will bring to mind the correlations of the above banding stories and necessary facts of migration, covey formations, losses of birds in migration, and the history of the second year migrations of the same birds.

No funds were available for winter studies, but it is likely that a month in the surrounding territory with net and notebook would reveal a great deal of information as the covies. For instance, it seems unusual, and disappointing to the writer, that so few recoveries have been made, particularly where only one was obtained from a covey. It raises the important question of what has happened to the other banded birds of the same covey. From this solution might come the additional solution of how to stop the migration, and probably how to save a large percentage of birds from destruction. Again it is an indication that less than 10 percent and possibly as low as 5 percent of the birds raised are reaped in the shooting season. This surely is not so, and the answer may be that the balance of the birds do not complete their migration until after the open season. This would throw light on the common reports of covies "hiding out" during the open season and "returning after the season". But to accept this theory as correct without proving it by netting banded birds, would be a gross mistake. There are many problems that



need solution that can only be accomplished by extensive banding operations. Until they are understood, there is little chance of a practical game management program becoming valuable for general use.

This migration finding has put a new understanding of the community hunting possibilities. A cooperation of pasture--landowners and farmers with nesting areas and feeding areas, etc. looks inviting. By this means a sensible plan of operation, a careful check on numbers killed, and a knowledge of increase can be found and pursued.

Couple these banding records, with nesting studies, with food studies, and with studies of predators, and an authentic publication for use of sportsmen and game producers can be prepared. The result will, of course, be a greater number of birds for shooting, more revenue from this source for continuing game management advancement, and a happier relation between the producer and consumer of game birds.

There fore, it is urged that this quail investigation be continued on a broader scale than formerly, the expense will not be materially greater than that encountered in the 1932 work.

## FLORA AND FOODS

Food that naturally grow under favorable conditions in north-west Oklahoma, are one of the important factors in game management. Through native foods is the opportunity to provide a supply of sustaining feed for the upland game birds each day of 365 that make up each year's cycle. The added importance of this factor will be more fully understood when the many varieties are properly known, and their proportionate uses noted.

It is the opinion of the writer that it is the duty of the Game and Fish Commission to learn the valuable bird foods, teach them to their field men, and thence convey knowledge to sportsmen and producers. Further reading will show the reasons of this importance.

A collection of native seeds were gathered as a part of the study conducted on the Davison Ranch Project. It includes more than 140 species, and in addition, several tree, shrub, and weed seeds that are not native. Of these, about 75 are known to be used by quail, and about 10 by prairie chickens. Several are of no value as seed producers, but are used a great deal for green feed. Most of these valuable foods are found over the entire state of Oklahoma, and are supplemented by many others that do not occur in the Northwest. Because of this variation in native flora, the writer has several times recommended that the Game Department furnish quail stomachs from each section of the state by the rangers. It would have been a very small expense, and of inestimable value.

Prairie chicken and quail were collected at intervals from the project, and crops and gizzards preserved and sent to the Biological Survey for careful examination. Reports were filed with

the interested parties on these examinations. In addition, several were studied at the project headquarters, and records kept of the contents. By this method, there is no guesswork on what is being eaten, and the proportion of each is determined. Finding these facts, the next step is to experiment with the major plants to find satisfactory methods of producing them to the exclusion of those that have little or no value, of which there are many.

Different plantings of trees, shrubs, and herbs, both native and foreign, were made in an effort to secure better cover, permanent food supplies, and improve foods under conditions here. It resulted in finding a few that were more resistant to drought than even native flora, and some that were valuable for ornamental landscaping and bird food. The value of these for state park improvement, is evident, as is the case for shelter belts, soil erosion control, and forestry.

The three years covered by the report were record years of drought and most of the plantings died, as did most of the native grasses, trees, and weeds. Many of those surviving failed to produce seed except the season of 1932. However, some plantings were made at headquarters where some water was available to assure their start, and each species saved for study. The Great Plains Field Station, at Woodward, furnished several hundred plants from their nurseries, and cooperated in other ways. They even went so far as to introduce new food producing plants that promised to be of value on this project, and offered many helpful suggestions.

It may be thought at first that there is no place in game management for introduction of foreign plants, but it will be remembered on second thought that a great man of our most valuable

plants are not native, and it will also be noted that those foreign plants have taken hold by virtue of a very desirable habit, that of reproducing in spite of agricultural practices or adverse weather conditions. The water table under Oklahoma soil has dropped 18 feet, government specialists inform us, since civilization embarked on its program of 40 years ago, which has made necessary a transplanting of more drought resistant food producing plants for bird life. The more arid regions farther west have produced feed for bird life though it is not the same as our own species. Many native plants have no value directly to birds and can be replaced by game birds foods where game production is desirable. These are the justification for learning more of foreign as well as native plants.

There are two well known methods of increasing certain plant foods, at a reasonable cost--burning and discing. By burning over game lands some hard shelled seeds are permitted to sprout that otherwise lie in the ground for many years. Discing at one season of the year kills some plants and is instrumental in preparing the seeds of others to start their growth at the proper time to grow more rapidly and successfully than others that are not wanted. Some information was obtained on this subject by observation from other activities, and two 10 acre plots were fenced and laid off for the pursuit of discing and burning experiments, but the administration of the Game Department deemed this work unnecessary and refused support of it, so it was dropped.

The failure of domestic crops to keep through moisture, sunshine, and freezing and thawing; the ravages of rodents, reptiles, and animals on a small amount of grain; and the history of increases



in quail numbers on lands left to the growth of weeds--are proof of the need and value of a comprehensive attack on the problem of preservation and increase of those plants that produce edible seed in sufficient quantity to support larger numbers of upland game birds.

This portion of the investigation contains many details that are not thoroughly worked out, and an attempt will be made at this time to follow a policy of generalization, offering specific notes to bolster the interest.

The prairie chicken foods consist, mostly, of insects in summer; a large proportion, possibly 90 percent, of this is made of various species of grasshoppers. However, the records show more than 25 other insects were added. Too, a good many seeds are taken, which comprise but a small proportion of the bulk in each day's feeding. A grown chicken will consume about 30 full grown grasshoppers from 1-1/2 to 2 inches long, each morning and evening, the food digesting following the morning feeding as they rest, and again during the night following the evening feeding.

When August matures the abundant crop of acorns that is provided about four or five years on the low growing "shinnery", these acorns begin to take their place in the food requirements. As the fall advances, acorns become more and more the major food, until insects become exceptions. These acorns are 1/2 to 3/4 inch in diameter and from 1/2 to an inch long. They are swallowed whole, the hull being dissolved in the gizzard. The hilum or end fastening the acorn to the cup, is almost as hard as gravel, and is apparently used for this very purpose in grinding the food. Little gravel is found in the stomach of the prairie chicken.

Winter finds many chickens flying out to grain fields where

they use the grain left in the field as their chief food. But many never leave the pasture and live on the acorns, a few green sprouts that are available all winter, and a few insects that are probably scratched from under the pulch of leaves that falls from the low oaks. Years of plentiful acorns lessen the field migration.

Spring, which includes the gobbling season from late February until the crop of insects are again available, usually finds plenty of acorns and greens for the birds. Burning of the pastures does not destroy the acorns, though they may be scorched somewhat. Chickens have been found to be fat throughout the year without exceptions. Spring no exception either. In the spring of 1935, an acorn was a rarity and the stomachs examined contained no food except green leaves and the blossoms of the oak. Many birds were observed as they fed on these oak flowers, showing it to be their chief food. Any green plant in the winter and spring is readily eaten.

The seeds of the following plants are of importance to prairie chickens, ragweed (Ambrosia sp.), queen's delight (Stillingia sylvantica), hairy puccoon (Lithospermum carolinense), wild sweet-pea (Cracca virginiana), day flowers (Commelina crispa). Those plants affording greens most often include wild sweetpeas, hairy puccoons, prairie ragwort (Senecio plattensis and riddellii), Thelesperma gracile, beard-tongue (Pentstemon acuminatus), umbrella-wort, or wild four o'clock (Allionia glabra), and some of the evening primroses. All these plants, including both those for seeds and the others for greens are abundant over the sandhill country of the northwest Oklahoma.

Quail eat so many seeds that the list that follows can only be a part of the species that are important. Less quail stomachs

were examined than in the chicken investigations, due to the shortage of birds in winter. However, many crops and gizzards were collected by the writer, and several interested sportsmen, learning of the work, sent others from their season's killings.

This paragraph contains the major quail foods as determined by these limited examinations. Further study will doubtless add some of the species that are listed as used in small amounts or probably useful.. From the pea family come several major foods; wild sweet-pea, beggarlice (Meibomia sp.), scoralea (two species), pencil flower (Stylosanthes biflora), and black locust (Robinia pseudo-acacia), this last named being most valuable in late winter as the pods open and for its winter cover protection. The ragweed family adds several species: Ambrosia elatic, psilostachy, and trifida; and the marsh elders (Iva ciliata and zanthiifolia). Others include the dayflower (Commelina crispa), swamp dock (Rumex verticillatus), partridge pea (Chamaecrista fasciculata), two of the puccoons (Lithospermum carolinense and linearifolium), Texas nettle (Solanum rostratum), sumacs (Rhus glabra), skunk brush (Rhus trilobata), poison ivy (Rhus radicans), spurge such as queen's delight (Stillingia sylvatica), Texas croton (Croton texensis) glandular croton (Croton glandulosus), snow-on-the-mountain (Dicliophyllum marginatum) and branching tragia (Tragia ramosa). Then a few species of Amaranthus (blitoides, hybridus, and spinosus) known as hog or pig weeds, lamb's quarter (Chenopodium album) and winged pigweeds (Cyclonema striplidifolium), sunflower (Helianthus annuus), paspalus grass (Paspalum Stramineum).

Of lesser value in the stomachs examined are Illinois Mimosa, wild four o'clock, pink oleome, rough leaved dogwood, jimson-weed, and smilax. Among other promising seeds are scoralea, white prickley poppy, heart leaved ivy, honeylocust, red-bud, American elder,

buck-bush, acorns, morning glory, and Virginia Creeper.

A few of the grass seeds are probably important, and many others, weeds and flowers. Even though the seeds are small, they are eaten by quail, as high as 2,000 pigweed seeds making a meal for a quail.

Experimental planting of Vitex (two sp.), Colutea, Halimodendrum, Privet, Cissus incisa, Gleditsia, Jujube, Lonicera, buckthorn, june berries, and sumacs, all promise well as bird foods along with ornamental values. The Colutea, Vitex, Gleditsia, sumacs, Cissus, and Halimodendrum are more drouth resistant than the others and more resistant than most of the native plants. Their value as food producers is enhanced by the excellent cover they extend.

No more interesting or valuable factor in the needs of game birds will be found than in the study of plants and their value to the birds. A display of seeds of various sizes, shapes, and colors would be most attractive in the office, or State Fairs, as has been noted by the writer in connection with the reference collection at project headquarters. Few people have any idea of the wonderful provision nature made for its feathered inhabitants and the food for many thousand of them is destroyed every year for lack of this knowledge.

Employees of the Game Department should be schooled in the kinds of growing plants that harbor the game they protect, the sportsmen should understand the part played by the cover and good producing terrain over which he hunts, and the farmer should learn those plants that furnish the sustenance for the game he hopes to produce--all of which dictates an educational program through the conservation agency. All that seems wrong with the theory is that more knowledge

needs to be cataloged accurately and enthusiastically, a purpose of this Davison Ranch project that deserves continuance.

The study and understanding of providing food for quail has been but lightly touched but sufficient has been noted to show its value. There is every indication that a thorough knowledge of this one phase of game management would answer many questions concerning the decrease of quail and the failure to increase. It would probably point the way for a quail program that would prove much more successful than any plan Oklahoma has pursued in its history. The work should be broadened to include the several parts of the State that are most widely divergent.

#### FIRE, ITS USE ON PASTURE LANDS AND ITS EFFECTS ON QUAIL AND PRAIRIE CHICKEN

Burning is a necessary procedure in the use of shinnery lands for grazing cattle because otherwise the oak grows so rank that the grass is shaded out beneath. Too, when rains come in abundance, or when few cattle are run in a pasture, more grass will grow than is consumed. The following summer the old grass that grew the previous year no longer has any fattening properties and makes the new grass unpalatable. Therefore, a portion of the pasture must be burned each year to provide the valuable fattening of cattle. The years of 1933 and 1934 were exceptions to this usual procedure because there was no old grass left after the drouth conditions had shortened the supply and cattle ate even the oak brush to survive.

The use of fire on game producing lands must be understood for it is obvious that a great deal of harm can result. However, that is but half the story because the benefits that can be obtained are equally valuable. In fact where the basic industry is cattle



raising an equitable plan of burning must be worked out.

The past history of this reaching area proved that fires are not a strong deterrent in the increase of either quail or prairie chicken. But how to avoid any damage is interesting. Theories of proper time to burn are useless unless based on nesting dates, thorough knowledge of foods, and something of the insect control. As a foundation for thought these three items are destroyed to some extent by fires--nesting protection, feed, and covey protective growth.

Elsewhere a more detailed report of nesting dates and facts are contained though they are not as complete as would have been desired. Roughly, it was learned that quail and prairie chicken nesting did not begin prior to April 10. Burning later than this would likely destroy a few nests up to about the 20th of April when any further fires would begin to take a material toll of nests. Now, to consider the effects of these dates on the requirements of grazing industry. Fire is not advisable in early spring because of the damage done by the February, March, and early April winds. Burning after the grass begins to green is wasteful except for the first 10 days when the growth is very uneven. This generally occurs between the 1st and 20th of April, occasionally in late March but then it is usually followed by a killing frost that undoes all the good that was looked forward to.

It is then agreeable to the best interests of both, so far as the date is concerned to allow the burning to be delayed until April 10. There is one more thing regarding the date that is important. Land burned over following a rain or heavy dew, does not burn so severely, that is, not into the roots. High winds are prevalent later than burning can be done, and the presence of moisture

at the ground surface, saves many leaves from burning, thus creating a coverage for the bare sand. The benefit to chickens is in the acorns left but scorched instead of burned, and the frequent patches of 1/4, 1/2, or several acres that is left unburned. For both the birds and the cattle the protection of the oak motts is advisable since it protects them both from excessive heat in summer and northern blizzards in winter.

The problem of foods is still deeper and less compatible between the grazing and bird feeding. As for the acorns, they are undesirable on grazing lands for some cattle begin to eat them in August, doing well like they would on corn, but soon finding them harder to find, and losing lots of flesh as a result. It is this reason that causes many cattle men to permit the burning of the mott, also. Acorns are not produced on the plant that is burned, or on the first year growth. The second year bears well, the third exceeding it by about double as the plant is larger. Other valuable seed producing plants are not harmed by this burning (on this area), are in fact benefited because the oak growth does not shade it out. The sumacs, plums, and like shrubbery would be prevented from bearing fruit as they, too, require the second year growth to bear.

Food values have not yet been fully considered until the insect problem is studied--a study that the writer is not very well informed on. Until better knowledge is developed perhaps a few general observations and theories would be worthwhile on this subject. The failure to burn in 1833, 1934 and 1935 is one fact. The immense increase of grasshoppers and other insects is another fact. Whether the fire would control the latter or not is not stated as a

fact, but as a probable result. In 1935 the cutworms ate about 95 percent of the leaves off the oaks other than in the taller motts, the grasshoppers taking more than half of those. Under normal conditions, there was no lack of grasshoppers for the birds, this area being abundantly supplied. The increase has become a menace to all green vegetation, and thus a menace to stock and birds, alike.

The protective covering for covies was mentioned in the advisability of saving the oak motts, the balance of the cover showing satisfactory cover by the time young birds were hatched, in fact, the lower cover is probably the better for summer range that permits earlier access to feeding. The better growth of grass is better winter protection than the oaks as it changes very little while the oaks drop the broad leaves.

There is reason to suppose that fire is a cleaning agency, assisting both stock and birds by the destruction of lice, mites, insects, and diseases. It would surely be aided by the sterilizing effects of the sun's rays that are then permitted to penetrate through to the ground. Ashes left from the burned vegetation are doubtless a valuable dusting powder.

Many plant seeds, such as the partridge pea (*Chamaecrista fasciculata*) are so hard as to require fire or other means of insuring a good germination. Mr. H. L. Stoddard has carried on very extensive research with fire and its relation to seeds, birds, etc. The Davison Ranch would ordinarily have afforded much more information on the subject of fires but of course the drouth made that impossible.

The first year of the investigation, when severe burning occurred in late March, was followed by the most successful increase of

chickens and quail under the four years observed. Of course, this is not conclusive proof as there are other factors considered, but it does indicate that fire was not seriously detrimental--at least not nearly so much as drouths.

The use of fire on game management areas appears worthy of annual use, possibly by burning one portion one year, another a second, and a third the next. Because of its low cost, control of obnoxious plants, insects, etc., would be obtainable on any sized area where plowing or discing would be prohibitive. It certainly deserves a thorough study, that it may become an aid and never a detriment to the production of game on pasture and agricultural lands of Oklahoma.

#### WATER REQUIREMENTS OF PRAIRIE CHICKEN AND QUAIL

Because the subject is generally misunderstood, the facts concerning the water needs of upland game birds was studied carefully during the period of research. Most of the efforts to improve game conditions in Oklahoma have contained, as a major requirement, the idea that water was needed. Game refuges, restocking areas, and educational features have therefore been restricted to the low lands, more or less wooded, and to those parts of the state where rainfall provides more watered draws. Incidentally, it set up the conception that these were the main part of game requirements, but failed to recognize that it dictated game management in areas most susceptible to floods, and most used by predators.

The following findings will be found to agree with the investigation in the Southeastern States by Herbert L. Stoddard. Moisture conditions in northwest Oklahoma are less favorable than in Georgia and Florida where the average rainfall is about 53 inches while the

Davison Ranch receives but 23 inches under normal conditions. The 1933 rainfall was but 12 and 1934, 18.

1932 was below average rainfall, amounting to about 20 inches, and a period of 32 days was recorded when there was no dew, or rain in July and August. Prairie chickens were increasing by about 30 percent above natural losses and were developing at that time at the age of 6 to 11 weeks. Quail were from 8 weeks old down to hatching, several covies hatching during and following this period.

No birds, young or old, prairie chicken or quail were found to have visited any of the few watering places on the area. In fact it is, of course, impossible for the majority of them to have made the trip to water and return in one day. No ill effects on any of the 700 birds handled was noted, and no substantial loss occurred. The many covies of quail were under almost daily observation before, during and following this dry period. No tracks were found at the surface water holes though the ground is sandy and leaves no chance of bird watering without making tracks. While most of the covies were too far from water to visit it, several were within easy walking, and feeding distance of water, but they did not use it either.

The exception to this rule was at headquarters where overflow water runs through heavy cover, as long as the windmill pumps. These birds evidently learned to drink water daily, as on still days when there was no water at the mill, they would often come to the lily pond in the back yard and line up around its edge, drinking a small amount.

In the record dry years of 1933 and 1934, when all vegetation except the oak dried up in late June, July and August, there were still longer periods without rain or dew than recorded in 1932.



Besides, practically no newly matured seed, high in moisture content, was available. About 50 old cock chickens watered each night at one well for nearly a month. A pair of quail were watering there, too, and once a covey of half-grown chickens were seen. An occasional quail or chicken watered at other places but no important percent found water worth going to. No young quail were ever found to have gone to these watering places (other than at the house) during this season.

Constant observation shows that the birds retire from watered lowlands to nonflooding areas, away from the habitat of the dangerous Cooper's and Sharp-shinned Hawks, and the beaten trails of animals and rodents, around water and trees.

In the autumn, both quail and prairie chickens may be found at watering places early in the morning and late at evening. 50 or 150 prairie chickens will be found sometimes at one place, a few drinking, but most of them just playing around the edge. Some will come into water all winter and in the spring until mating season, but again the number is so small as to assure the fact that it is not a requirement for their survival of health. The spring of 1935 had no rain or dew for many days, but a choking dust was in the air most days, and a heavy coating on all vegetation at all times. Yet no watering was observed other than an occasional chicken until mid-April when none were to be seen at water.

Certain chickens that get the habit of drinking daily will spend a lot of time drinking, evidently consuming large amounts of water, and these few observations would tend to convince one of the needs of water, were the other findings not pursued.

Two covies of quail lived the whole winter through in favorite feed patches that were more than a mile from the nearest water.

The places were visited many times and showed without doubt that the birds were not making the long trips that would be necessary each day. No tracks were at the water's edge. The covies that did migrate were usually found in reach of water, but not always. They did find better protection from severe winter storms and what appears a possibility--a return to remembered quarters of the winter before.

Water may be a drawing factor in winter, but of no necessity in summer. For the breeding season, in the highest heat, none is of advantage.

#### ARTIFICIAL PROPAGATION, PARASITES, INBREEDING, MISCELLANEOUS

Artificial propagation, or pen raising, of quail and prairie chickens has been tried for several years. The former can be done quite successfully, the latter, to date, failing almost entirely. More than 100 prairie chickens were furnished to several breeders and the Oklahoma Game Farm at El Reno, but the survival of three from eight 1934 young in August 1935 is the only record of survival in Oklahoma.

Probably the most valuable returns from artificial means of reproducing these birds is in the study that is permitted of the bird's habits. It is necessary as an aid to field observation in accomplishing a complete life habits understanding. While several hundred birds may be released by the hatchery, yet it is evident that more accurate knowledge of the problem confronting them in the field is necessary to assure the value of the pen raising.

In the future research that should be carried on at the Davison Ranch Project, a small outlay for experimental pen raising of chickens should be provided. A comprehensive method of pen raising can be accomplished at this small expense without the destruction of so many birds as has been done.

A disappointing factor in the shortage of funds for this field investigation has been in the much larger expenditures for artificial propagation which, it must be admitted, offer no promise of approaching the value to the sportsmen, or numbers to the the quail, that a better management of the game lands would give. Particularly in the case of the prairie chicken, no other efforts have been made in its rehabilitation, no other funds expended, except those on this project and the accompanying transfer of birds. It seems, therefore, that this one bird, native and valuable game, deserves more attention and financial support than has been given it to date.

PARASITES, while showing no ill effects in the field, are found to infect practically every grown prairie chicken that was examined. It is a serious menace that might become a grave problem and should therefore be studied and anticipated before necessary--a time that is almost too late. The lice are detrimental, too, and this study would be possible with a pen raising provision.

INBREEDING deserves particular mention because the theory of "shooting up the covies" is so often expressed by game officials and sportsmen. All too many are anxious to believe this misguided theory, and teach it as a persuader to go into a farmer's flock. On the face of it, it sounds probable, since the argument usually attends that his quail are not increasing. But the trouble is evidently not inbreeding but shortage of habitat--food, protective covering, etc.

Mr. Stoddard carried on extensive research on this theory both afield and in the pens, exploding the soundness of it beyond doubt. The Davison Ranch study, not having access to pens, was able only to note the birds in the field and surmise from the handling of 2,100 live prairie chickens and 850 live quail that inbreeding was

no deterrent.

Of the approximately 3,000 birds, thus observed, but one was found in an unhealthy condition. This young chicken, a member of 9 young in a covey, was very light weight, though appearing well. This is no evidence to permit the wholesale shooting of many coveys to "scatter" them. The providence of nature that provided well for the birds before guns were invented, is still apparently capable of preserving the virility of the bob-white quail and lesser prairie chicken.

The continued banding operations will show more fully what inbreeding actually occurs along with other problems of covey formation.

The theory of quail raising two coveys a year is expounded a great deal, and therefore deserves denial with a work or two of proof. The observations of several hundred quail in the field, here, showed no such actions and a careful thought of the situation would almost be convincing that it could not happen.

The idea of the second covey from a single pair comes from observing smaller birds with older young. This occasionally happens as a result of two coveys in the same range, in which event, the netting and banding operations have shown in every instance two pair of old birds. Mr. Stoddard found that an orphaning of some young accounted for this, too, but here no loss of either parent was noted except in one case, which was the care of 14 young by two old cocks. These birds were netted and banded, and seen in the field several times, but isn't proof that the cocks laid the eggs.

The normal process of raising a covey of quail in northwest Oklahoma covers about 20 weeks beginning in late April or early May. This makes a date of maturity for the young in mid-September. For an old bird to lay a clutch and hatch it out, would require another six weeks. As has been told before, the birds, if broken up, apparently try again, accounting for late hatched birds and the opportunity for two sizes of young running together. This theory, like all others that tend to teach exaggerated reproduction, should be discouraged and refuted.

#### SUMMARIZING THE FUTURE NEEDS OF FIELD STUDY--ITS PLACE IN GAME REHABILITATION

Summarizing the needs of the future investigation of upland game will complete a reputable guide for the Game and Fish Department upon which to depend for guidance in the administration of a restoration program, state-wide. No worthy rehabilitation of quail and prairie chickens is likely to be attained until this authority is established and the Game administration makes it available to the farmer and other land occupant. Further stumbling attempts to increase these birds by theoretical rehabilitation plans, that have little more than hope for a foundation, make the return of depleted numbers more and more widespread. Most people are in desperate search of a single method to bring about a haven for wildlife, as is attested by the enthusiastic cooperation afforded programs of importing birds, artificial propagation, changing seasons, or bag limits, or predator destruction campaigns. While one after the other fail, to a large extent, the goal of their promoters, an unhealthy discontent increases and the bird population decreases.



A state wide collection of foods and birds for stomach examinations to ascertain what is valuable as food and then teach it to rangers, sportsmen and land occupants, is urged for the next five years or longer.

A large part of the State's quail and prairie chicken area is comparable to the Davison Ranch area. The study by observation, banding, and experimental plantings of foods, should be extended on this area to complete the investigation already founded. This requires expansion on some studies, continuance as before in others, and the use of what has been definitely established in the remainder. Three years is a minimum, after which a like period on a much lesser scale would be satisfactory.

Specifically, the project requires a small pen-raising set-up, the setting aside of about 2,500 acres of prairie country for purely experimental study which would include; fire experiments determining the value and extent of burning that should be permitted for the welfare of the game; on which concentrated nesting studies could be made throughout April, May, and June; finding of crow control methods in keeping with economic value; banding studies that have thrown much light on game management practices, should be continued and the same and additional records kept of them; a study of parasites made, principally as a part of the pen-raising activities; the extension of the gobbling ground census to cover the entire Davison Ranch each year, which would include a continuance of four year records on the 10,000 acre area and should establish a method of census-taking on small areas at moderate expense by the present employees of the conservation departments.

The history of quail increases shows a following of the breaking of the sod, hit-and-miss farming, and the abandonment of the same. But to establish sound game management on lands that are too valuable to handle this way, requires some discing and plowing experiments to learn cheaper methods of producing bird foods to the exclusion of weeds that are of no value other than cover.

The raising or importations of pheasants, Hungarian Partridges, scaled quail, or other foreign game birds, is not recommended for this locality as all such attempts have made no progress. It is not of interest to the writer until the welfare of those birds that are native and of superior qualities, has been taken care of and developed far ahead of present knowledge.

It is recommended that the prairie chicken propagation efforts of the State Fish and Game Department be placed under the direction of one person who will have it as his major problem to see successfully carried out. It is a problem that is apart from fishing, deer, turkey, and in most part from quail. The peculiar opportunities for census taking, netting, and transfer offer a more comprehensive picture for administration than other branches. In this problem, what has been accomplished, can be made of larger value. In fact, the advances are often lost in the new policies of a new administration that has no knowledge of the prairie chicken and its needs.

An experimental "community game preserve" should be encouraged and established for the propagation of game and the entertainment of sportsmen. The laws of the state are drawn, principally, by hunting sportsmen without due knowledge of the problems of production. Such laws as paying the farmers ten cents for each quail

killed is an insult to the high sport of game hunting, but "free hunting" is an obstacle to game rehabilitation in a settled country. A "community game preserve" for hunting would solve some of these problems that separate the land occupant from the hunter. Officials should not frown on "commercialization" of the business of game production on private lands, for the sport of hunting is worth the production cost. The foregoing sentence should not be confused with the old practice of selling "rights" to the killing of birds that nature had stored over many years, and which had not yet been "hogged out". The person who has every bit of his dependence for a livelihood on the farm he operates cannot and will not produce game at his own expense for the benefit of others. Since this includes such a large percent of the lands of Oklahoma, a moderate-cost-method of game production is dictated, and the Game Department is responsible for its establishment. These are things that make the Davison Ranch Project of such vital importance. No other program is parallel to or interfering with it. No expenditure of money is so just or deserving. It should not be neglected or curtailed.

While the Davison Ranch is the only area from which goodly numbers of lesser prairie chickens can be netted for restocking purposes, and while the native hatchery stock for the Darlington Quail Farm, was provided from it, the chief value at this time is the opportunity to establish low cost production of prairie chicken and quail. It has been pointed out, time and again, that low cost production cannot be accomplished without more facts. It is true that birds can be produced anywhere at some cost, indoors, in cities or on skyscrapers but the fundamental game production is in

the field, and there the future generations will find its production possible in numbers sufficient for sport, or not at all.

Census taking methods and summer banding studies have opened a field of advanced knowledge in anticipation of increases for the hunting season that promise a better administration of the game affairs. In this connection, it should be remembered that in 1933 and 1934, the facts as reported from this project were reflected accurately during and following the open quail season, while, according to the game officials, allrangers, sportsmen, and farmers had reported abundant birds. The accuracy of the studies two months or more before the hunters and farmers were able to change their reports, are worthy of note, since in each of the two years mentioned publicity should have been given to the need of lower bag limits, fewer hunting days, and less immigration of outside hunters. The contrary was true, the officials not being convinced of the authenticity of reports from the single agency of investigation. Someday, its authority will be established, and the sooner it is, the less obstructions will be permitted in the pathway of increased game.

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The accomplishments of the project must be so convincing to the reader, if he has followed it through from the beginning, to assure him that the progress already made has far exceeded the cost. A forethought into the final accomplishments that can be obtained by its continuance, should likewise convince him of its advisability.

With the hope that a favorable consideration will be accorded it, and that the resulting conservation and increase of upland game will be many fold, the report is respectfully submitted.

August 24, 1935

Verne E. Davison