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Scope of Study: Conservationists agree that the greatest hope for the disappearing wildlife is education. The study of biology provides a natural approach to the development of conservation concepts and practices. This report involved a study of the most common wildlife of Oklahoma. It lists several suggested activities suitable for biology classes. It also presents lists of films and reference books pertaining to various birds and mammals. The research materials used were books and pamphlets dealing with conservation of wildlife.

Findings and Conclusions: Wild animals are among this nations most valuable resources. They play an important role in the natural processes of the world. Many birds and small land animals help control insects. Songbirds and ornamental birds delight the ear and eye of man. Wild animals provide recreation, skins, fur, and food, and make our surroundings more interesting. Given a chance, wildlife will restore itself faster than any other resource. By teaching wildlife conservation as a part of biology many young citizens can learn the importance of perpetuating the wildlife of this nation. Conservation and good citizenship go hand in hand.

ADVISER'S APPROVAL

F. M. Baumgartner

TEACHING WILDLIFE CONSERVATION
AS A PART OF BIOLOGY IN
THE SECONDARY SCHOOL

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PREFACE

The subject of wildlife conservation is now considered so important that many governmental agencies, private organizations, elementary and high schools, and colleges have developed educational programs on the subject. In spite of all these developments, relatively few people clearly understand the habits and needs of wildlife. Some of our country's wildlife is still disappearing at a rapid rate. Conservationists say that the only hope is education. This must be the kind of education that will teach every American what conservation is, make him understand its importance to everyone, and make him want to practice it. It must teach the citizen to demand and support good conservation programs. Conservation and good citizenship go hand in hand.

This wildlife conservation guide is intended to serve as a useful guide for the integration of wildlife in biology courses in the secondary schools.

The author extends sincere thanks to Dr. F. M. Baumgartner who so kindly assisted in the preparation of this guide and to Dr. James H. Zant, Director of the National Science Foundation at Oklahoma State University.

Dr. A. M. Stebler supplied valuable printed material from the library of the Oklahoma Cooperative Wildlife Research

Unit at Oklahoma State University.

Deep appreciation is also extended to the Department of Wildlife Conservation of Oklahoma, The U. S. Department of Agriculture, The Michigan Department of Conservation and Department of Public Instruction, and The National Association of Biology Teachers.

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Finally, I give my gratitude to my wife, Lucille, whose encouragement and proof reading aided the author in completing this report.

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CHAPTER I

INTRODUCTION

According to the Holy Bible man was given dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.¹ Before the world was destroyed by the flood, God gave Noah these instructions: "And of every living thing of all flesh, two of every sort shalt thou bring into the ark, to keep them alive with thee; they shall be male and female."² Later when the flood was over and Noah was unloading the animals Jehovah said, "And the fear of you and the dread of you shall be upon every beast of the earth, and upon every fowl of the air, upon all that moveth upon the earth, and upon all the fishes of the sea; into your hand are they delivered."³ It is here we find the first records of wildlife conservation.

Since the dawn of history, conservation has been one of man's greatest needs. It has seldom been practiced. For thousands of years civilization grew up in fertile, well watered regions, flourished a while, and then disappeared. Where great nations once thrived, today the lonely traveler sees only empty landscape.

¹Genesis 1:28
²Genesis 6:19
³Genesis 9:2

When the early settlers came to America, they found a land of tremendous natural wealth. Nothing they had known in Europe prepared them for the abundance of fertile soils, the luxuriant forests, the great lakes and rivers, the rich mineral deposits, and the varied wildlife. It was common to hear people speak of America's "inexhaustible resources."

The reckless use of the resources and wasteful hunting practices have greatly reduced the wealth of our nation. The Congress of the United States Government is aware of this constant loss of wealth and wildlife. It is of utmost importance to educate the youth of this nation to conserve the resources inherited from previous generations.

The study of biology provides a natural approach to the development of conservation concepts and practices. It is imperative that our citizens learn to understand certain fundamental relationships that exist between soil, plant cover, mineral supply, water, and animal life. These constitute a natural part of the biology curriculum.

The purpose of this study is to develop units that can be co-ordinated with the biology program in our secondary schools. This is designed to be a guide for biology teachers to provide the youth of America with an understanding of the value of the wildlife of their nation. Specific examples and plans will be provided for instructors to help instill in their students an appreciation for wildlife and a desire to protect and preserve it for future generations.

There are three good reasons for developing workable units. These are (1) wildlife plays an important role in the natural processes of the world, (2) wild animals play leading roles in the balance of nature, (3) given a chance, wildlife will restore itself faster than any other resource. Since teachers help mold useful citizens, the classroom is the proper place to teach conservation.

This research report is intended to be a guide for high school biology teachers. The author plans to give a brief history of wildlife conservation, to give some basic concepts in wildlife conservation, and then give some practical activities that can be used in studying the food habits, cover requirements, mating habits, and rate of increase of the birds and mammals of Oklahoma. The author will review literature written by experts in the fields mentioned above. A list of films and teaching aids will also be a part of this research report.

Wild animals are among our most valuable resources. They play a role that is only partly known and understood. Many birds and small land animals help control insects. Songbirds and ornamental birds delight the ear and eye of man. Wild animals and fish provide us with recreation, skins, fur, food, and make our surrounding more interesting. Wild plants are also an important kind of wildlife. They give shelter to wild animals, provide seeds, and fruits for them to eat. They also have great value to man because of their beauty and scientific interest.

Wild plants and animals play leading roles in the balance of nature. Sometimes man is not aware of the importance of a particular plant or animal until he has destroyed it. The wise farmer welcomes songbirds, even though they may eat some of his fruits. He knows that they more than pay for what they take from his fields by eating harmful insects. Even the skunk is the farmer's friend. It destroys grasshoppers, caterpillars, meadow mice, crickets, and a few small birds. Most animals are important in nature's balance in some way.

Many sportsmen and nature lovers have organized to give wildlife a chance to survive. The government; federal, state, and local also has taken important steps in this direction. Laws have been adopted for establishing game refuges, restricting hunting, and protecting birds and mammals.

The conservation of wildlife should include all of the valuable and useful animals, not of game alone. Some species once classed as vermin, or useless animals, have now come to be recognized as valuable. For instance, we now realize that most hawks do much more good than harm, by helping to control such pests as rats and mice.

If it is to become vital, conservation instruction must be founded first of all upon an understanding by the teacher of the fundamental concepts of conservation and an awareness of the techniques for developing them. It is a fact that teachers, like others, attach less importance to and tend to avoid those subjects matter areas in which they are least

informed.

Really, we are losing an immense amount of wildlife protection each year because conservation is not taught in our secondary schools. The doctrine of imperative individual duty has not been taught in our secondary schools as it should be taught. A few teachers have indeed covered the ground: but it is evident that their proportion is small.

Teachers, do not say to your pupils, "It is right and nice to protect birds" but say, "It is your duty to protect all harmless wild things and you must do it."⁴

Patrick Henry spoke wisely when he said, "I know no way of judging the future but by the past." Today the question is, shall we sensibly apply the lessons of the past to the problems of today?

⁴William T. Hornaday. Our Vanishing Wildlife. Charles Scribner's Sons. New York, 1913. p. 377.

CHAPTER II

HISTORY OF WILDLIFE CONSERVATION

For a better background of the history of wildlife conservation the overall conservation movement must be considered.

The first movement of conservation started in the United States with a German immigrant, Franklin Benjamin Hough, forester and physician. He wrote and presented a paper in 1873, "On the Duty of Government in the Preservation of Forests," before the American Association for the Advancement of Science. This presentation stimulated interest in our Natural Resources. In 1876 President Grant sent this report to Congress, where the position of forestry agent was created under the Department of Agriculture.¹

Conservation education in the United States had its beginning toward the end of the last century, after congress passed the Morill Act in 1862, which created the land grant colleges.

It is not clear just where or when the first educational work in conservation was offered at the college level. Whether or not the botanist and horticulturists were the first

¹Robert Steele Funderburk. The History of Conservation in the United States. McQuiddy Printing Company. Nashville, Tennessee, 1948. pp.4-14.

to formally offer such work, they apparently laid a good foundation for it in a number of institutions. Such outstanding educators as V. M. Spalding at the University of Michigan, W. J. Beal at Michigan State, S. B. Green at the University of Minnesota, C. T. Bessey at the University of Nebraska, H. H. McAffee at Iowa State College, and A. N. Prentiss at Cornell University were known to have incorporated some forestry instruction in their botanical, horticultural and agricultural courses.²

It is a matter of historical record that there was a pronounced movement in this country for the conservation of the national resources in earlier years, but during the term of President Theodore Roosevelt it reached a climax. He recognized that natural resources were being exhausted partly as a result of unnecessary waste. In 1908 the President called a meeting of all the governors to discuss the problem of conserving our natural resources, shortly after this meeting there were forty-nine members appointed to the National Conservation Commission. Gifford Pinchot became chairman of this commission.

In sad contrast to the President's wise, farsighted conservation policies, was the reactionary viewpoint of a few powerful members of the Congress. As a result of the efforts of these men, Congress not only refused to appropriate even \$25,000 for the expenses and necessary needs for the National

²Charles E. Lively, and Jack J. Preiss. Conservation Education in American Colleges. The Ronald Press Company. New York, 1957. pp. 32-35.

Conservation Commission, but it even prevented the scientific bureaus in Washington, maintained by the Government from doing any work for the Commission. Thus did a small group in Congress defeat, although only for the time being, the hopes of the President, and we believe, those of the whole people as well.

A great contribution to conservation was made by Dr. Charles Richard Van Hise, President of the University of Wisconsin. In 1910 he published a book, "The Conservation of the Natural Resources in the United States." In this excellent book he brought together much of the essential information that had a bearing on the conservation of our resources.

The United States Biological Survey had an outstanding influence on the public about the need for conservation. It was established in 1885.

With the birth of the conservation movement during the administration of President Theodore Roosevelt, the notion of "renewable resources" came into being, wildlife came to be regarded as renewable resource. Among the earliest enlightened protagonist of wildlife welfare was the growing group of trained foresters.

Aldo Leopold, although a trained forester, was one of the earliest to do work in the field of wildlife. Some of his earliest works were done with the birds of the forest. His outstanding book, "Game Management" in 1933, is still recognized as one of the best authorities on management practices. He was engaged by the University of Wisconsin and

later became head of the new department, Wildlife Management. Other universities quickly added wildlife management to their curriculum.

During the administration of Theodore Roosevelt 148,000,000 acres were added to the national forests, 64,000 acres of this was set aside in southwestern Oklahoma near Cache, this is the Wichita Mountains Wildlife Refuge established in 1905. These refuges were set up to make a natural habitat for wildlife.

Wildlife management in Oklahoma had its beginning when the state legislature established the Oklahoma Game and Fish Commission in 1925. The name of this department was later changed to Department of Wildlife Conservation.

Oklahoma A. & M. College first offered a curriculum in Wildlife Conservation in the fall of 1939. The Oklahoma Cooperative Wildlife Research Unit was initiated in 1948. In 1959 Oklahoma State University added an Aquatic Biology Laboratory to its department of Zoology. The laboratory is used for fisheries and water contamination research. The University of Oklahoma operates a Biological Research Station on Lake Texoma to give students actual experience in wildlife management.

The reason that wildlife conservation had a slow beginning was because of the idea held by most people that wildlife would disappear with the westward movement of civilization. It was only natural that people would base opinions on the results of past experiences.

Even though the field of wildlife conservation is very

young it has made some remarkable advancements in the past
thirty years.

CHAPTER III

SOME BASIC FACTS IN WILDLIFE CONSERVATION

This paper deals primarily with animals but we must consider other factors to see the entire picture of wildlife conservation.

On every acre of land there is a teeming community of plants and animals, varying from the simpler forms that live in the soil through numerous more advanced groups of the plant and animal kingdom. All plants and animals play a certain role to make up a biotic community. The soil bacteria, the protozoans, the lowly earthworm may in the aggregate be more productive, and thus basically more important than the conspicuous birds and mammals on the surface.

To completely understand the problems of animals one would need to go to great lengths in the study of both animal and plant ecology. With the changing of the vegetation (plant succession) on a given piece of land you find that the animal population also changes. It is possible for a person to determine from the basic vegetation what animals may or may not be present.

Ecological communities vary as a whole or in detail. The aggregation of living matter produced on a given area changes with each growing season. For instance, a year of

severe drought may greatly decrease the production of plant food. Lacking a dependable supply of that food, animals may die of starvation or be the victims of other chains of events originating in the shortage of food. Reduction in animal life may, in turn, have effects on the plant growth the following season. Sometimes the cause and effects are obvious, at other times they are obscure.

Not only can weather enter into the changes but man is a very deciding factor on what plants and animals that are found in a given area. Man can and does alter animal communities as he goes about remaking the face of the earth to suit his notions or needs. He cuts down the forest and immediately the animal life, dependent on the woodland, must move on or perish. He plows the grasslands, and the same alternatives confront the animal populations here. When he drains the marshes and lakes, the marsh birds fly elsewhere and the aquatic life dies.

The effect of man on wildlife habitat or environment is perhaps the greatest single factor limiting wildlife. Man's impact on wildlife often determines the number of plants and animals and also the conditions under which they live. If land is managed for farm crops, wildlife is in most cases a secondary product of the land. Fortunately in Oklahoma there are many small areas along fence rows, woodlands along streams, and land that has been placed in the soil bank. These areas make excellent retreats or sanctuaries during the hunting seasons.

In the study of wildlife it is considered desirable to study the same area over as long a time as possible. A continuing study of a given area will bring the attention of the students to many basic factors operating on it. For example, seasonal changes and changes in the use of land in any area affect both plants and animals. In order for the pupil to gain an understanding of these changes, the teacher should select suitable activities spread over the school year. This will give the student a better understanding about the environment influence on different animals.

There are three basic concepts upon which any sound program of wildlife conservation must be built as set forth by Ira N. Gabrielson.¹

1. Soil, water, forest, and wildlife conservation are only parts of one inseparable program.
2. Wildlife must have an environment suited to its needs if it is to survive.
3. Any use that is made of any living resource must be limited to not more than the annual increase if the essential seed stock is to be continually available.

It should be clear from these concepts that wildlife is primarily a by product of land use. Except on public and private hunting or fishing sanctuaries, it is seldom the primary object of land use. For this reason, its management must be integrated with and largely subordinate to the man-

¹Ira N. Gabrielson. Wildlife Conservation. The Macmillian Company. New York, 1942. pp. vi-100-112.

agement of land for agriculture, forest, and mineral use. Management under these conditions requires intimate knowledge of the habits and living requirements of all forms of wildlife.

The basic living requirements of all wild animals are food, water, cover and a climate to which they are adapted. Certain species have special requirements, such as salt for deer and grit for quail and pheasants. The particular kinds of food, water and cover required by different animals is usually a fixed characteristic of each species. For example, quail feed primarily upon seeds of grain, and weeds, fruits, and insects, whereas, many birds such as warblers and vireos, feed almost entirely upon insects.

From the above information, the author has tried to point out some basic ideas of wildlife conservation.

CHAPTER IV

THE VALUE OF TEACHING WILDLIFE CONSERVATION

Today more than ever, people tend to judge value by the dollar and cents method. They can only determine the worth of things in terms of money. The real value of wildlife cannot be determined in this fashion.

Teaching wildlife conservation to our young people will be the best way to make them realize how important certain species of birds and mammals are in maintaining the balance of nature. If the ideas of taking care of our wildlife are instilled into the minds of the younger generation the harvest of results may show up for many years to come.

Many people think of conservation as not using a certain thing but it should not be interpreted this way. The term has a wider meaning. It really means "wise use" of either plants or animals.

The conservation of our natural wild animal life is a phase of biology which has seldom been stressed in the schools. We have stood idly by and watched animal after animal disappear from the face of the earth. We now realize that time can no longer be wasted if we are to save much of what yet remains.

Today we may look back and see extinction of such birds

as: Great Auk 1844, Passenger Pigeon 1914, Heath Hen 1932. There is little hope for the Ivory-billed Woodpecker and the Whooping Crane seem to be holding its own but just by a small thread.

Through misunderstanding and the desire to kill, our hawks and owls have been reduced alarmingly over the country. Our National Bird, the Bald Eagle, that we so proudly display as the symbol of freedom and an emblem of justice, receives so little protection that it is rapidly disappearing from many of our states.

The author has found in his high school classes that a discussion of the conservation of birds, mammals, fish, trees or flowers, always stimulates keener interest, awakens enthusiasm and creates a liking for this field of science. Few students remember all the basic facts taught in biology but they seldom forget the studies that were made of the animals and plants found growing outside the classroom. Not only will classes take a new interest in the biology course, but the students will become acquainted with a part of biology that will be retained long after most facts are forgotten. And the great out-of-doors with the many forms of life we are studying will receive untold aid from the new constructive attitude of the developing citizens.¹

Children and young people are naturally observant. They see much that escapes older eyes. They are interested in

¹Ellsworth D. Lumley. "The Teaching of Conservation in High School Biology." Science Education, 1935. 19:161-162.

what they see, and if given the opportunity, will ask dozens of questions regarding their observations. In the past they lacked efficient and truthful teachers to interpret the meaning of what they saw. In days gone by, the young people were dependent to a great extent upon superstitions, propaganda, and falsehoods to explain the living world about them. The result is therefore, that thousands of adults today are firm believers of such things as: all hawks are "chicken hawks" and should be killed on sight; owls are mysterious birds that fly about during the night feeding upon game and song birds; blue herons, kingfishers, white pelicans and all fish eating birds are a menace to the sport of fishing and should be killed at every opportunity; bounties on predators is a method of saving our wildlife.

Many of the men that today control the future of our wildlife, by being members of game commissions, believe the above falsehoods and not only believe them but have the power to put them into practice. Their function, on boards sometimes, is for prestige instead of the future of wildlife.

The educational task of conservationists is doubly hard when young people see such examples of game management being practiced by supposed authorities.

Young people must be taught truths. They must see the results obtained from scientific research. Then we can hope to save many of our wild birds and mammals.

Education is no longer the process of pouring countless facts into the heads of the learners. Education today is

concerned with the individual's ability to use facts. The building of citizens with the ability not only to fit their environment but also to improve their environment is one of the major problems of our schools. Closely coupled with this is the problem of educating youths and adults to the wise use of leisure time. Work in conservation fits into such an educational program.

Among the contributions of conservation instruction are: an understanding and appreciation of the environment; an understanding of the relationship that exist between man and other animals; an understanding of cause and effect; the development of a more scientific attitude; a greater ability to separate facts from propaganda; a recognition of some of the leading authorities in game management and conservation.

It is only through education that we can hope to bring under control many of the abuses now practiced against the wild animals. Education, of a character that will consider the relation of wildlife to all of us, will mean the salvation of many vanishing forms.²

Stimulate and develop the wildlife interest of private land owners. Conservationists say that the greatest hope for our disappearing wildlife is through education. Since students today will be land owners tomorrow, they should become aware of the economical and recreational value of wild animals.

Of all the values that could be incorporated into a conservation program Dr. Ira N. Gabrielson so wisely stated the

²Ellsworth D. Lumley. "The Value of Teaching Conservation." Nature Magazine, 1936. 26:113-114.

following four needs.³

1. The education of children in the fundamental aspects of conservation of all our natural resources.
2. Coordination of the activities of the existing conservation organizations.
3. The financing of the work of these groups.
4. Creation of public opinion as to the need for conservation of our natural resources and the translation of that opinion into action.

³Ira N. Gabrielson. "A Future Program for Wildlife Conservation." American Wildlife, 1941. 29:54.

CHAPTER V

GAME BIRDS

Game birds are any birds commonly hunted as game for sport and food.

The native game birds of Oklahoma are turkey, prairie chicken, and quail. There are three introduced species that are doing fairly well in the state. They are pheasant, francolin, and jungle fowl. The pheasants have finally become established well enough to have a short season. Most of these birds are found in the northwestern part of the state. The francolin and jungle fowl have been introduced in the past two or three years. The francolin has been stocked in the southwestern part of the state since this area was much like the environment in India from where it came. The jungle fowl has been released in the southeastern part of the state. The wooded hills in southeastern Oklahoma are similar to the area in Spain from where it came.

The native turkey of the state practically disappeared at one time. Through restocking and careful management they have increased in the western and northwestern sections of Oklahoma.

Prairie chickens are found mostly in the northeastern and northwestern parts of the state. This is due to the fact that

they need extensive prairie areas with plenty of grass.

The bobwhite quail is by far the most common game bird in the state and for this reason, the author plans to devote this chapter to activities that a biology class may use to learn more about this bird. These activities may be used to study most any game bird found in Oklahoma.

At the end of this chapter there will be a list of books, pamphlets, and films that can be used to introduce this study of game birds.

Suggested Activities

1. Locate a tract of land that can be used for an entire school year so different studies may be carried on throughout the season.

Contact some local farmer or rancher interested in wildlife conservation and explain the program.

2. Collect as much printed material on this subject as possible.

Free material may be had by contacting the Oklahoma Conservation Department, National Audubon Society, and National Wildlife Federation. The books and pamphlets, listed at the end of this chapter, are found in the library of Oklahoma State University.

3. Invite speakers with experience in quail studies.

Contact the Wildlife Conservation Department of Oklahoma and explain to them the work the class is doing and they will send a game biologist to speak to the class.

Invite the local game ranger because he understands the local situation.

4. Take census of the bobwhite found on the plot of land.

This census can be taken by the class by walking in a straight line with not more than fif-

teen feet between each member. Cover the area completely each time a census is taken. Keep a record and make comparisons from the first census in the fall until the last census in the spring.

5. Look for different kinds of sign of bobwhite.

Roosting sign may be found in short grass where the birds can escape from any enemy that may come upon them. This roosting site can be detected by the way that quail roost. They roost with their tails together and in this way the droppings are all in one pile. Tracks may be found in damp areas.

6. Food habits study.

Study some research reports of food habits that have been made about quail of Oklahoma. Contact some of the local sportsmen and get them to save crops from the birds they kill during season. This material may be placed in envelopes treated with an insecticide. The time and place collected should be placed on the envelope. Compare the material collected in your local community with the reports studied. Make a survey of the plants found on the area that serve as quail food. In this way the students will learn the names of a variety of plants. Collect seeds from the plants and make a comparison with the seeds found in the crops of the quail and in this way identify them.

7. Determine how much cover bobwhite need before they will stay in an area.

When the class is making a census, record from what kind of cover the quail are flushed and where they fly to.

8. Markings used to determine young from adult birds.

To identify young birds, spread the wing and find the greater upper primary coverts, on them will be gray or buff-tipped ends. Also the seventh feather on the greater upper primary coverts will show a ragged appearance.¹

¹Henry S. Mosby. Manual of Game Investigational Techniques. Edward Brothers Inc. Ann Arbor, Michigan, 1960. Sec. 6.24.

The adults will show a solid color throughout the entire feathers on the greater upper coverts.

9. Economic importance.

This can be determined by the information received during the food habits study. The student will learn the kinds of insects that quail feed on and that these insects are harmful to crops.

10. Life history.

This material can be found in the publications listed.

11. Study external features and feather tracts of birds.

12. Study the skeleton of the bird.

A picture of the bird is shown with all parts named.²

²Arthur A. Allen. Ornithology Laboratory Notebook. Comstock Publishing Company, Inc. Ithaca, New York, 1947. p.9.

GAME BIRD FILMS

- Bobwhite in the Fence Row. Oklahoma Wildlife Conservation Department. Oklahoma City 5, Oklahoma.
- Bobwhite through the Year. Oklahoma Wildlife Conservation Department. Oklahoma City 5, Oklahoma.
- Birds are Interesting. Audio-Visual Center. Oklahoma State University. Stillwater, Oklahoma.

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CHAPTER VI

BIRDS OF PREY

The birds of prey include the following: eagles, vultures, hawks and owls.

These birds are so named because of their feeding habits. They feed primarily on other birds and animals. The hawks and owls swallow their food whole or in large morsels and within the stomach the undigestible portions of the meal are rolled into compact pellets and ejected within a short time from the mouth. These pellets, about as large as one's thumb or smaller, depending upon the size of the bird, are composed of fur, feathers, scales, bones, the hard parts of insects, and the like, according to the nature of the bird's food. The vultures feed primarily on carrion but at times catch small animals and swallow them whole.

The hawks and owls have curved bills for tearing and sharp claws for holding their prey. The hawks do their searching for food during the day while the owls are nocturnal.

The eyes of birds of prey are probably the most highly developed organs of vision in the world. They are so large that in most instances the two eyeballs occupy more space in the skull than the brain itself.

The cornea or outermost transparent envelope of the eye

is very convex, and its shape can often be altered by tiny muscles not found in the eyes of other animals. The lens, the image-focusing element of the eye, is also much better supplied with muscles; the retina, or image-receiving element, is more sensitive. With the power of rapid and delicate focusing, such an eye can be transformed almost instantly from a telescope into a microscope. The eye possesses not two eyelids, but three. The third "lid" known as the nictitating membrane, is located in the inner corner of the eye. In the eyes of birds this nictitating membrane is transparent and can be pulled across the cornea to protect it from dust as well as from high winds which have a tendency to dry off the eyeball. Since the nictitating membrane is transparent, the bird is not temporarily blinded when winking its eyes.¹

A common name for the vultures is buzzard. In Oklahoma there are two species; the Turkey Vulture and the Black Vulture. The Turkey Vulture is by far the most common although in certain parts of the state the Black Vulture is very common.

The vultures detect their food by sight and not by smell. They are almost voiceless birds. The sounds they make are hoarse grunts and hisses which carry only for short distances. When attacked, vultures often spew forth at the offender a malodorous mass from the crop, an extremely effective means of defense. The young birds are frequently fed by having this same loathsome substance regurgitated into their open mouths by the parents.

¹Leon Augustus Hausman. Birds of Prey. Rutgers University Press. New Brunswick, N. J.

Eagles are so very rare in Oklahoma that a class will seldom be able to find one to study. Eagles are mostly found in mountainous areas and around large lakes. Even though the Bald Eagle is the national emblem many have been killed just for the sake of killing.

To sum the entire actions of the birds of prey up into a few words Paul L. Errington has so aptly put it, "It is unfortunate that man, the specialist in evil, sees in predation among wild animals so much evil that isn't there."²

In this chapter the author will deal primarily with the hawks due to the fact that students will be able to see more hawks during the day than they will owls due to their nocturnal habits.

At the end of this chapter will be a list of films, books, pamphlets, and publications dealing with birds of prey.

Suggested Activities

1. Learn to identify the different hawks.

Use any good book that has color plates of the hawks so they can be separated by their characteristics.

2. Keep a record of the hawks in the local community.

3. Study food habits.

This can be carried on best by using some of the reference books.

Look around the base of the tree where they have a nest. Bones and pellets will be found.

²Alexander Sprunt, Jr. North American Birds of Prey. Harper and Brothers. New York, 1955. p. xviii.

4. Economical value.

The value of hawks can be determined by doing the food habits study. By reviewing the reports that have been made of hawks the students will find out that they do much more good than they do harm.

FILMS FOR BIRDS OF PREY

Birds of Prey. Oklahoma Wildlife Conservation Department.
Oklahoma City 5, Oklahoma.

Know the Hawks. National Wildlife Federation. 232 Carroll
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2:190-205.

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J. Wildl. Mgt. 8:198-208.

CHAPTER VII

SONG BIRDS

The song birds are by far the common birds in most areas of the state of Oklahoma.

The song birds actually get their name because of the construction of their throats. The syrinx has four or five distinct pairs of intrinsic muscles, inserted at ends of three upper bronchial half-rings and thus constituting a highly complex and effective musical apparatus. These birds are in the order Passeriformes or perching birds.

The following is a list of the most common song birds: robin, cardinal, bluebird, blue jay, Baltimore oriole, purple martin, brown thrasher, mocking bird, and house sparrow. Many birds could be added to the above list.

The chief function of a song in most species is to proclaim territory. It warns males of the same species to keep away. But song also serves as a mating invitation to opposite sex, and subsequently helps maintain and strengthen the bond between the pair. There are also calls of warning and distress. Also some birds spend time just sitting around and singing for enjoyment.

A unit of this type would not be complete unless the importance of bird life was stressed because of their habits

of feeding on insects and weed seeds.

If the above points are clearly understood by the students, conservation of bird life, would have more meaning.

Suggested Activities

1. Learn to identify the birds by songs and physical characteristics.

To learn to identify the birds by song, there are two recommended ways; order a recording of the songs of birds and also make field trips so students can associate the song with the bird. An excellent book to use as a guide in learning to identify the birds by their physical characteristics is "A Field Guide to the Birds" by Roger Tory Peterson.

2. Nest identification.

This may be accomplished by collecting nests and using a key to determine which bird has used it.

To help in nest identification have each student find ten nests and identify the birds using them. Write the name of the bird on a tag and tie it on the tree and after the nest has been vacated collect the nest. In this way the students will have a positive identification. Determine the kinds of material used in making the nest and also the distance they are from the ground.

3. Request each student to observe a nest that has young birds in it for an hour.

Require a written report with the following information.

- a. The number of young in the nest.
 - b. The number of times the adults brought food during the hour.
 - c. The kinds of food brought to the young.
 - d. Which bird did the most feeding the male or female?
4. Determine the type of habitat that each bird prefers.

This may best be achieved by keeping records of the places that each bird is found. From this type of information the students will soon learn where to look for certain birds.

5. Compare the type of bill of the insect feeding birds with seed eaters.
6. Request each student to keep a list of the birds seen during the entire year.
7. Make a monthly census of the birds in the local area and post the list on the bulletin board.
8. As a home project have each student build a birdhouse.
9. Build a feeding station and place it on the school ground and observe and record the birds using it.
10. Prepare and present an assembly program on all birds studied.

FILMS ABOUT SONG BIRDS

- Birds Nesting Time. Audio-Visual Center. Oklahoma State University. Stillwater, Oklahoma.
- Robin Red Breast. Audio-Visual Center. Oklahoma State University. Stillwater, Oklahoma.
- Birds of the Countryside. Department of Wildlife Conservation. Oklahoma City 5, Oklahoma.
- Birds of the Woodland. Educational Material Services. University of Oklahoma. Norman, Oklahoma.

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CHAPTER VIII

SMALL GAME MAMMALS

In this chapter the author will consider the conservation of rabbits and squirrels.

Oklahoma is inhabited by two kinds of tree squirrels. The fox squirrel, Sciurus niger, is common in most sections of the state. Gray squirrels, Sciurus carolinensis, live in the eastern and southeastern part of the state in the timbered areas.

The fox squirrels are large and handsome. Some of them weigh as much as three pounds. Their colors vary. Some are jet black, others reddish gray, and the colors of others vary between these shades. Fox squirrels are generally considered good eating and are often hunted.

Gray squirrels usually weigh one to one and one-half pounds. They become quite tame. Gray squirrels are very common in city parks.

Rabbits rank as the world's most popular small game. Nature made rabbits prolific to fill the demand.

The state is inhabited by the following three kinds of rabbits: swamp, cottontail, and jackrabbit.

The swamp rabbit is confined largely to the eastern half of the state and particularly to stream habitats. This rab-

bit usually prefers low wet places in the vicinity of streams, ponds and lakes. It has a unique characteristic in that the toes are covered with a light covering of hair which enables it to swim with ease and to walk on very marshy or muddy soils.

The black-tailed jackrabbit is actually a hare. Major differences between rabbits and hares are the following: rabbits are born without hair and blind; hares are born furred and open eyed.

This hare is distributed over the entire state with the exception of the southeastern section and parts of the extreme northeastern region.

To cope with its enemies the jackrabbit relies primarily on its running ability, its keen sense of hearing, and good eyesight.

The cottontail is by far the most common of the rabbit family found in the state.

Rabbits like all other animals need food and cover to survive and multiply. Four litters per year are not uncommon here with the litter size averaging about four to six. With this potential it is easy to see why game management such as provision of multiflora rose hedges, ungrazed briar patches, stone piles and brush piles interspersed with winter cover can increase rabbits about five fold over the number found on overgrazed pastures and open pineland.

The cottontail feeds on almost all types of succulent vegetation including buds and bark of a variety of trees.

Rabbits are sedentary "critters" and rarely move over

a mile from their birthplace, often spending their lives in an area less than ten acres.

Since the habits of the rabbits and squirrels are so different, the author will make a list of activities for both animals.

Suggested Activities

Squirrels

1. Study the food habits.

This can be achieved by studying research papers that have been prepared by persons that are experts in this field.

Let students in the class look for sign where squirrels have been feeding.

2. Study the life history of the squirrels.
3. Locate some squirrel nest and also some hollow trees that are used as homes while they are raising their young.
From this information determine the population.

Rabbits

1. Locate a plot of land that may be used as a study area.

Make a census of this area. This may be accomplished by stationing students at points around the area and then have the other members of the class walk through the area and run the rabbits by the counters. In this way an accurate count can be made.

2. Study the life history of all the rabbits.
3. Do a food habits study.

Make field trips with the students have them look for sign where the rabbits have been feeding. The rabbits feed on the bark of young trees and shrubs.

4. Make brush piles for protection.

FIIMS

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Common Animals of the Woods. Department of Wildlife Conservation. Oklahoma City 5, Oklahoma.

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CHAPTER IX

FUR-BEARING MAMMALS

The fur-bearing mammals found in Oklahoma are: beaver, badger, raccoon, mink, opossum, skunk, muskrat and nutria.

The fur trade in Oklahoma developed with settlement and served as a source of income incidental to the regular farm income, and such is still the case today. There are but few professional trappers in the state today. The bulk of the trapping is done by farm boys.

For many years the burbearers were neglected throughout the country, while such wildlife species as the migratory and upland game birds and game mammals received prior consideration.

It is remarkable that many of the furbearers have been able to maintain more or less steady populations through the years, in spite of gunning and trapping pressures both for sport and for the market.

The opossum is the most common burbearing mammal. It is found everywhere in the state.

The opossum is the only marsupial native to North America. Marsupials are mammals that have pouches for carrying and protecting their young. Baby opossums are blind and naked when born. They live inside their mothers pouch for about

two months.

In the daytime this animal is usually found in dens in hollow trees, in the ground, and in rocky bluffs. At night the opossum wanders about rather slowly in search of food.

Its food consists of both plant and animal matter including persimmons, green corn, apples, berries, insects, small mammals and frogs. The opossum's occasional pilfering of eggs and poultry is offset by its value as a furbearer and scavenger.

The raccoon, or "coon" as he is commonly called, is well distributed over most of the state. Greatest populations naturally occur in the more heavily timbered eastern portion, but good numbers exist in the central and western areas.

The raccoon has two distinct markings, ring-tail and black mask across the eyes.

This animal usually hunts for food at night along the streams or in the uplands. It is known to feed on a wide variety of plants and animals, the most common of which are field corn, fruits, mast, crayfish, fish, turtles, insects, small birds, frogs and rodents. The common belief, that the raccoon washes its food before eating, is not altogether true, since it often feeds far from water.

The mink is by far the most valuable of the furbearers found in the state. Not many years ago it was not uncommon for a mink pelt to bring \$25.00.

The mink, a member of the weasel family, lives most of its life along the streams and is seldom seen because it is

most active at night. The den may be a burrow or a rock crevice. Most of the food of this mammal consists of fish, toads, frogs, crayfish, various rodents and small birds. The food habits of the mink differ from the weasel in that fewer mice are eaten by the mink.

The skunk is found in most all areas of the state. In most of the western part of the state the skunk is generally confined to the watercourses, while in the eastern section it is found near farms and around openings at the edges of the forest.

This mammal may be seen during the day but its usual time of activity begins in late afternoon and continues throughout the night. It usually moves about rather slowly, exploring everything, with great confidence in its ability to cope with any danger that might arise. It has the power to discharge a characteristic well-known fluid from its scent glands. This ability also characterizes the spotted skunk or civet cat.

A great deal of the skunk's food is obtained during the warmer months by digging in the sod for grubs and ground beetles. Grasshoppers and crickets also make up an important part of the insect diet. Meadow mice and cottontail rabbits form the major portion of the rather meager mammal diet. Small amounts of vegetable matter, such as berries and fruits, as well as a few birds, are eaten.

It would be difficult to do much field studying of the furbearing animals and for that reason the literature suggest-

ed at the end of the chapter would be excellent to study the habits of these animals.

Suggested Activities

1. Learn the tracks of all the furbearers.

Find literature that has pictures of the tracks of all the furbearing animals. Use this as a guide to help the students learn the differences in the kinds of tracks made by different animals. The best places to look for tracks are muddy areas.

2. Food habits study.

This can be accomplished by tracking the animals and finding out where it feeds. Do a scat study. This is a study of the droppings of the animals to determine the food eaten by the animals.

3. Censusing.

There are several ways that can be used to determine the population. The literature at the end of this chapter will have the needed directions.

4. Den counts.

During a field trip have the students locate as many places as possible that fur bearing animals are using for homes.

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CHAPTER X

PREDATOR MAMMALS

The predator mammals found in Oklahoma are red wolves, red fox, gray fox, coyotes, and bobcats.

This group of animals may also be classed as fur-bearers because they are sometimes taken for their pelts.

The predator animals are criticized more than any other group of animals. Sometimes this is just but in most cases it is unjust. Because a farmer finds a coyote feeding on a calf that may have died, he lays blame on the coyote for the kill.

The bobcat is shy and furtive in its behavior and is very seldom seen. Most activity takes place at night, but it may be seen occasionally in the daytime. It is an able hunter and catches and feeds upon rabbits, mice, squirrels, opossums, some game birds, and occasionally kills small domestic stock, such as lambs and pigs.

The red fox is reddish yellow above and white below. This fox seems to have no preference for either completely forested areas or for open prairies, as the highest populations are known to occur in the open timbered ridges in eastern Oklahoma.

Diet of the red fox is extremely varied and includes

mice, fruit, berries, nuts, fish, snakes, and poultry. Mammals usually make up at least fifty percent of the food eaten. Rarely does this fox catch a bobwhite, and most of the poultry eaten is devoured as carrion.

The gray fox is sooty gray mixed with black on the upper part of the body. The diet of the gray fox is very similar to the diet of the red fox.

One of the main differences in the two kinds of fox is the fact that a gray fox has many dens and a red has only one.

Fox hunting is a very popular sport in Oklahoma. The red fox makes the best race because he refuses to go to his den but will run completely out of his normal range.

The red wolf has habits that are somewhat like the coyote. They hunt for their food in packs. They live in dens, which they build in hollow logs, openings between rocks, or holes dug in the ground.

The coyote is distributed throughout western and central Oklahoma and is quite common in the northeastern section. It apparently is extending its range more to the wooded parts of the state since it has been recorded everywhere in the state.

The coyote is typically an animal of the plains and prairies to which it is very well adapted. Most of its foraging is done at night. It feeds largely on carrion but will eat any flesh it is able to obtain. Some ranchers are of the opinion that it feeds entirely on domestic stock, but recent food habit studies show that it feeds also on cottontail rabbits, various injurious rodents, small birds, and even wild

fruits and berries.¹

Lots of care must be taken to point out all the habits of this group so students will obtain the proper concepts about this group of predator mammals.

It is imperative that the instructor stress the importance of predators in keeping nature at a constant balance. Should the predator mammals be exterminated in a certain locality, the rodents and other animals preyed on by predators would increase to such great numbers that the environment could not support them.

Suggested Activities

1. Explore the community to determine the kinds and extent of predatory mammals found in the locality.
2. Interview an early settler of your community of the question. How have the predators of our community changed during the last half century?
3. Visit a taxidermist to view different species of predators preserved.
4. Invite the local game ranger to talk to the class about his work in the field.
5. Collect and analyze scats.
6. Organize a nature or conservation club in the community or school and outline a constructive program of activities related to wildlife for the year.
7. Prepare and present an assembly program about the animals studied.

¹Game Mammals of Oklahoma. Educational Pamphlet No. 1. Wildlife Conservation Department of Oklahoma. 1960.

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CHAPTER XI

SUMMARY

The author has presented a guide for incorporating wildlife conservation with biology on the high school level. It is hoped that by using this guide the students will develop a fair understanding of the various concepts of wildlife. It is further hoped that each pupil will approach and solve wildlife problems in keeping with the scientific method.

An endeavor has been made to channel the students in a direct approach to the study of wildlife ecology, which is the key to wildlife conservation. By studying species present in the pupil's own locality, it is easier to extend the study to one involving species peculiar to other states and regions.

The final evaluation of the students' comprehension and attitudes is left to the discretion of the individual biology teacher. A few evaluation suggestions might include the following.

1. Does the pupil cooperate with others in furthering practical wildlife conservation values?
2. Does he appreciate the contribution that wildlife conservation can make to life and living generally?

3. Does the pupil show that he has improved certain individual skills such as thinking, judging and forming conclusions?
4. Can he organize and summarize the wildlife values in keeping with the scientific method?

The final evaluation of this guide will be a more educated and informed generation dedicated to the responsibility of perpetuating Oklahoma's wildlife.

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