

BOY SCOUT TROOP 236

FISH AND WILDLIFE MANAGEMENT

1. Describe the meaning and purposes of fish and wildlife conservation and management.

2. List and discuss at least three major problems that continue to threaten your state's fish and wildlife resources.

3. Describe some practical ways in which everyone can help with the fish and wildlife conservation effort.

4. List and describe five major fish and wildlife management practices used by managers in your state.

5. Do ONE of the following:
 - a. Construct, erect, and check regularly at least two artificial nest boxes (wood duck, bluebird, squirrel, etc.) and keep written records for one nesting season.

 - b. Construct, erect, and check regularly bird feeders and keep written records of the kinds of birds visiting the feeders in the winter.

- c. Design and implement a backyard wildlife habitat improvement project and report the results.
 - d. Design and construct a wildlife blind near a game trail, water hole, salt lick, bird feeder, or birdbath and take good photographs or make sketches from the blind of any combinations of 10 wild birds, mammals, reptiles, or amphibians.
6. Do ONE of the following:
- a. Observe and record 25 species of wildlife. Your list may include mammals, birds, reptiles, or fish. Write down when and where each animal was seen.
 - b. List the wildlife species in your state that are classified as endangered, threatened, exotic, games species, fur bearers, or migratory game birds.
 - c. Start a scrapbook of North American wildlife. Insert markers to divide the book into separate parts for mammals, birds, reptiles, and fish. Collect articles on such subjects as life histories, habitat, behavior, and feeding habits on all of the four categories and place them in your notebook accordingly. Articles and pictures may be cut from old discarded newspapers or science, nature, and outdoor magazines, or can be photocopied from other sources. Enter at least 10 articles on mammals, 10 on birds, 5 on reptiles, and 5 on fish. Put each animal on a separate sheet in alphabetical order. Include pictures whenever possible.

7. Do ONE of the following:
 - a. Determine the age of five species of fish from scale samples or identify various age classes of one species in a lake and report the results.
 - b. Conduct a creel census on a small lake to estimate catch per unit effort.
 - c. Examine the stomach contents of three species of fish and record the findings.
 - d. Make a freshwater aquarium. Include at least four species of native plants and four species of animal life, such as whirligig beetles, freshwater shrimp, tadpoles, water snails, and golden shiner. After 60 days of observation, discuss with your counselor the life cycles, food chains, and management needs you have recognized.

WHY MANAGE FISH AND WILDLIFE?

The Early Settlement Days

Most of the North American continent was a vast wilderness teeming with fish and wildlife wherever the creatures' needs --- shelter, food, water, and living space --- were available. For example roughly 300 years ago vast herds of bison, estimated to number some 60 million, roamed the prairies. But as the settlers pushed farther and farther west, this species was one of many that were heavily utilized to meet the needs and wants of the burgeoning population of newcomers. In little more than 100 years after settlement of the prairies, only a few hundred of these magnificent animals were alive.

Another species, the passenger pigeon, suffered an even worse fate, and became a well-known symbol of our excessive usage of wildlife species in the absence of any management efforts. A species is a group of organisms such as the passenger pigeon, which is capable of interbreeding. Once the most abundant bird in the world, passenger pigeons migrating in flocks would fill the sky and take hours to pass. But since they were considered good to eat, they could be sold to restaurants or other people for two cents each. This was called market hunting. As this excessive harvest was going on, trees that the passenger pigeons needed for food and nesting were being removed to make room for farmland, homes, and roads. This beautiful bird was unable to survive, and the last one died in a Cincinnati zoo in 1914.

An example of wildlife variety and abundance that existed until the early 1900's is contained in a report from Lt. Col. George Armstrong Custer at Fort Abraham Lincoln, Dakota Territory, in October 1873. he described his cavalry's expedition into Yellowstone and listed a portion of the game animals he and his men killed during a 90-day period as follows: 41 antelope; 4 buffalo; 4 elk; 4 black-tailed deer 2 American deer, 2 white wolves; and geese, prairie chickens, and other feathered game in large numbers. This is not to imply that their consumption of game birds and animals was excessive, especially since they probably had little, if any other, available food. But considering how rapidly the nation was being settled by increasing numbers of people, the need for conservation and management practices soon became apparent as the wildlife resources were depleted.

During those early days, the lakes, rivers, and streams were free of

pollutants. Excessive sediment and other factors that impair water quality eventually stemmed from more intensive development and resource use such as agriculture, timber cutting, mining, transportation, manufacturing, and related waste disposal.

An interesting point to be remembered during the early settlement days of this continent is that fish and wildlife did not flourish everywhere. The members of the Lewis and Clark expedition ate well when game animals were found, but their records show that they sometimes had to eat their own dogs and horses to survive. Contrary to an often-held belief, wildlife does not always thrive everywhere, all the time, if simply left alone. Even in the early days, any one species had to have a certain combination of shelter, food, water, and living space to exist. In wildlife management this is referred to as "habitat."

How the Land has Changed

In looking back on the settlement of this country, it is easy to get the impression that the taking of excessive numbers of fish and wildlife by market hunters was the main reason for the fast and drastic decline in populations. This is a misconception. More important is how the greatly expanding population of humans altered the land.

The land was cleared, plowed, and planted. Forests were cut to supply wood for homes, barns, railroads, and a myriad of other uses. marshes were drained for farms, dry land was irrigated. Range lands became grazing lands for livestock. Human activities loaded the lakes and rivers with sediment and eventually with pollutants. As the human population grew, wildlife lands became towns and cities, roads and highways, golf courses, shopping centers, and parking lots.

The loss of lands and waters for fish and wildlife use continues to this day. Experts estimated that up to 2 million acres of land suitable for wildlife would be lost every year during the last two decades before the year 2000. This averages more than 225 acres an hour for 20 years. Lands and waters used by wildlife are at risk even if not developed. For example, the emission of pollutants as a result of a highly industrialized society are transported by air currents and sooner or later returned to earth to damage waters and forests.

Human Population Growth

The disappearance of lands and waters where fish and wildlife can survive is closely linked with an explosive growth in worldwide human populations. Consider for a moment the fact that humans reached the first billion on earth about 1830. A hundred years later we became 2 billion. In 1960 we became 3 billion, and in 1975, 4 billion. Experts predict that we will reach 10 billion in the first half of the 21st century and will approach 30 billion by the end of that century.

Anthropomorphism---Big Word, Simple Meaning

By far the greatest majority of Americans do not have a good understanding of fish and wildlife. So much land and water suitable for fish and wildlife has been converted to other uses --- farms, highways, towns, and cities --- that many people have little opportunity to observe these creatures firsthand. Also, most people now live near cities far removed from natural fish and wildlife habitat.

From this lack of understanding has spread a misconception that now is a plague for fish and wildlife managers. it is called anthropomorphism, which means, in simple terms, regarding animals as humans. The cruel cougar mercilessly murdered the defenseless, devoted daughter of the horrified chipmunk.” This statement is an example of regarding animals as humans. Cougars are not cruel, although to some people they may seem to be. They are not merciless, and they don’t commit murder. Chipmunks certainly do not have devoted daughters in the same sense that humans do.

You can probably recall a number of movies and television shows you have seen, and books that you have read, that make you believe that animals think like humans, have human emotions, and have human physical needs such as housing, certain kinds of food, even entertainment!~ You may have attached some of these characteristics to your pets. However, remember that all animals need shelter, food, water, and living space.

Our loss of closeness to fish and wildlife and our resulting diminished understanding of these creatures is similar to the way we have become removed from our sources of energy and the raw material with which clothing, automobiles, stereos, houses, toothpaste, and other products are made. For example, there is a story, presumably true, about a city

youngster who stumbled across a pile of discarded milk bottles behind his uncle's barn and thought he had found a cow's nest! We tend to take the sources of products, and wildlife, for granted because we are not familiar with the sources.

Mother Nature

Perhaps at least part of the problem is that many people have trouble with the fact that Mother Nature, an anthropomorphic term, is not a thoughtful and forgiving guardian of wildlife. Wild animals are constantly engaged in a struggle to stay alive. They must compete for food, water, shelter, and space, with their own kind and with other species. Usually, far more animals are produced than the land and water can support. Only a few of the strongest, and sometimes the luckiest it seems, survive long enough to produce young. Hungry adult deer, for example, will actively compete with their own fawns for scarce winter food. They push and butt the weaker deer aside even though they will surely die of starvation. A duckling that cannot keep up with the rest of the brood is simply abandoned and will soon succumb to a predator or some other fatal end. A predator is an animal that lives by preying upon others. To be successful and effective in any wildlife management pursuit, a person must accept the harsh realities of nature. The creatures of the wild are not human beings.

BASICS OF FISH AND WILDLIFE MANAGEMENT

At the Center --- Habitat

Perhaps the word is familiar to you, but to many the meaning of habitat is foreign, or at least hazy. It can be defined in a number of ways, but in fish and wildlife management it refers to the needs of any given species, or individual specimen, to survive. This generally means proper amounts of water, food, shelter, and living space. Fish and wildlife are generally very exacting in their habitat needs.

Some fish require water of a certain depth, clarity, temperature, and flow rate. Other fish can't survive in that kind of water but require water of a totally different nature. Certain species of wildlife need precise temperature, certain kinds of trees or other vegetation, and minimum or maximum amount of sunlight.

Different species may occupy the same territory at the same time because

certain requirements are the same, but they might be consuming totally different food, and perhaps utilizing totally different shelter. A rabbit might find shelter in a brush pile and food in green leafy plants while directly above a squirrel might be living in a hollow tree and eating acorns.

Food and Cover Chart

Mammal	Foods	Cover
Badger	Ground squirrels, mice, prairie dogs, birds, eggs	Hole in ground
Beaver	Bark and twigs of aspen, cottonwood, willow, other deciduous trees, root grasses	Lodge made of saplings partially underwater, a den in a bank
Black Bear	Acorns, beech nuts, grasses, roots, fruits, berries, ants, honey, mammals, birds, fish, and frogs, carrion	Wooded area
Chipmunk	Seeds, nuts, acorns, berries, insects, birds' eggs, young mice	Underground nest
Cottontail Rabbit	Dandelions, common plantain, lance-leaved plantain, clover, and many other types of vegetation	Brushy areas
House Rat, House Mouse	Ragweed, lamb's-quarters, redroot, tumbleweed, foxtail, various grains and vegetation products, meat	Grasses and weeds; in house, walls, litter, trash areas
Striped Skunk	Insects, small mammals, eggs, snakes, crayfish, poultry	Brush along watercourses, woodlands
Opossum	Small birds, frogs, mammals, eggs, insects, fruit, carrion	fish, Trees, burrows
Otter	Fish, crayfish, birds, small mammals	Den in stream bank with underwater entrance; hollow log
Porcupine	Bark and twigs of pines and other trees; shrubs and grown plants	Trees, brush, caves, rock crevices
Prairie Dog	Grasses, weeds, roots, clover, grains	Burrows

Raccoon	Frogs, fish, shellfish, small mammals, birds, eggs, reptiles, insects, fruit, corn, nuts	Hollow trees or logs
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Mammal	Foods	Cover
Red Fox	Mice, other small mammals, birds, fruit	Hollow logs or stumps burrows in banks, etc.
Red Squirrel	Berries, nuts, seeds, insects, birds' eggs, fledgling birds	Tree cavity, old woodpecker's nest; always in the forest
Weasel	Small mammals and birds	Rock pile, downed log, burrow in stream bank
White-tailed Deer	Twigs and leaves of shrubs, trees; mast, grasses, and broken plants	Heavy brush, woodlands
Woodchuck	Grass, clover, crops, weeds, etc.	Wood piles, stone walls burrows in ground

Bird	Foods	Cover
Barred Owl	Birds, mice, frogs, crayfish	Tree hollow in wooded swamp or forest
Black-capped Chickadee	Insects, seeds, berries, other fruits	Hole in tree, nest box
Cardinal	Grubs, beetles, grasshoppers, caterpillars, beetles, seeds, fruits	Hedgerows, trees, shrubs
Domestic Pigeon	Brains, seeds, acorns	Trees, buildings, bridges
House Sparrow	Grains, seeds, beetles, other insects, worms	Trees, bird boxes, buildings
Meadowlark	Caterpillars, beetles, cutworms, grasshoppers, seeds, grain	Grassy areas of fields
Mallard	Marsh plants, insects, mollusks, small fish	Freshwater marsh
Red-tailed Hawk	Small mammals, reptiles, frogs, insects	Woodlands
Robin	Worms, fruit	Trees, shrubs, buildings
Starling	Insects, grains, seeds	Brushy shrubs, nest boxes, tree holes

Habitat needs may change drastically by season or by the age of a given

animal. A young wild turkey, for example, must have a rich protein diet of insects to provide growth; later in the same year, it will require berries, seeds, acorns, and similar foods. This a case of species' dietary needs being well matched to the habitat; in the spring when the birds are small, the woodland habitat of the wild turkey is teeming with insects, and in the fall the other foods the birds need in their maturity are plentiful.

Knowing the precise habitat needs of any species of fish and wildlife and knowing how to provide these needs in certain balances is the center of effective fish and wildlife management.

You will not get very far into this subject without hearing the world habitat time after time.

Plant and Animal Succession

Another factor that the wildlife manager must understand is plant and animal succession. Basically this means that when land is cleared of vegetation (by fire, lumbering, etc.), different kinds of vegetation appear in successive stages; annual weeds appear first, then perennial weeds, then shrubs, then certain kinds of trees and finally trees such as oaks, maples, and hickories that represent the final of climax stage. Generally with each successive stage of plant growth the animal life changes also, depending on various species' habitat needs. Plant and animal succession can be manipulated to accommodate certain wildlife species and to discourage other species.

As deep water habitats (lake, river, marine) and wetlands (marsh, swamp, bog, fen, prairie) become older, they undergo a process known eutrophication; a change in depth, size, vegetation, an character through gradual filling. As they age, depending on location some change to scrub-shrub wetlands and become forested wetlands and eventually forests, and others become prairie. succession is hastened by drainage and tillage practices that increase erosion and sedimentation.

Reproduction Rates

Most species of fish and wildlife have the ability to produce far more offspring than available habitat will support --- this is nature's way of assuring that the species will be continued. There are some exceptions; a polar bear has two cubs every three years, and a female condor produces only a single egg every 2 years. Perhaps this is appropriate and reflects

the traditional seasonal availability of food.

The white-tailed deer is a species that is well known for reproducing at rates far greater than the habitat can support. Unless its numbers are kept under control, generally by hunting, it tends to overpopulate until the food supply is depleted and disease and starvation set in.

Sometimes high reproductive capability can work against the best interests of fish and wildlife managers. For example, when many large predator fish are removed from a lake the smaller fish such as bluegills become over populated and deplete the food supply. Without adequate food they fail to grow to a desirable size and are no longer of interest to anglers.

Sometimes a high reproductive capability fails to produce a desirable number of a given species. The American lobster found along the coastal waters of New England is a case in point. An adult female produces more than 20,000 eggs once every 2 years, but a harsh environment, including predation, results in only a few individuals surviving to adulthood from the 20,000 eggs. Therefore strict limits must be placed on the harvest of this species.

Management Practices

Methods of managing fish and wildlife are highly diverse and are changing constantly as new ideas develop, as research produces new fish and wildlife information, and as land uses change.

As a forest matures, its value for a variety of wildlife species generally diminishes. The wildlife manager might then decide that for wildlife needing early growth forest habitat, trees should be thinned or removed completely (clear-cut) to open the way for ground vegetation. This management method might also provide food and cover for certain species of wildlife.

For the same reason, controlled burning might be required to discourage one kind of vegetation and stimulate the growth of another that is preferred by wildlife. Along with the removal of vegetation, the planting of a particular kind of plant or mix of certain plants might provide critical habitat needed for certain wildlife species. This kind of management is often merely a substitute for natural forces like forest and prairie fires

that must be controlled in order to protect other resources.

Improving stream habitat for fish might involve installation of physical structures like log dams and deflectors, large boulders, and anchored trees. It might also involve establishing stream bank vegetation. Junk automobiles, tires, abandoned barges, and construction rubble are examples of materials that have been used to create artificial food and shelter for fish in artificial coastal reefs. Brush and discarded Christmas trees are used for the same purpose in inland lakes.

Offshore oil and gas production platforms have proven to create tremendous artificial fish habitats. In the Gulf of Mexico there are more than 4,000 such rigs, intended primarily for oil and gas production, but also providing a great fishery. The early life stages of numerous algae, coral, barnacles, sponges, and other marine organisms drift in currents until they find a suitable habitat, or die. When they attach to the drilling platform framework that is underwater they can metamorphose into adult forms, grow and propagate, becoming a food source for other marine creatures. Today, nearly a fourth of all saltwater recreational fishing trips originating in Texas, Louisiana, and Mississippi head for the offshore drilling rigs in central and western parts of the Gulf to harvest the bounty of fish provided by the artificial fish habitat.

Platform legs also provide shelter from currents and predators, as well as convenient navigational reference points for fish. In essence, they create new habitats and increase the number of animals a given area of ocean can support.

Much the same thing happens on platforms of the California coast. Mussels grow so quickly and abundantly that they must constantly be scraped off so that their added bulk does not cause strong currents to weaken the platform. A Santa Barbary company now harvests thousands of pounds of these mussels every week for sale to four-star restaurants in a number of states. Huge schools of fish also can be found beneath these oil drilling platforms. Platforms no longer in use for drilling are increasingly being left in place for use as fishing holes, to substitute, or mitigate, for environmental damage elsewhere and generally to create habitat for fish and other sea life.

Another way that fish are managed is by chemically removing undesirable

fish populations and releasing desired species to replace them.

perhaps the best-known management methods are hunting and fishing regulations. Generally the goal is to set regulations so that only harvestable surpluses are removed by hunters and anglers. Breeding populations are then maintained at the optimum numbers the habitat can support.

If too many game animals are harvested from a certain area, there would be too few to make maximum use of the habitat (food, water, shelter, space). If too few are harvested the surpluses will run short of habitat and as a result may die because of starvation or disease, and other less desirable species might move in and take over. The situation is not quite as clear-cut with fish, but the idea is basically the same.

Dealing with habitat needs, plant and animal succession, reproduction rates, and various other factors affecting fish and wildlife becomes highly challenging and complicated in the field of fish and wildlife management.

Damage Control --- Also Management

Another part of fish and wildlife management consists of damage control -- practices to reduce or eliminate conflicts between humans and fish and wildlife.

Almost any animal at times can cause trouble for humans. Some situations are just plain nuisances, like raccoons upsetting trash cans. More serious cases occur when wildlife causes financial losses, like blackbirds by the thousands invading a farmer's corn or rice field, or coyotes killing sheep, or wild horses and burrows overgrazing and destroying the range, thereby making forage unavailable for antelope and other animals. The worst kind of conflict is when wildlife threatens the health or safety of humans, like a rabid fox wandering into a schoolyard or a flock of starlings on a collision course with a jet aircraft.

There are two general methods for reducing these problems. First, the habitat can be made unacceptable for the offending species. Second, the targeted animal or group of animals can be fenced out, repelled, live trapped, and released elsewhere, or if necessary, selectively destroyed by the safest and most humane means available. Habitat management is usually the long-term solution, because if an animal is deprived of food

water, shelter, or living space, it will have to move elsewhere or die.

To relieve an animal damage problem, wildlife managers often use a combination of control methods that are safe, selective, effective, and humane. Anyone who needs to resolve a problem between wildlife and people should be sure that the right method is used so that other animals and the environment are not hurt.

One ominous forecast is certain. Conflicts and competition with wildlife will increase as more people occupy more wildlife habitat.

A Success Story

If fish and wildlife management had not been as tremendously successful as it has been, we would be living in quite a different environment today.

By the early 1900's, forests were fast disappearing in the face of massive logging, and uncontrolled fires. Range lands were being overgrazed and becoming highly eroded. Market hunters were slaughtering wildlife without restriction. The passenger pigeon was almost gone, and only a relatively few beaver, antelope, whooping cranes, elk, white-tailed deer, wild turkeys, egrets, herons, trumpeter swans, wood ducks, and fur seals remained. It was assumed that all the larger game animals would soon be gone. Since that time the human population has mushroomed, and land use requirements that totally exclude fish and wildlife have increased tremendously.

But in spite of all the factors that would lead one to predict a continued downward trend in fish and wildlife populations, there are many examples showing that the downward trend can be reversed.

Fisheries management is technology having to do with our fish resources. A highly successful fisheries management story is shared by inland states in which striped bass were introduced in freshwater reservoirs throughout the nation. The striped bass is an anadromous species, meaning it normally spawns, or lays its eggs, in freshwater coastal streams and returns to the ocean and bays to grow and mature. Fisheries managers learned techniques for artificially spawning and rearing striped bass, making it possible to stock this fish in freshwater reservoirs where it reaches trophy sizes of 30 to 60 pounds. Another benefit is that this fish has the ability to consume competing forage and non game species,

resulting in better survival and faster growth rates for the more desirable game and pan fish species.

Another impressive fisheries management success story concerns the Great Lakes. The entrance of the sea lamprey (an eel-like fish parasite), excessive harvesting, and habitat deterioration practically eliminated several important fish species by the middle 1950's. Then a chemical was found to control the sea lamprey, water clean-up efforts were initiated, regulations were adopted to prevent excessive harvest, and a program was undertaken to stock lake trout, other species of trout, and even salmon, which were not native to the Great Lakes. Today the Great Lakes attracts anglers from all over the United States to catch the hefty lake trout, steelhead, chinook and coho salmon, and other challenging game fish.

Many other examples can also be cited. Through habitat improvement, improved survey work, and better hunting regulations, many species are more plentiful today than decades ago, even though much of their former habitat has been taken for other uses. White-tailed deer are far more plentiful now, for example, than they were at the turn of the century. Wood ducks, once assumed headed toward extinction, are now plentiful enough so that hunting bag limits and open seasons have been extended.

Modern wildlife management has also been successful in bringing endangered and threatened species from near extinction to comfortable reproducing numbers. The bald eagle is a prime example of success in this area, as is the eastern timber wolf in Minnesota, and the alligator in Florida and Louisiana. Throughout the world many species that would be gone by now are still with us, in many cases thriving, because of modern wildlife management techniques.

FISH AND WILDLIFE VALUES

In any discussion of fish and wildlife management and efforts to assure the existence of creatures in certain number throughout the nation, it seems only fair to quest why. One answer is that people simply enjoy seeing fish and wildlife, and even enjoy just knowing the creatures exist, even if unseen. Fish and wildlife also help us understand all living things and how all plant and animal life forms exist in relationship to each other. There are many other reasons, but perhaps the most commonly thought of reason to maintain fish and wildlife, are hunting and fishing.

Hunting

There are over 20 million American hunters.

Prevents overpopulation. Hunting generates funds to help finance the conservation and management of all wildlife, including songbirds and other non game wildlife. Hunting activities stimulate the economy in many parts of our country, providing jobs and income for many people. Hunting can also be used as a management tool to reduce the number of animals in any given area, thereby, for example, lessening depredations on crops and orchards.

Hunting is related by written and unwritten laws. to make sure that it remains a sport and that the hunter does not take unfair advantage of the quarry.

Written rules and regulations concern types of weapons, bag limits, open seasons, shooting hours, and many other specific details.

Unwritten rules are self-imposed by true sportsmen, and are considered an essential part of the hunting ethic tradition. In a hunting situation, there are no judges or referees other than the hunter's own sense of fair play and adherence to and acceptance of the hunting ethic. For example landowners as well as other hunters must be treated with special courtesy. Sportsmen respect and learn all they can about wildlife. True sportsmen know that safety must never be compromised and that their equipment must be well cared for and proper for the hunt.

Sportsmen are expected to pass up opportunities when a clean kill is less than certain, because wounding an animal is humiliating and shameful for the hunter, and often leads to a slow, painful death for the animal.

Fishing

Fishing is second only to swimming as the most popular leisure time activity in the U.S.

Observing

Endangered Species

Endangered means that there only a few individuals of a species remaining

alive. They are in danger of becoming extinct. Extinct means that not one individual of a species is still alive. The word threatened is used to describe a species that is almost endangered.

The principal reason animals are becoming endangered at an ever-increasing rate is that people are causing major changes in their natural environment. Because many animals have very specific habitat requirements, what appears to us to be a minor change may be devastating to the animal. We know now that very small amounts of some pesticides eaten by brown pelicans, bald eagles, and peregrine falcons may kill them or make them unable to produce young. In fact, these two species nearly became extinct some years back through wide use of a pesticide called DDT, which found its way into their diets and caused their eggs to develop only thin, fragile shells. These thin-shelled eggs tended to break in the nest before the young were hatched, resulting in a rapid and drastic decline in population of both species. Less subtle habitat changes like draining and filling wetlands (marshes, sloughs, and swamps), building dams on rivers and streams, clearing land, or building cities and airports can have an enormous impact on animals that are not able to adjust to a new or changed environment. Abrupt changes give sensitive wildlife species no time to adapt and no place to retreat.

A great many of the world's plant and animal species that have existed in the past are now extinct. The reptile-like dinosaurs have been gone from this earth for millions of years. Species have been appearing and disappearing since the beginning of time. But before humans, these events were caused essentially by major climatic changes and natural catastrophes.

Since humans appeared on earth, however, and especially during the past few hundred years when the human population has skyrocketed, the extinction process has accelerated drastically.

Some animals are on the endangered species list because they compete with people. Wolves and grizzly bears are examples of animals that were deliberately killed because they fed on domestic livestock.

Some of the whales, sea turtles, alligators, crocodiles, spotted cats, and others have been reduced to the endangered status because they had considerable commercial value.

Others, like the badlands bighorn sheep, Merriams elk, and eastern elk were exterminated by meat and trophy hunters prior to 1910. Many of these extinct animals were destroyed before most people thought seriously about conservation.

the introduction of foreign animals has resulted in the loss of a number of our native species. Introduced birds and animals such as starlings and rats, introduced diseases, and overgrazing and foraging by sheep and cattle have drastically impacted native animals and their habitats. About 40 percent of Hawaii's native birds are now extinct; and another 40 percent are endangered. Birds and animals that have evolved on an island are especially vulnerable to introduced predators. For example, just a few years ago tree-climbing snakes gained access to the Island of Guam in the North Pacific, and in just a short time virtually wiped out the flourishing bird populations.

The same causes that contribute to the endangered status of mammals and birds also generally apply to fish. Harmful environmental change brought about by human activity is thought to be the most important cause. In fact, fish are even more vulnerable than mammals or birds, as most fish are "captives" of their stream or lake habitats and unable to move at will to the next mountain or valley if disturbed by human activity. On the brighter side, some success has been achieved in recent years for improving chances for survival of several endangered species. Four fish species once include on the endangered fish have been reclassified as threatened, a less critical category, though still indicating the need for continued protection.

Some of these species were at least partially restored as a result of successful transplants to new and undisturbed habitats where they have a better chance to survive. Others have benefited from habitat improvement and the adoption of more protective regulations. Endangered fishes reared at fish hatcheries will be useful in future restoration programs.

Why should people try to save endangered species, sometimes at a considerable cost? Perhaps the answer is that extinction is so final. If people are responsible for endangering an animal, they have an obligation to future generations of humans to try to save that animal. Furthermore, it is in our interest to preserve all species, because a variety of living

things provides a greater diversity of recreational, scientific, and economic benefits for everyone.

Environmental Barometers

A somewhat subtle fish and wildlife value is that the creatures serve humans as environmental barometers. A barometer is an instrument used to help forecast weather.

Years ago, coal miners carried caged canaries with them into deep underground mines. Someone kept a constant sharp eye on the bird, because its behavior reflected the condition of the air. Canaries are much more sensitive to impure air than humans. If the canary died, the miners headed for the surface because deadly methane gas was probably present.

In much more subtle ways, fish and wildlife can serve to measure the quality of the environment. Clear, cool streams that ought to support trout, but do not, suggest something may be drastically wrong with the quality of the water. A fish die-off is often the first sign of pollution in a water supply. In some localities, careful studies have uncovered in fish and shellfish alarming concentrations of chemicals known to be harmful to humans. These chemicals, once present in sufficient concentrations, may impair the animals nervous systems, reduce reproduction, or kill them outright. The presence or absence of fish and wildlife can reflect the way people live and how well or badly they are treating the environment. Ideally, we should strive to assure that most species remain in abundance. If this were the case, the quality of the environment for humans would be healthy, too.

WHO'S RESPONSIBLE FOR FISH AND WILDLIFE?

In a very real sense the responsibility for fish and wildlife must be shared by everybody, but officially this responsibility belongs to the public agencies.

The U.S. Fish and Wildlife Service within the Department of the Interior has primary responsibility for the management of migratory birds (ducks, geese, rob, woodpeckers, for example); for endangered and threatened species (whooping cranes, California condors, grizzly bears); and for some marine mammals (polar bears, walruses, and sea otters). A major part of the service's responsibility for these groups of wildlife is discharged on the national Wildlife Refuge System. More than 420

refuges, totaling nearly 90 million acres, represent the largest system of lands in the world devoted to the management of wildlife.

The Department of Commerce, through its National Marine Fisheries Service, is responsible for providing the scientific and technical information needed to conserve, manage, and develop living marine resources. The information and analyses they provide are the basis for management and development decisions that support the growth and stability of the U.S recreational and commercial marine fishing industries.

Other federal land management agencies, such as the U.S. Forest Service, the national Park Service, and the Bureau of Land Management, administer millions of acres of public lands. They also have responsibilities for wildlife by virtue of their presence on these lands.

Each of the 50 state governments has a conservation department or game and fish division with the responsibility of managing so-called resident fish and wildlife species. In all, some 50 million acres of habitat are managed by the states for fish and wildlife, both game and non game species.

A similar arrangement between the states and federal government exists with fish. The federal government has a responsibility for managing fisheries in international water and in waters contained on federal lands. The states manage the fisheries in inland waters contained within the states.