WILDLIFE

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LEARNING OBJECTIVES

Team members will be able to:

- Identify common wildlife species and wildlife signs
- Identify basic wildlife survival needs
- Describe specific adaptations of wildlife to their environment and their role in the ecosystem
- Describe predator/prey relationships and identify examples
- Describe food chains and food webs and cite examples
- Describe factors that limit or enhance population growth
- Evaluate a given habitat and its suitability for a designated species when given a description of its habitat needs
- Describe ways a habitat can be improved for specific species through knowledge of its specific requirements
- Discuss the concept of carrying capacity (biological & cultural) and limiting factors
- Discuss various ways the public and wildlife managers can help in the protection, conservation, management, and enhancement of wildlife populations
- Describe the potential impact of the introduction of non-native species
- Describe major factors affecting threatened and endangered species and methods used to improve the populations of these species
- Describe wildlife diseases with human implications

I. INTRODUCTION

Wildlife is generally referred to as any wild living organism, including non-domesticated plants. Wildlife lives in a free condition, providing for its own food, shelter and other needs in environments that provide suitable habitat. Wildlife refers to species that are not domesticated, and includes (but is not limited to) wild orchids, spiders, birds, reptiles, fish, amphibians and mammals. Wildlife exists in various forms all over the planet from the middle of the largest cities to the heart of our most pristine forests and wetlands. Wildlife is all around us even if we don't see or hear it. People and wildlife share similar environments, needs and problems.

Every wildlife species needs a home. This home or habitat includes food, water, shelter and space and must be available in a suitable arrangement. The availability of suitable habitat is the key to wildlife survival. Wildlife species have a variety of adaptations that help them to survive. These adaptations can include physical characteristics such as body shape, fur, feathers, feet, legs, teeth, coloration and beaks. Some adaptations are behavioral. Wildlife species display a variety of behaviors in predator/prey relationships that help them to survive. Other adaptive behaviors influence feeding, breeding and movement.

Massachusetts is home to a variety of wildlife. Plants, birds, and insects are often visible, however, mammals tend to be secretive. As a result we must rely on traces including tracks, scat, gnawings, midden piles, rubbings, nests, burrows, feathers, fur/hair, rubs, game trails, flattened grass, egg cases, sounds, and pellets that can offer information on the animal's life. The use of field guides can help you to identify what you are looking at and will enhance your learning experience in the field. These guides cover a range of topics from animal tracking, birds, reptiles & amphibians, astronomy, trees, geology, fish etc.

BIODIVERSITY

Biodiversity (biological diversity) can be defined as the diversity of life and its many processes. This richness or diversity includes wild species, their genetic variability, the natural communities they make up and live in, and the environmental processes that maintain them.

II. PEOPLE AND WILDLIFE

USES

Wildlife is used for food, clothing, spiritual well being, and enjoyment. Wildlife is also an economic resource. Wildlife users contribute billions of dollars to the economy every year by visiting parks and zoos, and by buying bird seed, bird feeders, binoculars, cameras, hunting and fishing equipment, field guides, furs, videos, memorabilia, and much, much more (the list seems endless). Whether economical, consumptive, spiritual or recreational in value wildlife plays an important role in human society.

DISTURBANCE

People influence animal populations both directly and indirectly. Some people believe that if they don't hunt, fish, or trap they have no effect on wildlife but all people effect wildlife in their daily activities. For example, a simple process (like eating) has an impact, and will continue to effect wildlife species. Whether you eat wild or domestic meat or consider yourself a vegetarian, you are still effecting wildlife and the environment. For instance, the land that is used to grow crops for human or livestock consumption was once wildlife habitat for many species; when that land is converted the natural ecosystem is disrupted. Remember that habitat loss is the biggest threat to wildlife species today. Each component of the ecosystem must be kept in balance. The daily activities of human beings do in fact influence the environment. There are many ways in which humans have and continue to influence the environment. Two human influences of importance on wildlife historically have been urbanization and cultivation.

URBANIZATION AND URBAN SPRAWL

Compared to any other human factor urbanization has probably had the greatest impact on the environment. Many environmental problems created by humans are compounded because humans tend to concentrate together to live and work-they urbanize. Concentrations of people in limited geographic areas create problems of habitat loss, waste concentration, and degradation of natural resources. As the human population continues to grow through natural means and immigration, and people live longer, more land will be occupied and more resources will be used. This results in urban sprawl: the growth of cities.

Rural areas become urban areas and an increase in pollution and habitat loss occurs. If our human population continues to grow exponentially we will continue to drastically affect natural communities.

Humans (*Homo sapiens*) are part of the natural environment just as any other species. Humans, along with beaver, are able to manipulate their environment for food, water, and shelter. Even though habitat loss through urbanization has been devastating to some species, other wildlife populations have adapted to urban and suburban settings. Raccoon, coyote, opossum, beaver, deer, squirrels, skunks, crows, chipmunks, garter snakes, black bear, and many songbirds are all examples of some of the species whose populations benefit from the urban or developed environment. Urban areas provide these species with virtually predator free living, additional food sources (ex. trash, landscaping), safe and easy to locate shelters (ex. under porches, garages, sheds) and many other benefits that make life for these species much easier.

People generally enjoy the aesthetic value of wildlife. However, people who share common areas with wildlife often begin having concerns about “backyard” wildlife. These species often go from being regarded as welcome additions to the area to "pests." Biologists would like to prevent animals from being regarded as pests. Educating the public, promoting tolerance of wildlife among people, and keeping wildlife populations under control are the methods biologists use. The best thing you can do to eliminate problem wildlife is to prevent the problem from ever occurring. The Division of Fisheries and Wildlife (MassWildlife) can provide advice on ways to prevent conflicts with wildlife and other wildlife issues. You can phone the MassWildlife office nearest you or visit www.masswildlife.org .

Northeast Wildlife District (Acton):	(978) 263-4347
Southeast Wildlife District (Buzzards Bay):	(508) 759-3406
Central Wildlife District (West Boylston):	(508) 835-3607
Western Wildlife District (Pittsfield):	(413) 447-9789
Connecticut Valley Wildlife District (Belchertown):	(413) 323-7632
Field Headquarters (Westborough):	(508) 389-6360

CULTIVATION

When people discovered the ability to domesticate flora and fauna, many hunter/gatherer cultures converted into agricultural societies. Even though agriculture was extremely important to the human population, it was quite destructive to wildlife populations. Agriculture resulted in a radical transformation of the vegetation patterns and related animal life: plant and animal communities were altered, the water cycle was affected, and the spread of many exotic diseases, plants and animals occurred.

Cranberry Bogs in Wareham, MA www.skypic.com

It is important to note that agriculture can also be beneficial to some species, by providing an alternate food source. For example, Massachusetts's black bears will travel miles to cornfields, especially in seasons of low hard mast (acorn) production, and eat the corn. They can cause a lot of damage to local farmers in some years. Some Massachusetts farmers have lost up to ¾ of their corn crop due to bear damage.

III. FOOD CHAINS AND FOOD WEBS

All living organisms are part of a food chain. The chain is driven by the sun, which provides the energy for green plants to perform photosynthesis. This process allows the plants to fix inorganic compounds into plant tissues that can later be digested by animals. Plants and phytoplankton are considered the primary producers in a food chain. They compose the most basic trophic level (a stage in a food chain shared by organisms that feed on the same food type) upon which all successive levels depend. Plants, herbivores, and carnivores constitute different trophic levels. Herbivores are usually considered the primary consumers of a food chain. Secondary consumers such as carnivores feed off the herbivores. Food chains do not follow simple pathways, since most animals feed on more than one type of food based on what is available to them. Food webs are a complex system composed of several linked food chains in an ecosystem. Without the transfer of matter and energy from one organism to another through food webs, ecosystems would cease to exist.

NUTRIENT EXCHANGE

Nutrients are constantly exchanged (recycled) between links in an ecosystem. Respiration, decomposition, and excretion are ways that nutrients are returned to the system. Decomposers and fire release large amounts of residual energy back into a system. If it were not for fire and the more common decomposers (i.e. bacteria, fungi and insects), nutrients would remain trapped in dead organic matter. Bacteria and fungi perform most of the world's decomposition, with insects and other invertebrates also playing an essential role. Examine the nutrient exchange diagrams on the next page.

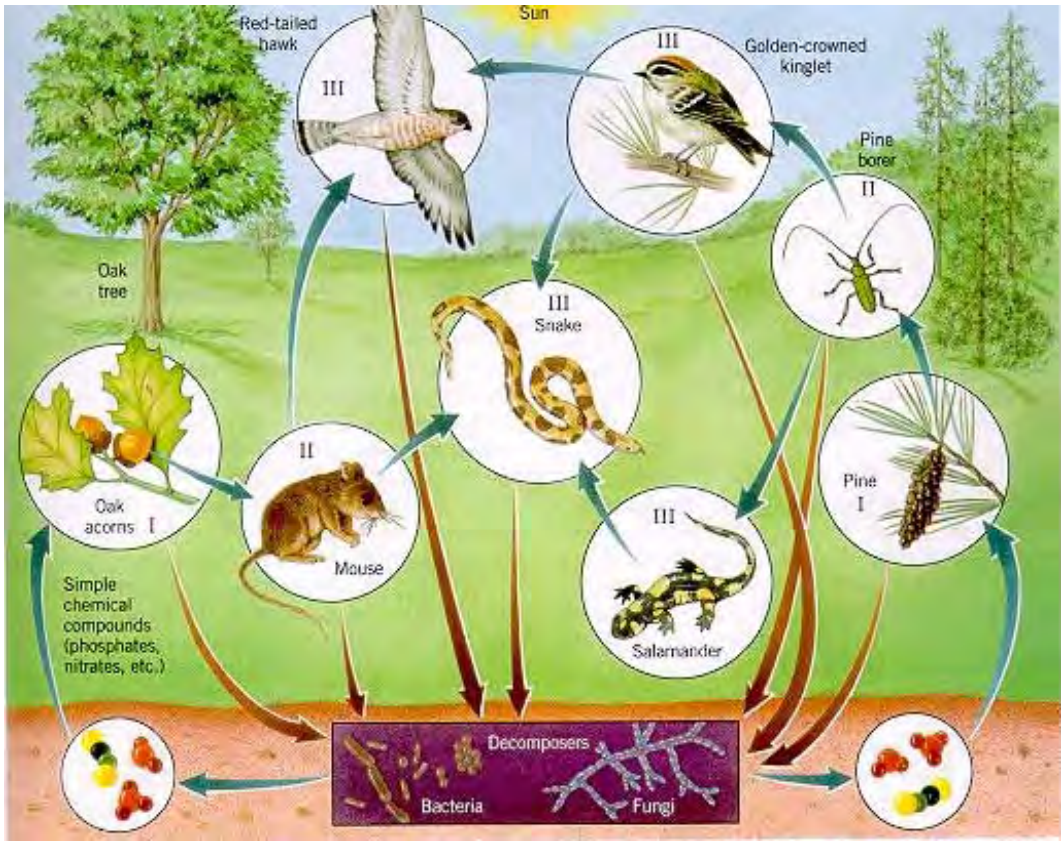
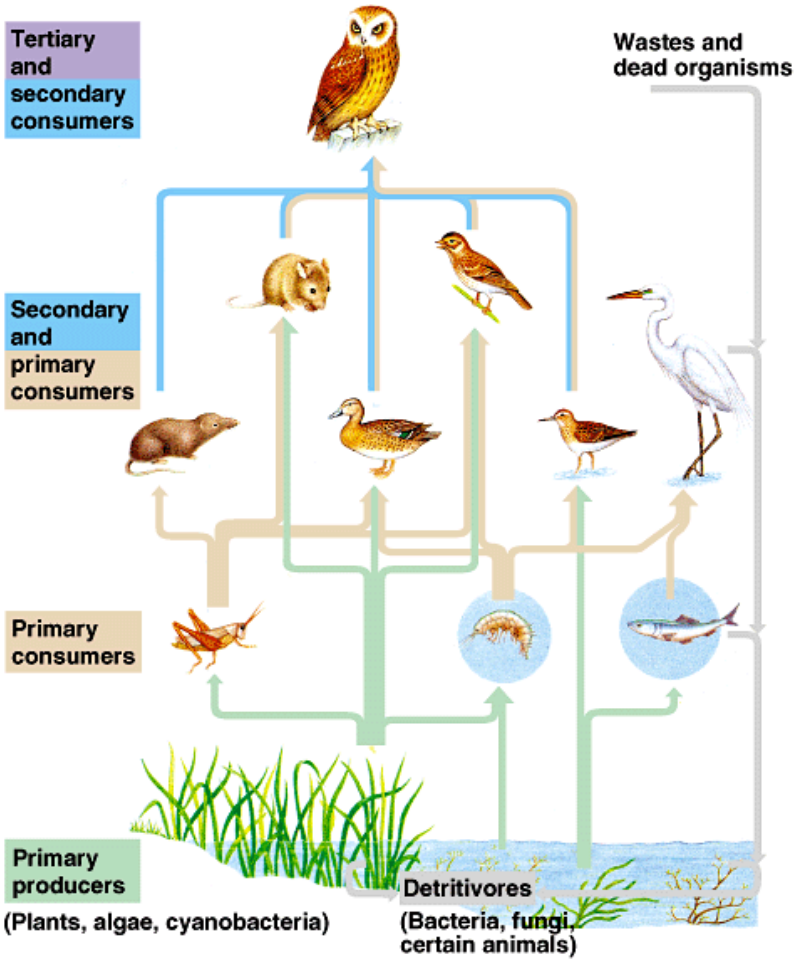


Image from: www.weedeco.msu.montana.edu/.../FoodWeb.JPG



IV. POPULATION ECOLOGY

The key to managing wildlife is to think of it in terms of populations, rather than individual organisms. A *population* is the total number of individuals, of the same species, that occupy a specific area. *Population density* is the number of individuals in a given population within a specific area (i.e. # deer/ sq. mile). Unlike individual organisms, populations do not have limited lifetimes. Their longevity is not limited by time, but by habitat availability. The general goal of managing populations is to manage for sustainable, healthy population levels that ensure the survival of the species and the proper function of ecosystems, while minimizing conflicts between people and wildlife. Biologists for the most part manage populations. They are rarely concerned about individual animals. The exception to this rule is in the management of rare or endangered species when populations have become so small that individuals are the only units left. Any image ideas for here?

V. WILDLIFE MANAGEMENT

Wildlife management is based on the best scientific, technical, and social knowledge available. State and federal agencies employ many specialists to help preserve and manage wildlife and wildlife habitats. These employees do field work, conduct laboratory research and oversee human interactions with wildlife. Universities and colleges, private and non-profit wildlife oriented agencies, zoos and museums, private industry and others all employ people trained in the wildlife field.

REASONS

Why manage wildlife? When wildlife and humans share common space there will be conflict between the two: human-wildlife and wildlife-wildlife. Humans can affect wildlife directly (such as by draining wetlands) or indirectly (such as by providing food sources that support higher-than-normal predator densities). These conflicts can lead to the decline or extinction of species and wildlife communities which biologists strive to prevent. A good example of human-wildlife conflict is deer. When Europeans began to colonize Massachusetts they converted most of the forestland to farmland. Even though this was beneficial for the human population, the habitat loss resulted in the near elimination of deer from Massachusetts for nearly two centuries. Farm abandonment and active management has brought the deer back to sustainable population numbers. However, continued management is needed to minimize current conflicts.

Even though deer play an important role in the ecosystem, if their numbers go unchecked they can easily multiply and surpass the level where the land can support the herd. Over-browsing occurs at this level, altering plant composition, distribution and abundance. These changes may have drastic effects on the local plant and animal communities. Populations of species whose survival has been dependent on the characteristics of the habitat before over browsing occurred may decline. This is a risk not only with deer, but with many animals that reach high population numbers. In order to maintain a balance in the natural environment it is essential to keep population levels under control.

DETERMINING POPULATION LEVEL

How does a biologist determine what the population level is? There are three main techniques used to determine population size: census, estimate, and index. A *census* is a complete count of every individual. This is the most accurate way to determine a population size and is useful for animals that live in open, easy to count areas. Aerial surveys are often used by biologists to census winter waterfowl flocks in open areas. A census is rarely used if a species lives in thick vegetation, variable topography, or if the population is large. It is very difficult to count every individual in a population. In these cases an estimate or index would be useful.

An *estimate* is based on a statistical sample and calculated to determine a population size. It is not as accurate as a census, but if a study is done correctly, an estimate is an effective technique to deduce a population's size. Mark-recapture studies are probably the most common means of obtaining population estimates. For example a biologist may capture a certain number of mice, mark them with an ear tag, and return them to the population. The next day the biologist captures mice again, some of them marked and some unmarked. By comparing the number of marked to unmarked animals, the biologist can obtain a population estimate (NOTE: this is a simplified example, a study must be conducted over a long period of time to obtain an accurate estimate).

An *index* is a quantitative measure of a population that measures a species that is easy to observe and is assumed or known to be directly related to population size. When considered over time an index can provide knowledge of the <u>relative</u> population levels and changes over time. For example, a deer population's reproductive rate can be a good indicator of population health and can tell whether or not the population is above or below carrying capacity (reproductive rates are highest at half the carrying capacity). When the adult does of a herd are having triplets and yearlings are having young, this indicates a high reproductive rate and a population level around half the carrying capacity. Even though indices are the least accurate way of determining population size, they are usually the easiest and least expensive technique and are used quite often.

CARRYING CAPACITY

Carrying capacity (K) is an important concept in population management. Biological carrying capacity is the maximum population that a specific ecosystem can support over long periods of time. Carrying capacity for many wildlife species is in a constant state of change, both seasonally and from year to year. Alteration of habitat quality or quantity may increase or decrease the carrying capacity. Cultural carrying capacity is the maximum population level with which the human population can compatibly coexist with. The biological and cultural carrying capacity can differ tremendously. The biological capacity tends to be greater than the cultural. For example, the land may be able to support a high population of deer, however, when population levels are high then conflicts between humans and deer increase (deer-vehicle collisions and damage to agriculture and ornamental plantings). The cultural carrying capacity is dependent on the sensitivity of the local human population to the presence of wildlife. The sensitivity level can vary from person to person and be dependent on the land-use practices, priorities and attitudes of the people, and local densities of the various wildlife species.

Even with the influence of people, populations can reach biological carrying capacity. This indicates that the number of animals has reached the point where the availability of food, water, and shelter is not sufficient to support any more animals in good health. This leads to habitat degradation and intense competition for resources among the animals. At this point body weight and reproductive rates decrease, while death through starvation and disease increases. The degraded habitat, low reproductive rate, and increased mortality of the animals can cause a population to crash. It is important to keep population levels below the carrying capacity. The healthiest level for a population is around half the biological carrying capacity (K/2). At this level (K/2) there are fewer animals with the result that there is less competition for food, water, and shelter. This leads to healthier animals, high reproductive rates and less damage to the habitat and other wildlife or plant species.

HARVESTING

What is harvest and how does it relate to carrying capacity? Harvest is the regulated removal of a certain number of individuals from a population. It allows a biologist to maintain the population at a desired level (usually K/2). Hunting, trapping, and fishing are harvest techniques that can be used to regulate the population levels of various types of

wildlife including mammals, birds, fish, reptiles, and amphibians. To a biologist, harvest management is the most effective and least expensive tool for managing game species with high population levels. For proper harvest management a biologist needs to have an estimate of the current population size and an understanding of the biological and cultural factors that influence that population. The biological factors that directly effect population size are birth rate (natality*), death rate (mortality), reproductive rate, age & sex ratios, recruitment, immigration and emigration. Much of this information is often gathered through mandatory check stations and kill reports. Cultural factors that effect populations and harvests include human population densities, the number of conflicts between wildlife and humans, the number of people who hunt, and the amount of land open to hunting. Research and monitoring is then used to insure that the numbers are correct and that proper management occurs.

After considering the current population size and the various factors that influence the wildlife population, a biologist can determine the appropriate number of individual animals needed to be removed from a population to bring the population level to the desired level. After the number of individuals to be removed is determined, a biologist has several tools available to regulate the level of removal...

- season lengths (how long the harvest season will be)
- daily and seasonal bag limits (how many may be harvested)
- sex or age limitations (what sex or how old the individuals harvested can be)
- limited entry (limit the # of access sites or the # of participants)
- timing of the season (what time of year will the harvest take place)
- equipment restrictions (what type of equipment can be used)
- size restrictions (what size harvested individuals have to be)

VI. RARE AND ENDANGERED SPECIES

When most people think of wildlife management they think of “game” species (species that are hunted), however, wildlife officials are also dedicated to “nongame” species. Nongame & game species have many benefits to humans (aesthetic, recreational, economical) and the ecosystem (roles they play in the ecosystem).

Endangered species is any species of plant or animal in danger of extinction throughout all or a significant portion of its range. Threatened species is any species of plant or animal whose numbers are low and decreasing rapidly and which may therefore become endangered within the foreseeable future throughout all or a significant portion of its range. The terms endangered and threatened are universally recognized terms. Species of special concern is a term used by MassWildlife to designate those species that occur in small numbers, or with such a restricted distribution or with such specialized habitat requirements that they could easily become threatened. Extirpated species (ex. Regal Fritillary) are species that no longer occur in a region or a state, but which continue to exist elsewhere.

Although extinction is a natural occurrence, excessive and intensive human activities in the environment have caused a dramatic increase in its rate. Loss of habitat as a result of human activity is considered to be the most pervasive cause of species extinction. Other major causes of endangerment and extinction include habitat changes, unregulated or illegal harvest and/or collection, disruption of migration routes and breeding behaviors, contamination by pollutants, predator control, competition or predation from introduced species and other natural causes.

Nongame species play an essential role in the ecosystem and their management is important. Managing animals with low populations differs from managing animals with high populations. The goal of managing rare species is to increase population size. This is done through one or more of the following methods:

- habitat protection
- captive breeding and foster parent programs
- controlling predators and competitors
- controlling human activities
- other techniques specific to that species

VII. LAWS AND REGULATIONS

Laws and regulations are established in order to enforce the requirements that are made for the management of all wildlife. The MassWildlife Abstracts contain a summary of the wildlife laws and regulations in Massachusetts. Environmental Police Officers (EPOs) are the primary personnel responsible for enforcing these wildlife laws and regulations in Massachusetts. In other states EPOs are referred to as game wardens, conservation officers, or wildlife officers. Federal agents within the U.S Fish and Wildlife Service enforce migratory waterfowl, endangered species, and other laws governing interstate transportation of wildlife and the commercial use of wildlife.

IMPORTANT WILDLIFE LEGISLATION

Migratory Bird Treaty Act (1918): this act placed all migratory birds under the protection of the federal government

Migratory Bird Conservation Act (1929): created refuges for migratory waterfowl

Migratory Bird Hunting Stamp Act (1934): authorized the money for refuges (above) to come from the sale of migratory bird hunting stamps

Pittman-Robertson Act (1937): levied 10% tax on manufactured sporting goods. Guns, ammunition, and archery equipment are taxed and the money goes to wildlife management and research.

Dingell-Johnson (1950): 10% manufacturer tax on sport fish rods, reels, lures, and creels. Note: Dingell-Johnson is the equivalent to Pittman-Robertson; however it relates to fishing equipment rather than hunting

Endangered Species Act (1966; Amended 1973): required that the Dept. of Interior identify all species of animals and plant species endangered or threatened with extinction. The act also required that the habitat of endangered species be protected. This act prohibits the hunting, killing, harassing, selling, exporting, or importing of endangered species or their body parts.

Massachusetts Endangered Species Act (1990): the act provides for many of the same protections contained in the national Act including the regulatory protection of designated habitats for listed species.

Wallop-Breaux Amendment (1984): this was an amendment to the Dingell-Johnson Act of 1950. It expanded the DJ act to include virtually all fishing equipment and added a 3% sales tax on electric outboard motors and selected fish finders.

Note: Pittman-Robertson and Dingell-Johnson / Wallop-Breux are very important Acts to state agencies. In most states, including MA, most of the funding for wildlife management comes from hunting and fishing license sales and directly from the revenue of these two acts. General Tax dollars do not pay for the management of wildlife in Massachusetts. The revenue from the tax on hunting and fishing equipment first goes to the federal government where 6% is used for administrative duties. The government then appropriates the funds to the states based on a specific formula. The major components of the formula are: 1.) the number of hunting and fishing licenses sold in the state and 2.) the land area (size) of the state. The more hunting and fishing licenses sold and the larger the state, the more money is appropriated to that state.

VIII. DISEASES

Diseases originate from infectious and noninfectious pathogens such as viruses, bacteria, parasites and toxic materials. Lyme and Rabies are examples of diseases with human implications, along with *Giardia*, Brucellosis, *Leptospirosis*, *E. Coli*, *Tularemia*, and Rocky Mountain Spotted Fever. There are hundreds of diseases that effect wildlife species, some of which are fatal. Some can be transmitted to humans and some can not. Disease transmission to humans does occur, but following simple common sense precautions can prevent infection of humans and pets.

Disease plays a natural role in many ecosystems. In animals with high population levels disease can be a limiting factor and aid in decreasing population size. Other limiting factors such as predation, weather conditions, accidents, food availability and habitat quality can contribute to fluctuations in wildlife populations. Because of limiting factors, wildlife populations cannot grow indefinitely. Limiting factors may result from natural causes as well as human activities.

Disease outbreaks are often more common in species at high population densities, since the animals are stressed and in frequent contact, leaving them more vulnerable to infection. Disease can sometimes be referred to as a density dependent factor, a factor that is influenced by population size (i.e. the higher the population size the more animals will be killed by a specific disease). A density independent factor is a factor that is not effected by the population size. A tornado could be called a density independent factor. When a tornado hits, it does not matter what the current population size of a species may be, it will remove the same percentage of individuals whether the population is high or low.

RABIES

Rabies is a virus that affects the nervous system of mammals and is primarily transmitted by the bite of an infected animal. Transmission from direct contact with saliva or a mucous membrane (eye, mouth, nose) can also occur. The virus is incapable of surviving and reproducing on its own: it thus requires a host species to survive. All mammals are susceptible to the disease (raccoons, foxes, skunks and bats are the most common carriers). Other animals (birds, reptiles, amphibians, etc) are not susceptible. Unless treated, once transmitted the virus is almost always fatal. If a person is bitten or scratched

by a known (or suspected) rabid animal, they should contact their physician or local authorities immediately for advice.

Rabies may cause an animal to act unusually tame, affectionate, lethargic, or partially paralyzed, or it may make the animal restless, agitated, or aggressive, to the point that it may bite at real or imaginary objects.

To learn more about wildlife diseases visit: www.mass.gov/dfwele/dfw/dfw_disease.htm

IX. RESOURCES & REFERENCES

This resource and reference list is just a start. There are a number of other resources available from your school or local library, world wide web, local nature center, museum, state park, wildlife professionals, sportsmen and women, and colleges!

- Division of Fisheries and Wildlife (MassWildlife)-laws & regulations, wildlife diseases, wildlife management publications, living with wildlife in Massachusetts series, list of Massachusetts wildlife species at www.masswildlife.org

- The Fish and Wildlife Abstracts – This annual publication covers the general laws & regulations pertaining to fishing, hunting and bag limits. Contact MassWildlife at 508-389-6300 www.masswildlife.org

- Natural Heritage and Endangered Species Website – MA State Rare Species List, Vernal Pool Certification Guidelines, Species Occurrence Lists by Counties and much more. www.state.ma.us/dfwele/dfw/nhesp

- Massachusetts Wildlife Magazine – a quarterly publication on various natural resource topics within the Commonwealth (subscription $6.00/year or $10/2 years). Back issues on desired topics can be obtained for $3.00 by contacting MassWildlife at (508) 389-6300

- Project WILD – interdisciplinary conservation and environmental education program emphasizing terrestrial and aquatic wildlife, and ecosystems. Activity guide is available through a six to eight-hour teacher training workshop. Contact Project WILD Coordinator, MassWildlife at (508) 389-6310

- Massachusetts Furbearer Facts – Provides information on the fourteen species of furbearer. Contact 508-389-6310.

- A Field Guide to Dragonflies and Damselflies of Massachusetts Blair Nikula, Jennifer L. Loose, and Matthew R. Burne. 2002 www.state.ma.us/dfwele/dfw/nhesp

- A Field Guide to the Animals of Vernal Pools Leo P. Kenney, Matthew R. Burne, Massachusetts Division of Fisheries & Wildlife Natural Heritage & Endangered Species Program & Vernal Pool Association, 2000.

- Peterson Field Guide Series – field guides to birds, mammals, animal tracks, insects, reptiles, trees, etc. Available at most libraries and bookstores.

- New England Wildlife - Habitat, Natural history, and Distribution Richard M. DeGraaf and Manuko Yamasaki, University Press of New England, 2001

- Field Guide to Skulls and Bones of Mammals of Northeastern United States Richard Wolniewicz. www.fieldguidebones.com

- Tracking and the Art of Seeing, How to Read Animal Tracks and Sign – Paul Rezendes, Camden House Publishing, Inc. 1992

- Field Guide to New England – National Audubon Society, Alfred A. Knopf, Inc., New York, 1998

Additional links can be found at http://www.maenvirothon.org/wildlife.htm

X. GLOSSARY

Abiotic – non-living components of the environment, including soil, water, air, light, temperature and nutrients

Acid – a substance with a pH value below 7; sour in taste, or corrosive in nature

Adaptation – the genetically determined characteristics that improve the ability of a species to survive in its environment and to successfully reproduce

Aesthetic – relating to or dealing with the beautiful

Aestivation – dormancy, typically seasonal during drought or heat

Air bladder – (also known as swim bladder) internal gas filled sacs lying above the intestine of fish, used for buoyancy

Algae - simple one celled or many celled organisms that are capable of photosynthesis; usually aquatic. Unlike true plants, algae lack organs such as leaves, roots and flowers.

Alkaline - Having a pH greater than 7, the opposite of acid. Alkaline soil or water is able to neutralize acid precipitation or discharge.

Amphibian – an animal that typically lives in an aquatic habitat breathing by gills as young, and terrestrial habitat breathing by lungs and through moist glandular skin as adult

Anadromous - fish that live in salt water and migrate to fresh water (rivers) to spawn

Anaerobic - occurring, acting, or living, in the absence of oxygen

Animalia - the animal kingdom, including animals with and without a backbone

Aquaculture - the deliberate growing of plants and animals in freshwater environments

Arboreal – inhabiting trees

Autotroph – an organism capable of producing its own food; plants and algae

Bag limit – the maximum number of animals allowed to be taken by an individual in regulated fishing or hunting

Behavior – the actions and reactions of humans or animals in response to stimuli

Benthic zone - that section of a water body near the bottom

Bioaccumulation – the storage of chemicals in an organism in higher concentrations than are normally found in the environment

Biodiversity – the full range of variety and variability within and among living organisms and the ecological complexes in which they occur; term encompasses ecosystem or community diversity, species diversity, and genetic diversity

Biological carrying capacity - the maximum population that a specific ecosystem can withstand (support) over long periods of time

Biomagnification – the accumulation of chemicals in organisms in increasingly higher concentration at successive trophic levels

Biome – a large geographic area with somewhat uniform climatic conditions; a complex of communities characterized by a distinctive type of vegetation and maintained under the climatic conditions of the region

Biota - all the living components of an ecosystem

Biotic factors – environmental influences caused by living organisms

Birth rate - the ratio of the number of live births to a total population over a period of time

Bog - a wetland formed where low oxygen levels and soil temperature cause incomplete decomposition and limited drainage, in an accumulation of fibrous peat

Brackish water – water containing a salinity level between freshwater and salt water

Brood – the offspring of a bird or mammal

Browse – to feed on the twigs, leaves, and shoots of woody plants and other vegetation

Burrowing – to dig a hole or tunnel for habitation or refuge

Carapace – upper (dorsal) shell of a turtle

Carnivore – an animal who's diet consists of primarily meat

Carrion – the bodies of dead animals, decaying

Carrying capacity – the maximum number of individuals or inhabitants that a given environment can support without detrimental effects

Catadromous - fish that live in fresh water and return to the ocean to spawn

Census - count of each individual member of a population

Circadian rhythm – periodic activity of an organism of approximately 24 hours duration

Class – name given a group of related orders

Community – a group of plants and animals living and interacting with one another in a specific region under relatively similar environmental conditions

Competition – the simultaneous demand by two or more organisms for limited environmental resources, such as nutrients, living space, or light

Conservation – management practice involving the wise use of natural resources, to provide maximum benefit over a sustained period of time

Consumptive use – any use that involves activity resulting in the harvesting of wildlife

Courtship – a behavior pattern that ensures mating with a suitable partner of the correct species at the correct time

Cover – the vegetation, debris, and irregularities of the land that provide concealment, sleeping, feeding, and breeding areas for wildlife

Crepuscular – an animal primarily active during low light times, usually at dawn and dusk

Cultural carrying capacity – the largest number of a wildlife species that humans will tolerate in their community

Death rate - ratio of the number of deaths to a specific population at a specific time

Decomposers – organisms which feed on and break down dead plant or animal matter

Density – the size of a population of a single species in a given area

Detritus - dead plant, animal, and other organic matter that will build up on the forest floor or the bottom of lakes, ponds, and streams

Display – an observable behavioral pattern that is used to communicate visually

Dissolved oxygen - oxygen in solution in water; this is the oxygen that is available to organisms that breathe with gills

Diurnal - refers to an animal that is primarily active during daylight hours

Domesticated – a species removed from its wild state to be raised and bred for human use

Ecology - the study of the interactions between living organisms and their environment

Ecosystem - a functional system comprised of a community of organisms and their environment, including energy transfers and nutrient cycling

Ecotone – transition zone between two different types of communities

Ectothermic – an organism that regulates its body temperature largely by exchanging heat with it's surroundings, cold-blooded

Edge community – the area that borders two habitats, a transition zone

Emigration - the movement of members of a species out of a specific area; contributes to the decrease in population growth

Endangered species - species whose surviving numbers have dropped to such extremely low levels that they are in immediate danger of extinction

Endothermic – an organism that generates its own heat to maintain its body temperature, warm-blooded

Estuary – a site where fresh and salt-water meet, usually at the mouth of a river as it enters the ocean

Eutrophication – the natural aging process of a body of water; process may be accelerated by human activity including industrial or agricultural runoff, sewage effluent, or the introduction of exotic plant species

Evaporation - changing of a substance from a liquid to a gas

Exotic species – a species not native to a particular area, usually introduced by human action; once introduced a particular species will often thrive, out-competing the native species originally occupying that particular niche; also called alien or invasive species

Extirpated – a species that has been exterminated from a specific geographic region or part of its historic range, but exists in other areas

Facultative species - a species that doesn't require one specific habitat type for its survival, but will seek out given habitat type if it is within its home range

Family - taxonomic group ranked below order and above genus

Fauna – animals

Flora – plants

Flyway – fly routes established by migratory birds

Food chain - a transfer of food energy as it passes from producers through the various trophic levels in an ecosystem, such as from producers to herbivores, carnivores, and finally decomposers

Food web - an integration of the many food chains existing in an ecosystem, showing the complex interwoven pathways of energy flow between the organism living in that environment

Fragmentation – reduction of a large habitat area into small, scattered remnants

Game species – designation for animals that may be managed and hunted only under strict regulation

Habitat - an environment used by an organism comprised of food, water, shelter, space in an appropriate arrangement

Harvest – removing surplus animals from a given population to ensure the health of the habitat in which that animal resides

Herbivore – an animal whose diet consists of primarily plants

Heterotrophs – an organism that can not produce its own food

Hibernation – winter dormancy in animals characterized by a great decrease in body temperature and metabolism.

Homeotherm – an animal with a fairly constant body temperature

Home range – the area where an animal travels in the scope of normal activities

Humus – organic material derived from partial decay of plant and animal matter

Immigration - the movement of an organism, species, or population into a new area

Indigenous – a naturally occurring species

Insectivorous – insect eaters

Introduced species – a non-native species that is intentionally or accidentally brought in to an ecosystem

Invasive species – a plant or animal species that has the ability to significantly displace desirable species

Kingdom – the highest taxonomic ranking of living organisms

Limiting factors – influences in the life history of any animal, population of animals, or species (ex. food, water, disease, shelter, space, climate, predation, pollution, hunting, poaching, and accidents)

Massachusetts Division of Fisheries & Wildlife (MassWildlife) – Massachusetts state agency charged with the management, protection, and restoration of all inland flora, and fauna as well as the habitat for which it resides; five component parts of the division include Wildlife, Fisheries, Natural Heritage and Endangered Species, Information & Education, and Realty

Migratory – birds or other animals that make annual seasonal moves from one region or country to another

Native – a plant or animal species that was produced, grew, or originated in a certain region

Natural resources – raw material supplied by the natural world utilized by humans (fossil fuels/timber/certain fish & wildlife)

Niche - the ecological role or position that a living thing or group of living things occupies in an ecosystem

Nocturnal – an animal primarily active at night

Non-game species – all wildlife species that are not commonly hunted, killed, or consumed by humans

Nymph – larval phase of an aquatic insect

Obligate species - a species requiring a certain type of habitat for its survival

Omnivore – an animal that diet consists of both plants and animals

Order – name given to a group of related families

Parasite – an organism that lives by deriving benefit from another organism, usually doing harm to the organism from which it derives benefit

Pelage – body covering on a mammal

Pelt – the skin and fur of a fur-bearing animal

Photosynthesis - the process where green plants use chlorophyll, sunlight, water, and carbon dioxide to create water, oxygen, and carbohydrates such as starches, sugars, and waxes; primary source of energy in the global ecosystem

Phylum – taxonomic grouping ranked below kingdom and above class

Phytoplankton - tiny drifting organisms in aquatic environments that are capable of photosynthesis

Plastron – lower (ventral) shell of a turtle

Pollution - something introduced into an ecosystem that stresses the organisms within the ecosystem causing effects ranging from sickness to death; there are many kinds of pollution including: chemical - those that are toxic in nature, ecological - those that are naturally occurring, but can still have serious effects if the situation has become unnatural, organic - oversupplying an aquatic ecosystem with certain nutrients resulting in high rates of production and decay, thermal - substances added to an aquatic ecosystem at temperatures above or below normal

Population - the total count of individuals, of the same species, that occupy a specific area

Population density - the number of individuals in a given population within a specific area

Predator – an animal that hunts & then kills other animals for its food

Preservation – protection that emphasizes non-consumptive values and uses

Prey – an animal hunted, killed, and typically consumed by predators

Range – the geographic region where a plant or animal normally lives and grows

Recruitment - the number of individuals added to a population at a given time (includes reproduction and immigration)

Redds – disturbed area of river or stream where adult salmon deposit, fertilize, and guard their eggs

Renewable resource – resources that have the potential of lasting indefinitely because the supply is replaced through natural processes (timber/grasslands/fresh water)

Reproductive rate - number offspring produce over a specific time period

Riparian - located or living along or near a stream, river, or body of water

Scat - fecal material

Scavenger - an organism that habitually feeds on refuse or carrion

Spawning – the act of releasing and fertilizing eggs by aquatic or amphibian animals, such as fish and frogs

Species – a naturally occurring population of organisms that is reproductively isolated from other populations or groups

Species of special concern – a species that is neither threatened nor endangered, but its surviving numbers are so low that if they drop any lower they will become threatened or endangered

Sustainability – maintaining resources in such a way to be able to renew themselves over time or to keep in existence and supply with necessities

Symbiosis – a close living relationship between organisms

Taxonomy – the science of classifying organisms

Temperate – of or relating to moderate climates, between tropical and polar

Terrestrial – living or growing on land

Threatened species - a species whose surviving numbers in certain areas are so low that they are at risk of becoming endangered

Trophic level - a stage in the food chain that is occupied by life forms that feed on the same type

Vernal pool - a temperate pond that exists only during the wet season of the spring, and dries up later, in the growing season

Vertebrate - an animal with an internal bony skeleton

Water cycle - the continuous circulation of water in systems throughout the planet, involving condensation, precipitation, runoff, evaporation, and transpiration

Watershed - the total land area drained by a river system

Wetland - any land area that tends to be regularly wet or flooded

Wildlife – undomesticated species of plants and animals; includes but is not limited to, insects, spiders, birds, reptiles, fish, amphibians, and mammals

Wildlife management – the application of scientific knowledge and technical skills to protect, preserve, conserve, limit, enhance, or extend the value of wildlife and its habitat

Zooplankton - plankton that is composed of tiny, often times microscopic, animals and animal matter.

NOTE: Most of these terms came from

1. Project WILD & Aquatic Project Wild - Education Activity Guide, Council for Environmental Education
2. Pond and Brook - A guide to the Natural Study of Fresh Water Environments
3. The Dictionary of Ecology and Environmental Science; Henry W. Art (ed.), copyright 1993; Henry Holt and Company, Inc.
4. Elements of Ecology – Robert Leo Smith, HarperCollins Publishers, 1992

APPENDICIES

Ecology