-Forest Environment-

Wildlife Ecology

Adapted from the on-line Teachers Guide
http://mff.dsisd.net

MICHIGAN STATE
UNIVERSITY
EXTENSION

WILDLIFE ECOLOGY BASICS

Forest wildlife ecology, in many ways, is synonymous with forest ecology. The forest ecology basics can be reviewed in the Forest Ecology chapter. Wildlife are dependent upon the vegetation that supports them, so changes in vegetation significantly impact wildlife populations. "***Succession***" (see Forest Ecology) is a key principle in wildlife ecology and should be remembered with considering wildlife populations. With each change, there are "winners" and "losers". Humans often equate "good" management and "bad" management to the species of wildlife they "like" or "don't like". Natural resource management increasingly tends to take a landscape perspective to ensure a balance of habitats for all species of wildlife. However, this does not always happen as well as it could because both public and private natural resource policy is not always driven by science! More commonly, it is driven by public opinion as expressed and interpreted by legislators and other decision-makers.

Sections include:

What is Wildlife?
Habitat
Population Dynamics
Cycles
Winter Adaptations
Species Lists

Various aspects of wildlife ecology can be applied to many fundamental curriculum concepts.		
Geometry Geography Biology Location Place Movement Region	History Change Timelines Charts & Graphs Economics Civic Involvement Ecology	Vocabulary Definition Critical Thinking Compare/Contrast Math Functions Relationships Non-linear Thinking
There's much more to wildlife ecology than romance and cute little animals!		

What is Wildlife?

The word "wildlife" is almost a uniquely North American term. Equivalents in other languages are hard to find, but the concept has spread to other countries. Concern about wildlife in America began in earnest in the last half of the 1800s, although the scientific roots can probably be traced to game management of the royal ownerships in Europe. Widespread and uncontrolled logging occurred throughout most of the eastern forests over the course of a century. The rise of conservation included both wildlife and timber resources.

The definition of "wildlife" often includes only vertebrates, particularly popular species such as those that are hunted, trapped, cause problems, or are endangered. Vertebrates are animals with backbones, including birds, mammals, fishes, amphibians, and reptiles. A more expansive definition of wildlife would include all animal lifeforms in an ecosystem, in this case, a forest system. For the most part, this Teacher Guide will view wildlife in terms of vertebrate species.

The term ***"game species"*** refers to an animal that is either hunted or trapped. Michigan lists 115 animals as game species. ***"Non-game species"*** are all the other animals. ***"Endangered and threatened species"*** are a special group of non-game species whose populations are low in either Michigan or the United States. In Michigan, there are ten endangered or threatened forest wildlife species. There is a "***Michigan List***" and a "***Federal List***", both contain many more than ten species, but they include species typical of non-forest habitats. The ***Michigan Natural Features Inventory*** [*http://web4.msue.msu.edu/mnfi*] keeps track of all these species and designations. An ***"extinct"*** species is one that can no longer be found *anywhere* in the world. An ***"extirpated"*** species is one that no longer occurs in a place (such as a state or region) where it once used to.

Michigan Forest Vertebrates That Are Threatened or Endangered

Osprey
Bald Eagle
Red-Shouldered Hawk
Merlin
Long-Eared Owl
Yellow-Throated Warbler
Kirtland's Warbler
Gray Wolf
Marten
Northern Copperbelly Snake

Michigan has about ***575 species*** of vertebrates (see tables at chapter end). Each has a unique set of habitat preferences and requirements. These habitat preferences and requirements change during the life cycle of most species, and many change with the season. Computing all the variables would result in an almost limitless number of habitat combinations. Managing for every species in every conceivable situation is an impossible task, even assuming we knew all the variables, which we do not.
For the most part, wildlife are managed by communities. Single species are not usually the primary focus of a management plan in an area or region. Notable exceptions include species such as white-tailed deer, Canada geese, ruffed grouse, bald eagles, and Kirtland's warblers. Populations of many game species are directly managed through hunting and trapping regulations. Habitat for some endangered and threatened

species is sometimes managed exclusively for that species. In other cases, restrictions on activities are prescribed by law, such as the prohibition of certain practices during a certain time period (usually breeding season), within a stated distance or area.

Numbers of Michigan Wildlife by Taxonomic Group	
Birds	*306*
Fish	*146*
Mammals	*68*
Reptiles	*30*
Amphibians	*25*
Total Vertebrates	*575*
Insects	*15,000-20,000*
Snails	*195*
Mollusks	*79*
Other Taxa	*????*
Forest Species	*224*

Rather than direct management of a species population, *habitat* is managed for as much diversity as possible, with the explicit assumption that by providing as many alternatives as possible, each species of wildlife will find what it needs to maintain a viable population. Because habitat management is largely a matter vegetation management, forest management is also wildlife management. Actions by foresters, farmers, and other folks have affected wildlife populations more than professional wildlife managers. However, wildlife biologists now co-manage many public and private lands. This is one of the primary reasons why habitat considerations, at both the stand level and landscape level, are so important in forest management.

Does this "habitat diversity" management technique work? Probably. Since forest management became common in Michigan (perhaps within the last 50 years), no wildlife species has been lost from Michigan's forests . . . that we know of.

Habitat

Many schools introduce the idea of ***"habitat"*** at the fourth or fifth grade level. Habitat features can be expressed in five categories.

- Site Quality
- Space and Home Range
- Food & Water
- Shelter
- Variability

Number of Michigan Forest Vertebrate Species by General Habitats

Topographical Position	Deciduous (Hardwoods)	Conifers (Softwoods)	Mixed Forest	All Forest
Upland	155	116	157	200
Lowland	108	101	66	158
Total Species	182	146	171	224

In Michigan, there are about 224 forest vertebrates.
There are about 10 endangered or threatened forest vertebrates.
Note: Columns and rows do not add up to the "totals" because many species frequent multiple habitat types. Totals refer to the number" of different species in each category. Source: Michigan DNR

"Site quality" incorporates factors such as soil, topography, climate extremes, precipitation, and drought frequency. Each of these factors are fairly easy to measure and evaluation. Productivity of a given site will vary according the specific combination

of site factors. Sites that produce high amounts of biomass, will generally support more wildlife species and larger populations than poor quality sites.

Every species has a minimum ***"space"*** requirement. Space is needed to obtain life's necessities. A large predator, such a wolf, needs more space in which to meet it's needs than a field mouse. ***"Home range"*** is the area within which an animal will feel comfortable, and is some cases, actively defend. The amount of space and the size of a home range of a particular species will vary with the season and sometimes by gender. This particular true during the breeding season and during winter vs. summer months. Many species acquire basic necessities from multiple forest and vegetation types. The relative proximity of these different types is an important habitat feature.

"Food and water" are obvious needs of every living thing. During the course of a year, availability and quality of food and water can change dramatically. Wildlife, not just birds, will often migrate to avoid lean times. Others might hibernate or undergo other metabolic changes. White-tailed deer have different sets of digestive enzymes to accommodate the changes in browse. Frogs may spend the winter buried in pond muck. During frozen months, locating liquid water can be a challenge.

"Shelter" is needed for a variety of purposes. The first to come to mind is protection against adverse weather. Shelter is also needed to escape predators. Young grouse and beaver are expelled from their parents home range in the fall when food begins to grow scarce. The young animals must find new suitable habitat. This search usually makes them much more vulnerable to predation and severe weather. Shelter or specific habitat conditions are also needed for courtship displays, nesting, rearing young, and roosting or loafing. Male woodcock have fairly specific requirements for their dancing grounds and performing their sky dance.

"Variability" of habitat quality and habitat needs makes management difficult, as discussed above. Wildlife needs vary with the season and life stage of a species. Additionally, all species have preferred habitat and minimum habitat conditions. For example, a population may do best in a collection of aspen types, but if adequate amounts of aspen are unavailable, the species will use alternatives and get by, until some environmental extreme occurs, such as a very cold winter. A species that is flexible in its habitat adaptability is sometimes called a ***"generalist"***. A species with a rather narrow and specific range of requirements may experience severe population fluctuations with changes in the environment. These species are referred to as ***"specialists".*** Species that are very sensitive to certain environmental changes are sometimes used as ***"indicator species"***. These species clue wildlife managers into subtle environmental conditions and changes that would otherwise be difficult to measure or assess. For instance, the presence and abundance of stonefly and caddisfly larvae in streams will tell us much about the conditions in that stream and the adjacent upland habitat.

In forest management, wildlife habitat ranks high on the list of desired objectives. However, the area of some of the most endangered forest habitats, young early

successional forests, is declining. These habitats also harbor some of the rarest forest wildlife species. Keep in perspective, of course, that most threatened and endangered species are from non-forest habitats. Many people tend to place emphasis on older forests with big trees . . . usually later stages of succession. The decline of young early successional forests (not just forests of young trees) with its complement of shrubs, understory flora, and small early successional tree species have begun to catch the eye of researchers and ecologists. These tend to be "waste places" and not regarded as valuable habitat by many viewers. However, these kinds of forests are becoming increasingly important refugia for a number of special species. Because research has yet to yield much of the habitat requirements for all wildlife, forest managers tend to think in landscape terms and provide as much diversity in composition and structure as possible. Beauty is often in the eye of beholder and, unfortunately, some valuable habitat types rank low on the visual scales of many forest visitors.

Population Dynamics

A wildlife population is a group of individuals of the same species that have some basis of commonality. We can talk about the population of white-tailed deer in a geographic region; or the population of sticklebacks in a particular stream. Populations can be linked to a feature in the landscape, to other populations, a time period, or other criteria. Wildlife populations have inherent qualities that help in defining the welfare of various species.

Age Structure	Interspecific Dynamics
Lifespan	Intraspecific Dynamics
Sex Ratio	Territoriality & Home Range
Natality & Mortality	Migrations
	Carrying Capacity

Age Structure: The proportional amounts of young and old age classes reveal much about a population. There should be some kind of balance among the classes and the "proper" balance will vary by species and season. Generally, the age structure can be depicted by a triangle, with the numerous young on the bottom and the very few oldsters at the top. "Age" might be measured in years, weeks, or days, depending upon the species considered. At the end of the food-rich season, the youngest age classes are usually swollen. The winter will kill many individuals, but the usually the young and very old experience the highest mortality rates. Humans sometimes have a strong impact on the age structure of a population. White-tailed deer have few animals beyond 4.5 or 5.5 years largely because of hunting pressure, although an individual is capable of living a decade or more. A heavily fished lake may reduce the number of sizable (aka older) adults to the point where breeding might be reduced.

Lifespan: Obviously, different species have different lifespans. Most insects complete their life cycles during the warm season. Some have multiple generations during that time. Other species live for years and individuals must have adaptations and adequate habitat to survive regular periods of food-shortages and inclement weather. Species toward the end of food chains are usually much longer-lived that those in the beginning. Long-lived species have strategies that favor the survival of fewer individuals. Shorter-lived species generally utilize the opposite strategy. The combination of lifespan and age structure reveal much about the general health of a population, either a wildlife population or a stand of trees.

Sex Ratio: Each species has an "ideal" sex ratio. Usually this is somewhere around 50:50, but not necessarily. Honeybees, for example, have almost no males. A particular sex ratio will help maximize ***"fecundity"***, or the ability of a species to produce new individuals. Males of some species will mate with as many females as possible. Other species, such as swans and geese, tend to be more monogamous.

Natality and Mortality: Natality is the inherent ability of a population to increase in numbers. Mortality deals with the level of death within a population. These terms are usually expressed as *rates* that reflect pressures to increase and decrease population size. The size of a population is impacted by many factors, which vary over time. At a particular point in time, natality factors or mortality factors may dominate, causing a population to increase or decrease. Some factors are fairly predictable, such as the average clutch/litter size or the onset of winter. Other factors, such as extreme weather events or disease epidemics, can have great impacts but are not predictable.

Interspecific Dynamics: These are relationships *among* or *between* species. The ***predator-prey*** relationship is a well-known example of an *inter*specfic dynamic. Interspecific dynamics can be antagonistic or beneficial. Lichens are two species (an algae and a fungus) working in concert to the benefit of both. This is called a ***"mutualistic"*** relationship. A ***"commensal"*** relationship is where one species requires another, but the host is relatively unaffected. Another kind of interspecific relationship would be ***parasitic***. Mosquitoes draw blood essential to the completion of their life cycle, at the expense of another species. Species that *require* something from another species are termed ***"obligate"***. When the relationship is beneficial but not *required,* it is termed ***"facultative"***.

Intraspecific Dynamics: There are relationships among individuals of a population. Competition for food, shelter, and other requirements are common examples. Mating and establishing territories are other examples. A species might be colonial in nature or live primarily as individuals. There are many life strategies.

Territoriality and Home Range: An individual or population of a species may actively mark and/or defend a particular area. The male robin that challenges anything resembling another male robin is expressing ***"territoriality"***. A ***"home range"*** is the amount of space an animal needs acquire the resources to meet its needs. A predator such as a wolf may have a home range of many square miles, while an earthworm has

almost none. The *amount* of area for either a territory or home range is not necessarily constant. It often varies with the season. After the breeding season, male robins resume a gregarious nature. Ruffed grouse will "expel" their young before the onset of winter because winter home ranges are larger than summer home ranges. The young animals must seek their own new habitat.

Migration: Winters and dry seasons result in less available food and water. Animals have a wide range of strategies to accommodate these seasonal fluctuations. Migration is one such strategy. Autumn bird migration is the most familiar. Many species of birds fly south more because of food shortages, rather than cold temperatures. Bald eagles, which normally migrate, will remain a winter resident if a food source is available. Other animals, besides birds, will migrate. Deer and other "ungulates" move between winter and summer ranges. Many fish species will seek out different waters with the season. Monarch butterflies move to Mexico. Not all migrators leave Michigan for better climates. Some actually come *to* Michigan! Chickadees, snow buntings, and great gray owls regularly arrive from more northern latitudes to become winter residents in our state.

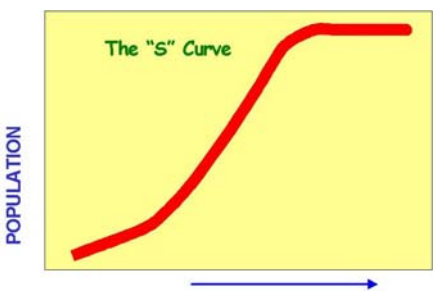
Carrying Capacity: The physical and biological resources of an area, varying with the season, will support only so many individuals. This maximum amount called the ***"carrying capacity"***. When most species approach their particular carrying capacity, mortality factors overtake natality factors and the population growth declines. For some species, this ecological balancing-act is fairly regulated without great fluctuations. With other species, there is a normal "boom and bust" cycle. Ruffed grouse and snowshoe hare populations are good examples. There are a few species that can maintain high population densities long enough to actually damage their habitat and substantially reduce the carrying capacity. Deer and moose are classic examples of species than can damage their habitat. Humans may very well fall into this category, as well.

Cycles

The size of wildlife populations sometimes display cycles of highs and lows over time. There are four basic cycles to consider.

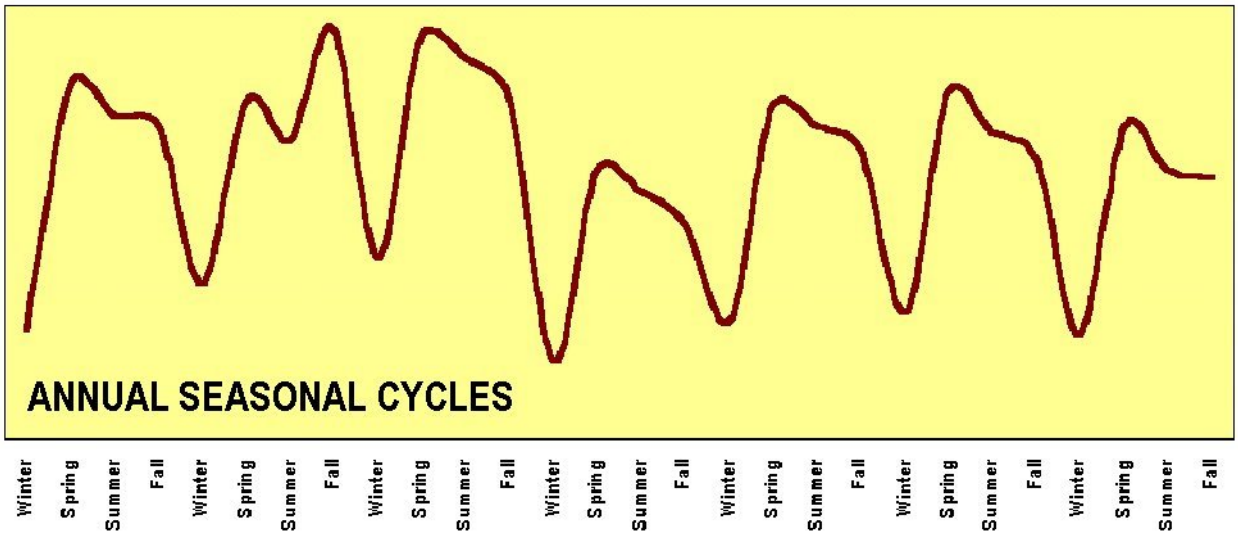
1. The Theoretical Growth Curve

All populations have a tendency to increase. Continued increases are checked by environmental limiting factors. Many populations, especially small animals such as insects or rodents, increase exponentially. Population size will then reach a plateau or crash. The numbers of bacteria in a petri dish will increase slowly at first, then expand very rapidly until the food is gone or toxins produced reach lethal levels. This curve is often referred to the ***"S-curve"***.



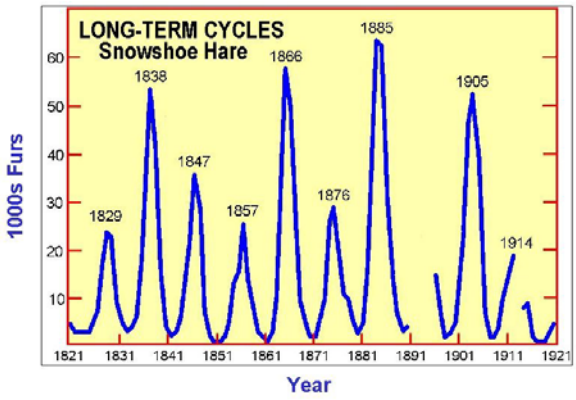
2. Annual Cycles

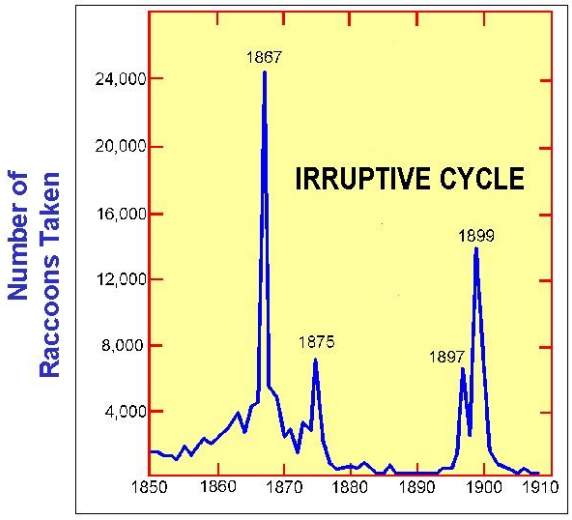
Most species will experience annual population highs and lows based on the seasons. The winter season or dry season are when food and water become most limiting. The end of the breeding season is when populations tend to peak.



3. Short and Long Term Cycles

For a complex of reasons, sometimes not understood, populations display regular cycles over a number years. Ruffed grouse are well-know for their ten-year cycles. Trapping records suggest that Canada lynx and snowshoe hare have parallel ten-year cycles, although some biologists have questioned the data analysis. Lemmings are famous for their four-year cycles with such large numbers during peaks that farms and towns become invaded. Every 10-12 years forest tent caterpillars will defoliate large expanses of hardwood forests in Michigan. On longer cycle, roughly 30-40 years, the same relationship is found between spruce budworm and balsam fir.





4. Irregular or Irruptive Cycles

These are major changes in the populations level of a species that occur without any particular pattern. Strong weather or climate events, such as a hurricane or drought, may cause a crash. In other cases, the causes cannot be known for certain. Why did

Canadian raccoons populations reach peak at six times their normal, steady-state level in 1867? Why did a South American rodent population inexplicable crash, upsetting the ecology of large region? Why did the mule deer population of the Kaibab Plateau in Arizona go through the roof around 1920, emaciate the habitat, reduce the carrying capacity of the land, then crash? Even more peculiar, why did mule deer populations near the Kaibob *not* experience such an event?

Winter Adaptations

In the north, winter is period of lean resources and a challenging environment. Animals survive by employing one or more adaptive strategies; 1) migration & movement, 2) dormancy, or 3) toughing it out. The complexity and variation of adaptations is tremendous. A more thorough study of how animals respond to their environment is an incredible journey into chemistry, morphology, physiology, and many other fields of study.

Winter is the most stressful time of year in the north for most forms of life. The key hardships are a lack of food and cold temperatures. However, don't let a reduction in activity appear as if there is nothing going on in the woods!

A lack of food occurs for at least two reasons, both related to low temperatures. The first reason has to do with a reduction in active plant life. Plants, of course, are the sources of nearly all food chains. The second reason has to do with availability. For many animals, food sources are buried under snow or ice. Deep snow is not a problem for all creatures. To field mice, it is a protective layer against most predators. To predators, deep snow means a time of going hungry.

Specialized adaptation to winter involves exploring chemistry, physics, and animal behavior. Managing an energy budget is the key to survival. There are many ways to manage this budget, primarily through combinations of physical attributes (morphology, habitat, and behavior) and physiological capabilities (body chemistry and metabolic controls).

How Do Animals Respond to Cold Winters?

There are three main strategies to surviving inclement conditions, migration, dormancy, and toughing it out. Each species is suited to a particular variant of one strategy or the other, or a combination of strategic elements.

1. Migration and Movement. Many species migrate between seasons. Some, such as the arctic tern, travel 10,000 miles between winter and summer habitats. It's difficult to ignore the migration of geese, cranes, and ducks . . . and difficult to believe that monarch butterflies actually migrate

to Mexico. How in the world do tiny hummingbirds fly all the way across the Gulf of Mexico? The return of the colorful and vociferous warblers becomes obvious in the Spring, but their departure in the Fall is generally missed. The first Spring bluebird is noted by many . . . but few can mark their departure date.

Migration is not always a dramatic, long-distance affair. Other species, such as white-tailed deer, move to areas that are more survivable. Deer pretty much vacate the Lake Superior watershed during the deep snow season. Biologists have been able to track some of these migration patterns in the U.P. Reptiles and amphibians move to protected places underground or under water to avoid freezing temperatures. Fishes will move to different waters. More recently, most of us noted the indoor migration of the Asian ladybird beetle!

For those people who prefer to be indoors most of the winter, the outdoors may appear to be uniformly cold and uncomfortable. However, there are many microclimates where winter stress is significantly lower. Logs, caves, holes, dead trees, spruce and cedar stands, under snow, and human structures are examples of places that provide shelter from winter extremes. These are critical places for wildlife.

Not all migrators leave Michigan, either. Some actually migrate *TO Michigan* for the winter or on a cyclical basis! Chickadees and great gray owls are two good examples. The playful, curious, and nearly fearless whisky-jack makes its presence well-known at camps and many winter feeders. During lows in the snowshoe hare population cycles, Canada lynx may roam into the U.P. in search of food. We need to remember that our winters are not as severe as we sometimes boast about. There is a large land mass to our north where winters are considerably longer and colder!

2. Dormancy. There are several forms of dormancy as the taxonomic groups are surveyed. Definitions are difficult due to the many variations of dormancy. There has been a lot of research into how animals cope with inclement weather, winter in this case.

Torpidity is a controlled reduction of body metabolism, evidenced by low oxygen consumption rates and lower body temperatures. A key part of the definition is accurate metabolic control. It is a phenomenon restricted to warm-blooded animals. Cold-blooded animals experience different physiology in response to adverse conditions. Some animals will undergo daily states of torpidity as a response to a lack of food and in combination with other environmental conditions. Other species undergo seasonal torpidity. In the north, **hibernation** is the most dramatic form. Torpidity is not restricted to northern species and can be found in the tropics, too. **Estivation** is a kind of torpidity in very hot and dry conditions.

Many northern species undergo metabolic changes that allow them to "sleep" through the winter. Sleep, of course, is not what they do, but torpor can superficially appear that way. The most advanced form of torpor is hibernation. Hibernation is quite complex and fascinating. Although definitions are evasive, hibernation is a *controlled* significant

drop in metabolism to a selected level, although the term hibernation is sometimes used for cold-blooded animals and any form of winter dormancy. Chipmunks, certain mice, ground squirrels, and groundhogs are examples of true hibernators. Their body temperatures are maintained a few degrees above their ambient environment, which is usually in a place protected from weather extremes. Hibernators are usually small animals because small animals have high rates of metabolism to begin with. Increases in these already high rates of metabolism in order to maintain body temperature comes at a metabolic cost that is just too high for some species.

True hibernators cannot be easily "woken up". They are largely unresponsive to external stimuli. Generally they maintain only a sufficient amount of specialized fat reserves to carry them through the winter season and arouse them during the late winter or early spring. Arousal is a very expensive metabolic process that they can usually afford to do only a few times, sometimes only once. Bears do not hibernate, although this continues to be argued. Their body temperatures drop only a few degrees and metabolism is reduced to only moderate rates. Female bears give birth during the winter, something that would not be possible for a true hibernator. Lastly, bears can easily be aroused in the winter and then drop back into a state of torpidity. Don't be fooled by a "hibernating" bear in its den!

Dormancy in cold-blooded animals is a reduced state of metabolic activity largely controlled by environmental conditions. Cold-blooded animals must become dormant during the winter because they lack the internal control over their metabolism. Many seek sheltered places and undergo chemical changes to prevent their tissues from freezing. Others can tolerate certain levels of ice between cells, commonly in tandem with chemical changes. Spring peepers, chorus frogs, gray tree frogs, and wood frogs tolerate and regulate a frozen state. Good snow cover is essential to survival, as they overwinter under leaf litter on the forest floor. These frogs thaw out in the spring, which is why we hear them sing so early in the season on those increasingly warm evenings.

Insects overwinter as eggs, pupae, or adults. Dormancy is often coupled with specialized chemical adaptations to help survive the winter season. Some have the ability to resist freezing, others can tolerate freezing to certain degrees. There are also insects that can employ either strategy. Chemicals associated with dormancy are sugars and certain alcohols such as glycerol, sorbitol, mannitol, and ethylene glycol.

Plants also experience dormancy but cannot relocate to sheltered places, other than reverting to seeds on the ground and roots under the ground. Tree adaptations are covered in the Tree Physiology chapter.

3. Toughing It Out. Winter remains an active time of the year because many species have adapted to active lifestyles during the winter. Cold-blooded animals (amphibian, reptiles, and insects) must find sheltered places where they can ride out the winter without freezing and being eaten by predators. Fish continue to be active (as ice-fishers know!) but often at a reduced rate. For some species, the winter energy equation is

always negative, meaning they cannot consume or conserve enough energy to survive the winter. While consumption and conservation are critical, these species must rely on fat reserves and their margin for survival is often slim. This is part of the reason why long and severe winters can take a heavy toll on wildlife populations whose northern range occurs in Michigan.

There is a wide array of morphological, physiological, and behavioral adaptations for winter survival. A few examples are provided below, but investigations into the lives of active winter animals will reveal many combinations of survival strategies.

- Bergmann's Rule states that northern species of a particular genus or similar class of birds or mammals tend to be larger in size, although this is not always true. Larger body size means a higher body mass-to-surface area ratio. It's easier to retain heat. Polar bears are larger than tropical bears. White-tailed deer in Michigan dress out at higher weights than their counterparts in Texas or Florida.
- Body appendages tend to get smaller in the north, as a heat conservation measure. Snowshoe hares have smaller ears that cottontail rabbits. Mammalian legs and snouts are frequently shorter and stouter.
- Specialized fat, called brown fat, is produced during the food-rich seasons and expended during cold seasons. This is also the kind of fat that most hibernators use for arousal and many migrators use for fuel.
- Various "heat exchange" mechanisms can be found in animal circulatory systems that reduce heat loss to body extremities.
- Certain fish and herptiles produce chemicals within and between cell walls that can lower their freezing temperature a few degrees. In sheltered environmental niches, these few degrees can mean the difference between life and death.
- Some mammals, such as flying squirrels and small rodents, will occupy collective dens to conserve body heat, even though some species are non-colonial during the warm season. This is part of the reason that some species of snakes will do the same thing.
- Food preferences change with the season. Some browsers, such as white-tailed deer, have changes in digestive enzymes to cope with the different food sources. This is one of the reasons why biologists argue against winter deer feeding. If not done correctly, a deer can starve to death with a belly full of corn.
- Ruffed grouse "snow roost" during periods of extreme cold. Snow provides a very effective barrier against severe cold. They will rest under the snow until the severe weather passes. Folks who snowshoe or cross-country ski too close to these snow roosts are often caught off-guard when a grouse explodes out of the snow. Large piles of grouse droppings are spring-time indicators of how severe the winter was.
- Aquatic mammals, such as otter and mink, grow thick layers of insulating fat and have specialized fur. Similarly, ducks, geese, and swans have feathers and oil glands that keep water away from the skin. Some have efficient circulatory heat exchangers between the body and the feet. It's usually not the cold that causes waterfowl to migrate. It's more a matter of food shortages.

- Birds and mammals undergo seasonal changes in feathers and pelage. Trappers know that winter pelts are the highest quality because they are thicker and have different kinds of hair.
- Muskrats and beaver construct shelters, partly for protection from severe weather. A number of animals dig burrows, such as groundhogs, foxes, chipmunks, and moles.
- Many species of birds can adjust their internal body temperature downward to reduce the temperature gradient with environmental temperatures, thus reducing heat loss. They also tend to shiver a lot to maintain body temperatures.

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LISTS, LISTS, and MORE LISTS

The following lists were derived from a number of sources, including published resources, and observations by biologists and natural resource managers. They are not necessarily complete and alternative sources may have different listings. That's the reason the exact number of species will vary from source to source. The purpose of these lists is to make the point that there are MANY vertebrate species in Michigan, most of which we have probably not even heard of before. Furthermore, vertebrates comprise only a few of the many taxonomic groups!

Michigan is host to thousands or tens of thousands of species of animals. Each species has a set of habitat requirements. A diversity of habitat will benefit the most number of species, although we need to remember that some species benefit from less diverse landscapes. For every rule, there is nearly always a few exceptions.

The majority of these vertebrate species are dependent upon the forest in one way or another, even if indirectly. Indirect use would include most of our inland fish species, for example, as water quality is influenced by forest cover. Another example of occasional use would be a belted kingfisher, which uses shoreline and riverbank branches to perch upon; or an otter or mink which can often be seen in woodland settings.

Below are individual tables for five groups of vertebrates; Birds, Fishes, Mammals, Reptiles, and Amphibians.

BIRDS– **306 Species** (part 1 of 6)

Family	**SPECIES**	Genus	Species
Gaviidae	RED-THROATED LOON	*Gavia*	*stellata*
	COMMON LOON	*Gavia*	*immer*
Podicipediformes	PIED-BILLED GREBE	*Podilymbus*	*podiceps*
	HORNED GREBE	*Podiceps*	*auritus*
	RED-NECKED GREBE	*Podiceps*	*grisegena*
Podicipedidae	EARED GREBE	*Podiceps*	*nigricollis*
Pelicanidae	WHITE PELICAN	*Pelecanus*	*erythrorhyncos*
Phalacrocoracidae	DOUBLE-CRESTED CORMORANT	*Phalacrocorax*	*auritus*
Ardeidae	AMERICAN BITTERN	*Botaurus*	*lentiginosus*
	LEAST BITTERN	*Ixobrychus*	*exilis*
	GREAT-BLUE HERON	*Ardea*	*herodias*
	GREAT EGRET	*Ardea*	*alba*
	SNOWY EGRET	*Egretta*	*thula*
	LITTLE BLUE HERON	*Egretta*	*caerulea*
	CATTLE EGRET	*Bubulcus*	*ibis*
	GREEN HERON	*Butorides*	*virescens*
	BLACK-CROWNED NIGHT HERON	*Nycticorax*	*nycticorax*
Anatidae	GREATER WHITE-FRONTED GOOSE	*Anser*	*albifrons*
	SNOW GOOSE	*Chen*	*caerulescens*
	CANADA GOOSE	*Branta*	*canadensis*
	MUTE SWAN	*Cygnus*	*olor*
	TRUMPETER SWAN	*Cygnus*	*buccinator*
	TUNDRA SWAN	*Cygnus*	*columbianus*
	WOOD DUCK	*Aix*	*sponsa*
	GADWALL	*Anas*	*strepera*
	AMERICAN WIDGEON	*Anas*	*americana*
	AMERICAN BLACK DUCK	*Anas*	*rubripes*
	MALLARD	*Anas*	*platyrhyncos*
	BLUE-WING TEAL	*Anas*	*discors*
	NORTHERN SHOVELER	*Anas*	*clypeata*
	NORTHERN PINTAIL	*Anas*	*acuta*
	GREEN-WING TEAL	*Anas*	*crecca*
	CANVASBACK	*Aythya*	*valisineria*
	REDHEAD	*Aythya*	*americana*
	RING-NECKED DUCK	*Aythya*	*collaris*
	GREATER SCAUP	*Aythya*	*marila*
	LESSER SCAUP	*Aythya*	*affinis*
	HARLEQUIN DUCK	*Histrionicus*	*histrionicus*
	SURF SCOTER	*Melanitta*	*perspicillata*
	WHITE-WINGED SCOTER	*Melanitta*	*fusca*
	BLACK SCOTER	*Melanitta*	*nigra*
	OLD SQAUW	*Clangula*	*hyemalis*

Birds, continued (table 2 of 7)

Family	SPECIES	Genus	Species
Anatidae	BUFFLEHEAD	*Bucephala*	*albeola*
	COMMON GOLDENEYE	*Bucephala*	*clangula*
	HOODED MERGANSER	*Lophodytes*	*cucullatus*
	COMMON MERGANSER	*Mergus*	*merganser*
	RED-BREASTED MERGANSER	*Mergus*	*serrator*
	RUDDY DUCK	*Oxyura*	*jamaicensis*
Cathartidae	TURKEY VULTURE	*Cathartes*	*aura*
Accipitridae	OSPREY	*Pandion*	*haliaetus*
	BALD EAGLE	*Haliaeetus*	*leucocephalus*
	NORTHERN HARRIER	*Circus*	*cyaneus*
	SHARP-SHINNED HAWK	*Accipiter*	*striatus*
	COOPER'S HAWK	*Accipiter*	*cooperii*
	NORTHERN GOSHAWK	*Accipiter*	*gentilis*
	RED-SHOLDERED HAWK	*Buteo*	*lineatus*
	BROAD WING HAWK	*Buteo*	*platypterus*
	SWAINSON'S HAWK	*Buteo*	*swainsoni*
	RED-TAILED HAWK	*Buteo*	*jamaicensis*
	ROUGH-LEGGED HAWK	*Buteo*	*lagopus*
	GOLDEN EAGLE	*Aquila*	*chrysaetos*
Falconidae	AMERICAN KESTREL	*Falco*	*sparverius*
	MERLIN	*Falco*	*columbarius*
	GYRFALCON	*Falco*	*rusticolus*
	PEREGRINE FALCON	*Falco*	*peregrinus*
Phasianidae	RING-NECKED PHEASANT	*Phasianus*	*colchicus*
	SPRUCE GROUSE	*Falcipennis*	*canadensis*
	RUFFED GROUSE	*Bonasa*	*umbellus*
	SHARP-TAILED GROUSE	*Tympanuchus*	*phasianellus*
	WILD TURKEY	*Meleagris*	*gallopavo*
	NORTHERN BOBWHITE	*Colinus*	*virginianus*
Rallidae	KING RAIL	*Rallus*	*elegans*
	VIRGINIA RAIL	*Rallus*	*limicola*
	SORA	*Porzana*	*carolina*
	YELLOW RAIL	*Coturnicops*	*noveboracensis*
	COMMON MOORHEN	*Gallinula*	*chloropus*
	AMERICAN COOT	*Fulica*	*americana*
Gruidae	SANDHILL CRANE	*Grus*	*canadensis*
Charadriidae	BLACK-BELLIED PLOVER	*Pluvialis*	*squatarola*
	SEMI-PALMATED PLOVER	*Charadrius*	*semipalmatus*
	PIPING PLOVER	*Charadrius*	*melodus*
	GOLDEN PLOVER	*Pluvialis*	*dominica*
	KILLDEER	*Charadrius*	*vociferus*
Recurvirostridae	AMERICAN AVOCET	*Recurvirostra*	*americana*
Scolopacidae	GREATER YELLOWLEGS	*Tringa*	*melanoleuca*
	LESSER YELLOWLEGS	*Tringa*	*flavipes*
	SPOTTED SANDPIPER	*Actitus*	*macularia*
	SOLITARY SANDPIPER	*Tringa*	*solitaria*
	UPLAND SANDPIPER	*Bartramia*	*longicauda*
	WILLET	*Catoptrophorus*	*semipalmatus*
	WHIMBREL	*Numenius*	*phaeopus*
	HUDSONIAN GODWIT	*Limosa*	*haemastica*
	MARBLED GODWIT	*Limosa*	*fedoa*

Family	**SPECIES**	Genus	Species
Scolopacidae	RUDDY TURNSTONE	*Arenaria*	*interpres*
	RED KNOT	*Calidris*	*canutus*
	SANDERLING	*Calidris*	*alba*
	SEMI-PALMATED SANDPIPER	*Calidris*	*pusilla*
	WESTERN SANDPIPER	*Calidris*	*mauri*
	PECTORAL SANDPIPER	*Calidris*	*melanotos*
	WHITE-RUMPED SANDPIPER	*Calidris*	*fuscicollis*
	BAIRD'S SANDPIPER	*Calidris*	*bairdii*
	LEAST SANDPIPER	*Calidris*	*minutilla*
	PURPLE SANDPIPER	*Calidris*	*maritima*
	DUNLIN	*Calidris*	*alpina*
	STILT SANDPIPER	*Calidris*	*himantopus*
	BUFF-BREASTED SANDPIPER	*Tryngites*	*subruficollis*
	SHORT-BILLED DOWITCHER	*Limnodromus*	*griseus*
	LONG-BILLED DOWITCHER	*Limnodromus*	*scolopaceus*
	COMMON SNIPE	*Gallinago*	*gallinago*
	AMERICAN WOODCOCK	*Scolopax*	*minor*
	WILSON'S PHALAROPE	*Phalaropus*	*tricolor*
	RED-NECKED PHALAROPE	*Phalaropus*	*lobatus*
	RED PHALAROPE	*Phalaropus*	*fulicaria*
Laridae	POMARINE JAEGER	*Stercorarius*	*pomarinus*
	PARASITIC JAEGER	*Stercorarius*	*parasiticus*
	LAUGHING GULL	*Larus*	*atricilla*
	FRANKLIN'S GULL	*Larus*	*pipixcan*
	LITTLE GULL	*Larus*	*minutus*
	RING-BILLED GULL	*Larus*	*delawarensis*
	HERRING GULL	*Larus*	*argentatus*
	BONAPARTE'S GULL	*Larus*	*philadelphia*
	THAYER'S GULL	*Larus*	*thayeri*
	ICELAND GULL	*Larus*	*glaucoides*
	LESSER BLACK-BACKED BULL	*Larus*	*fuscus*
	GLAUCOUS GULL	*Larus*	*hyperboreus*
	GREAT BLACK-BACKED GULL	*Larus*	*marinus*
	SABINE'S GULL	*Xema*	*sabini*
	BLACK-BACKED KITTWAKE	*Rissa*	*tridactyla*
	CASPIAN TERN	*Sterna*	*caspia*
	COMMON TERN	*Sterna*	*hirundo*
	FORSTER'S TERN	*Sterna*	*forsteri*
	BLACK TERN	*Chlidonias*	*niger*
Columbidae	ROCK DOVE	*Columba*	*livia*
	MORNING DOVE	*Zenaida*	*macroura*
Cuculidae	BLACK-BILLED CUCKOO	*Coccyzus*	*erythropthalmus*
	YELLOW-BILLED CUCKOO	*Coccyzus*	*americanus*
Tytonidae	BARN OWL	*Tyto*	*alba*
Strigidae	EASTERN SCREECH-OWL	*Otus*	*asio*
	GREAT HORNED OWL	*Bubo*	*virginianus*
	BARRED OWL	*Strix*	*varia*
	LONG-EARED OWL	*Asio*	*otus*
	SHORT-EARED OWL	*Asio*	*flammeus*
	SNOWY OWL	*Nyctea*	*scandiaca*
	NORTHERN HAWK OWL	*Surnia*	*ulula*

Birds, continued (table 4 of 7)

Family	SPECIES	Genus	Species
Strigidae	BOREAL OWL	*Aegolius*	*funereus*
	GREAT-GREY OWL	*Strix*	*nebulosa*
	NORTHERN SAW-WHET OWL	*Aegolius*	*acadicus*
Caprimulgidae	COMMON NIGHTHAWK	*Chordeiles*	*minor*
	WHIP-POOR-WILL	*Caprimulgus*	*vociferus*
Apodidae	CHIMNEY SWIFT	*Chaetura*	*pelagica*
Trochilidae	RUBY-THROATED HUMMINGBIRD	*Archilochus*	*colubris*
Alcedinidae	BELTED KINGFISHER	*Ceryle*	*alcyon*
Picidae	RED-HEADED WOODPECKER	*Melanerpes*	*erythrocephalus*
	RED-BELLIED WOODPECKER	*Melanerpes*	*carolinus*
	YELLOW-BELLIED SAPSUCKER	*Sphyrapicus*	*varius*
	DOWNY WOODPECKER	*Picoides*	*pubescens*
	HAIRY WOODPECKER	*Picoides*	*villosus*
	BLACK-BACKED WOODPECKER	*Picoides*	*arcticus*
	NORTHERN FLICKER	*Colaptes*	*auratus*
	PILEATED WOODPECKER	*Dryocopus*	*pileatus*
Tyrannidae	OLIVE-SIDED FLYCATCHER	*Contopus*	*cooperi*
	EASTERN WOOD PEWEE	*Contopus*	*virens*
	YELLOW-BELLIED FLYCATCHER	*Empidonax*	*flaviventris*
	ACADIAN FLYCATCHER	*Empidonax*	*virescens*
	ALDER FLYCATCHER	*Empidonax*	*alnorum*
	WILLOW FLYCATHER	*Empidonax*	*traillii*
	LEAST FLYCATCHER	*Empidonax*	*minimus*
	EASTERN PHOEBE	*Sayornis*	*phoebe*
	GREAT CRESTED FLYCATCHER	*Myiarchus*	*crinitus*
	WESTERN KINGBIRD	*Tyrannus*	*verticalis*
	EASTERN KINGBIRD	*Tyrannus*	*tyrannus*
Laniidae	LOGGERHEAD SHRIKE	*Lanius*	*ludovicianus*
	NORTHERN SHRIKE	*Lanius*	*excubitor*
Vireonidae	WHITE-EYED VIREO	*Vireo*	*griseus*
	BLUE-HEADED VIREO (solitary)	*Vireo*	*solitarius*
	YELLOW-THROATED VIREO	*Vireo*	*flavifrons*
	WARBLING VIREO	*Vireo*	*gilvus*
	PHILADELPHIA VIREO	*Vireo*	*philadelphicus*
	RED-EYED VIREO	*Vireo*	*olivaceus*
Corvidae	GRAY JAY	*Perisoreus*	*canadensis*
	BLUE JAY	*Cyanocitta*	*cristata*
	AMERICAN CROW	*Corvus*	*brachyrhynchos*
	COMMON RAVEN	*Corvus*	*corax*
Alaudidae	HORNED LARK	*Eremophila*	*alpestris*
Hirundinidae	PURPLE MARTIN	*Progne*	*subis*
	TREE SWALLOW	*Tachycineta*	*bicolor*
	ROUGH-WINGED SWALLOW	*Stelgidopteryx*	*serripennis*
	BANK SWALLOW	*Riparia*	*riparia*
	CLIFF SWALLOW	*Petrochelidon*	*pyrrhonota*
	BARN SWALLOW	*Hirundo*	*rustica*
Paridae	BLACK-CAPPED CHICKADEE	*Poecile*	*atricapillus*
	BOREAL CHICKADEE	*Poecile*	*hudsonicus*
	TUFTED TITMOUSE	*Baeolophus*	*bicolor*
Sittidae	RED-BREASTED NUTHATCH	*Sitta*	*canadensis*
	WHITE-BREASTED NUTHATCH	*Sitta*	*carolinensis*
Certhriidae	BROWN CREEPER	*Certhia*	*americana*

Birds, continued (table 5 of 7)

Family	SPECIES	Genus	Species
Troglodytidae	CAROLINA WREN	*Thryothorus*	*ludovicianus*
	HOUSE WREN	*Troglodytes*	*aedon*
	WINTER WREN	*Troglodytes*	*troglodytes*
	SEDGE WREN	*Cistothorus*	*platensis*
	MARSH WREN	*Cistothorus*	*palustris*
Regulidae	GOLDEN-CROWNED KINGLET	*Regulus*	*satrapa*
	RUBY-CROWNED KINGLET	*Regulus*	*calendula*
Sylviidae	BLUE-GRAY GNATCATCHER	*Polioptila*	*caerulea*
Turdidae	EASTERN BLUEBIRD	*Sialia*	*sialis*
	VEERY	*Catharus*	*fuscescens*
	SWAINSON'S THRUSH	*Catharus*	*ustulatus*
	HERMIT THRUSH	*Catharus*	*guttatus*
	WOOD THRUSH	*Hylocichla*	*mustelina*
	AMERICAN ROBIN	*Turdus*	*migratorius*
	TOWNSEND'S SOLITAIRE	*Myadestes*	*townsendi*
	GRAY-CHEEKED THRUSH	*Catharus*	*minimus*
	VARIED THRUSH	*Ixoreus*	*naevius*
Mimidae	GRAY CATBIRD	*Dumetella*	*carolinensis*
	NORTHERN MOCKINGBIRD	*Mimus*	*polyglottos*
	BROWN THRASHER	*Toxostoma*	*rufum*
Sturnidae	EUROPEAN STARLING	*Sturnus*	*vulgaris*
Motacillidae	AMERICAN PIPIT	*Anthus*	*rubescens*
Bombycillidae	CEDAR WAXWING	*Bombycilla*	*cedrorum*
	BOHEMIAN WAXWING	*Bombycilla*	*garrulus*
Parulidae	ORANGE-CROWNED WARBLER	*Vermivora*	*celata*
	BLUE-WINGED WARBLER	*Vermivora*	*pinus*
	GOLDEN-WINGED WARBLER	*Vermivora*	*chrysoptera*
	TENNESEE WARBLER	*Vermivora*	*peregrina*
	NASHVILLE WARBLER	*Vermivora*	*ruficapilla*
	NORTHERN PARULA	*Parula*	*americana*
	YELLOW WARBLER	*Dendroica*	*petechia*
	CHESTNUT-SIDED WARBLER	*Dendroica*	*pensylvanica*
	MAGNOLIA WARBLER	*Dendroica*	*magnolia*
	CAPE MAY WARBLER	*Dendroica*	*tigrina*
	BLK-THROATED BLUE WARBLER	*Dendroica*	*caerulescens*
	YELLOW-RUMPED WARBLER	*Dendroica*	*coronata*
	BLK-THROATED GREEN WARBLER	*Dendroica*	*virens*
	BLACKBURNIAN WARBLER	*Dendroica*	*fusca*
	YELLOW-THROATED WARBLER	*Dendroica*	*dominica*
	PINE WARBLER	*Dendroica*	*pinus*
	KIRTLAND'S WARBLER	*Dendroica*	*kirtlandii*
	PRAIRIE WARBLER	*Dendroica*	*discolor*
	PALM WARBLER	*Dendroica*	*palmarun*
	BAY-BREASTED WARBLER	*Dendroica*	*castanea*
	CERULEAN WARBLER	*Dendroica*	*cerulea*
	BLACK & WHITE WARBLER	*Mniotilta*	*varia*
	BLACKPOLL	*Dendroica*	*striata*
	AMERICAN REDSTART	*Setophaga*	*ruticilla*
	PROTHONOTARY WARBLER	*Protonotaria*	*citrea*
	WORM-EATING WARBLER	*Helmitheros*	*vermivorus*
	OVENBIRD	*Seiurus*	*aurocapillus*

Birds, continued (part 6 of 7)

Family	SPECIES	Genus	Species
Parulidae	NORTHERN WATERTHRUSH	*Seiurus*	*noveboracensis*
	LOUISIANA WATERTHRUSH	*Seiurus*	*motacilla*
	KENTUCKY WARBLER	*Oporornis*	*formosus*
	CONNECTICUT WARBLER	*Oporornis*	*agilis*
	MOURNING WARBLER	*Oporornis*	*philadelphia*
	COMMON YELLOWTHROAT	*Geothlypis*	*trichas*
	HOODED WARBLER	*Wilsonia*	*citrina*
	WILSON'S WARBLER	*Wilsonia*	*pusilla*
	CANADA WARBLER	*Wilsonia*	*canadensis*
	YELLOW-BREASTED CHAT	*Icteria*	*virens*
Thraupidae	SCARLET TANAGER	*Piranga*	*olivacea*
	SUMMER TANAGER	*Piranga*	*rubra*
Emberizidae	EASTERN TOWHEE (rufous-sided)	*Pipilo*	*erythrophthalmus*
	CHIPPING SPARROW	*Spizella*	*passerina*
	CLAY-COLORED SPARROW	*Spizella*	*pallida*
	FIELD SPARROW	*Spizella*	*pusilla*
	VESPER SPARROW	*Pooecetes*	*gramineus*
	LARK SPARROW	*Chondestes*	*grammacus*
	SAVANNAH SPARROW	*Passerculus*	*sandwichensis*
	GRASSHOPPER SPARROW	*Ammodramus*	*savannarum*
	HENSLOW'S SPARROW	*Ammodramus*	*henslowii*
	LECONTE'S SPARROW	*Ammodramus*	*leconteii*
	SONG SPARROW	*Melospiza*	*melodia*
	LINCOLN'S SPARROW	*Melospiza*	*lincolnii*
	SWAMP SPARROW	*Melospiza*	*georgiana*
	WHITE-THROATED SPARROW	*Zonotrichia*	*albicollis*
	HARRIS' SPARROW	*Zonotrichia*	*querula*
	AMERICAN TREE SPARROW	*Spizella*	*arborea*
	WHITE-CROWNED SPARROW	*Zonotrichia*	*leucophrys*
	FOX SPARROW	*Passerella*	*Illaca*
	LAPLAND LONGSPUR	*Calcarius*	*lapponicus*
	DARK-EYED JUNCO	*Junco*	*hyemalis*
	SNOW BUNTING	*Plectrophenax*	*nivalis*
Cardinalidae	NORTHERN CARDINAL	*Cardinalis*	*cardinalis*
	ROSE-BREASTED GROSBEAK	*Pheucticus*	*ludovicianus*
	INDIGO BUNTING	*Passerina*	*cyanea*
	DICKCISSEL	*Spiza*	*americana*
Icteridae	BOBOLINK	*Dolichonyx*	*oryzivorus*
	RED-WINGED BLACKBIRD	*Agelaius*	*phoeniceus*
	EASTERN MEADOWLARK	*Sturnella*	*magna*
	WESTERN MEADOWLARK	*Sturnella*	*neglecta*
	YELLOW-HEADED BLACKBIRD	*Xanthocephalus*	*xanthocephalus*
	RUSTY BLACKBIRD	*Euphagus*	*carolinus*
	BREWER'S BLACKBIRD	*Euphagus*	*cyanocephalus*
	COMMON GRACKLE	*Quiscalus*	*quiscula*
	BROWN-HEADED COWBIRD	*Molothrus*	*ater*
	ORCHARD ORIOLE	*Icterus*	*spurius*
	NORTHERN ORIOLE	*Icterus*	*galbula*
Fringillidae	PURPLE FINCH	*Carpodacus*	*purpureus*
	HOUSE FINCH	*Carpodacus*	*mexicanus*
	PINE GROSBEAK	*Pinicola*	*enucleator*

Birds, continued (part 7 of 7)

Family	SPECIES	Genus	Species
Fringillidae	RED CROSSBILL	*Loxia*	*curvirostra*
	WHITE-WINGED CROSSBILL	*Loxia*	*leucoptera*
	PINE SISKIN	*Carduelis*	*pinus*
	AMERICAN GOLDFINCH	*Carduelis*	*tristis*
	EVENING GROSBEAK	*Coccothraustes*	*vespertinus*
	COMMON REDPOLL	*Carduelis*	*flammea*
	HOARY REDPOLL	*Carduelis*	*hornemanni*
Passeridae	HOUSE SPARROW	*Passer*	*domesticus*
Source: Michigan Bird Records Committee, consistent with the checklist from the American Ornithologists Union (excluding casuals & accidentals).			

FISHES– **146 Species** (part 1 of 4)

Family	SPECIES	Genus	Species
Petromuyzontidae	LAMPREY, CHESTNUT	*Ichthyomyzon*	*castaneus*
	LAMPREY, NORTHERN BROOK	*Ichthyomyzon*	*fossor*
	LAMPREY, SILVER	*Ichthyomyzon*	*unicuspis*
	LAMPREY, AMERICAN BROOK	*Lampetra*	*appendix*
	LAMPREY, SEA	*Petromyzon*	*marinus*
Acipenseridae	STURGEON, LAKE	*Acipenser*	*fulvescens*
Lepisosteidae	GAR, SPOTTED (gar-pike)	*Lipisosteus*	*oculatus*
	GAR, LONGNOSE (gar-pike)	*Lipisosteus*	*osseus*
Amiidae	BOWFIN	*Amia*	*calva*
Hiodontidae	MOONEYE	*Hiodon*	*tergisus*
Anguillidae	EEL, AMERICAN	*Anguilla*	*rostrata*
Clupeidae	ALEWIFE	*Alosa*	*pseudoharengus*
	SHAD, GIZZARD (hickory shad)	*Dorosoma*	*cepedianum*
Cyprinidae	CENTRAL STONEROLLER	*Campostoma*	*anomalum*
	GOLDFISH	*Carassius*	*auratus*
	DACE, REDSIDE	*Clinostomus*	*elongatus*
	CHUB, LAKE	*Couesius*	*plumbeus*
	SHINER, SPOTFIN	*Cyprinella*	*spiloptera*
	CARP, COMMON (German carp)	*Cyprinella*	*carpio*
	MINNOW, BRASSY	*Hybognathus*	*hankinsoni*
	SHINER, STRIPED	*Luxilus*	*chrysocephalus*
	SHINER, COMMON	*Luxilus*	*cornutus*
	SHINER, REDFIIN	*Lythrurus*	*umbratilis*
	CHUB, SILVER	*Macrhybopsis*	*storeriana*
	DACE, PEARL	*Margariscus*	*margarita*
	CHUB, HORNYHEAD	*Nocomis*	*biguttatus*
	CHUB, RIVER (horned dace)	*Nocomis*	*micropogon*
	SHINER, GOLDEN	*Notemigonus*	*crysoleucas*
	CHUB, BIGEYE	*Notropis*	*amblops*
	SHINER, PUGNOSE	*Notropis*	*anogenus*

Fishes, continued (part 2 of 4)

Family	SPECIES	Genus	Species
Cyprinidae	SHINER, EMERALD	*Notropis*	*atherinoides*
	MINNOW, SILVERJAW (shiner)	*Notropis*	*buccatus*
	SHINER, IRONCOLOR	*Notropis*	*chalybaeus*
	SHINER, BIGMOUTH	*Notropis*	*dorsalis*
	SHINER, BLACKCHIN	*Notropis*	*heterodon*
	SHINER, BLACKNOSE	*Notropis*	*heterolepis*
	SHINER, SPOTTAIL	*Notropis*	*hudsonius*
	SHINER, SILVER	*Notropis*	*photogenis*
	SHINER, ROSYFACE	*Notropis*	*rubellus*
	SHINER, SAND	*Notropis*	*stramineus*
	SHINER, WEED	*Notropis*	*texanus*
	SHINER, MIMIC	*Notropis*	*volucellus*
	MINNOW, PUGNOSE (shiner)	*Opsopoeodus*	*emiliae*
	MINNOW, SUCKERMOUTH	*Phenacobius*	*mirabilis*
	DACE, NORTHERN REDBELLY	*Phoxinus*	*eos*
	DACE, SOUTHERN REDBELLY	*Phoxinus*	*erythrogaster*
	DACE, FINESCALE	*Phoxinus*	*neogaeus*
	MINNOW, BLUNTNOSE	*Pimephales*	*notatus*
	MINNOW, FATHEAD	*Pimephales*	*promelas*
	DACE, BLACKNOSE	*Rhinichthys*	*atratulus*
	DACE, LONGNOSE	*Rhinichthys*	*cataractae*
	CHUB, CREEK (horned dace)	*Semotilus*	*atromaculatus*
Cobitidae	ORIENTAL WEATHERFISH	*Misgurnus*	*anguillicaudatus*
Catostomidae	QUILLBACK	*carpiodes*	*cyprinus*
	SUCKER, LONGNOSE (redside, sturgeon sucker)	*Catostomus*	*catostomus*
	SUCKER, WHITE (mullet)	*Catostomus*	*commersoni*
	CHUBSUCKER, CREEK	*Erimyzon*	*oblongus*
	CHUBSUCKER, LAKE	*Erimyzon*	*sucetta*
	SUCKER, NORTHERN HOG (hogmolly)	*Hypentelium*	*nigricans*
	BUFFALO, BIGMOUTH	*Ictiobus*	*cyprinellus*
	BUFFALO, BLACK	*Ictiobus*	*niger*
	SUCKER, SPOTTED	*Minytrema*	*melanops*
	REDHORSE, SILVER	*Moxostoma*	*anisurum*
	REDHORSE, RIVER	*Moxostoma*	*carinatum*
	REDHORSE, BLACK	*Moxostoma*	*duquesnei*
	REDHORSE, GOLDEN	*Moxostoma*	*erythrurum*
	REDHORSE, SHORTHEAD	*Moxostoma*	*macrolepidotum*
	REDHORSE, GREATER	*Moxostoma*	*valenciennesi*
Ictaluridae	BULLHEAD, BLACK	*Ameiurus*	*melas*
	BULLHEAD, YELLOW	*Ameiurus*	*natalis*
	BULLHEAD, BROWN	*Ameiurus*	*nebulosus*
	CATFISH, CHANNEL	*Ictalurus*	*punctatus*
	STONECAT	*Noturus*	*flavus*
	MADTOM, TADPOLE	*Noturus*	*gyrinus*
	MADTOM, MARGINED	*Noturus*	*insignis*
	MADTOM, BRINDLED	*Noturus*	*miurus*
	CATFISH, FLATHEAD	*Pylodictis*	*olivaris*
Esocidae	PICKEREL, GRASS (mud pickerel)	*Esox*	*americanus*
	PIKE, NORTHERN	*Esox*	*lucius*
	MUSKELLUNGE	*Esox*	*masquinongy*

Fishes, continued (part 3 of 4)

Family	SPECIES	Genus	Species
Umbridae	MUDMINNOW, CENTRAL	*Umbra*	*limi*
Osmeridae	SMELT, RAINBOW	*Osmerus*	*mordax*
Salmonidae	HERRING, LAKE (cisco)	*Coregonus*	*artedi*
	WHITEFISH, LAKE	*Coregonus*	*clupeaformis*
	BLOATER (chub)	*Coregonus*	*hoyi*
	CISCO, DEEPWATER (chub)	*Coregonus*	*johannae*
	KIYI (chub)	*Coregonus*	*kiyi*
	CISCO, BLACKFIN (chub)	*Coregonus*	*nigripinnis*
	CISCO, SHORTJAW (chub)	*Coregonus*	*zenithicus*
	SALMON, PINK (humpback)	*Oncorhynchus*	*gorbuscha*
	SALMON, COHO (silver)	*Oncorhynchus*	*kisutch*
	TROUT, RAINBOW (steelhead, bow)	*Oncorhynchus*	*mykiss*
	SALMON, CHINOOK (king)	*Oncorhynchus*	*tshawytscha*
	WHITEFISH, PYGMY	*Prosopium*	*coulteri*
	WHITEFISH, ROUND (menominee)	*Prosopium*	*cylindraceum*
	SALMON, ATLANTIC	*Salmo*	*salar*
	TROUT, BROWN (brownie)	*Salmo*	*trutta*
	TROUT, BROOK (speckled trout)	*Salvelinus*	*fontinalis*
	TROUT, LAKE (mackinaw, siscowit)	*Salvelinus*	*namaycush*
Percopsidae	TROUT-PERCH	*Percopsis*	*omiscomaycus*
Aphredoderidae	PERCH, PIRATE	*Aphredoderus*	*sayanus*
Gadidae	BURBOT (lawyer, eelpout)	*Lota*	*lota*
Cyprinodontidae	BANDED KILLIFISH	*Fundulus*	*diaphanus*
	TOPMINNOW, STARHEAD	*Fundulus*	*dispar*
	TOPMINNOW, BLACKSTRIPE	*Fundulus*	*notatus*
Poeciliidae	MOSQUITOFISH, WESTERN (topminnow)	*Gambusia*	*affinis*
Atherinidae	BROOK SILVERSIDE (skipjack)	*Labidesthes*	*sicculus*
Gasterosteidae	STICKLEBACK, BROOK	*Culaea*	*inconstans*
	STICKLEBACK, THREESPIINE	*Gasterosteus*	*aculeatus*
	STICKLEBACK, NINESPINE	*Pungitius*	*pungitius*
Cottidae	SCULPIN, MOTTLED	*Cottus*	*bairdi*
	SCULPIN, SLIMY	*Cottus*	*cognatus*
	SCULPIN, SPOONHEAD	*Cottus*	*ricei*
	SCULPIN, DEEPWATER	*Myoxocephalus*	*thompsoni*
Percichthyidae	PERCH, WHITE	*Morone*	*americana*
	BASS, WHITE	*Morone*	*chrysops*
Centrarchidae	BASS, ROCK (goggle-eye)	*Ambloplites*	*rupestris*
	SUNFISH, GREEN	*Lepomis*	*cyanellus*
	PUMPKINSEED (sunfish)	*Lepomis*	*gibbosus*
	WARMOUTH (redeye, goggle-eye)	*Lepomis*	*gulosus*
	SUNFISH, ORANGE-SPOTTED (sunfish)	*Lepomis*	*humilis*
	BLUEGILL (sunfish)	*Lepomis*	*macrochirus*
	SUNFISH, LONGEAR (sunfish)	*Lepomis*	*megalotis*
	SUNFISH, REDEAR (shellcracker)	*Lepomis*	*microlophus*
	BASS, SMALLMOUTH (bronzeback)	*Micropterus*	*dolomieu*
	BASS, LARGEMOUTH	*Micropterus*	*salmoides*
	CRAPPIE, WHITE (croppie, speck)	*Pomoxis*	*annularis*
	CRAPPIE, BLACK (croppie, speck, strawberry bass)	*Pomoxis*	*nigromaculatus*
Percidae	DARTER, EASTERN SAND	*Ammocrypta*	*pellucida*
	DARTER, GREENSIDE	*Etheostoma*	*blennioides*

Fishes, continued (part 4 of 4)

Family	SPECIES	Genus	Species
Percidae	DARTER, RAINBOW	*Etheostoma*	*caeruleum*
	DARTER, IOWA	*Etheostoma*	*exile*
	DARTER, FANTAIL	*Etheostoma*	*flabellare*
	DARTER, LEAST	*Etheostoma*	*microperca*
	DARTER, JOHNNY	*Etheostoma*	*nigrum*
	DARTER, ORANGETHROAT	*Etheostoma*	*spectabile*
	DARTER, BANDED	*Etheostoma*	*zonale*
	PERCH, YELLOW	*Perca*	*flavescens*
	LOGPERCH	*Percina*	*caprodes*
	DARTER, CHANNEL	*Percina*	*copelandi*
	DARTER, BLACKSIDE	*Percina*	*maculata*
	SAUGER (pickerel)	*Stizostedion*	*canadense*
	WALLEYE (pickerel, walleyed pike)	*Stizostedion*	*vitreum*
Sciaenidae	DRUM, FRESHWATER (sheepshead)	*Aplodinotus*	*grunniens*
Gobiidae	GOBY, ROUND	*Neogobius*	*melanostomus*
	GOBY, TUBENOSE	*Proterorhinus*	*marmoratus*

Source: Sea Grant and MSU Extension lists. Includes Great Lakes fishes.

MAMMALS– 68 Species (part 1 of 2)

Family	SPECIES	Genus	Species
Didelphidae	VIRGINIA OPOSSUM	*Didelphis*	*virginiana*
Soricidae	ARCTIC SHREW	*Sorex*	*arcticus*
	MASKED SHREW	*Sorex*	*cinereus*
	SMOKY SHREW	*Sorex*	*fumeus*
	PYGMY SHREW	*Sorex*	*hoyi*
	WATER SHREW	*Sorex*	*palustris*
	NORTHERN SHORT-TAILED SHREW	*Blarina*	*brevicauda*
Talpidae	LEAST SHREW	*Cryptotis*	*parva*
	EASTERN MOLE	*Scalopus*	*aquaticus*
Vespertilionidae	STAR-NOSED MOLE	*Condylura*	*cristata*
	NORTHERN MYOTIS (long-eared bat)	*Myotis*	*septentrionalis*
	EASTERN SMALL-FOOTED MYOTIS	*Myotis*	*leibii*
	LITTLE BROWN BAT	*Myotis*	*lucifugus*
	INDIANA BAT	*Myotis*	*solalis*
	SILVER-HAIRED BAT	*Lasionycteris*	*noctivagans*
	EASTERN PIPISTRELLE	*Pipistrellus*	*sublfavus*
	BIG BROWN BAT	*Eptesicus*	*fuscus*
	RED BAT	*Lasiurus*	*borealis*
	HOARY BAT	*Lasiurus*	*cinereus*
	EVENING BAT	*Nycticeius*	*humeralis*
Leporidae	EASTERN COTTONTAIL	*Sylvilagus*	*floridanus*
	SNOWSHOE HARE	*Lepus*	*americanus*
	EUROPEAN HARE	*Lepus*	*europaeus*

Mammals, continued (part 2 of 2)

Family	SPECIES	Genus	Species
Sciuridae	EASTERN CHIPMUNK	*Tamias*	*striatus*
	LEAST CHIPMUNK	*Tamias*	*minimus*
	WOODCHUCK	*Marmota*	*monax*
	FRANKLIN'S GROUND SQUIRREL	*Spermophilus*	*franklinii*
	13-LINED GROUND SQUIRREL	*Spermophilus*	*tridecemlineatus*
	GRAY SQUIRREL	*Sciurus*	*carolinensis*
	FOX SQUIRREL	*Sciurus*	*niger*
	RED SQUIRREL	*Tamiasciurus*	*hudsonicus*
	NORTHERN FLYING SQUIRREL	*Glaucomys*	*sabrinus*
	SOUTHERN FLYING SQUIRREL	*Glaucomys*	*volans*
Castoridae	BEAVER	*Castor*	*canadensis*
Dipodidae	MEADOW JUMPING MOUSE	*Zapus*	*hudsonicus*
	WOODLAND JUMPING MOUSE	*Napaeozapus*	*insignis*
Cricetidae	WHITE-FOOTED MOUSE	*Peromyscus*	*leucopus*
	DEER MOUSE	*Peromyscus*	*maniculatus*
	SOUTHERN RED-BACKED VOLE	*Clethrionomys*	*gapperi*
	PRAIRIE VOLE	*Microtus*	*ochrogaster*
	MEADOW VOLE	*Microtus*	*pennsylanicus*
	WOODLAND VOLE	*Microtus*	*pinetorum*
	MUSKRAT	*Ondatra*	*zibethicus*
	SOUTHERN BOG LEMMING	*Synaptomys*	*cooperi*
Muridae	NORWAY RAT	*Rattus*	*norvegicus*
	HOUSE MOUSE	*Mus*	*musculus*
Erethizontidae	PORCUPINE	*Erethizon*	*dorsatum*
Canidae	COYOTE	*Canis*	*latrans*
	GRAY WOLF	*Canis*	*lupus*
	RED FOX	*Vulpes*	*vulpes*
	GRAY FOX	*Urocyon*	*cinereoargenteus*
Ursidae	BLACK BEAR	*Ursus*	*americanus*
Procyonidae	RACCOON	*Procyon*	*lotor*
Mustelidae	MARTEN	*Martes*	*americana*
	FISHER	*Martes*	*pennanti*
	ERMINE	*Mustela*	*erminea*
	LONG-TAILED WEASEL	*Mustela*	*frenata*
	LEAST WEASEL	*Mustela*	*nivalis*
	MINK	*Mustela*	*vison*
	BADGER	*Taxidea*	*taxus*
	NORTHERN RIVER OTTER	*Lutra*	*canadensis*
Mephitidae	STRIPED SKUNK	*Mephitis*	*mephitis*
Felidae	BOBCAT	*Lynx*	*rufus*
	LYNX (Canada Lynx)	*Lynx*	*canadensis*
	COUGAR	*Felis*	*concolor*
Cervidae	ELK	*Cervus*	*elaphus*
	WHITE-TAILED DEER	*Odocoileus*	*virginiana*
	MOOSE	*Alces*	*alces*

Source: Primarily from Baker, R.H. Michigan Mammals, 1993, updated taxonomy from Whitaker & Hamilton, 1998.
Notes: Myotis keenii is now M. septentrionalis (Whitaker & Hamilton, 1998). European Hare; Lepus europaeus in Whitaker & Hamilton, L capensis in Baker. Least chipmunk is Tamias in Whitaker & Hamilton and Eutamias in Baker. Wolverine excluded in Whitaker & Hamilton. Baker uses 'Felis' for bobcat and lynx, Whitaker & Hamilton use 'Lynx'. Baker includes Woodland Caribou and Bison and Whitaker & Hamilton do not. Whitaker & Hamilton states extirpation dates for bison (~1800), caribou (~1915), and wolverine (~1860). Cougar has been included due to many unofficial sightings in the U.P.

REPTILES– **30 Species** (part 1 of 1)

Family	SPECIES	Genus	Species
Chelydridae	SNAPPING TURTLE	*Chelydra*	*serpentina*
Kinosternidae	COMMON MUSK TURTLE	*Sternotherus*	*odoratus*
Emydidae	SPOTTED TURTLE	*Clemmys*	*guttata*
	WOOD TURTLE	*Clemmys*	*insculpta*
	EASTERN BOX TURTLE	*Terrapene*	*carolina*
	BLANDING'S TURTLE	*Emydoidea*	*blandingii*
	COMMON MAP TURTLE	*Graptemys*	*geographa*
	PAINTED TURTLE	*Chrysemys*	*picta*
	RED-EARED SLIDER	*Trachemys*	*scripta*
Trionychidae	SPINY SOFTSHELL TURTLE	*Apalone [Trionyx]*	*spninfera*
Scincidae	FIVE-LINED SKINK	*Eumeces*	*fasciatus*
Teiidae	SIX-LINED RACERUNNER	*Cnemidophorus*	*sexlineatus*
Colubridae	NORTHERN WATER SNAKE	*Nerodia*	*sipedon*
	NORTHERN COPPERBELLY SNAKE	*Nerodia*	*erythrogaster*
	QUEEN SNAKE	*Regina*	*septemvittata*
	KIRTLAND'S SNAKE	*Clonophis*	*kirtlandii*
	EASTERN GARTER SNAKE	*Thamnophis*	*sirtalis*
	BUTLER'S GARTER SNAKE	*Thamnophis*	*butleri*
	NORTHERN RIBBON SNAKE	*Thamnophis*	*sauritus*
	BROWN SNAKE	*Storeria*	*dekayi*
	NORTHERN RED-BELLIED SNAKE	*Storeria*	*occipitomaculata*
	EASTERN SMOOTH GREEN SNAKE	*Liochlorophis*	*vernalis*
	BLUE RACER	*Coluber*	*constrictor*
	BLACK RAT SNAKE	*Elaphe*	*obsoleta*
	WESTERN FOX SNAKE	*Elaphe*	*vulpina*
	EASTERN FOX SNAKE	*Elaphe*	*gloydi*
	EASTERN MILK SNAKE	*Lampropeltis*	*triangulum*
	NORTHERN RINGNECK SNAKE	*Diadophis*	*punctatus*
	EASTERN HOGNOSE SNAKE	*Heterodon*	*platirhinos*
V iperidae	EAST MASSASAUGA RATTLESNAKE	*Sistrurus*	*catenatus*

Source: MSU Extension: Harding & Holman (1997). Holman, Harding, Hensley, & Dudderar (1999).

AMPHIBIANS– **25 Species** (part 1 of 1)

Family	SPECIES	Genus	Species
Proteidae	MUDPUPPY	*Necturus*	*maculosus*
Sirenidae	WESTERN LESSER SIREN	*Siren*	*intermedia*
Salamandridae	CENTRAL NEWT	*Notophthalumus*	*viridescens*
	RED-SPOTTED NEWT	*Notophthalumus*	*viridescens*
Ambystomatidae	SPOTTED SALAMANDER	*Ambystoma*	*maculatum*
	BLUE-SPOTTED SALAMANDER	*Ambystoma*	*laterale*
	SMALL-MOUTHED SALAMANDER	*Ambystoma*	*texanum*
	MARBLED SALAMANDER	*Ambystoma*	*opacum*
	EASTERN TIGER SALAMANDER	*Ambystoma*	*tigrinum*
Plethodontidae	RED-BACKED SALAMANDER	*Plethodon*	*cinereus*
	FOUR-TOED SALAMANDER	*Hemidactylium*	*scutatum*
Bufonidae	AMERICAN TOAD	*Bufo*	*americanus*
	FOWLER'S TOAD	*Bufo*	*woodhousii*
Hylidae	BLANCHARD'S CRICKET FROG	*Acris*	*crepitans*
	WESTERN CHORUS FROG	*Pseudacris*	*triseriata*
	BOREAL CHORUS FROG	*Pseudacris*	*triseriata*
	NORTHERN SPRING PEEPER	*Pseudacris*	*crucifer*
	GRAY TREEFROG	*Hyla*	*versicolor*
	COPE'S GRAY TREEFROG	*Hyla*	*chrysoscelis*
Ranidae	GREEN FROG	*Rana*	*clamitans*
	BULLFROG	*Rana*	*catesbeiana*
	NORTHERN LEOPARD FROG	*Rana*	*pipens*
	PICKEREL FROG	*Rana*	*palustris*
	MINK FROG	*Rana*	*septentrionalis*
	WOOD FROG	*Rana*	*sylvatica*

Source: MSU Extension: Harding & Holman (1999).