

Maryland Mammals

Class: Mammalia

There are 426 species of mammals that live in North America and, according to Maryland Department of Natural Resources Wildlife and Heritage Service, there are approximately 100 of them found in our state. Of these, there are at least 88 species in the Coastal Plain, which includes 33 species of marine mammals such as whales (Figure 1) and dolphins (Table 1). Some of these include *introduced* species such as the Sika deer (Figure 2), nutria, Norway rat, and the house mouse. There are also accidental or transient species such as the manatee (the same male manatee “Chessie” that visited the Bay in 2001 and 2011- Figure 3). There are other species of mammals that historically once lived in Maryland but have now been *extirpated* from the region; the American bison, eastern puma, elk, and gray wolf. Elk were last recorded as being in Maryland in the 1700s, but the state is looking into restoring elk to its mountain regions. There is a small population of elk in neighboring Pennsylvania.

What Makes a Mammal a Mammal?

As a group, mammals have been a dominant class of animals for the last 65,000,000 years (following the extinction of the dinosaurs), but fossil remains have been found indicating that mammals have been around since at least the middle of the late Triassic period (ca 185 MY). Since their origins, they have developed characteristics that make them unique among vertebrate animals.

Mammals can be separated from other animals by the fact that they all have 1) true fur (marine mammals such as whales have bristle fur at some point in their life); 2) they all breathe atmospheric air (even whales and dolphins must come to the surface to breathe air as well as

those mammals that live most of their life underground such as moles); 3) all, except for a few species in the region of Australia, give birth to live young; 4) they are warm-blooded (*endothermic*), which means they can, to some degree, regulate their body temperature and live in temperature extreme areas that other animals cannot; 5) they nurse their young, 6) they have a four-chambered heart, which is important in thermoregulation and oxygen transport; and, 7) with few exceptions they are all quadrupeds (walk on all four legs) and have a tail with humans, bats, and some marine mammals being the exceptions. In bears and bobcats the tail is greatly reduced. In marine mammals (seals, whales, dolphins, etc.) the forefeet are transformed into flippers and in whales the hind limbs have disappeared except for two small bones embedded deeply in the body near the tail. Mammals are also considered to be *K-selected* species in that their young are few in number, often *altricial* at birth (Figure 4), and therefore require nurturing and protection at a very early age.

Regarding teeth there are different formulas (types of teeth) found among mammals with respect to what constitutes their primary diet. For instance humans have a formula of 2123/2123 where there are 2 incisors, 1 canine, 2 premolars, and 3 molars on each side of the upper and lower jaws, respectively. Rodents, which gnaw but do not tear, have lost their canines, but a shrew, which is an insectivore, has a dental formula of 3133/1113. An exception would be the least shrew, which has a 3123/1113 formula. Conversely wolves and foxes have a 3142/3143 formula. Some whales have no teeth at all.

Adaptive Radiation

As mentioned, mammals have dominated the world for the last 65-70 M years. During that time they have invaded and adapted to every type of environment. Their feet have evolved

from ancestors having toes with digits to the 2 hoofed deer or single hoof horse. As they lost digits their speed and adaptation to the localized environment increased. Some took to trees, others live underground, while others live in the open ocean. These changes to body shape, form, and function that allows them to thrive in different environments is known as ***adaptive radiation***. The largest mammal in the world, the blue whale which grows to over 100 feet and 100 tons, is a recorded visitor to Maryland's offshore waters. Likewise, the smallest animal in the world, the pygmy shrew, which weighs less than $\frac{1}{12}$ of an ounce, is also native to Maryland (Figure 5).

Native, Feral, Introduced, Naturalized, Transplanted, Exotic, Threatened, or Endangered?

With today's trade and movement of animals on a global scale, including interests in rare or unusual species, it is often difficult, without historical records, to know which mammals are ***native, introduced, transplanted, naturalized, or exotic***. Moving animals outside their native range can be problematic as there may not be any natural predators or disease that keeps the population under control. When there is no means to keep an organism's population growth in check (assuming they can successfully reproduce) the "new" species can rapidly expand their range leading to ***competition*** for a ***niche*** that can result in either displacement or replacement of native species and, in worse case scenarios, may lead to extirpation or even extinction. The same situation can found with some ***feral*** animals (Figure 6) such as cats, pigs, or even horses (e.g., the Assateague Island feral pony population).

Why it is important to understand these terms and concepts of moving animals around and the impact they may have on native species as well as the rest of the ***biota*** is not only a practical issue it is an ethical issue. Both practically and ethically such introductions, whether

intentional or not, can lead to some species with similar habitat requirements to become *threatened* or *endangered*; both of which have legal ramifications and potential *ecosystem* impact implications.

Observing Mammals

On the whole, mammals are actually surprisingly difficult to observe in nature; there are exceptions of course such as squirrels, deer, and rabbits. Some of the reasons for the difficulty in field observations are that many are secretive and/or “shy,” many are *crepuscular* (mice, rabbits, ferrets) or *nocturnal* (opossums, bobcats, raccoons), some are *arboreous* (flying squirrels – Figure 7) or can fly (bats), others are *cursorial* (most carnivorous predators) and, surprisingly a large number of mammals are often *fossorial* (found in dens such as moles, coyotes, and groundhogs Figure 8). Almost all are quite well camouflaged or *cryptic*. As such, one rarely goes “mammal watching” as you would with birds. Instead of direct observation one looks for signs of a species presence such as tracks, *scat* (Figure 9), claw marks on trees or the ground, nests, houses, mounds, food piles, bones and/or skulls, antlers, or teeth. Even observing multiples of these “signs” does not guarantee correct identification of the species. Sometimes, even with direct observation, it is difficult to identify the animal. Such is the case with bats when they are flying, some marine mammals, shrews, and mice. In addition, many mammals vary in color over the seasons, which further compound correct identification.

Good habitat to look for mammals is obviously in the woods, especially along edges or *ecotones* (Figure 10); the transition areas from one ecosystem to another such as wooded lots to open fields, parks, or development areas. Other good locations would be along old fence lines or stone walls; the edges of lakes, ponds, or bogs; old barns or buildings; and caves or abandoned

mines. Some mammals hibernate in the winter or *estivate* in summer making them even harder to observe; although most mammals are active year-round.

Often one can observe mammals, especially the larger ones, at night through the use of a flashlight. Remember, however, there are laws that protect harassing animals, and you should be familiar with what is and is not legal with respect to observing wildlife at night. Other opportunities for observing mammals in the wild are associated with determining which habitats they frequent and then establishing a blind or a “stand” and sitting quietly while observing. Early morning and late evening during feeding times (crepuscular periods) can be quite productive. It is important to note that animals are much more aware of their surroundings than the observer. While you may see them before they see you, it is possible they may smell you or hear you and you not even recognize it.

Many mammals are **sexually dimorphic** wherein one sex is larger than the other. In most cases the male is the larger of the sex. Also, while there are rare exceptions for the most part, male Cervids (deer family) have **antlers** (as opposed to **horns**) whereas the female does not. Notable exceptions in North America are caribou and reindeer, but neither is found in Maryland. Thus, if you see a deer in Maryland with antlers it is most likely a male.

Regardless of when you “observe” mammals it is always a good practice to have binoculars to look for detail and a field notebook to take notes. Remember to “think small” as many mammals such as mice, shrews, and voles are quite small and often stay hidden under leaves or brush. Written observations such as feeding behavior, movement, mating rituals, “play,” time of movement, moon phase, weather, whether or not there are young with a mother, etc. are all good things to note to learn more about the particular animal’s life habits and will

help you better understand life histories; which, in turn, builds a deeper appreciation for the animal in nature.

Is it a Predator or Prey?

Other points to consider when you are observing mammals are to determine if you are observing a predator or a prey. If you do not know if the animal you are observing is a predator or a prey look at its body shape and design. Does it have a body design for fast acceleration such as a rabbit or for long, sustained running like a fox? How muscular does it appear? Is it sleek and toned or have strong, muscular hind-quarters? Are its teeth incisors and/or molars (Figure 11) used for gnawing, grinding and crushing or canines (Figure 12) used for tearing? Once you know the difference between such animals determining whether it is a predator or a prey should become easier. Remember also that some predators may also be a prey for another, usually larger, predator.

The roles of predators and prey are very important to the overall population balance of not only a given species but to the ecosystem as a whole. For instance, for prey animals like deer or even rabbits, if they are healthy and can successfully avoid being preyed upon the population may grow to the point that they can overgraze or over browse and area such that the vegetation becomes sparse. Because of the loss of nutritional quality and/or quantity they begin to become weak and die or more easily fall to a disease or a predator that can more readily capture them. Overgrazing can also lead to serious erosion problems or the possibility of an invasive plant species taking hold and outcompete the more preferred native vegetation.

With an animal such as whitetail deer, the population growth without a predator (including man) may become so large in urban and suburban areas that they eat expensive

ornamental plants in your yard or worst cause serious injury due to car accidents when they cross highways. For this reason, some states now provide wildlife corridors underneath highways to prevent animals from crossing into traffic.

Conversely, if the predators become so abundant and effective they capture the prey with ease they will eventually reduce the prey population beyond the point for the predators to stay healthy. At this point they may soon begin to die off due to starvation and/or disease. Thus, the predator-prey relationship is has an important ecological principle in nature to help maintain balance of the populations and the habitat in which both groups live.

How Healthy is This Animal?

Given the above ecological principle, you next want to observe the animal's overall health condition by seeing if they appear healthy or *emaciated* (Figure 13). This information will give some indirect indication of their well-being, which could be related to food availability, disease, or even potential population densities (maybe they are overpopulated and there is insufficient food to maintain the population numbers that exist – see above). In observing overall health characteristics you should consider things such as the color and sheen of their coat (fur). Is full and healthy or scraggly and mangy? This simple observation can tell you a lot about the population as a whole.

If you see an emaciated deer in Maryland you need to have some concern and make sure you report it to Maryland Department of Natural Resources, especially if you live in Western Maryland. Since its first discovery in Maryland in 2010, **Chronic Wasting Disease** in deer is a growing concern (Figure 14). This fatal disease is a transmissible neurological disorder that produces small lesions in the brain. It is similar to “mad cow disease” in cattle and “scrapie” in

sheep. The agent is believed to be a *prion* – an altered protein that causes other normal proteins to change and cause the characteristic sponge-like holes in the brain. It however has not been reported as being a *zoonotic* disease that can be transferred to humans, nor has it been reported in cattle or other domestic livestock.

A note of caution, however, is appropriate with observing mammals. Never handle or harass animals in the wild. As indicated some may have diseases that could infect you (see below). Others, like certain shrews, may have venomous bites (will probably make you sick but probably not kill you). During mating season and when otherwise startled, large animals, especially the males, may be aggressive and attack and can cause humans physical harm. A female with young is almost always protective – so be very cautious around all animals at any time but especially large animals such as bears when there may have cubs nearby.

Remember also that wild animals are not tame and domesticated like a pet dog or cat. Thus, if they are acting peculiar, they may have a disease that can actually be transferred to humans (zoonotic i.e., rabies and Lyme disease). So it is always a good rule of thumb not to handle wild animals (alive or dead) unless you are sure they are not diseased or you are protected from transfer.

Zoonotic Diseases

Some of the zoonotic diseases of concern that may be transferred to humans are: 1) **rabies** – a virus that can be transferred by bites or exposure to a fresh wound or mucus membrane from an infected raccoon, skunk, fox, coyote, or bat; 2) **Hantavirus** – a virus transmitted by bites, ingestion or inhalation of contaminated food and water from urine, saliva, and feces of infected animals such as rodents and chipmunks – fortunately it has not been

recorded in Maryland' 3) the **plague** – a bacteria, which, like the hantavirus, has not been found in Maryland – it indirectly comes from the bites of infected fleas from infected mammals – mostly rodents; 4) **Tularemia** – a bacteria that can come from direct contact, ingestion, inhalation, handling, or consuming water contaminated by feces, urine, tissue of infected animals from a variety of vertebrates including rodents, rabbit, carnivores, ruminants (cows and deer) and even birds – it can also be transmitted by ticks; 5) various tick and flea-borne bacterial diseases such as **Lyme**, **Rocky Mountain Spotted** fever, and **Ehrlichiosis**; 6) **Baylisascaruasis** – a roundworm parasite where raccoons are the definitive host and it is transmitted by the ingestion of the eggs or tissue cysts from infected prey species that has contaminated soil, water or objects that find their way into humans – the parasite eggs are shed in feces from small mammals (rabbits, woodchucks, mice, rats) and domestic dogs; 7) **Giardiasis** – an intestinal parasite that comes from drinking contaminated water downstream from animal (domestic dogs, cats, livestock, small rodents, beavers, muskrats) and even human wastes; 8) **Echinococosis** – better known as tapeworms that come from ingestion of eggs or uncooked tissue cysts from infected animals – it may also be transmitted by flies that mechanically transport the eggs; 9) **Cat Scratch Fever** – is a bacterial disease contracted by a scratch, bite, or even lick from a domestic or wild cat or kitten; 10) **Brucellosis** – an infectious bacterial disease that is normally passed between different mammals (sheep, goats, cattle, deer, pigs, feral animals) – it can be transmitted to humans by coming in contact with animals or animal products that are contaminated with the bacteria – it is rare in the US but has been reported in feral hogs in the Carolinas.

For any of these diseases to be manifested in humans you must have what is known as a *disease triad* (a susceptible host (i.e., the mammal in question and you as a final host, a disease agent (the virus, bacteria, fungi, or parasite), and the environment suitable for both. So the best

way to prevent animal disease transmission to humans is to break the cycle by avoiding handling. In areas where the disease is known to be present take preventative measures such as proper hygiene, not eating uncooked or under-cooked meat, using tick sprays, and/or not drinking water from surface waters without first treating it.

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Glossary¹

Aboreous – An organism living in or among trees.

Adaptive Radiation – The diversification of related species into a large range of ecological niches through the process of adaptation.

Altricial – Poorly developed and relatively helpless at hatching or birth.

Antlers – appendages grown on the heads of members of the deer family that are made of bone, are branched, and are shed after the breeding season. In most species, only males bear antlers.

Biota – All of the animals and some of the plants involved in a fishery or wildlife system. Most often defined as all living organisms.

Competition – The relationship between two or more organisms living in the same area that have overlapping niche requirements for a resource that is limited in supply.

Crepuscular – Of or pertaining to the twilight hours at dawn and dusk.

Cryptic - hidden

Cursorial – An organism with a highly developed ability to run.

Disease triad – the three conditions necessary for a zoonotic disease to be manifested – a susceptible host, the disease agent itself, and a suitable environment for both.

Ecosystem – An interacting system of biotic and abiotic components in a particular area or place.

Ecotone – The transition between two different ecosystems (i.e., a wooded area and an open meadow).

Emaciated – Abnormally thin or lean by a gradual wasting away of the flesh – usually associated with an injured, starved, or diseased animal.

Endangered Species – A species that is in danger of becoming extinct throughout all or a portion of its range.

Endothermic – Animals with the ability to maintain body temperature at some specific level regardless of ambient temperature. Their primary source of heat comes from within their bodies.

Estivate – exhibiting hypothermy (the lowering of body temperature in endotherms to save energy during periods of stress) in the summer.

Exotic organism – an organism introduced from another zoogeographical region.

Extirpate – To eliminate an organism from a portion or all of its native range.

Feral animal – An animal that has reverted to the wild state after having been domesticated.

Fossorial – Burrowing into the earth.

Horns – Horns are made of the same material as hair, claws, and hooves, and are permanently attached to the head. In many species, both males and females have horns although in many the male's horns are much larger and heavier.

Introduced organism – An exotic or transplanted organism – a nonnative species.

Invasive organism – An introduced organism that rapidly expands its range.

K-selected species – A species with a reproductive strategy that involved production of small numbers of offspring with high levels of parental care.

Native organism – An organism that is indigenous to or originally found in a given area.

Naturalized organism – A naturally occurring offspring produced by an exotic or transplanted organism.

Niche – The role or function of a biological organism in a biotic community.

Nocturnal – Of or pertaining to night; active during periods of darkness.

Prion – an infectious protein, without its associated nucleic acids that is considered to be the source of the disease known as Chronic Wasting Disease

Scat – The droppings of some animals – usually in reference to mammals; also called pellets.

Threatened Species – A species that is likely to become endangered throughout all or a portion of its range.

Transplanted organism – An organism moved outside its native range but within the same zoogeographical region.

Wildlife Corridor - an area of habitat connecting wildlife (especially free-ranging mammals) that has artificially been separated from its normal habitat by human activities (such as roads, development, or logging).

Zoogeographical Regions – Regions or realms that represent continents or portions of continents are relatively isolated from one another in terms of animal dispersal. North America is in the Nearctic zoogeographical region while Central and South America are in the Neotropical region.

Zoonotic – an animal disease that can be transferred to humans such as rabies.

¹ Adapted from Willis, David W., Charles G. Scalet, and Lester D. Flake. 2009. *Introduction to Wildlife and Fisheries An Integrated Approach*. 2nd Edition, (W.H. Freeman; New York). 461 pp.; North American Glossary <http://www.mnh.si.edu/mna/glossary.cfm>.

Table 1: Maryland’s Coastal Plain Wild Mammal Species

Order	Family	Species	Status	
Perissodactyla (Odd-toed Ungulates)	Equidae (Horses)	Assateague Pony	Feral	
Artiodactyla (Even-toed Ungulates)	Cervidae (Deers)	White-tailed deer	Introduced Extirpated	
		Sika Deer		
		Elk		
	Suidae (Pigs)	Pigs, Boars	Feral	
	Bovidae (Cattle, etc.)	American Bison	Extirpated	
Carnivora (Carnivores)	Canidae (Dogs)	Coyote	Extirpated	
		Common Gray Fox		
		Red Fox		
		Gray wolf		
	Felidae (Cats)	Bobcat	In Need of Conservation Extirpated	
		Eastern Puma		
	Mephitidae (Skunks)	Striped Skunk		
	Mustelidae (Weasels, Badgers, Otters)		Northern River Otter	
			Ermine	
			Long-tailed Weasel	
			American Mink	
	Procyonidae (Raccoons)	Northern Raccoon		
Ursidae (Bears)	American Black Bear			
Cetacea (Whales, Dolphins, Porpoises)	Balaenidae (Right Whales)	North Atlantic Right Whale	Endangered	

Balenopteridae (Roquals)

Minke Whale	
Sei Whale	Endangered
Blue Whale	Endangered
Fin Whale	Endangered
Humpback Whale	Endangered

Delphinidae (Dolphins, Killer Whales, Pilot Whales)

Short-beaked Common or Saddleback Dolphin	
Short-finned Pilot Whale	
Long-finned Pilot Whale	
Killer Whale	
Melon-headed Whale	
False Killer Whale	
Pantropical Spotted Dolphin	
Striped Dolphin	
Atlantic Spotted Dolphin	
Spinner Dolphin	
Rough-toothed Dolphin	
Bottlenose Dolphin	
Risso's Dolphin	

Phocoenidae (Porpoises)

Harbor Porpoise	
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Physeteridae (Sperm Whales)

Pygmy Sperm Whale	
Dwarf Sperm Whale	
Sperm Whale	Endangered

Ziphiidae (Beaked Whales)

Blainville's Beaked Whale	
Grevais's Beaked Whale	
True's Beaked Whale	
Cuvier's Beaked Whale	
Goose Beaked Whale	

Pinnipedia (Seals and Walruses)

Phocidae (Hair Seals)

Harbor Seal	
Harp Seal	
Gray Seal	
Hooded Seal	

Sirenia (Manatees and Dugongs)

Trichechidae (Manatees)

	Manatee	Accidental–transient
Chiroptera (Bats)		
	Vespertilionidae (Vesper Bats)	
	Big Brown Bat	
	Silver-haired Bat	
	Red Bat	
	Hoary Bat	
	Eastern Small-footed Myotis	Endangered
	Little Brown Bat	
	Northern Long-eared Myotis	
	Evening Bat	
	Eastern Pipistrelle	
Didelphimorphia (Opposums)		
	Didelphidae (Opposums)	
	Virginia Opposum	
Insectivora (Shrews, Moles, Hedgehogs)		
	Soricidae (Shrews)	
	Northern Short-tailed Shrew	
	Least Shrew	
	Masked or Cinereus Shrew	
	Southern Pygmy Shrew	Rare
	Talpidae (Moles)	
	Star-nosed Mole	
	Eastern Mole	
Lagomorpha (Rabbits, Hares, Pikas)		
	Leporidae (Rabbits and Hares)	
	Eastern Cottontail	
Rodentia (Rodents)		
	Castoridae (Beavers)	
	American Beaver	
	Diplodidae (Jumping Mice)	
	Meadow Jumping Mouse	
	Muridae (Rats, Mice, Voles, Lemmings)	
	Meadow Vole	
	Muskrat	
	Marsh Rice Rat	
	Eastern Harvest Mouse	
	White-footed Mouse	Extirpated

Southern Bog Lemming	Rare
House Mouse	Introduced
Norway Rat	Introduced
Black Rat	Introduced
Capromyidae (Nutria)	
Nutria	Introduced
Sciuridae (Squirrels, Chipmunks, Marmots, Prairie Dogs)	
Southern Flying Squirrel	
Woodchuck	
Eastern Gray Squirrel	
Eastern Fox Squirrel	
Delmarva Fox Squirrel	Endangered
Eastern Chipmunk	
Red Squirrel	

Figure 1. Long-finned pilot whale as an example of marine mammals found along the coast of Maryland. Photo credit: <http://4.bp.blogspot.com/-coQ5SjX1GG0/T6scQSfE-QI/AAAAAAAAADXA/pDUS-8ASATQ/s1600/Long+finned+pilot+whale1.jpg>



Figure 2: Sika deer (member of the elk family) from Maryland's Eastern Shore as an example of an introduced species. Photo credit: http://dnr.maryland.gov/wildlife/hunt_trap/deer/sika/index.asp



Figure 3: "Chessie" the manatee that visited the Chesapeake Bay in 2001 and 2011: Photo Credit: Hank Curtis at <http://soundwaves.usgs.gov/2011/10/fieldwork5.html>



Figure 4. Altricial baby rabbits. Notice lack of fur, closed eyes, and helpless posture. Photo credit: <http://www.rabbit.org/care/babies.html>



Figure 5: World's smallest mammal (Pygmy Shrew). Photo Credit: Thomas French - <http://www.outdooralabama.com/watchable-wildlife/what/mammals/insectivores/ps.cfm>



Figure 6: Feral pigs. Photo credit:

- A) http://www.dfw.state.or.us/conservationstrategy/news/2010/2010_march.asp,
- B) <http://thebigpocket.blogspot.com/2007/12/feral-pig-attacks-austin-resident.html>



Figure 7: Flying squirrel as an example of an arboreal animal. Photo credit:
<http://eavice.wordpress.com/2012/02/27/dw-sugar-gliders-compered-to-flying-squirrels/>



Figure 8: Groundhog as an example of a fossorial animal: Photo credit:
A: http://www.dnr.state.md.us/wildlife/Plants_Wildlife/Wood_Chuck.asp
B: <http://www.20twentygraphics.com/blog/bid/116544/What-s-Your-Groundhog-Day-Prediction>



Photo by: Dan and Lin Dzurisin



Figure 9: Animal scat A) Deer scat; B, C) Owl scat (pellet)
Photo credit:

A) <http://www.bear-tracker.com/deepscat1.html>

B, C) <http://www.wbu.com/chipperwoods/photos/owls.htm>



Figure 10: Example of an **ecotone** – the transition zone between two adjacent, but different, plant communities (habitats). Photo credit:

http://www.elkhornslough.org/research/conserv_ecotone.htm



Figure 11: Jaw bones of a deer with incisors and molars for grinding plant material. Photo credit:

<http://durhamtownship.com/portfolio/archives/002296.php>



Figure 12: Skull of a carnivore (coyote) with strong canine teeth. Photo credit:

<http://www.promiselandranch.net/Skulls%20and%20Bones.html>



Figure 13. Picture of an emaciate squirrel – always wear gloves if handling emaciated or sick animals as they may carry diseases that can infect humans. Photo credit:

<http://www.squirrelsandmore.com/basic-steps-to-hand-rearing-a-baby-squirrel?store=default>



Figure 14: A deer with Chronic Wasting Disease. Photo Credit: Wyoming Game and Fish Department - <http://www.cwd-info.org/index.php/fuseaction/about.overview>

