



## Maryland-Specific Information for Project WILD Activities

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*Wes Moore, Governor*

This guide is designed as a quick reference tool to supplement Project WILD activities with Maryland-specific information. If you have additional information to share and/or find any outdated information, then please contact:

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<http://dnr.maryland.gov> 410-260-8566. Toll Free in Maryland: 1-877-620-8DNR, ext.8566

## Adaptation Artistry

Ecological Knowledge > Changes and Adaptations  
Project WILD Terrestrial



**Maryland Links:** Over 450 species of birds have been documented in Maryland. Many of these species have very unique adaptations. The following table contains a few species found in Maryland and their special adaptations.

Body Part	Adaptation	Species	Advantage
Beak	Pouch-like	Brown Pelican	Holds fish
	Long and thin	American Avocet	Probes shallow water for insects
	Short and stout	Northern Cardinal	Aids in cracking seeds
Color	Dull plumage	Bobwhite Quail	Camouflage
	Bright plumage	Scarlet Tanager (male)	Attracts mates
	Counter shading	Northern Mockingbird	Provides camouflage
Feet	Long toes	Great-blue Heron	Helps walk on mud
	Clawed	Bald Eagle	Can grasp prey
	Webbed	Mallard Duck	Helps walk on mud and swim
Legs	Long, slender	Black-necked Stilt	Aids in wading
Wings	Broad, rectangular	Turkey Vulture	Can glide to search for prey
	Fringed feathers	Owls (all species)	Allows for silent flight to hunt prey
	Sharp-pointed	Peregrine Falcon	Can fly fast and easily maneuver to hunt prey

### Additional Resources:

- Audubon Migration Explorer
  - <https://explorer.audubon.org/home>
- *Beaks!*, a book by Sneed B. Collard, III
- Bird Sleuth by Cornell Lab of Ornithology
  - <http://www.birdsleuth.org/>
- Cornell Lab of Ornithology: All About Birds
  - <http://www.birds.cornell.edu/>
- Flight Adaptations game
  - <https://academy.allaboutbirds.org/flap-to-the-future-the-flight-adaptations-game/>
- Maryland Ornithological Society
  - <http://www.mdbirds.org/>
- Project Beak <http://projectbeak.org/adaptations/start.htm>
- List of Maryland Birds with some fact sheets
  - [https://dnr.maryland.gov/wildlife/Pages/plants\\_wildlife/mdbirds.aspx](https://dnr.maryland.gov/wildlife/Pages/plants_wildlife/mdbirds.aspx)

## Aquatic Roots

Sustaining Fish and Wildlife Resources > Issues and Trends  
Project WILD Aquatic



**Maryland Links:** Hundreds of species have been introduced to Maryland either accidentally or intentionally. Many of these introduced species lack predators or diseases which naturally keep the populations in check. So, many times, these species can rapidly spread in their introduced regions while also outcompeting native species for resources. When introduced species become either biological or economic problems in their introduced ranges, the species are called invasive. The following list includes some of the invasive, aquatic species found in Maryland.

1. Chinese Mitten Crab (crustacean)
2. Hydrilla (aquatic plant)
3. MSX and Dermo (protists)
4. Mute Swan (waterfowl)
5. Northern Snakehead (fish)
6. Nutria (aquatic mammal)
7. Phragmites (plant)
8. Purple Loosestrife (plant)
9. Rusty Crayfish (crustacean)
10. Red Swamp Crayfish (crustacean)
11. Water Chestnut (aquatic plant)
12. Zebra Mussel (bivalve)



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### Additional Resources:

- Aquatic Invasive Species Kit & Lesson Plans
  - <http://dnr.maryland.gov/wildlife/Pages/Education/Aquatic-Invasive-Species-Education-Program.aspx>
- Center for Invasive Species
  - <http://www.bugwood.org/> , <http://www.invasive.org>
- Invasive Plant ID Cards for Kids (PDF)
  - [http://dnr.maryland.gov/wildlife/Documents/Invasive\\_plants\\_cards.pdf](http://dnr.maryland.gov/wildlife/Documents/Invasive_plants_cards.pdf)
- Plant Invaders of Mid-Atlantic Natural Areas, 4th ed (PDF)
  - <https://www.invasive.org/alien/pubs/midatlantic/midatlantic.pdf>
- Maryland Invasive Species Council
  - <https://mdinvasives.org/>
- Maryland Wildlife and Heritage Service, Statewide Eyes Citizen Science
  - [https://dnr.maryland.gov/wildlife/pages/statewide\\_eyes.aspx](https://dnr.maryland.gov/wildlife/pages/statewide_eyes.aspx)

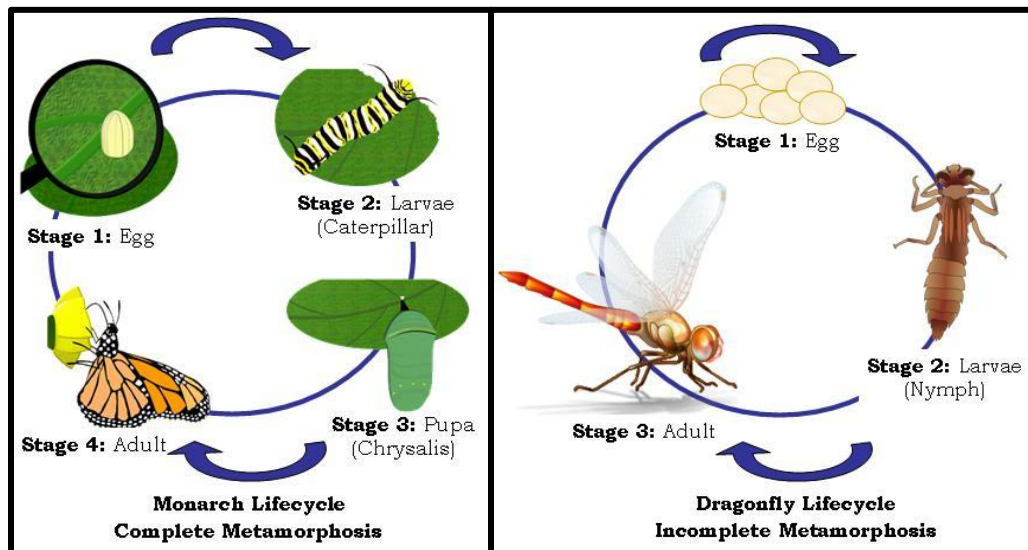
## Are You Me?

Ecological Knowledge > Wildlife Populations

### Project WILD Aquatic

**Maryland Links:** Every plant and animal begins life, matures and dies in a series of stages called a **life cycle**. In many animals, including fish, mammals, reptiles and birds- development from conception to birth or hatching to adulthood is gradual, with each “stage” blending into the next. Some young are born looking like miniatures of their parents while others look significantly different when they are young compared to adults. Amphibians such as frogs and newts undergo a big change or **metamorphosis** during their life. Frogs emerge from eggs as tadpoles, living their life underwater until their bodies begin to change and they grow legs and lungs.

Insects, on the other hand, tend to hatch into worm-like larvae which eat and grow. The larvae then form a pupa. During the pupa stage, the insects go through a complete change within a protective covering (like a chrysalis) and then emerge as adults. Butterflies, beetles, bees, ants and flies all go through this example of “**complete metamorphosis**”. Some insects, however, do not have a pupa stage and undergo “**incomplete metamorphosis**”. Grasshoppers, crickets and dragonflies are all insects that have incomplete metamorphosis.



### Additional Resources:

- [Caterpillars to Butterflies & Lifecycle of a Beaver](#), by Bobbie Kalman
- Life Cycle of a Monarch Butterfly
  - <http://askabiologist.asu.edu/monarch-life-cycle>
- Life Cycles game (Bird, Butterfly and Frog)
  - [http://www.sheppardsoftware.com/scienceforkids/life\\_cycle/index.htm](http://www.sheppardsoftware.com/scienceforkids/life_cycle/index.htm)

## Back From the Brink

Sustaining Fish and Wildlife Populations> Issues and Trends  
Project WILD Terrestrial

**Maryland Links:** In the 1800s, many wildlife species were exploited due to lack of hunting regulations and due to loss of habitat. During this time, some species like the Passenger Pigeon were lost while many others declined to the point where they were almost gone. In Maryland, species like the elk, gray wolf, Eastern mountain lion, and American marten were extirpated (locally extinct) by the early 1900s. While those species were lost, others were saved thanks to early conservation efforts. Below are a few conservation success stories from Maryland:

1. **White-tailed Deer:** In 1902, deer populations in Maryland were so low that hunting was closed statewide. It took 25 years before the population increased to a point where hunting was allowed in Allegany County. However, even in the 1950s, populations were so low that relocation and population monitoring efforts were begun. Today, over 200,000 deer populate Maryland!
2. **Delmarva Fox Squirrel:** The Delmarva fox squirrel was one of the first animals protected under the federal Endangered Species Act. The population fell to 10 % of its historic range, confined mostly to remote areas of Maryland's Eastern Shore because of habitat loss and hunting pressure. The animal was listed as an endangered species in 1967. Thanks to reintroduction efforts and conservation initiatives, the squirrel was delisted in 2015.
3. **Wild Turkey:** By the turn of the 20th century, only a remnant of Maryland's once abundant wild turkey flock remained. Concern over low turkey populations resulted in a prohibition on turkey hunting in Garrett County from 1920 to 1933. Over the next 40 years, efforts to raise and release pen-raised birds failed but relocation of healthy individuals proved to be the key to a successful reintroduction. Today, wild turkeys can be found in all of Maryland's counties.

*Other Success Stories:* Black bears, river otter, bald eagle and more.

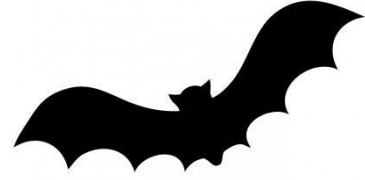
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### Additional Resources:

- Annual Maryland Deer Project Reports
  - [https://dnr.maryland.gov/wildlife/Pages/hunt\\_trap/Deer\\_AnnualReports.aspx](https://dnr.maryland.gov/wildlife/Pages/hunt_trap/Deer_AnnualReports.aspx)
- Annual Wild Turkey Reports
  - [https://dnr.maryland.gov/wildlife/Pages/hunt\\_trap/WildTurkey.aspx](https://dnr.maryland.gov/wildlife/Pages/hunt_trap/WildTurkey.aspx)
- Maryland Wildlife and Heritage Service
  - <https://dnr.maryland.gov/wildlife/Pages/default.aspx>

## Bat Blitz

Ecological Knowledge > Interdependence  
Project WILD Terrestrial



**Maryland Links:** Ten species of bats can be found in Maryland.

Maryland's bat species are all insectivores, feeding on beetles, flies, mosquitoes, moths, and the like. Maryland's bats can be divided into two groups: cave bats (those that hibernate) and tree bats (those that migrate or go through torpor).

### Tree Bats

- Eastern red bat (*Lasiurus borealis*)
- Hoary bat (*Lasiurus cinereus*)
- Silver-haired bat (*Lasionycterus noctivagans*)
- Evening bat (*Nycticeius humeralis*)

### Cave Bats

- Eastern small-footed bat (*Myotis leibii*)
- Little brown bat (*Myotis lucifugus*)
- Northern long-eared bat (*Myotis septentrionalis*)
- Indiana bat (*Myotis sodalis*)
- Tri-colored bat (*Perimyotis subflavus*)
- Big brown bat (*Eptesicus fuscus*)

Unfortunately, in 2010, white-nose syndrome was documented in a cave in western Maryland. Since then, many cave-dwelling bat species have declined by over 90% in their winter hibernacula (roosts).

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### **Additional Resources:**

- Bat Conservation International
  - <http://www.batcon.org/>
- Bat Count: A Citizen Science Story, by Anna Forrester
- Bat Education Trunks
  - [http://dnr.maryland.gov/wildlife/Pages/Education/education\\_trunks.aspx](http://dnr.maryland.gov/wildlife/Pages/Education/education_trunks.aspx)
- Bats and Diseases
  - [https://dnr.maryland.gov/wildlife/Pages/plants\\_wildlife/bats/nhpbatdisease.aspx](https://dnr.maryland.gov/wildlife/Pages/plants_wildlife/bats/nhpbatdisease.aspx)
- Discover Maryland's Bats
  - [http://dnr.maryland.gov/wildlife/Pages/plants\\_wildlife/bats/index.aspx](http://dnr.maryland.gov/wildlife/Pages/plants_wildlife/bats/index.aspx)
- Little Red Bat, by Carole Gerber

## Busy Bees, Busy Blooms

Ecological Knowledge > Interdependence

### Project WILD Terrestrial



**Maryland Links:** Over 430 species of bees can be found in Maryland. The majority of these species nest in the ground while around 30% nest in tubes and tunnels.

Interesting Maryland bees include the squash bee, which lives in the ground and only pollinates plants in the squash family (Cucurbitaceae). Bees in the Megachilidae family include leaf cutter and mason bees, both of which readily nest in artificial nest structures if the diameter and size of the tunnels are correct. About 20% of native bees only visit a small number of closely related flower species.

For animal pollinated plants, the color, shape, size, smell, etc of the flower all play into attractants for particular pollinators. Often, by examining these characters on flowers, you can surmise who is supposed to pollinate the plant. The relationships between pollinators and flowers are known as pollinator syndromes.

Pollinators in Maryland have experienced declines due to a number of factors including: habitat degradation and loss, pesticides, climate change, light pollution, and invasive species.

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#### Additional Resources:

- Bee and Pollinator Activities (PDF)
  - [https://dnr.maryland.gov/wildlife/Documents/LatH\\_Bee\\_Pollinator\\_Activities.pdf](https://dnr.maryland.gov/wildlife/Documents/LatH_Bee_Pollinator_Activities.pdf)
- Busy Bees Activity (PDF)
  - <https://dnr.maryland.gov/wildlife/Documents/Lesson-Plan-Busy-Bees.pdf>
- Common Bees of Maryland (PDF)
  - <https://dnr.maryland.gov/wildlife/Documents/CommonBees.pdf>
- Flower Dissection Sheet (good to pair w/ Busy Bees, PDF)
  - <https://dnr.maryland.gov/wildlife/Documents/FlowerDissectionSheet.pdf>
- Pollinator Syndromes Chart (PDF)
  - [https://www.pollinator.org/pollinator.org/assets/generalFiles/Pollinator\\_Syndromes.pdf](https://www.pollinator.org/pollinator.org/assets/generalFiles/Pollinator_Syndromes.pdf)
- The Bumblebee Queen, by April Pulley Sayre
- What's the Buzz: All About Pollinators
  - <http://dnr.maryland.gov/wildlife/Pages/habitat/wawhatsthebuzz.aspx>
- Xerces Society
  - <https://xerces.org/education>



## Fashion-A-Fish

Ecological Knowledge > Changes and Adaptations  
Project WILD Aquatic



### Maryland Links

Adaptation	Purpose	Species
Mouth angled upward/longer lower jaw	Feeds on prey it sees above it; small fish, or aquatic insects, often at surface of water	Mosquitofish, Rock bass, Smallmouth bass
Mouth with barbells	Feeds off the bottom; Can sense food in murky water	Catfish, bullhead, stonecat, sturgeon, madtom
Sucker-shaped mouth	"Vacuums" up food off the bottom; eats aquatic insects, vegetation	Suckers, sturgeons, carp
Thin, shorter, disc-shaped body	Agile around rocks/weeds; round shape harder for predators to swallow	Bass, perch, sunfish
Rounder, flat bellied body	Feeds off or rests on the bottom; less conspicuous to predators	Sucker, catfish, sturgeon
Torpedo-shaped body	Stream-lined for high speed or swimming in currents	Brook trout, rainbow trout,
Bright colored body	Attract potential mates	Rainbow darter, stickleback
Mottled color	Hides in rocks or on bottom	Northern pike, young sturgeon
Light colored belly	Less visible to predators below it	Perch, walleye, sturgeon, sucker, catfish
Flattened head and large pectoral fins	Lives in the swift water of riffles	Sculpins, darters
Large eyes	Feeds by sight	Walleye, perch, bass

### Additional Resources:

- Build-A-Fish Activity (Shedd Aquarium)
  - <https://mpt.pbslearningmedia.org/resource/lsp07.sci.life.evo.buildafish/build-a-fish/>
- Common Maryland Stream Fishes with pictures! (PDF)
  - <https://dnr.maryland.gov/streams/Publications/Common%20Fish.pdf>
- Key to Freshwater Fishes of Maryland (PDF)
  - [https://dnr.maryland.gov/streams/Documents/fishkey\\_2003\\_09edits.pdf](https://dnr.maryland.gov/streams/Documents/fishkey_2003_09edits.pdf)
- Maryland Fish Facts
  - <http://dnr.maryland.gov/Fisheries/Pages/fishfacts-index.aspx>

## Fishy Who's Who

Ecological Knowledge > Wildlife Populations

### Project WILD Aquatic

#### Maryland Links

Species	General Information
<b>American Eel</b> ( <i>Anguilla rostrata</i> )	The American eel has pectoral fins and a very long, continuous fin. Eels can grow over 3 feet long.
<b>Brook Trout</b> ( <i>Savelinus fontinalis</i> )	Brook trout have cream colored spots on a dark background. Brook trout are the only trout species native to Maryland.
<b>Brown Bullhead</b> ( <i>Ameiurus nebulosus</i> )	Brown bullheads are light to dark mottled on the sides and have a lighter underside with dark chin barbels. Brown bullhead are typically less than 12 inches in length.
<b>Channel Catfish</b> ( <i>Ictalurus punctatus</i> )	Channel catfish are long slender fish with barbels on the chin that look like long black whiskers. They have forked tails.
<b>Largemouth Bass</b> ( <i>Micropterus salmoides</i> )	Largemouth bass can be recognized by the lower jaw which extends past the back edge of the eye. It is dark green above with silvery sides and belly. Largemouth bass are not native to MD.
<b>Pumpkinseed</b> ( <i>Lepomis gibbosus</i> )	Pumpkinseeds are members of the sunfish family and are orange, green, yellow or blue in color, with speckles over their sides and back and a yellow-orange breast and belly. The coloration of the scales of the pumpkinseed is one of the most vibrant of any freshwater fish.
<b>Rainbow Trout</b> ( <i>Oncorhynchus mykiss</i> )	For the most part, Maryland rainbow trout have a greenish silver back and a silver sides with a faint red band that travel the length of the lateral line. They are not native to MD.
<b>Striped Bass</b> ( <i>Morone saxatilis</i> )	The striped bass is a silvery fish that gets its name from the seven or eight dark, continuous stripes along the side of its body.
<b>Yellow Perch</b> ( <i>Perca flavescens</i> )	The general coloring of yellow perch tends to be brassy green to golden yellow on their sides and white to yellow on their belly. Their most distinguishing feature is 6-8 dark vertical bands found across their back and sides.

#### Additional Resources:

- Fishing Fun Resource Guide (PDF)
  - [http://dnr.maryland.gov/wildlife/Documents/GUW\\_FishingFun.pdf](http://dnr.maryland.gov/wildlife/Documents/GUW_FishingFun.pdf)
- Key to Freshwater Fishes of Maryland (PDF)
  - [https://dnr.maryland.gov/streams/Documents/fishkey\\_2003\\_09edits.pdf](https://dnr.maryland.gov/streams/Documents/fishkey_2003_09edits.pdf)
- Maryland Fish Facts
  - <http://dnr.maryland.gov/Fisheries/Pages/fishfacts-index.aspx>

## Good Buddies

Ecological Knowledge > Interdependence

### Project WILD Terrestrial

#### Maryland Links

Organisms	Relationship	Comments
Barnacles- Sea turtles	Commensalism	Barnacles benefit from turtles by constantly being transported to new areas to grab food. There is no effect on the turtle.
Beggar-tick sunflowers and mammals	Commensalism	Beggar-tick sunflowers ( <i>Bidens</i> spp.) have sticky seeds that easily get caught in mammal fur. In turn, the mammals disperse the plant's seeds while there is little to no effect on the mammal.
Pitcher plant mosquito larvae- Pitcher plant	Mutualism	Pitcher plant mosquito larvae get a place to stay as well as access to food resources attracted by the pitcher plant. In turn, the larvae help feed on insect parts that the plant cannot readily digest.
Mycorrhizae- Orchids	Mutualism	Mycorrhizae are fungi which attach to the roots of plants. The fungi provide plants like orchids with additional sources of phosphorus while the orchid provides a place to stay as well as carbon to the fungi.
Deer tick- Deer	Parasitism	Deer ticks feed off the blood of deer and other mammals while often transmitting diseases in the process.
Cowbirds- Neotropical migrants	Parasitism	Cowbirds parasitize other birds by laying their eggs in other bird's nests. Often, cowbirds remove eggs from the other bird's nest and replace them with their own, leaving another bird to care for and raise the cowbird young.
Sea lamprey –Fish	Parasitism	Sea lampreys feed on the blood of other fish, and over time, they can kill their hosts.

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#### Additional Resources:

- Sea lampreys in Maryland
  - [http://eyesonthebay.dnr.maryland.gov/mbss/SA\\_spec6.cfm?species=Sea%20lamprey](http://eyesonthebay.dnr.maryland.gov/mbss/SA_spec6.cfm?species=Sea%20lamprey)

## Here Today, Gone Tomorrow

Ecological Knowledge > Biodiversity

### Project WILD Terrestrial

#### Maryland Links

The Wildlife and Heritage Service Natural Heritage Program tracks the status of over 1,250 native plants and animals that are among the rarest in Maryland and most in need of conservation efforts as elements of our State's natural diversity. Of these species, the Maryland Department of Natural Resources officially recognizes 566 species and subspecies as endangered, threatened, in need of conservation, or endangered extirpated. Only 39, or 7% of the total tracked species, are listed by the U.S. Fish and Wildlife Service as nationally endangered or threatened.

Summary of State Listed Species*		
Category	Plants	Animals
Endangered	248	98
Threatened	75	19
In Need of Conservation	n/a	36
Endangered Extirpated	67	32
Total	390	176

\* Summary of State Listed Species only includes species listed in COMAR 08.03.08.

Species can be classified as rare at the state level and/or the federal level. Species like black skimmers rarely breed in Maryland but are abundant in other parts of the country. For this reason, they are on the Maryland list of rare, threatened and endangered species but not federally listed. To see detailed range maps and listings for rare species, check out the NatureServe Explorer page listed below.

Since the time of European colonization in the 1600's, more than 500 species and subspecies of native animals and plants have become extinct in North America. Some of these had been abundant in the Chesapeake Bay region. For example, passenger pigeons blackened the sky during migration, Carolina parakeets roosted in coastal swamp forests, and heath hens boomed on rolling grassland hilltops.

Other species have become extirpated in Maryland, or locally extinct. These species include animals such as bison and gray wolf which are still found in other parts of the country.

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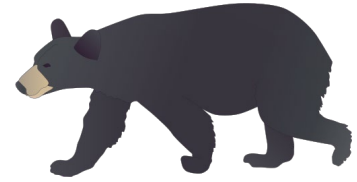
**Additional Resources:**

- Maryland Rare Species
  - [dnr.maryland.gov/wildlife/Pages/plants\\_wildlife/rte/espaa.aspx](https://dnr.maryland.gov/wildlife/Pages/plants_wildlife/rte/espaa.aspx)
- 2021 MD List of Rare Animals
  - [https://dnr.maryland.gov/wildlife/Documents/rte\\_Animal\\_List.pdf](https://dnr.maryland.gov/wildlife/Documents/rte_Animal_List.pdf)
- 2021 MD List of Rare Plants
  - [https://dnr.maryland.gov/wildlife/Documents/rte\\_Plant\\_List.pdf](https://dnr.maryland.gov/wildlife/Documents/rte_Plant_List.pdf)
- NatureServe Explorer
  - <https://explorer.natureserve.org/>
- US Fish and Wildlife Service, Endangered Species Program
  - [www.fws.gov/endangered](http://www.fws.gov/endangered)

## Limiting Factors: How Many Bears Can Live in This Forest

Ecological Knowledge > Wildlife Populations

### Project WILD Terrestrial



**Maryland Links:** Historically, black bears were found in all of Maryland’s counties. However, as settlers cleared the landscape for agriculture, industry, and timber production throughout the 18th, 19th, and early 20th centuries, most of Maryland’s suitable black bear habitat was lost. By the mid-1950s, only a few bears were estimated to remain in the state restricted to the rugged mountainous areas in western Maryland . In 1953, the black bear hunting season was closed due to concerns of a dwindling bear population. In 1972, the status of black bears was changed from ‘forest game animal’ to ‘endangered species’ in Maryland. In 1980, black bears were listed as a species of concern and then in 1985, they were considered to be “forest game”. Black bear hunting seasons remained closed until 2004.

Today, black bears are abundant in the western region of the state and often venture into the central part of the state in the spring. It is estimated that over 2,000 black bears can be found in Maryland today. Bears have an acute sense of smell, allowing them to easily detect insect larvae, fruit and carrion nearby. Bears are primarily opportunistic feeders which means that they will dine on the easiest meals they can find, including trash cans and bird feeders. Bears feed heavily during the fall months in order to increase fat reserves for the upcoming long winter.

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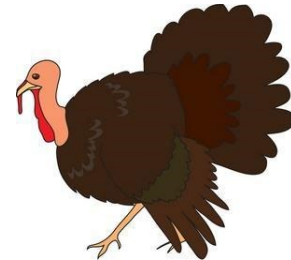
### Additional Resources:

- Black Bear Education Trunk
  - [http://dnr.maryland.gov/wildlife/Pages/Education/education\\_trunks.aspx](http://dnr.maryland.gov/wildlife/Pages/Education/education_trunks.aspx)
- Black Bears in Maryland
  - [http://dnr.maryland.gov/wildlife/Pages/plants\\_wildlife/black-bear.aspx](http://dnr.maryland.gov/wildlife/Pages/plants_wildlife/black-bear.aspx)
- Black Bear Calorie Cards (PDF)
  - <https://dnr.maryland.gov/wildlife/Documents/BearCalorieCounter.pdf>
- Other Black Bear Resources
  - [https://dnr.maryland.gov/wildlife/Pages/Education/PW\\_EducatorResources.aspx](https://dnr.maryland.gov/wildlife/Pages/Education/PW_EducatorResources.aspx)

## Let's Talk Turkey

Social and Political Knowledge > Historical and Geographic Development  
Project WILD Terrestrial

**Maryland Links:** According to early accounts, wild turkeys were abundant when European settlers arrived in Maryland in 1634 and welcomed as food. Although Lord Baltimore opened land west of the Tidewater area to settlement in 1732, the forest habitat of wild turkeys remained relatively undisturbed until the late 1700s when major expanses of forest were clear-cut to produce charcoal to fire iron furnaces. Later, with the invention of the steam engine and the development of railroads in the early 1800s, previously inaccessible forests in western Maryland were opened to timbering.



With unrestricted hunting and timber cutting, turkeys declined along with other forest wildlife species that shared their habitat. By the turn of the 20th century, only a remnant of Maryland's once abundant wild turkey flock remained, leading State Game Warden F. Lee LeCompte in 1919 to conclude, "Wild turkeys, outside of a few sections in the Western counties of our State, are practically extinct."

Concern over low turkey populations resulted in a prohibition on turkey hunting in Garrett County from 1920 to 1933. In 1925, Maryland initiated a program to restore wild turkeys by buying and releasing pen-raised turkeys into the wild. In 1930, the State established its own turkey farm, raising and releasing nearly 33,000 turkeys into the wild between 1930 and 1971. Expensive and not effective, the game farm program was abandoned in 1971 in favor of the trap and transplant approach.

With the invention of the rocket net in the 1950s, Maryland switched its efforts to trapping wild turkeys in more abundant areas and transplanting them to new areas. These efforts continued until 2001 and are the reason why wild turkeys are now abundant in Maryland again. The restoration effort was funded entirely with revenue from hunting license sales and Pittman Robertson Funds.

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### Additional Resources:

- Wild Turkey in Maryland
  - [https://dnr.maryland.gov/wildlife/Pages/plants\\_wildlife/WildTurkeyFactSheet.aspx](https://dnr.maryland.gov/wildlife/Pages/plants_wildlife/WildTurkeyFactSheet.aspx)
- Wild Turkey Education Trunk
  - [http://dnr.maryland.gov/wildlife/Pages/Education/education\\_trunks.aspx](http://dnr.maryland.gov/wildlife/Pages/Education/education_trunks.aspx)

## Lights Out!

Sustaining Fish and Wildlife Resources>Human Impacts  
Project WILD Terrestrial

**Maryland Links:** Maryland is rapidly losing its dark night skies with the Milky Way no longer visible for most of its residents. Light pollution has been increasing by about 2% every year. Unnecessary night light wastes electricity and can impact human health as well as the plants and animals in Maryland.

Birds that migrate at night, which includes most of our songbirds, use the moon and stars to help with navigation. Bright lights disorientate migrating birds and can cause them to circle. Lights draw birds towards buildings and the danger of glass windows. Organizations such as Lights Out Baltimore have been monitoring this danger by collecting the birds and bats that hit windows.



<https://i2.wp.com/astrophotography-telescope.com/>

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### Additional Resources:

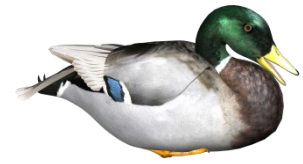
- Interactive maps of light pollution
  - <https://www.lightpollutionmap.info>
- Impacts of light pollution
  - <http://darksky.org/light-pollution/>
- Local impacts on migrating birds
  - <http://www.lightsoutbaltimore.org/>
- Maryland research on the impact of light on fireflies
  - <http://www.firefly.org/light-pollution.html>
- Local dark sky hero Lindsay Jacks
  - <https://www.baltimoremagazine.com/2014/8/12/activists-concerned-about-birds-crashing-into-buildings>



## Migration Headache

Ecological Knowledge > Wildlife Populations

### Project WILD Aquatic



**Maryland Links:** Many species of animals pass through Maryland during spring and fall migration. Others migrate to different habitats based on the seasons or to different areas of the state. Below is a table of some migratory species found in Maryland.

Species	Reasons for Migration
American Eel	Migrates to the Sargasso Sea (Atlantic Ocean) to lay eggs. All young will then migrate into freshwater streams to live throughout their lives.
Chimney Swifts	Migrates in late summer and early Fall for breeding and then to winter grounds.
Horseshoe Crabs	Migrates to beaches along Atlantic coast to breed.
Monarch Butterfly	Adults overwinter in Mexico, then it takes 4 generations to migrate to Canada and then back before the winter.
Red Knot	Migrate between South America and Arctic every year. Arrive on the Atlantic coast in the spring to fuel up on horseshoe crab eggs.
Spotted Salamander	Migrates from underground dwellings to temporary wetlands (vernal pools) in spring to breed.
Striped Bass	Migrate from the ocean upstream through the Chesapeake Bay to spawn in fresh water. They also migrate north off the east coast during the summer and return south in the winter.

### Additional Resources:

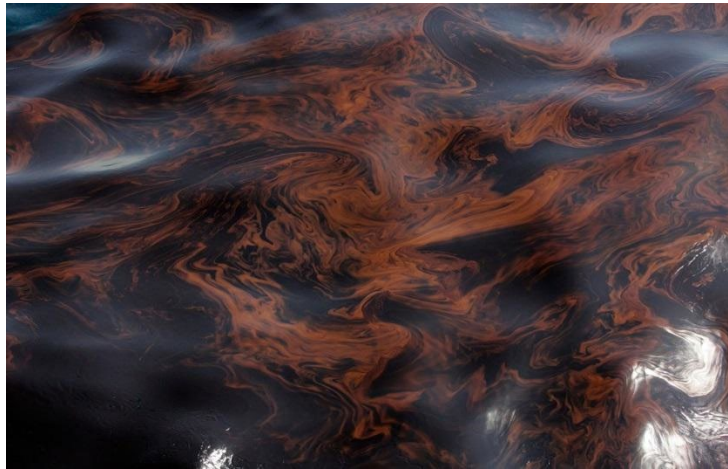
- Audubon Migration Explorer
  - <https://explorer.audubon.org/home>
- Basics of Bird Migration- Cornell
  - <https://www.allaboutbirds.org/news/the-basics-how-why-and-where-of-bird-migration/>
- Butterfly, Eel, by James Prosek
- Field Guide to Striped Bass
  - [https://www.chesapeakebay.net/S=0/fieldguide/critter/striped\\_bass](https://www.chesapeakebay.net/S=0/fieldguide/critter/striped_bass)
- On the Move: Mass Migrations, by Scotti Cohn
- Monarch Watch- conservation and education program on monarchs
  - <http://www.monarchwatch.org/>
- Project SNOWstorm- research project tracking snowy owl migration
  - <http://www.projectsnowstorm.org/>

## No Water off a Duck's Back

Sustaining Fish and Wildlife Resources>Human Impacts

### Project WILD Terrestrial

**Maryland Links:** On April 7, 2000, a pipeline running under a quiet tributary to the Patuxent River cracked and began leaking fuel oil into the environment. By the time the leak was discovered, more than 130,000 gallons of viscous, black oil had flowed into and over the pristine marshes of Swanson Creek. Emergency crews from the Potomac Electric Power Company (Pepco) and federal and state agencies worked through the night to contain the oil, but on the following evening a rogue storm of astonishing intensity blasted through the area and forced the oil over, under and through the floating barriers. By Sunday morning, April 8, the freed oil slick had contaminated miles of Patuxent River beaches and marsh, and was moving downstream in a deadly wave that would blacken 40 miles of shoreline.



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### Additional Resources:

- Gulf Oil Spill Resources from AFWA
  - <https://www.fishwildlife.org/projectwild/step-stem-and-wild-work/no-water-ducks-back>
- Patuxent River Chalk Point Oil Spill
  - <https://mde.maryland.gov/programs/Crossmedia/EnvironmentalEmergencies/Pages/oil-spill.aspx>
- Try Engineering: Oil Spill Solutions (PDF)
  - <http://ieee-ac.org/TISP/pdf/spillsolutions.pdf>

## Oh, Deer!

Ecological Knowledge > Wildlife Populations

### Project WILD Terrestrial

**Maryland Links:** Prior to the arrival of European immigrants, white-tailed deer inhabited all of Maryland and eastern North America. Native Americans hunted deer during all seasons. In Maryland, wolves and mountain lions preyed on all age classes and sexes of white-tailed deer.



By the 1700s, unregulated hunting and deforestation led to dramatic declines in deer populations. In 1900, deer only inhabited the far western sections of Maryland until deer management restricted hunting seasons. Today, over 200,000 deer can be found in Maryland at any given time.

Maryland white-tailed deer habitats include most parts of the state except for open water and the intensely developed urban areas (e.g. downtown Baltimore). Deer thrive in landscapes with wooded/brush sections and open areas such as cropland, pasture or landscaped yards. Deer use the wooded areas for food and cover, and open areas provide food. Landscapes with a bountiful interface of the forest and open areas support prime deer habitats.

Deer feed on nuts and berries, leaves, woody shoots and stems, grasses and cultivated crops. Some of their favorite natural foods include acorns, honeysuckle, poison ivy, green briar, young tree seedlings and mushrooms. Soybeans, corn and ornamental shrubs are several of their favorite foods planted by man.

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#### Additional Resources:

- White-tailed Deer Education Trunk
  - [http://dnr.maryland.gov/wildlife/Pages/Education/education\\_trunks.aspx](http://dnr.maryland.gov/wildlife/Pages/Education/education_trunks.aspx)
- Deer in Maryland
  - [http://dnr.maryland.gov/wildlife/Pages/hunt\\_trap/Deer.aspx](http://dnr.maryland.gov/wildlife/Pages/hunt_trap/Deer.aspx)
- Annual Maryland Deer Project Reports
  - [https://dnr.maryland.gov/wildlife/Pages/hunt\\_trap/Deer\\_AnnualReports.aspx](https://dnr.maryland.gov/wildlife/Pages/hunt_trap/Deer_AnnualReports.aspx)
- Maryland Wildlife and Heritage Service
  - <https://dnr.maryland.gov/wildlife/Pages/default.aspx>

## Owl Pellets

Ecological Knowledge > Interdependence

### Project WILD Terrestrial



**Maryland Links:** Eighteen species of owls can be found in North America, eight of which occur in Maryland. Barred owls, barn owls, Eastern screech owls and great-horned owls are commonly found throughout Maryland. Northern saw-whet owls migrate through the State in late fall and a few occasionally breed in western Maryland in the summer. Short-eared owls and long-eared owls historically nested in Maryland, but no breeding birds have been seen in a number of years. Snowy owls occasionally migrate through the State and can be seen along Assateague Island.

Owls are carnivorous and have special adaptations that enable them to hunt at night. For example, their eyes are large and fixed, with binocular vision and good depth perception. Because owls are unable to move their eyes, they have developed an incredibly flexible neck that allows them to turn their head 270 degrees, from one side to the other (humans can only rotate their heads about 180 degrees). Their eyes are also extremely light sensitive, allowing them to see well at night.

Another essential adaptation that allows owls to hunt at night is their extremely sensitive hearing. The facial disc enables owls to hear even a soft rustling in the grass as the disc acts to funnel and amplify sound to their ears. Many owls also have asymmetrical ears (one located higher on the face than the other) which allow the owl to detect both the distance and direction from which sound is coming more accurately.

Owls rely on silent flight to surprise their prey. Owl feathers are long and soft to help muffle sounds while flying. In addition, the leading edge of their flight feathers is soft and wavy to eliminate noise from wing flaps. These are all perfect adaptations for finding and catching prey at night, and explain why owls have become the most efficient hunters of the night.

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### Additional Resources:

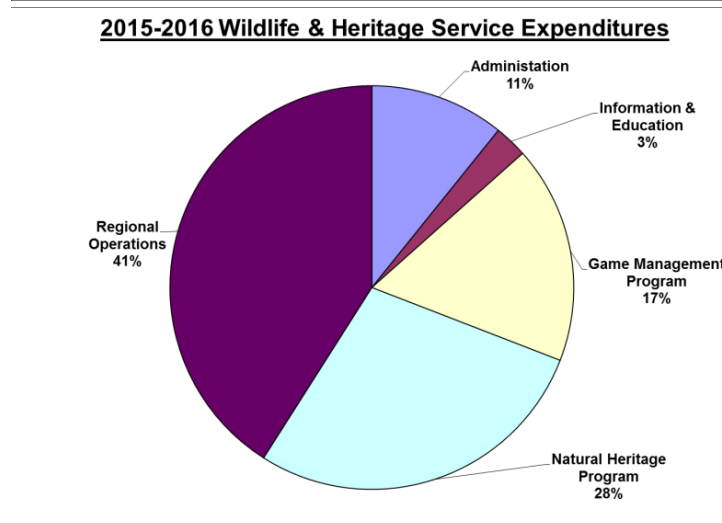
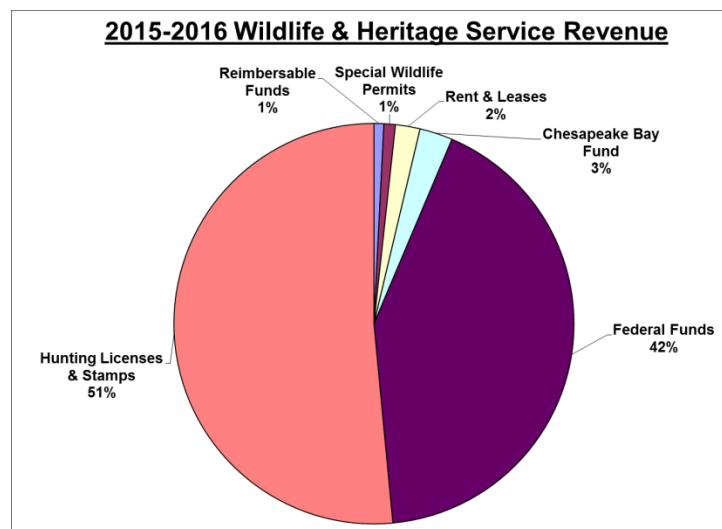
- Cornell Lab of Ornithology
  - <http://www.birds.cornell.edu/>
- Maryland Owls
  - <http://dnr.maryland.gov/wildlife/Pages/habitat/waowls.aspx>
- Owl Adaptations
  - <https://www.owlresearchinstitute.org/adaptations>
- Virtual Owl Pellet Dissection
  - <http://kidwings.com/virtual-pellet/>

## Pay to Play

Social and Political Knowledge > Economic, Commercial and Recreational Considerations  
**Project WILD Terrestrial**

**Maryland Links:** The majority of the funding for Maryland's Wildlife & Heritage Service comes from hunting licenses and fees (51%) and federal funds such as which are derived from an excise tax on sporting arms and ammunition. The federal aid funds are derived from an 11 percent excise tax on sport hunting devices and ammunition through the Pittman-Robertson Fund. For over 70 years, sportsmen and women have been contributing to this fund through the excise tax mechanism. Each state receives a share of the funds, which is administered by the U. S. Fish and Wildlife Service.

Hunters' dollars are used for hunter education programs, enforcement of wildlife regulations, wildlife-related education programs (like Project WILD!) and conservation programs. Other sources of funds include federal grants and the Chesapeake Bay and Endangered Species Fund, to which donations are made through the Maryland Income Tax Form. As an example of a typical annual revenue breakdown, the following chart shows a summary of Maryland's revenue for the fiscal year ending June 30, 2016.



## Phenology at Play

Ecological Knowledge > Interdependence

### Project WILD Terrestrial

**Maryland Links:** Although climate change is often viewed as something that will have impacts far away on polar bears and pikas, many Maryland species will be and are being impacted. Local climate change can be observed by monitoring the first appearance of certain animal species and the date of bud burst or first flowering of plants and trees.

Several Maryland species are expected to shift their ranges north as the climate warms including our state bird, the Baltimore oriole, and state butterfly, the Baltimore checkerspot. These two species may no longer breed in Maryland as the climate shifts. In addition, some local bird species depend on matching their arrival with the phenology of another species. One such species is the red knot which times its arrival in the Delaware Bay to the egg laying of horseshoe crabs.

The Acadian flycatcher (in the activity) is a fairly common bird throughout Maryland, breeding in woodlands usually close to streams.

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### Additional Resources:

- Impacts of climate change on Maryland wildlife
  - [http://dnr.maryland.gov/wildlife/Documents/SWAP/SWAP\\_Chapter6.pdf](http://dnr.maryland.gov/wildlife/Documents/SWAP/SWAP_Chapter6.pdf)
- Citizen science monitoring and data
  - [https://www.usanpn.org/natures\\_notebook](https://www.usanpn.org/natures_notebook)
  - <https://budburst.org/>
- Migration of red knot and its dependence on horseshoe crabs
  - <https://www.fws.gov/species/red-knot-calidris-canutus>
- Breeding Bird Atlas of Maryland
  - [https://www.pwrc.usgs.gov/bba/index.cfm?fa=explore.ProjectHome&BBA\\_ID=mddc2002](https://www.pwrc.usgs.gov/bba/index.cfm?fa=explore.ProjectHome&BBA_ID=mddc2002)
- Phenology calendars for amphibians and reptiles
  - <https://marylandnature.org/mara-resources/>
- Predicted changing range of birds due to climate change
  - <http://climate.audubon.org/birds/balori/baltimore-oriole>
- USA Phenology Network
  - <https://www.usanpn.org/monthly-chart>
- Using the phenology records of Thoreau
  - <https://www.americanscientist.org/article/spring-budburst-in-a-changing-climate>

## Turtle Hurdles

Sustaining Fish and Wildlife Populations> Issues and Trends  
Project WILD Aquatic

### Maryland Links:

Sea Turtles (Cheloniidae and Dermochelyidae) are fully aquatic turtles, emerging from the waters only to breed and lay eggs. In addition to huge lungs, they can also do without oxygen from the air as they submerge for up to 30 minutes. Most have hard shells; the leatherback (our only member of the Dermochelyidae family) lacks a bony carapace and instead has skin embedded with little bony deposits over its back.

All of Maryland's sea turtles are classified as either Threatened or Endangered. Maryland sea turtle species include:

1. Loggerhead Sea Turtle (*Caretta caretta*)- Threatened
2. Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)- Endangered
3. Green Sea Turtle (*Chelonia mydas*)- Threatened
4. Leatherback Sea Turtle (*Dermochelys coriacea*)- Endangered
5. Atlantic Hawksbill Sea Turtle (*Eretmochelys imbricata imbricata*)- Endangered

Sea turtles face many threats but in Maryland waters the main ones are marine plastic pollution, entanglement in fishing equipment and boat strikes.



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### Additional Resources:

- Maryland's Turtles
  - [https://dnr.maryland.gov/wildlife/Pages/plants\\_wildlife/herps/FieldGuide\\_OrderTestudines.aspx](https://dnr.maryland.gov/wildlife/Pages/plants_wildlife/herps/FieldGuide_OrderTestudines.aspx)
- First Sea Turtles hatch in Maryland
  - <https://www.nps.gov/asis/learn/news/first-confirmed-sea-turtle-nest-hatch.htm>
- Marine plastics
  - <https://marinedebris.noaa.gov/discover-issue>

## Water Canaries

Ecological Knowledge > Habitats, Ecosystems and Niches  
Project WILD Aquatic

**Maryland Links:** The Maryland Biological Stream Survey (MBSS) and multiple other stream monitoring organizations utilize bottom-dwelling macroinvertebrates as sensitive ecological indicators. Below are species commonly found in different systems:

**Sensitive** (aka typically found in healthy streams)

Mayfly, Stonefly, Caddisfly, Water Penny, Helgrammite and Fishfly

**Moderately Sensitive**

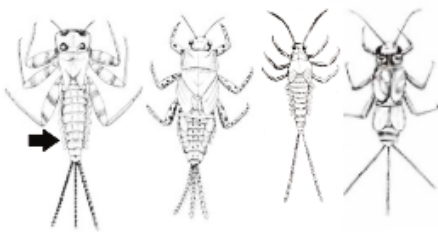
Caddisfly, Alderfly, Cranefly, Damselfly, Dragonfly, Scud, Crayfish, Clams,

**Pollution Tolerant**

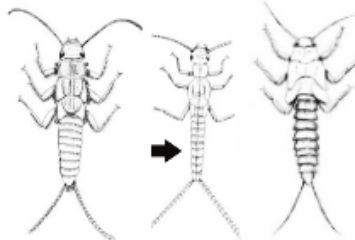
Black fly, Non-biting midge, Leech, Ramshorn snail, Pouch snail, Aquatic worm

### SENSITIVE ORGANISMS

POLLUTION-SENSITIVE ORGANISMS TYPICALLY FOUND IN HEALTHY STREAMS



**Mayfly: Order Ephemeroptera-** Plate-like or feathery gills on sides of lower body (arrow); three (sometimes 2) long, hair-like tails; 1"; abundant; 11 families.



**Stonefly: Order Plecoptera-** Two hair-like tails; six jointed legs with two hooked tips each; big antennae; no gills on lower half of body (arrow); 1½"; abundant; 9 families.



**Caddisfly: Order Trichoptera-** Six jointed, hooked legs just behind head; 2 hooks at back end; may be in a case made of stones, leaves or sticks; non-netspinning caddisflies have no bushy gills along bottom; 1"; abundant; 20 families.

### Additional Resources:

- Maryland's Streams
  - <http://dnr.maryland.gov/streams/Pages/OurMDStreams.aspx>
- MD Stream Macroinvertebrate Sheet (PDF)- portion shown above
  - [http://dnr.maryland.gov/streams/Documents/dnr\\_bugsheet.pdf](http://dnr.maryland.gov/streams/Documents/dnr_bugsheet.pdf)
- MD Stream Health- search an interactive map with data from streams across MD
  - <http://dnr.maryland.gov/streams/Pages/streamhealth/default.aspx>

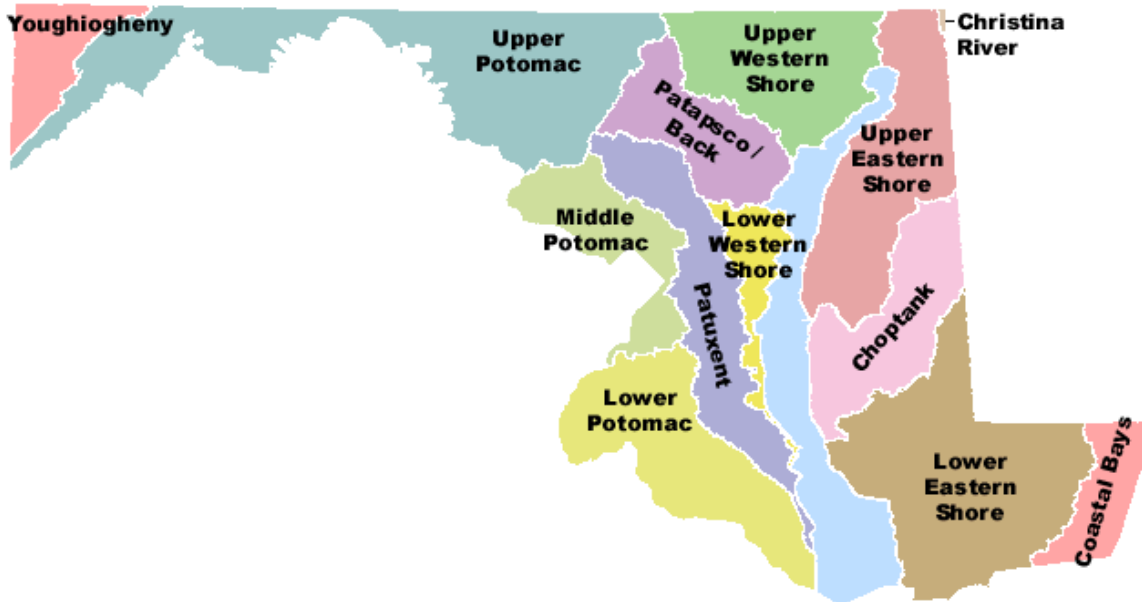


## Watershed

Sustaining Fish and Wildlife Populations > Human Impacts  
Project WILD Aquatic

**Maryland Links:** The Chesapeake Bay watershed extends about five hundred miles south from the headwaters of Otsego Lake, near Cooperstown, New York to the Atlantic Ocean and Suffolk, Virginia. It extends east from mountain streams near Blacksburg, Virginia to Berlin, Maryland (near Ocean City). It is essentially a giant, sprawling system of rivers that all drain into one shallow tidal basin, the Chesapeake Bay and its tidal tributaries (average depth, only 21 feet).

Most of Maryland falls within the Chesapeake Bay watershed. However, the State is also divided into several, smaller watersheds. Below is a map of Maryland's smaller watersheds as well as links to more information.



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### Additional Resources:

- MD Stream Health- search an interactive map with streams across MD
  - <http://streamhealth.maryland.gov/>
- Surf Your Watershed
  - <https://www.epa.gov/waterdata/surf-your-watershed>

## World Travelers

Sustaining Fish and Wildlife Populations> Issues and Trends

### Project WILD Terrestrial

**Maryland Links:** Hundreds of species have been introduced to Maryland either accidentally or intentionally. Many of these introduced species lack predators or diseases which naturally keep the populations in check. So, many times, these species can rapidly spread in their introduced regions while also outcompeting native species for resources. When introduced species become either biological or economic problems in their introduced ranges, the species are called **invasive**. The following list includes invasive species found in Maryland as well as some of their modes of introduction.

Organism	Nativity	Mode of Introduction
Common Reed ( <i>Phragmites australis</i> )	Europe	Likely accidental introduction through ballast water of ships in the 1700s and 1800s
Japanese Barberry ( <i>Berberis thunbergii</i> )	Japan	Intentional introduction- commonly planted as an ornamental species
Multiflora Rose ( <i>Rosa multiflora</i> )	Japan, Korea & E. China	Intentional introduction- was used as rootstock for ornamental roses as well as planted as living fence
Nutria ( <i>Myocastor coypus</i> )	South America	Intentional introduction- was released from fur farm on Eastern Shore of Maryland
Rusty Crayfish ( <i>Orconectes rusticus</i> )	Kentucky, Indiana, Ohio & Michigan	Accidental introduction- was commonly used as live bait and likely escaped
Northern Snakehead ( <i>Channa argus</i> )	China, Korea & Russia	Likely intentional introduction- commonly used as food fish and likely released into environment
West Nile Virus ( <i>Flavivirus</i> )	West Nile District of Uganda	Accidental introduction- possibly introduced by an infected mosquito or bird
Zebra Mussels ( <i>Dreissena polymorpha</i> )	Europe and W. Asia	Accidental introduction- likely introduced through ballast water into Great Lakes as well as attached to boats

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#### Additional Resources:

- Center for Invasive Species
  - <http://www.bugwood.org/> , <http://www.invasive.org>
- Plant Invaders of Mid-Atlantic Natural Areas, 4th ed
  - <https://www.invasive.org/alien/pubs/midatlantic/midatlantic.pdf>
- Maryland Invasive Species Council
  - <http://www.mdinvasives.org/>

## **Additional Resources to Supplement Project WILD Activities**

### **Backyard Wildlife Habitat (Wild Acres)**

- Contains fact sheets on ways to improve backyard and schoolyard wildlife habitat as well as fact sheets on local wildlife and plants
- <http://dnr.maryland.gov/wildlife/Pages/habitat/wildacres.aspx>

### **Maryland Invasive Species Council**

- Provides information and resources relating to invasive species in Maryland
- <http://mdinvasives.org/>

### **Maryland Wildlife Education Resources**

- Programs and printables to learn about Maryland wildlife
- <http://dnr.maryland.gov/Wildlife/Pages/Education/home.aspx>

### **Maryland Wildlife Lists**

- Lists of species found in Maryland as well as factsheets
- [http://dnr.maryland.gov/wildlife/Pages/plants\\_wildlife/mdwllists.aspx](http://dnr.maryland.gov/wildlife/Pages/plants_wildlife/mdwllists.aspx)

### **Project WILD Maryland DNR Site**

- Contains MD correlations as well as information on Maryland species
- <http://dnr.maryland.gov/wildlife/Pages/Education/ProjectWILD.aspx>

### **Project WILD National Site**

- Contains printable student pages and other curriculum resources
- <https://www.fishwildlife.org/afwa-inspires/project-wild>

