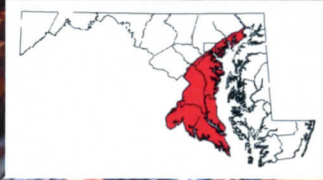


The Reptiles & Amphibians of Maryland's Upper Coastal Plain



Scott Smith
DNR-Wildlife & Heritage Services





Acknowledgements

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Herpetology



- Greek *herpeton* = crawling thing
- Greek *logos* = reason or knowledge
- **Amphibians & Reptiles – traditionally studied together (Ectothermic)**
- Historically difference between not noted
- **Convenience – methods of collecting & preserving similar**
- Amphibians & Reptiles = “Herps”



Herpetology, the study of reptiles and amphibians

Amphibian

- Greek “amphi” = double or both
- Greek “bios” = life.
- Amphibians have a “double” life – born of water living primarily on land; undergo “metamorphosis”.



Amphibian “double life”: egg mass to tadpole, then metamorphoses into adult body form.

Amphibians are “ectothermic” – body temp dependent on external environment.

Ancestral amphibians derived from fishes – 1st vertebrates to move onto land – gave rise to all other terrestrial vertebrates (>250 mya)



Amphibians



- Scale-less skin with many glands (usually moist/slimy)*
- Toes do not have claws
- Young pass through larval stage that is usually aquatic (tadpoles) before “metamorphose” into adult form
- Usually jelly-like eggs laid in water
- **Maryland amphibians** = frogs, toads & salamanders

(*Escape; toxic; anti-biotic; respiration)

Worldwide there are 3000+ amphibian species.



Reptiles



- **Descendants of early amphibians**
- **Skin has scales**
- **Toes have claws (in reptiles with toes)**
- **Young are small replicas of adults (no larval stage or metamorphosis)**
- **Shelled egg laid on land**
- **Maryland reptiles = turtles, lizards & snakes**

Yolk sac has 3 extra-embryonic membrane, the amnion, chorion & allantois – not present in fish or amphibians, but are present in birds & mammals.
Worldwide there are 6000+ reptile species.
Turtles are oldest living reptiles: >200 mya

Ectothermy Effects



- **Body Temperature varies widely**
 - low thermal maxima
 - freeze tolerance (amphibians)
- **Basking behavior (reptiles)**
 - digestion
 - gestation (developing eggs/embryos)
 - spermatogenesis
 - fight off disease (immune system)



Conowingo Dam & Northern Map Turtles

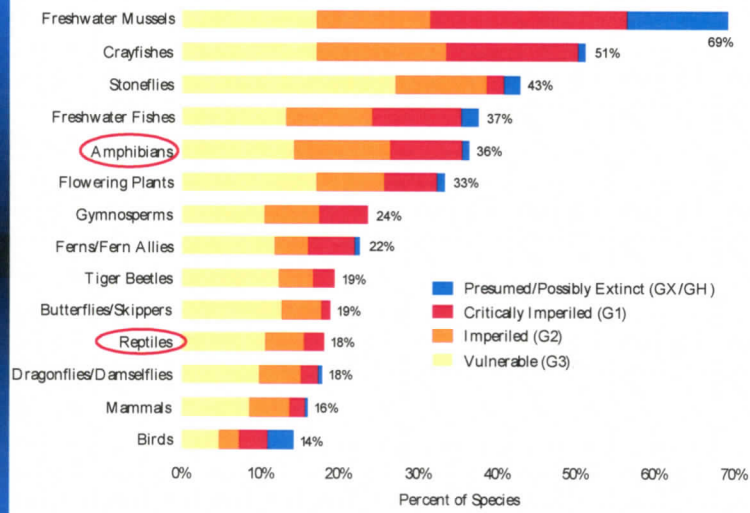


Pre-Release



During Release

Proportion of US species at risk by plant and animal group



Source: *Precious Heritage* (2000) © TNC, NatureServe

IUCN Red List - 2010

<u>Vertebrate Species Group</u>	<u>% of Species Globally Threatened</u>
---------------------------------	---

Primates	48%
Turtles	43%
Amphibians	30%
Mammals	21%
Birds	13%

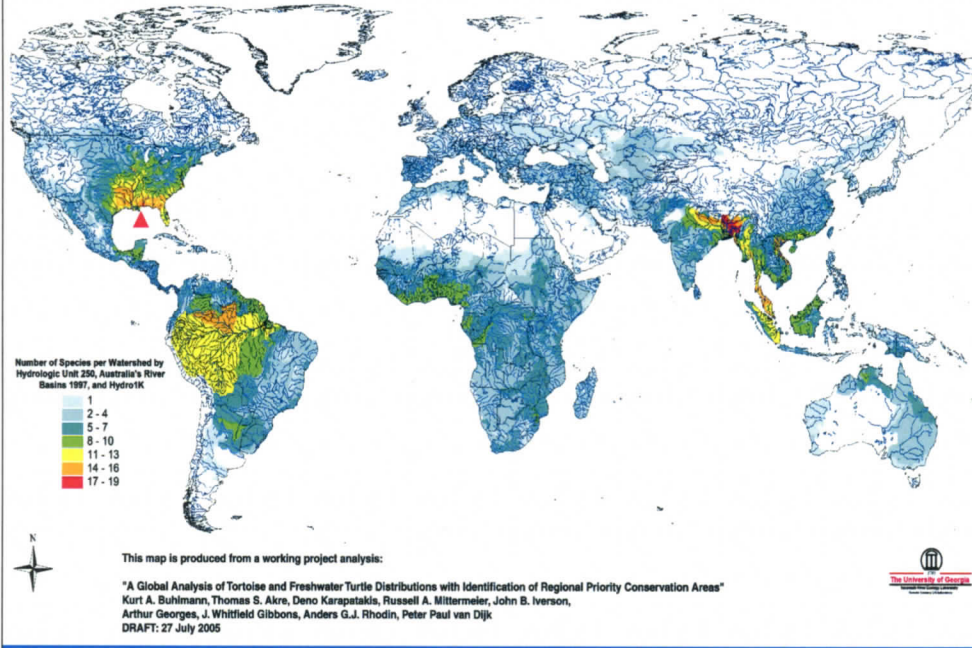
Source: Rhodin and van Dijk 2010

Reptile & Amphibian Species Diversity in Maryland, US, & World

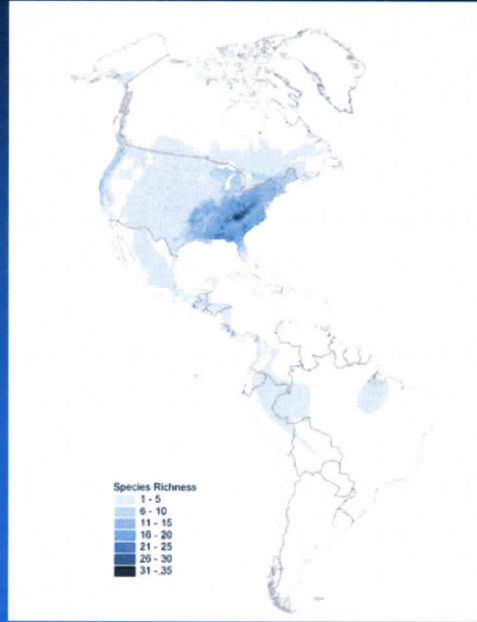
	<u>MD</u>	<u>W. Shore</u>	<u>US</u>	<u>World</u>
Turtles	19	12	58 (18%) ~	320
Lizards	6	5	127	3000+
Snakes	<u>27</u>	<u>19</u>	<u>131</u>	<u>2700+</u>
	52	36 (69%)	316	6020+
Salamanders	22	11	186 (60%) ~	310
Frogs & Toads	<u>20</u>	<u>16</u>	<u>103</u>	<u>2500+</u>
	42	27 (64%)	289	2810+
Total	94	63 (67%)	605	8830+

The numbers for US & World are different depending on author, date of publication and which taxonomy being used. Also note that there are other amphibian groups than those listed here. The US is one of world centers of diversity for turtles, and is THE world center of diversity for salamanders (SE US – Appalachians refugia during Ice Ages – species evolve on individual mountains).

Species Richness Map of the World's Tortoises and Freshwater Turtles



DIVERSITY OF NEW WORLD SALAMANDERS



2004



Aquatic Habitats

- **Seasonal Wetlands**
- **Permanent Wetlands**
- **Wet Meadows, Bogs & Fens**
- **Small Streams, Springs & Seeps**
- **Rivers**
- **Estuarine & Coastal (marsh, beach, water)**



Hydroperiod, pH, adjacent forest cover, and lack of fish predators important to many amphibians.

Seasonal Pond in Winter

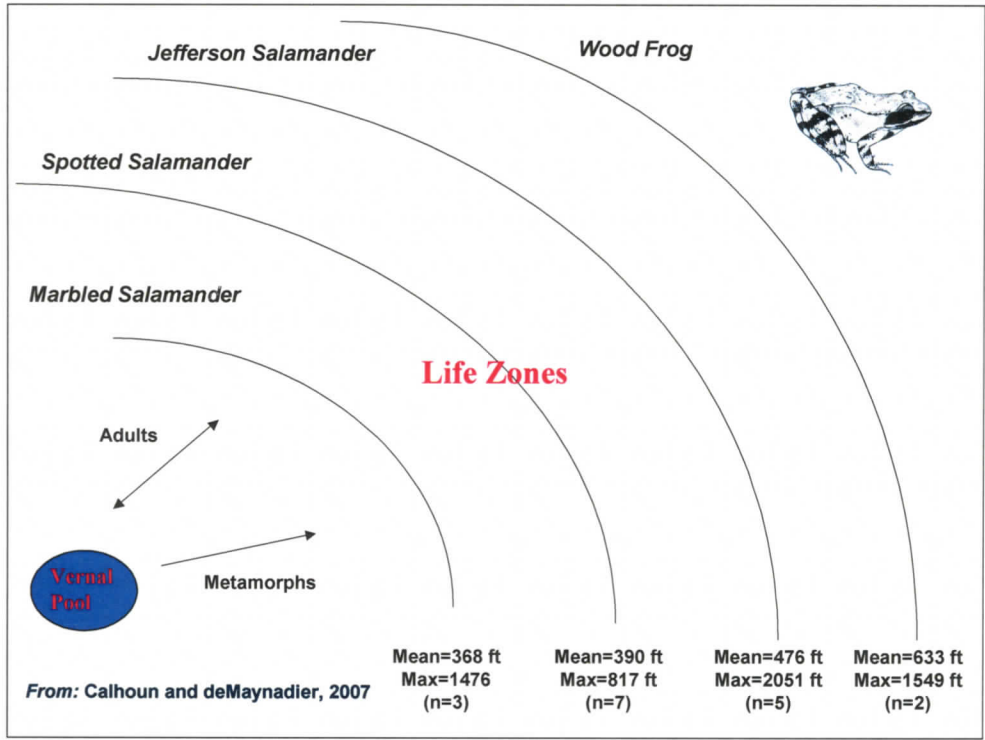


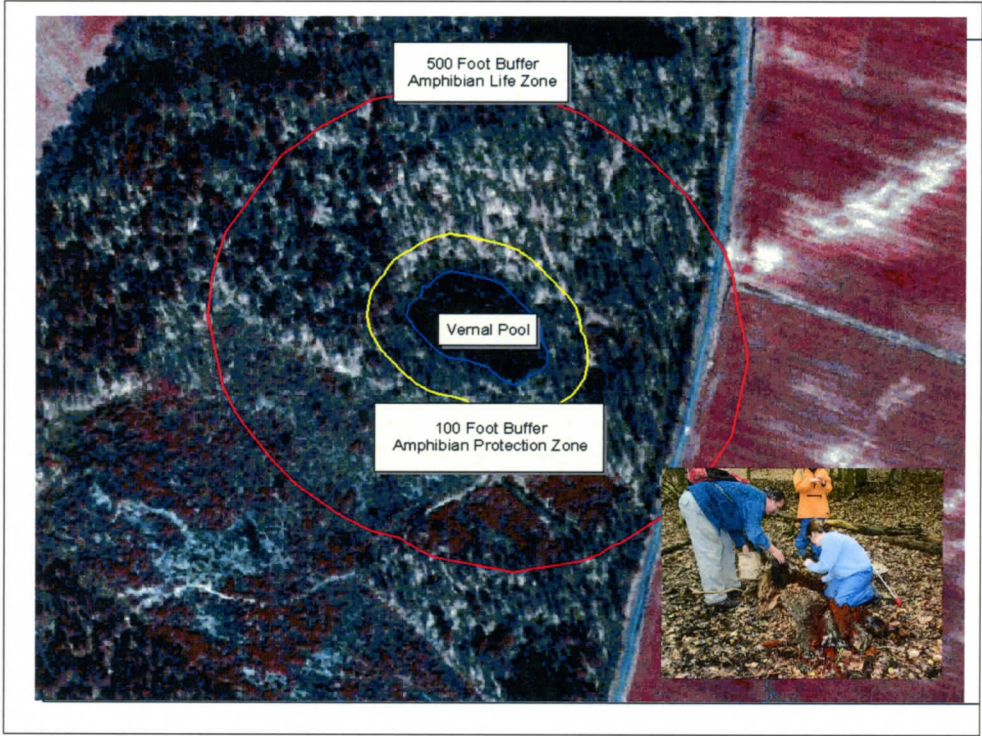
Trying to build appreciation for the seasonal wetland. They are much more than mosquito-infested swamps. The sinkhole pond in winter in Virginia.

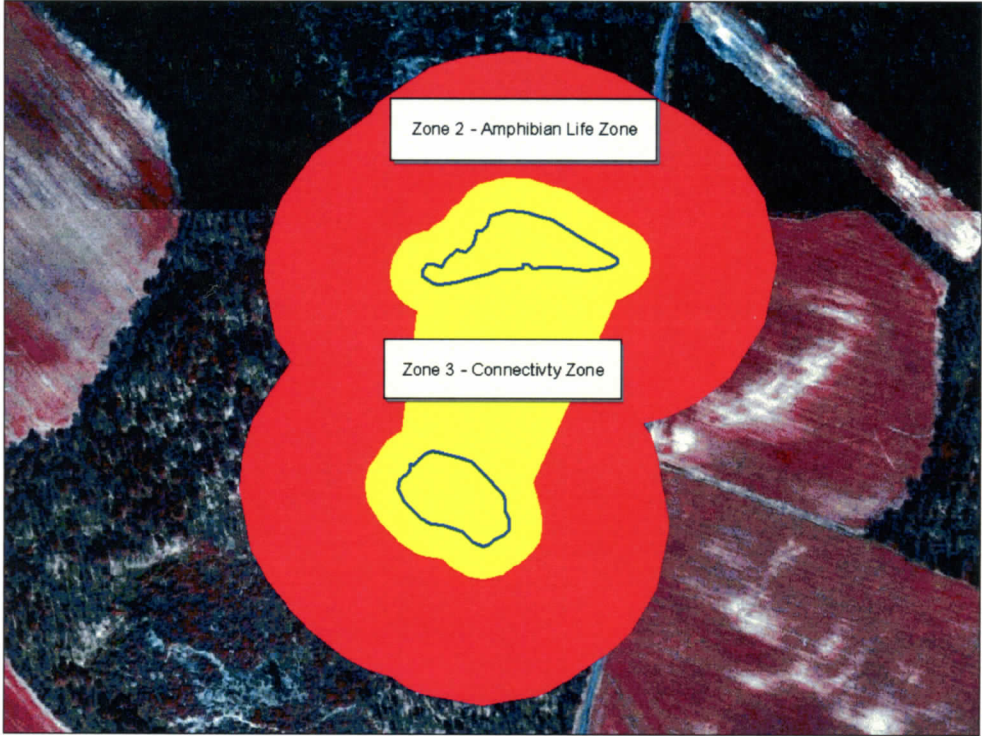
The same pond in June



The same wetland the next summer. Natural wetlands hold water for varying times of the year. Varying hydroperiods.







Terrestrial Habitats

- **Hardwood Forests**
- Spruce & Fir Forests
- Xeric Uplands & Pine Forests
- Grasslands & Old Fields
- Rock Outcrops & Talus
- Caves & Karst (limestone)
- Agricultural Lands
- Urban & Residential Systems



6 major threats to reptiles and amphibians:



habitat loss



disease & parasites

(Chytrid fungus & Ranavirus)

environmental pollution



PARC identified 6 MAJOR THREATS TO REPTILES AND AMPHIBIANS

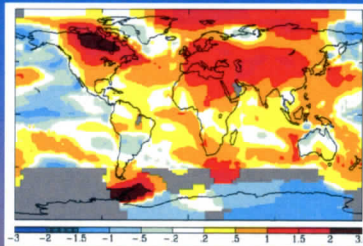
6 major threats to reptiles and amphibians:



unsustainable use

(Banned in 2007)

global climate change



(2-4.5°C by 2050)



invasive species

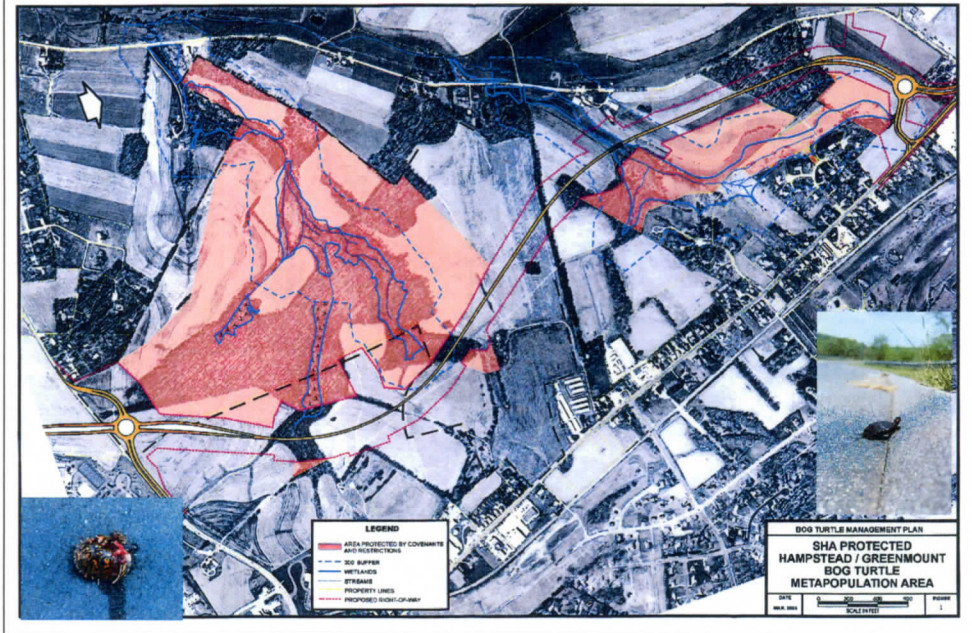
(plant & animal)

=



Of the six major reasons for species declines, habitat loss is the one overriding important factor for nearly all the species. As more land disappears for human development, it becomes more imperative that we effectively manage the remaining habitats. And the location of developments on the landscape can go a long way to allowing corridors or preventing movement and increasing fragmentation of habitats and species declines. The housing development industry is a group that PARC needs to work with.

Habitat Loss & Fragmentation



An example of habitat loss and fragmentation is from the Hampstead Bypass in Carroll County where through some careful planning and required wildlife crossing culverts some connectivity was maintained, but roadkill of turtles, etc is still an issue.

Temporal Habitat Loss?



Large clearcuts can be a problem if there is no adjacent forest land retained to allow species to recolonize the regenerating forest. Studies have shown that the quickest salamander to recolonize is the red-backed salamander which begins to do so in about 6 years. However other species like the spotted salamander make take 15-20 years before it will recolonize an area. The big problem is solar radiation and drying out of the soil. Amphibians need to keep their skin moist. Closed canopy forests are cooler and wetter.

Amphibian & Reptile Diseases

- Chytridiomycosis (Chytrid Fungus, *Bd*)
- Ranavirus (Frog Virus 3, ATV, Bohle's Iridovirus)
- Upper Respiratory Tract Disease (URTD; *Mycoplasma* bacteria) – Gopher & Desert Tortoises
- Fungal Dermatitis – lesions on rattlesnakes



Vance Vrendenburg



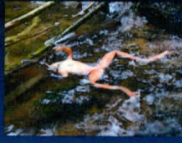
Ellen Bronson



Kevin McCurley

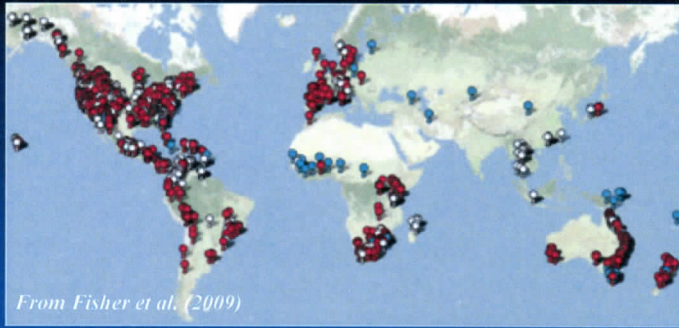
This is not a complete list – just those that are of major concern currently.

Chytrid: effects amphibians; responsible for extinctions and local extirpations in central & south america, Australia, and western US. Likely been in MD since 1930s – introduced by African Clawed Frogs used in early pregnancy testing of humans. **Ranavirus (RV):** more later in talk but effects amphibians & reptiles. FV3 is form of RV in MD; ATV=Ambystoma tigrinum Virus – effects tiger salamanders in midwest and SW US; Bohle's=Australia; **URTD:** Mycoplasma bacteria responsible for large die-offs of gopher tortoises in FL & desert tortoises in SW US. Has been documented in eastern box turtles in eastern US. We found antibodies for Micoplasma in 3 of 77 bog turtles tested in MD. **Fungal Dermatitis:** new disease that is primarily impacting timber rattlesnakes in New England, NY and upper midwest. Causes lesions on head and neck – prevalent at hibernacula – sick snakes exhibiting abnormal basking behavior (on snow, on super hot surfaces, etc.) – current regional study in which DNR is tangentially involved includes field surveys to test snakes for it.



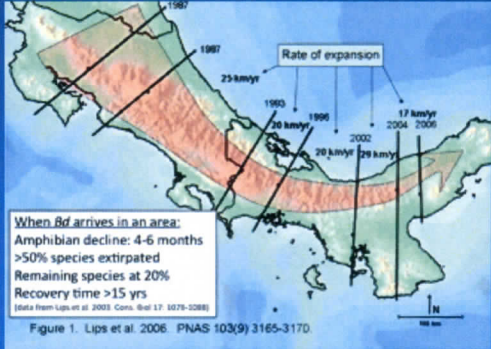
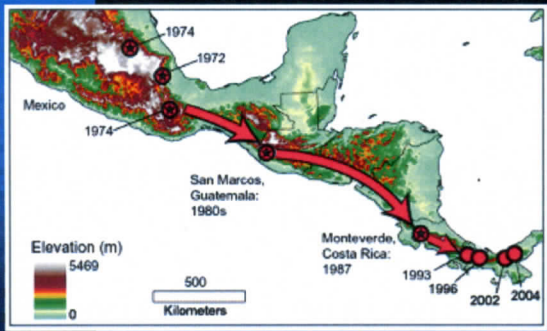
Chytridiomycosis

- Impairs electrolyte transport in skin (respiration, hydration, osmoregulation, and thermoregulation)
- **Temperature plays role: 12-23°C (about 54-73°F); absent above 27°C (81°F)**
- All elevations though more prevalent at higher
- **Novel pathogen – introduced by African Clawed Frogs (*Xenopus laevis*) in 1930s used for pregnancy testing**
- Subsequently spread by Global Pet Trade, Scientific Trade, Bullfrog Farming, and Bait Trade (tiger salamanders)



- *Bd* may be responsible for the greatest disease-caused loss of biodiversity in recorded history.
- Over past 30 years, *Bd* has caused the catastrophic decline or extinction of at least 200 species of frogs, even in pristine, remote habitats
- Over 350 amphibian species infected with *Bd*

Classic Wave-like Disease Front



From Lips et al. 2008

Figure 1. Lips et al. 2006. PNAS 103(9) 3165-3170



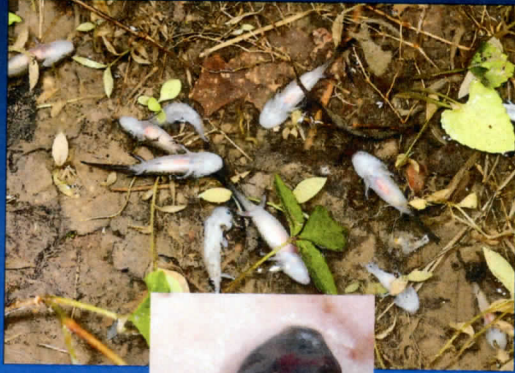
Ranavirus



- Emerging Infectious Disease
- **The most significant contributor to population declines in amphibians.**
- In North America –responsible for majority of catastrophic die-offs of spotted salamander larvae and wood frog tadpoles
- Increasingly responsible for turtle die-offs

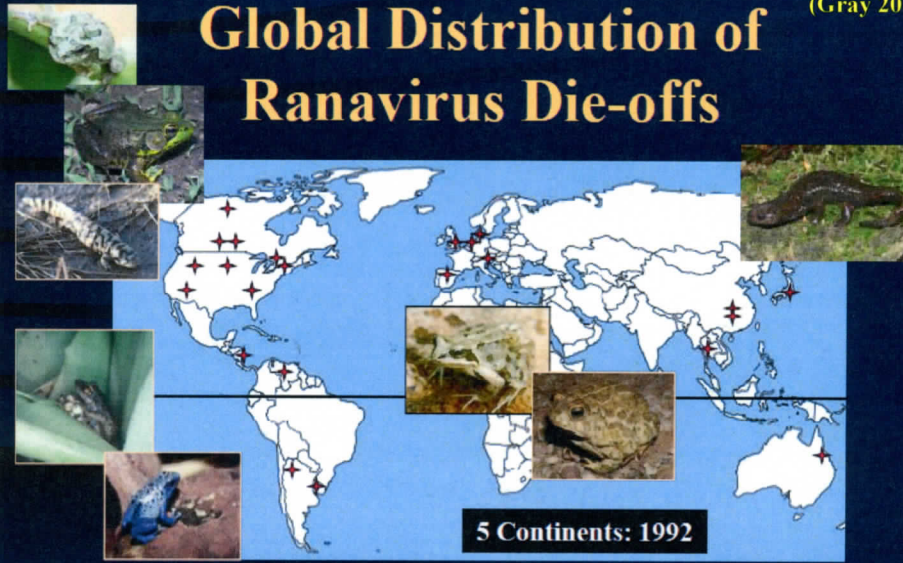
Emerging infectious diseases like ranavirus and chytrid fungus are a real problem. The recent Washington Post article about ranavirus in box turtles and wood frog and spotted salamander tadpoles is an illustration of this problem here in MD.

Ranavirus



(Gray 2011)

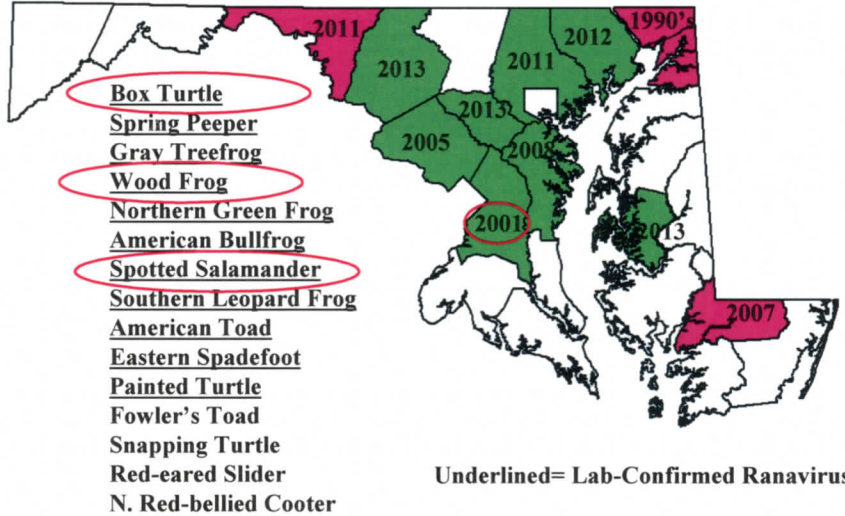
Global Distribution of Ranavirus Die-offs



All Latitudes, All Elevations

12 Families: Ranidae, Hylidae, Bufonidae, Leptodactylidae, Dendrobatidae, Discoglossidae, Rhacophoridae, Myobatrachidae, Ambystomatidae, Salamandridae, Hynobiidae, Cryptobranchidae

Maryland Counties with Lab-Confirmed (8) or Suspected (3) *Ranavirus*



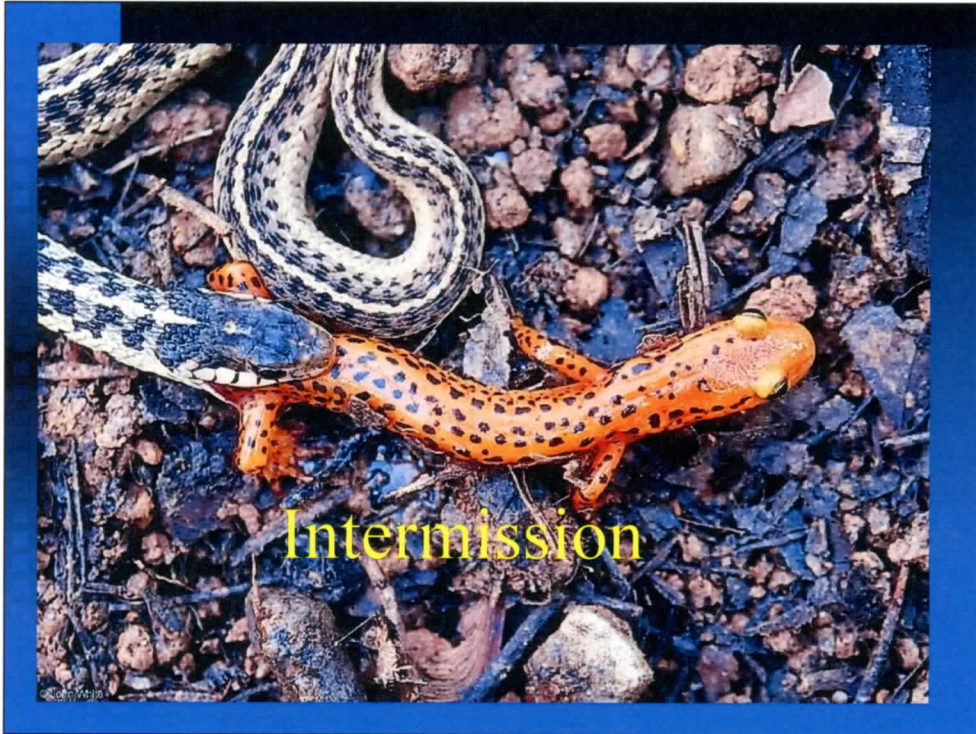
First lab-confirmed in MD in 2001, though it likely was here in late 1990s. As of 2013 it has been confirmed in 8 counties and is suspected in die-offs in 3 other counties. WOFR, SPSA and EBTU are most common species to succumb but has been found in a number of species in MD. The die-off at Seth Forest in 2013 was the first time RV has ever been detected in spadefoot toads.

Global Climate Change

- Skewed sex ratios in turtles/embryo death
- **Altered hydroperiods in seasonal wetlands**
- High elevation (mountain top) species lost
- **Increased infectious diseases (stress)**
- Range expansions & contractions
- **Invasive species favored**



Global climate change will have many effects on our native herps. Skewed sex ratios in turtle species with temperature-dependent sex determination (more females).

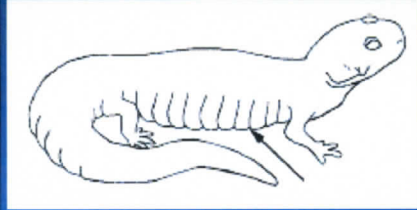


Amphibian & Reptile Identification

Salamanders (*Caudata*)

MD: 22 species

W. Shore: 11 species

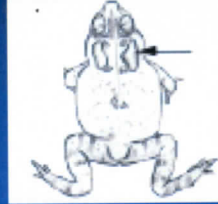


- **Costal Grooves**
- **Discernable Neck**
- **Tail & 4 Limbs (usu. same size)**
(Amphibian=No Scales)

Frogs & Toads (*Anura*)

MD: 20 species (1 introduced)

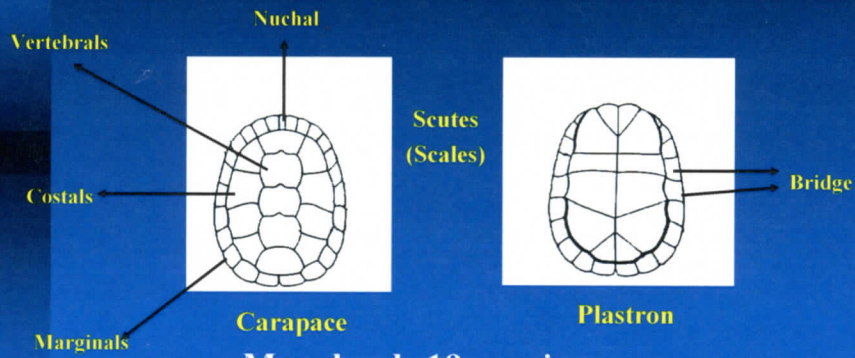
W. Shore: 16 species



- Short Bodies - No Neck
 - No Tail in Adults
 - 4 limbs with rear larger than front
 - Frogs: Long Legs for Leaping; Smooth Skin
 - Toads: Short Legs for Hopping; Warty Skin
- (Amphibian=No Scales)



Turtles (*Testudines*)



Maryland: 19 species
W. Shore: 12 species (1 introduced)

(Reptile=Scales)

Lizards (Squamata)

MD: 6 species

W. Shore: 5 species

- Moveable Eyelids
- External Ear Openings
- 2 Lungs
- 4 Limbs

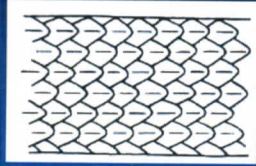
(Reptile=Scales)



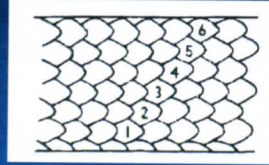
Snakes (*Squamata*)

Maryland: 27 species

W. Shore: 19 species

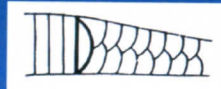


Keeled Scales

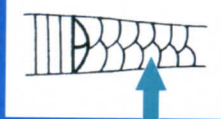


Smooth Scales

- Lack limbs, external ear openings, & eyelids
- Have long forked tongues
- Single Lung

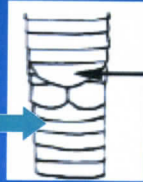


Single or Undivided Anal Plate



Divided Anal Plate

Subcaudals



Subcaudals



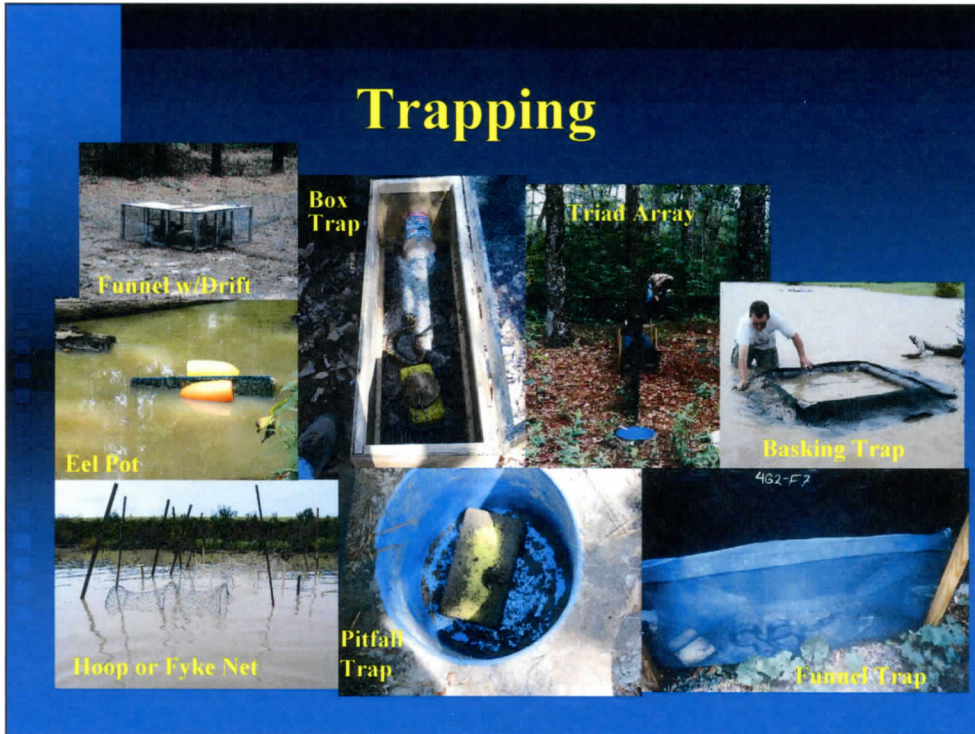
(Reptile=Scales)

Looking for Herps



Herps are usually found by looking down, the opposite of birding. Dipnets, seines, snake hooks, snake tongs, mussel buckets, even binoculars; all are useful to help find herps. They are often under or in “cover” objects.

Trapping



There are many herp trapping techniques – all require a DNR permit.

Ethical Handling Guidelines

- Use care and discretion
- Do not disturb nests +/- hibernacula
- Roll/lift cover objects towards you
 - ◆ Return without injuring
- Keep handling (& stress to the animal) to a minimum
 - ◆ Use nets, snake hooks, etc.
- Photograph *in situ*, when possible
- Return cover objects as found



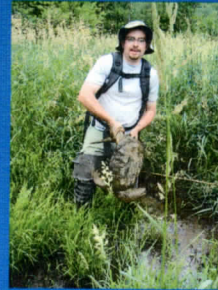
Proper Handling and Restraint

Amphibians (in general)

- ◆ **Handle with wet hands**
- ◆ **No lotions, bug spray, chemicals, etc.**
- ◆ **Inside wet, clear plastic bag or container**
- ◆ **Use Net (rather than hands when possible)**
- ◆ **Remember: Amphibian skin is fragile!**

Reptiles (in general)

- ◆ **Support weight**
- ◆ **Prevent bone breaks & fractures**
- ◆ **Beware of the bite!**



Disinfection Procedures

- **Why?**
 - ◆ Chytridiomycosis, ranavirus, URTD and other diseases
 - ◆ **Spread easily – individual to individual, in water, damp surfaces, etc.**
 - ◆ **Disinfect boots, gear, and any items that come in contact w/ aquatic habitats and moist leaf litter**
- **How to:**
 - ◆ 10% bleach solution (9 parts water, 1 part bleach)
 - ◆ **At least one minute (preferably 20 min soak)**
 - ◆ Scrub brush – remove dirt/fungus, etc
 - ◆ **Rinse with freshwater**
 - ◆ Clean skin w/ alcohol-based hand sanitizer
 - ◆ **Do not disinfect or rinse in freshwater habitats**



URTD=Upper Respiratory Tract Disease – found in turtles. Chytrid fungus (aka, BD) is impacting amphibians globally. Ranavirus, a type of iridovirus, is effecting both frogs and turtles.

Legal Issues – Know the Law

MD Herp Regulations

List A – common species – 4 w/o permit

List B – mostly turtles – 1 w/o permit

List C – rarest – no take allowed

Exceptions

Endangered Species Permit

Scientific Collecting Permit

(Passed in 1993; Revised 2008)



Permits from DNR are required for some activities.

Announcement:
Maryland's Amphibians and Reptiles Need You!

What? The Maryland Amphibian and Reptile Atlas (MARA): a 5-year atlas documenting amphibian and reptile distributions in Maryland.

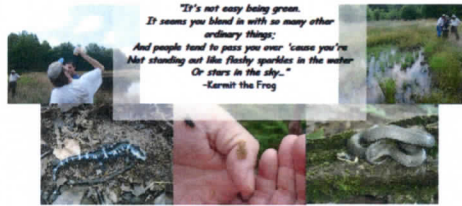


When? January 2010 through December 2014

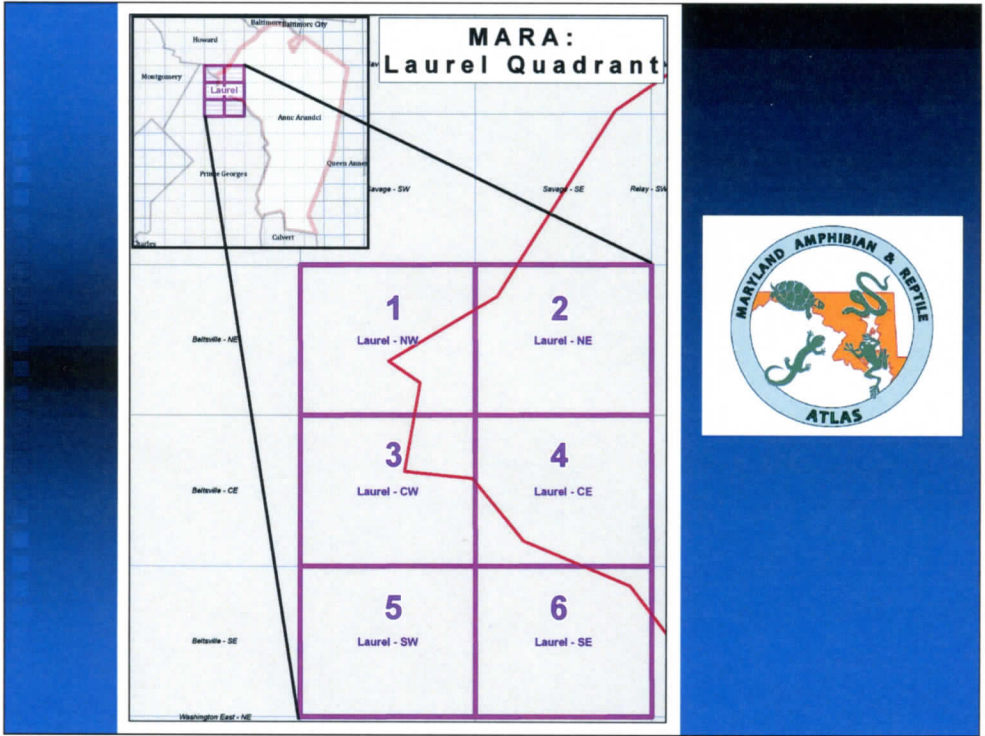
Where? Statewide on a grid-based geographic scale using U.S. Geological Survey (USGS) 7.5-minute quadrangle maps equally divided into six blocks of approximately 10 square miles each.

Who? **Volunteers** to conduct fieldwork and document the roughly 95 species and subspecies known to occur within the State.

Why? The atlas will establish a baseline for future efforts and to promote conservation and protection of amphibians and reptiles by systematically documenting amphibian and reptile distributions throughout the state.



Contact atlas@marylandnature.org with questions and to be referred to your County Coordinator!



Documentation & Verification

- ◆ Keep detailed records
- ◆ Include date, exact location
- ◆ Weather
- ◆ Habitat
- ◆ Observer names
- ◆ Verify by photo, sound recording, or voucher (if legal)



Species Accounts: Common Reptiles & Amphibians of Maryland's W. Shore



Spotted Salamander (*Ambystoma maculatum*)



Clear & "Milky" Egg Masses



Larvae

Red-spotted Newt (*Notophthalmus v. viridescens*)



Courtship



Juvenile (Red Eft)



Aquatic Adult



Egg Cluster

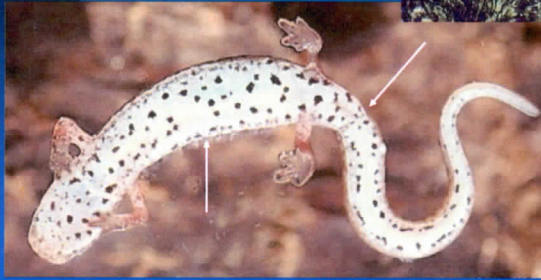


Red & "Lead" Color Phases



Eastern Red-backed Salamander (*Plethodon cinereus*)

Four-toed Salamander (*Hemidactylium scutatum*)



Fowler's Toad (*Anaxyrus fowleri*)



≥ 3 warts in large dark spots



American Toad (*Anaxyrus a. americanus*)



1-2 large warts in dark spots



Amplexus



Northern Spring Peeper (*Pseudacris crucifer*)



Cope's Gray Treefrog (*Hyla chrysoscelis*)

Gray Treefrog (*Hyla versicolor*)



Egg Mass



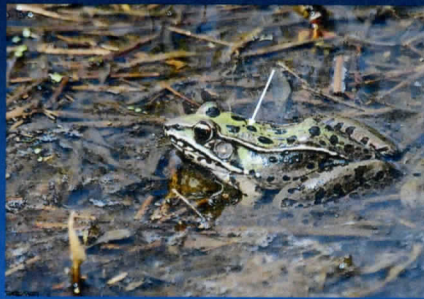
Raft of Egg Masses



Larvae

Wood Frog (*Lithobates sylvaticus*)

Southern Leopard Frog (*Lithobates sphenoccephalus utricularius*)



Larvae & Tail

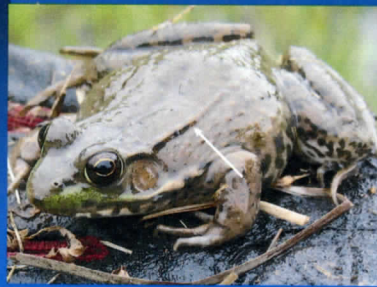
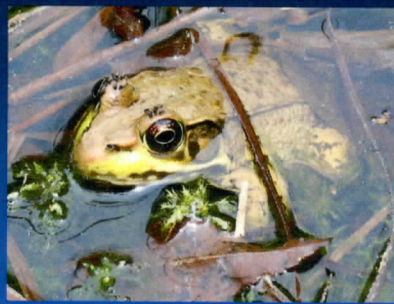


Larvae

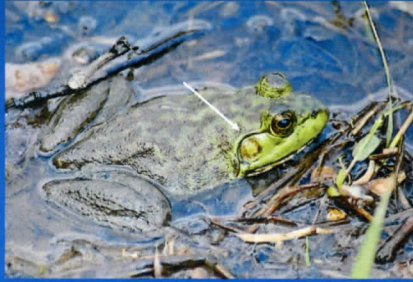


Pickereel Frog (*Lithobates palustris*)

Northern Green Frog (*Lithobates clamitans melanota*)



American Bullfrog (*Lithobates catesbiana*)



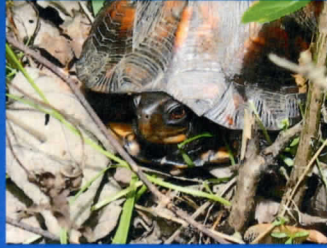
Eastern Box Turtle (*Terrapene c. carolina*)



Juvenile



Adult Male

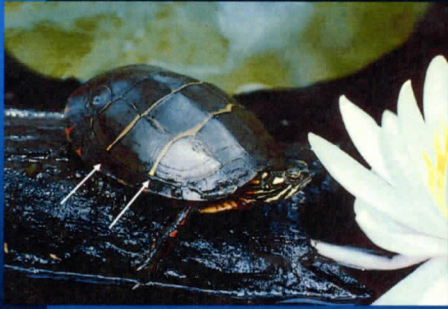


Northern Diamond-backed Terrapin (*Malaclemys t. terrapin*)



Hatchling





Eastern Painted Turtle (*Chrysemys p. picta*)

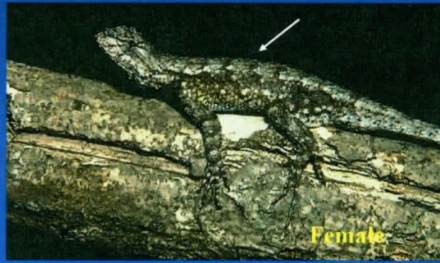
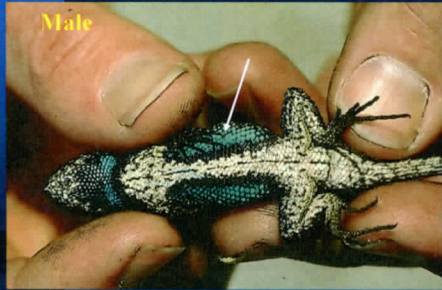
Eastern Snapping Turtle (*Chelydra s. serpentina*)



Plastron (Juvenile)



Eastern Fence Lizard (*Sceloporus undulatus*)



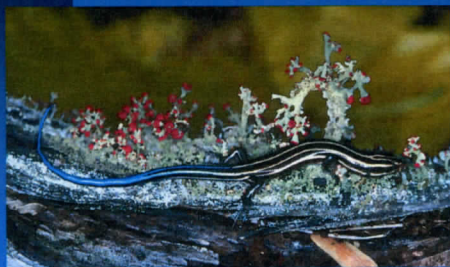
Common Five-lined Skink (*Plestiodon fasciatus*)



Male



Female



Juveniles

Broad-headed Skink (*Plestiodon laticeps*)



Female



Male



5 Labials

Northern Watersnake (*Nerodia s. sipedon*)



Scales keeled and anal plate divided.

Eastern Gartersnake (*Thamnophis s. sirtalis*)



Scales keeled and anal plate single (undivided).

Common Ribbonsnake (*Thamnophis s. sauritus*)



Scales keeled and anal single.

Northern Black Racer (*Coluber c. constrictor*)



Adults



Scales smooth and anal plate divided. Note is dark above and below, with some white on chin and throat.

Eastern Ratsnake (*Pantherophis alleghaniensis*)



Ventrals



Defensive Posture



Egg Eating



Juvenile

Scales weakly keeled and anal plate divided.

Northern Copperhead (*Agkistrodon contortrix mokasen*)



Scales weakly keeled and anal plate single. Venomous pit-viper.

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