




---

---

---

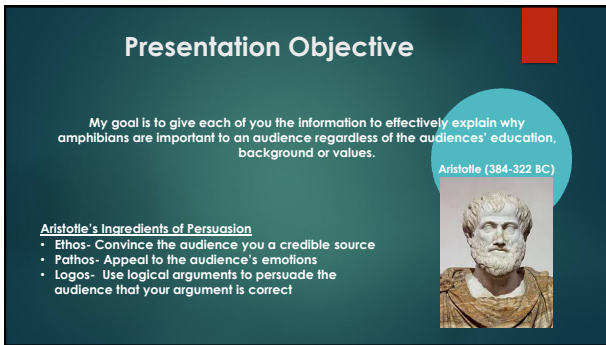
---

---

---

---

---




---

---

---

---

---

---

---

---




---

---

---

---

---

---

---

---

## Importance of Amphibians: Ethos



### Ethos

How can you explain to someone you are a knowledgeable source of amphibian information?



---

---

---

---

---

---

---

---

## Importance of Amphibians: Pathos

**Pathos:** An appeal to the audiences emotion.

### Amphibian Declines

6.9% (386 species) of frogs could become extinct within the century (Avery 2015)

Current extinction rates are 211X background rate (McCullum 2007)

Measure of Threat	Effect on Amphibian Species
Threatened	32.5% (1856:5743)
Species with Pop Declines	43.2% (2468:5743)
Critically endangered	7.4% (427:5743)
Species poorly understood	22.5% (1294:5743)

---

---

---

---

---

---

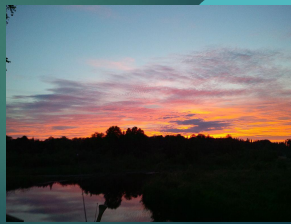
---

---

## Importance of Amphibians: Pathos

**Pathos:** An appeal to the audiences emotion.

No more summertime chorus



---

---

---

---

---

---

---

---

## Importance of Amphibians: Pathos

Pathos: An appeal to the audiences emotion.

### Amphibian Declines

No more catching  
of ~~the~~ ~~species~~ frogs  
become extinct within the  
(Arey 2015)

Current extinction rates are  
background rate (McCullum 200)



---

---

---

---

---

---

---

---

## Importance of Amphibians: Pathos

Pathos: An appeal to the audiences emotion.

No more catching  
salamanders in the creek



---

---

---

---

---

---

---

---

## Importance of Amphibians: Pathos

Pathos: An appeal to the audiences emotion.

Goodbye Kermit the frog



---

---

---

---

---

---

---

---

## Importance of Amphibians: Logos

**Ecosystem Services**  
 "These services are the components of ecosystems that influence human well-being." (Hocking and Bobbitt 2014)

Provision	Food, fresh water, fiber and medicine
Regulating	Purification, erosion control, climate control, pest species regulation
Culture	recreation, religion, spirituality and aesthetics
Support	Nutrient cycling, soil formation, primary production and other ecosystem functions

---

---

---

---

---

---

---

---

## Provisioning Services

**Major Consumers**

- France
- Belgium
- Luxembourg
- Singapore
- Hong Kong
- United States

**Major Exporters**

- Indonesia
- India
- Brazil

The figure shows a world map with trade flows of amphibians. Major consumers are listed as France, Belgium, Luxembourg, Singapore, Hong Kong, and the United States. Major exporters are listed as Indonesia, India, and Brazil. Four line graphs show the trade volume (in kg) for the USA, France, India, and Indonesia from 1980 to 2010. The USA graph shows a peak around 2000. The France graph shows a steady increase. The India graph shows a sharp increase starting around 2000. The Indonesia graph shows a steady increase.

---

---

---

---

---

---

---

---

## Provision Services

**Medicine**

- Potential stomach acid medicines
- Pregnancy Tests
- Limb Regeneration

The image shows two photographs of amphibians. The top one is a Gastric Brood Axolotl, a pale yellowish axolotl with pinkish gills. The bottom one is an African Clawed Frog, a green frog with a white stripe on its back. The text 'Gastric Brood Axolotl' is written above the top photo and 'African Clawed Frog' is written above the bottom photo. The name 'Wendy Aron Schwab' is written in the bottom right corner.

---

---

---

---

---

---

---

---



### Provision Services

**Medicine: Antimicrobial Secretions Inhibit HIV**  
(VanCompenolle, Taylor et al., 2003)

Secretion	Percent Inhibition
Casirin 1.1D	100
Casirin 1.1	~85
Miculatin 1.1	~75
Dermaseptin	~65
Ranabactin-2P	~55
Esculetin-MAR	~45
Pseudis-3AR	~35
Esculetin-2P	~30
RCCP	~25
Casirin 4.1	~20
Uperin 3.16	~15
Deltelin 5.6	~10
Ranabactin 6	~5
Magalain II	~2

Red-eyed Tree Frog (*Litoria chloris*)

---

---

---

---

---

---

---

---

---

---

---

---

### Provision Services

**Medicine: Antimicrobial Secretions Inhibit HIV**  
(VanCompenolle, Taylor et al., 2003)

**Familiar Species with Antimicrobial Peptide Secretions**

1. *Lithobates areolatus* (8 known) (Al, Lips et al., 2002)
2. *Lithobates caferbelanus* (9 known)
3. *Lithobates pipiens*
4. *Lithobates sphenoccephala*
5. *Lithobates clamitans*
6. *Lithobates palustris*

Red-eyed Tree Frog (*Litoria chloris*)

---

---

---

---

---

---

---

---

---

---

---

---

### Provision Services

**Medicine: Pain killers**

Dendrobatidae

Genus name and authority	Common name	Species
Adephobates (Grant, et al., 2006)		3
Andinobates (Twomey, Brown, Amézquita & Mejía-Vargas, 2011)		13
Ameerega (Bauer, 1986)		31
Colostethus (Cope, 1866)	Rocket frogs	21
Dendrobates (Wagler, 1830)	Poison dart frogs	5
Epiplatobates (Myers, 1987)	Phantasmal poison frogs	6
Excidobates (Twomey and Brown, 2008)		2
Hyalobates (Jiménez de la Espada, 1870)		58
Minyobates (Myers, 1987)		1
Oophaga (Bauer, 1994)		9
Phyllobates (Duméril and Bibrón, 1841)	Golden poison frogs	6
Ranitomeya (Bauer, 1986)	Thumbail dart frogs	21
Silverstoneia (Grant, et al., 2006)		3

---

---

---

---

---

---

---

---

---

---

---

---

### Regulating Services

#### Disease Vector Control

Species	2.0 g	3.0 g
<i>A. talpoideum</i>	~230	~350
<i>N. v. viridescens</i>	~260	~310

Eastern newt (*Notophthalmus viridescens*)

---

---

---

---

---

---

---

---

### Regulating Services

#### Disease Vector Control

Species	Mosquitoes Consumed
<i>A. talpoideum</i>	~280
<i>G. holbrooki</i>	~1000

---

---

---

---

---

---

---

---

### Regulating Services

#### Disease Vector Control

Species	Mosquitoes Consumed
<i>A. talpoideum</i>	~280
<i>G. holbrooki</i>	~1000

June July August

---

---

---

---

---

---




---

---

## Regulating Services

Invertebrate Pest Control

- Unknown degree of control
- Evidence of soy bean best control in Argentina

Rhinella arenarum	Leptodactylus latinasus	Leptodactylus chaquensis	Physalaemus albonotatus
			
78%	48%	44%	21%

---

---

---

---

---

---

---

---

---

---

## Regulating Services


Pollinator Control (Valencia-Aguilar, Corber-Gomez et al. 2013)

Many frogs prey upon pollinators meaning they might play a role in pollinator densities

Seed Dispersal (da Silva and De Brito-Periera 2004)

*Xenohyla truncata*

- Feeds on several varieties of fruits and might aid in seed dispersal.




---

---

---

---

---

---

---

---

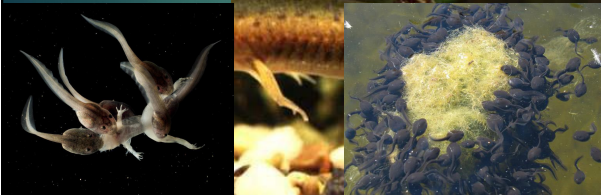
---

---

## Supporting Services

Aquatic Ecosystems

Primary Consumers  
Detritivores  
Predators  
Cannibals




---

---

---

---

---

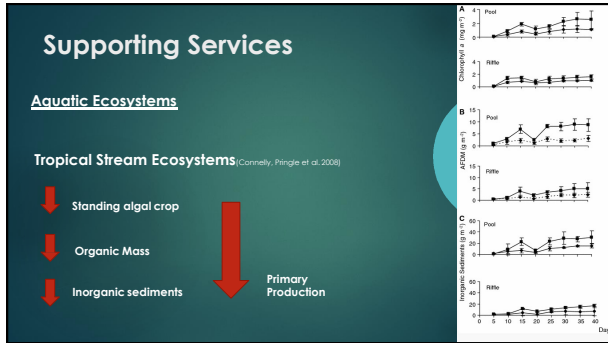
---

---

---

---

---




---

---

---

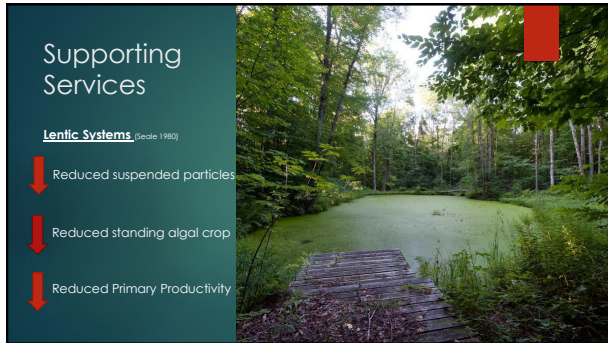
---

---

---

---

---




---

---

---

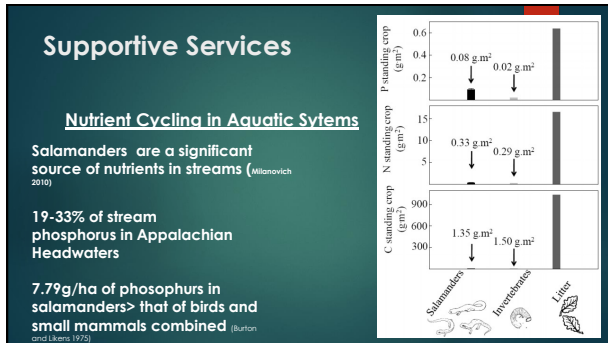
---

---

---

---

---




---

---

---

---

---

---

---

---

### Supportive Services

#### Nutrient Cycling studies of *Plethodon cinereus*


- Reduce decomposition rates

↓ Invertebrates

↓ Leaf litter breakdown

=

- Help cycle Na
- Sink for Ca, Mg, K, P, N, S and Zn (Burton and Likens 1975)



TODD FERRON 2012

---

---

---

---

---

---


---

---

### Supportive Services

#### Biomass

- 5 salamander species had higher biomass (1770g/ha) than all the birds visiting a wetland (1770g/ha) (Burton and Likens 1975)
- Second Highest standing caloric crop of any animal in southern Appalachians (Deer 1st)



In an area of NC there were an estimated 18,486 salamanders/ha JUST IN RIPARIAN HABITATS (Petranka and Murray 2001)

---

---

---

---

---

---

---

---

### Supportive Services

#### Biomass

With such significant biomass and caloric standing crop, amphibians play a significant role in efficiently converting invertebrates into food for higher trophic levels.



Central Trophic Level

---

---

---

---

---

---

---

---

## Assigning a Monetary Value to Amphibians

<p><b>Site:</b> Ellenton Bay, SC  <b>Animals Captured:</b> 392,605  <b>Dominant Species:</b> Southern Leopard Frog  <b>Value:</b> <b>\$3,605,848</b>  <small>(DeGregorio, Wilson et al. 2014)</small></p>	<p><b>Site:</b> Charlotte, NC  <b>Animals Captured:</b> 848,824  <b>Dominant Species:</b> Eastern Newt  <b>Value:</b> <b>\$6,021,007</b>  <small>(Wilcock and Dorcas 2009)</small></p>
---	--

---

---

---

---

---

---

---

---

---

---

## References

- ▶ Al, M. E., E. E. Ulan, F. C. Etnico, B. Fitzhugh, C. Miles, and J. M. Carlson. 2002. Antimicrobial peptides and protease inhibition in the skin secretions of the Cowfish, *Rioja asotata*. *Biochimica et Biophysica Acta (BBA) - Proteins and Proteomics* 1601:33-43.
- ▶ Alby, J. 2015. Current extinction rates of reptiles and amphibians. *Proceedings of the National Academy of Sciences of the United States of America* 112:13003-13008.
- ▶ Da Silva, H. R., and M. C. De Brito-Perello. 2006. How much fruit do fruit-eating frogs eat? An investigation on the diet of *Xenohyla turacosa* (Anura: Hylidae). *Journal of Ecology* 20:274-280.
- ▶ DeGregorio, S. A., J. D. Wilson, M. E. Dorcas, and J. W. Gibbons. 2014. Commercial Value of Amphibians Produced From an Isolated Wetland. *The American Midland Naturalist* 172:200-204.
- ▶ Flocking, D. J., and K. J. Babbitt. 2014. AMPHIBIAN CONTRIBUTIONS TO ECOSYSTEM SERVICES. *Herpetological Conservation and Biology* 9:1-17.
- ▶ McCollum, M. L. 2007. Amphibian Decline or Extinction? Current Declines Dwarf Background Extinction Rate. *Journal of Herpetology* 41:483-491.
- ▶ Pehavara, J. W., and S. S. Murray. 2001. Effectiveness of Removal Sampling for Determining Salamander Density and Biomass: A Case Study in an Appalachian Streamside Community. *Journal of Herpetology* 35:39-44.
- ▶ Seale, D. B. 1980. Influence of Amphibian Larvae on Primary Production, Nutrient Flux, and Competition in a Pond Ecosystem. *Ecology* 61:1311-1320.
- ▶ Stuart, S. N., J. S. Chanson, N. A. Cox, B. E. Young, A. S. L. Rodrigues, D. L. Fischman, and R. W. Waller. 2004. Status and trends of amphibian declines and extinctions worldwide. *Science* 306:1783-1786.
- ▶ Valencia-Aguilar, A., A. M. Conti-Gomes, and G. A. Buzi-Agudelo. 2013. Ecosystem services provided by amphibians and reptiles in Neotropical ecosystems. *International Journal of Biodiversity Science, Ecosystem Services & Management* 9:207-212.
- ▶ VanCompernelle, S. E., R. J. Taylor, E. Oswald-Richter, J. Jiang, B. E. Youree, J. H. Bowie, M. J. Tyler, J. M. Carlson, D. Wade, C. Allen, T. S. Dermody, V. R. Edwards-Limón, L. A. Hales-Smith, and D. Williams. 2005. Antiviral peptides from *Ambystoma talpoideum* resist a novel Human Immunodeficiency Virus infection and transfer of Virus from Dendritic Cells to T Cells. *Journal of Virology* 79:11168-1166.
- ▶ White, M. E., R. Lutz, C. M. Pringle, S. S. Shuman, P. J. Brey, B. Brame, C. Corneley, J. C. Colson-Squad, M. Hurtle-Brewer, A. D. Nuzzi, C. Montgomery, and S. Patterson. 2006. The effects of amphibian population declines on the structure and function of Neotropical stream ecosystems. *Frontiers in Ecology and the Environment* 4:27-34.
- ▶ Milanovich, J.E. 2010. Modeling the current and future roles of stream salamanders in headwater streams. Ph.D. Dissertation, University of Georgia, Athens, Georgia, USA | 56 p.

---

---

---

---

---

---


---

---

---

---

## Questions?




---

---

---

---

---

---

---

---

---

---