CAECILIANS — Or. Gymnophiona

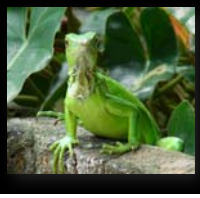
AMPHIBIAN DIVERSITY

Amphibians:

- **Cl. Amphibia**
- soft, moist skin
- no scales, no claws
- soft, jelly-like eggs
- aquatic larvae (tadpoles) ... *usually*

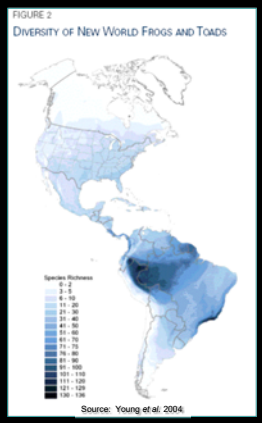
Reptiles:

- **Cl. Reptilia**
- tolerate dry conditions
- hard scales, claws
- hard, leathery eggs
- *(some snakes = viviparous)*



SALAMANDERS — Or. Caudata

AMPHIBIAN DIVERSITY



Global — ~ 7388 species
[1/4 described 2005-2014]
39% threatened

Largest families:
Hylidae
Strabomantidae
Bufonidae
Dendrobatidae
Centrolenidae

OVERALL AMPHIBIAN DIVERSITY—
TOP TEN NEW WORLD COUNTRIES

COUNTRY	NO. OF SPECIES
BRAZIL	731
COLUMBIA	698
ECUADOR	447
PERU	398
MEXICO	351
VENEZUELA	293
UNITED STATES	262
BOLIVIA	201
PANAMA	189
COSTA RICA	179

FROGS & TOADS — Or. Anura

AMPHIBIAN ECOLOGY

Avoiding Desiccation

- **Staying near water**
- **Being nocturnal, and burrowing**
  - Hylidae: mucus-polysaccharide coating
- **Estivation:** hibernate in dry times
- "**Seat patch**" - in toads

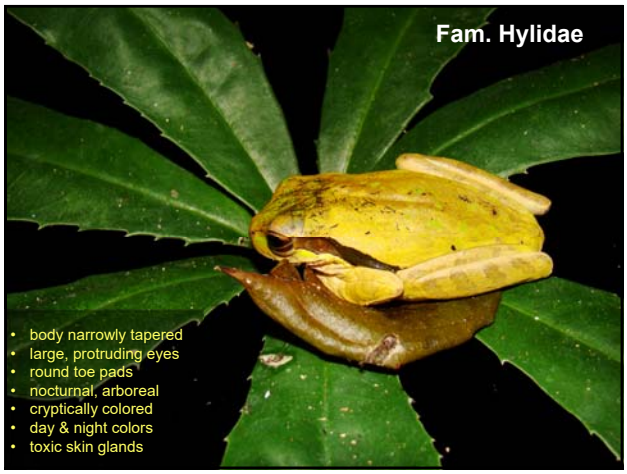
Rhinella margaritifer

***Smilisca* sp. from BSLL: ask Luis!**

Fam. Hylidae – *Hipsiboas* "leaf frogs"

Fam. Hylidae – *Hypsiboas calcaratus*

Fam. Hylidae – *Osteocephalus yasuni* (TBS)



Fam. Hylidae

- body narrowly tapered
- large, protruding eyes
- round toe pads
- nocturnal, arboreal
- cryptically colored
- day & night colors
- toxic skin glands

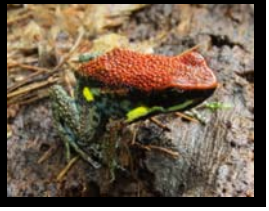
AMPHIBIAN ECOLOGY

Amphibs as Predators

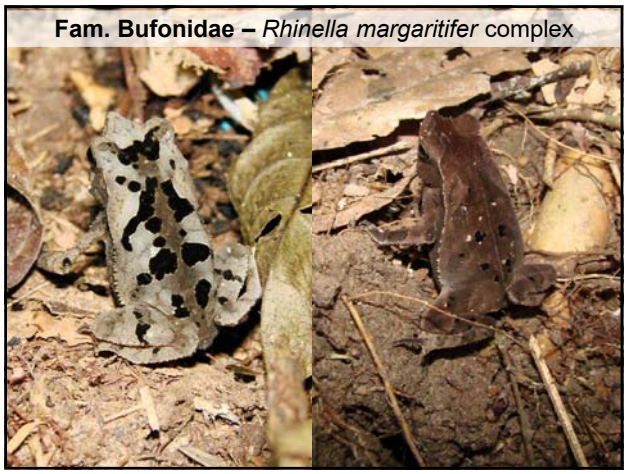
- **Adults carnivorous**
  - tadpoles: mostly eat algae & detritus (some cannibalism)
- **Sit-and-wait predators -** *"crypsis"*

Amphibs as Prey

- **Skin secretes toxins**
  - burning, temp. blindness, sneezing/respiratory distress, vomiting, paralysis, death *[Wash Hands!]*
- **Aposematic color** - *warning!*
- **Mucus glands -** make frogs slippery
- **Puffing up** - can't be swallowed



Fam. Bufonidae – *Rhinella margaritifer* complex



AMPHIBIAN REPRODUCTION

Most lay eggs: Oviparity

50% of spp. eggs laid in water --> to aquatic tadpoles

Parental care uncommon

Amplexus = the "love hug"

maintain vent-vent contact

fertilization is "external"

Fam. Bufonidae – *Rhaebo (=Bufo) guttatus* complex

- dry, warty skin
- tympanum (ear) visible
- hopping legs
- large parotid glands
- seat patch
- drier habitats
- often diurnal

AMPHIBIAN REPRODUCTION

Tropics: tremendous pressure to find predator-free water!

1. **Eggs on leaves, tadpoles drop into water when hatching**
   majority of tree frogs, glass frogs

PARENTAL CARE:

2. **Foam nests floating on water**
   smoky jungle frog (Leptodactylus pentadactylus)
3. **Eggs on land, tadpoles carried to water**
   many poison frogs (Dendrobatidae)
4. **Tadpoles carried by parent**
   Marsupial frog Gastrotheca has pouch in back
5. **Direct development (eggs to froglets)**
   Pristimantis -- Fam. Strabomantidae
6. **Vivipary -- some caecilians, some toads**

Fam. Bufonidae – *Rhinella margaritifer* complex

Leptodactylidae – *Leptodactylus pentadactylus*

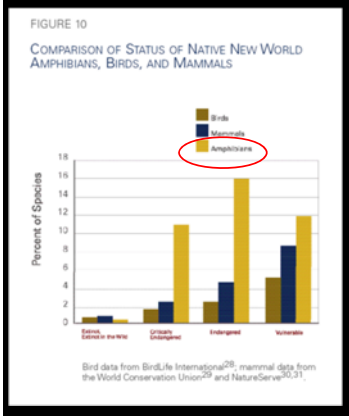
Poison Frogs — Dendrobatidae

- head as wide as body
- blunt snout
- aposematic coloration
- toxins in skin glands: alkaloids or BTX

- B***atrachotoxin (BTX)***
  - blocks sodium channels - nerves & muscles
  - *origin:* bacteria --> beetles --> ants
  - most toxic non-protein poison:
    - 1000X more toxic than cyanide
    - human-lethal ≈ 2 grains of table salt

- **Medicinal Uses**
  - Epibatidine: 200X morphine's potency

CAUSES OF AMPHIBIAN DECLINE



2 in 5 spp threatened (!)

7.4% **Critically Endangered**

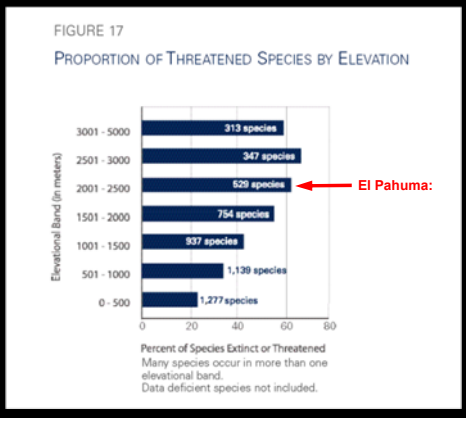
9 spp extinct in last 100 y

N. America: 21% spp threatened
pops declining 3.7% / year
RedList spp: 11.6% / year

S. America: 31%
Atelopus: 96 spp
3 extinct, 77 threatened!

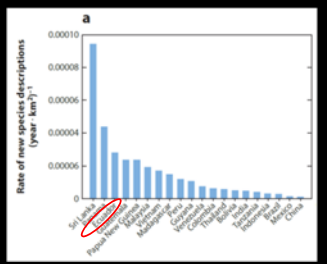
Spp. at Highest Risk:
restricted range
high elevation

CAUSES OF AMPHIBIAN DECLINE

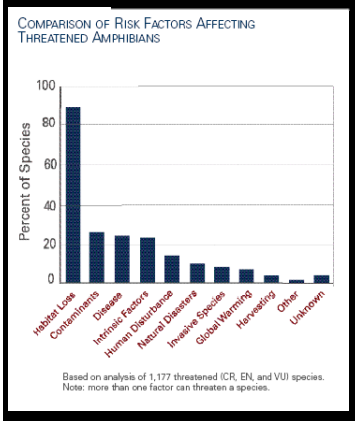


IUCN STATUS REPORT New World Amphibians - 2004

Catenazzi: State of the World's Amphibians - 2015



CAUSES OF AMPHIBIAN DECLINE



no single cause

"extinction vortex"

#1: Habitat Loss

threatens ~60% of assessed species (*2015*)

CAUSES OF AMPHIBIAN DECLINE

Environmental Contamination:
Acid Rain: *egg & tadpole mortality (esp. ponds)*
Toxins: *absorbed by skin -> deformations*
Eutrophication: ▲ *bacteria & fungus*

Climate change:
UV light -> DNA damage
Habitat Shifts: humid forest & mountains

Chytrid Fungus Disease:
Batrachochytrium dendrobatidis (= "chytrid" fungus)
- eggs & adults *(98% fatality in tadpoles)*
  - no tadpoles: algae ▲2X; N-uptake ▼ 50%
- attacks skin keratin
- deformations, breathing suppression, mortality

AMPHIBIAN CONSERVATION

Protected Area Assessment:
6316 spp. assessed
126,280 PAs

Species Coverage:
76% occur in PAs
24% entirely unprotected

Reptiles

Class Reptilia
- lack feathers & fur ... have scales & claws
- paraphyletic group vs. monophyletic *(whuh?)*

Poikilothermic ... *also Amphibians*
- body temperature control by behavior
- ectotherms = 1/2 - 1/10 metabolism of endotherms
- ecosystem supports high density
- *excellent prey ... efficient nutrient transfer*

SNAKES

Order Squamata, SubOrder Serpentes
- > 3000 spp.

Morphology
- evolved from lizards ... burrowing ancestor?
- linear body - only Right Lung functional
- binocular vision

Reproduction
- internal fertilization
- oviparous (elongated eggs)
  + ovoviviparous, viviparous

SNAKES

Predatory
- on birds, mammals, frogs, insects, snakes, eggs
  - **high nest predation rates*
- flexible jaws - swallow prey whole
- intestine reduces - ▼ maintenance costs

Venom (injected, vs. "poison" = inhaled, external) ... "Toxins"
- no claws to hold prey
- ~725 spp venomous, 250 potentially human-fatal
- aposematic coloration (in some)


Snail-eating Snake (Dipsas)

Family Colubridae

Whipsnakes, Ratsnakes, Racers, Garters, etc.

"typical" snakes
usually dominant (abundance)
rounded head shape, slender body, long tail

non-venomous (but predatory & biting)
a few venomous (e.g., Australian Boomslang)


Red Vine Snake (Tripanurgos)


Snail-eating Snake (Dipsas)


Vine Snake (*Oxybelis*)

Family Elapidae

Cobras, mambas, taipans, kraits, death adders, sea snakes
*Coral snakes -- S. America

very poisonous: all potentially deadly
slender shape, blunt head, brightly colored

short, hollow front fangs
non-erectile - no "stabbing bite"
neurotoxin: death by asphyxiation

Black Mambas (*Dendroaspis polylepis*) are among Africa's most dangerous snakes; they still *kill fewer people than hippos*

aposematic coloration; false corals very similar

Family Viperidae

Fer-de-lance, eyelash viper, bushmaster, rattlesnakes

"vipers" and "pit-vipers": many potentially deadly
mostly ovoviviparous
triangular head, stocky build, short tail, vertical pupils

Bothrops asper, Lalo Loor

Coral Snake (*Micrurus*)

Vipers & Venom

Viper Bites:
long, folding, rear-mouth, hypodermic front fangs
fangs erect when mouth gapes - "stabbing bite"
50% of bites are *"dry bites"*

Hematotoxin: proteases & anti-coagulants
progressive necrosis

Treatment:
DO NOT cut an X!! -- *death by blood-pressure collapse*
(1) stay calm; (2) ID snake; (3) limb BELOW heart; (4) evacuation
avoid antivenin unless in hospital
electric current & *Snake Shockers*

Coral Snake (*Micrurus*)

Viper Bite & Necrosis

global # of snake envenomations
~5 million snakebites/y --> ~20,000 deaths

Ecuador (2007): ~5000 bites
~90 fatalities

Bothrops asper bite - Ecuadorian boy (age 11)
bite 2 weeks old, treated only with antibiotics

Viper Bite & Necrosis

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Hog-nosed Viper

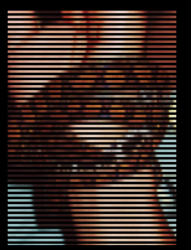
Fer-de-lance (*Bothrops atrox*)

Eyelash Viper (*Bothriopsis*)

Fer-de-lance (*Bothrops atrox*)

Fam. Boidae

Boa constrictors, Anacondas
"Pythons" (Old World)



non-poisonous, but powerful bite
strong-bodied, elongate, splotched patterns

aglyphous: fangs not grooved or hollow
death by asphyxiation

Boa = fully viviparous ... *"breeding ball"*
max Anaconda = 26 ft ... $50,000 prize for a 30-footer (WCS)


Boa Constrictor


Anaconda