

Collection of Physical and Media Specimens: Why Bother?



Rafe M. Brown

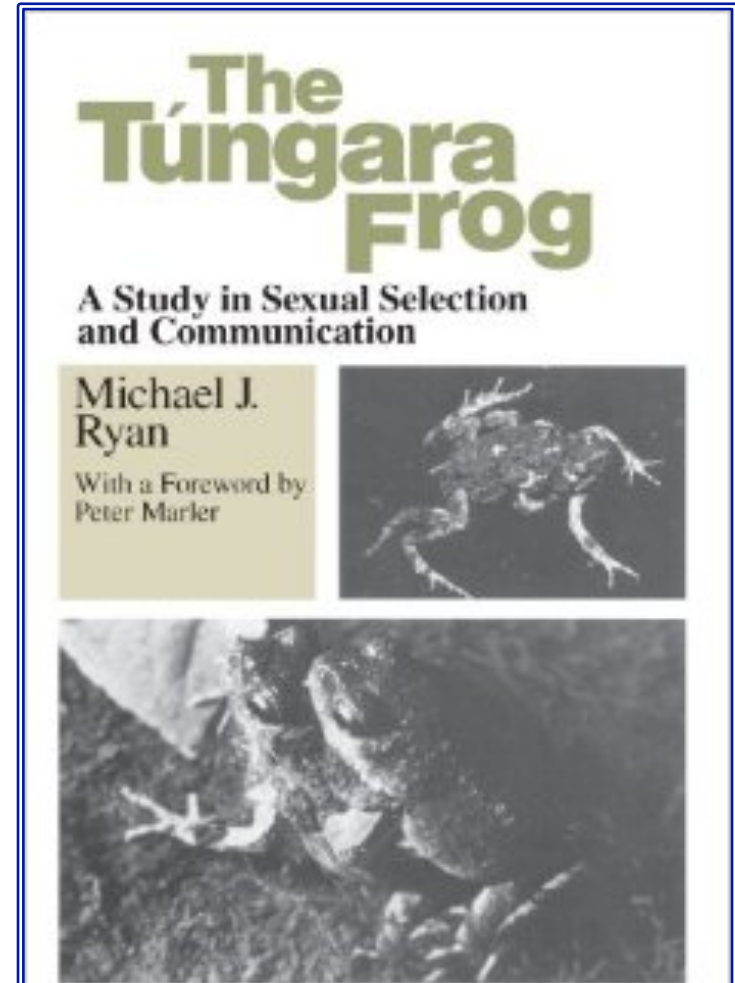
KU Biodiversity Institute



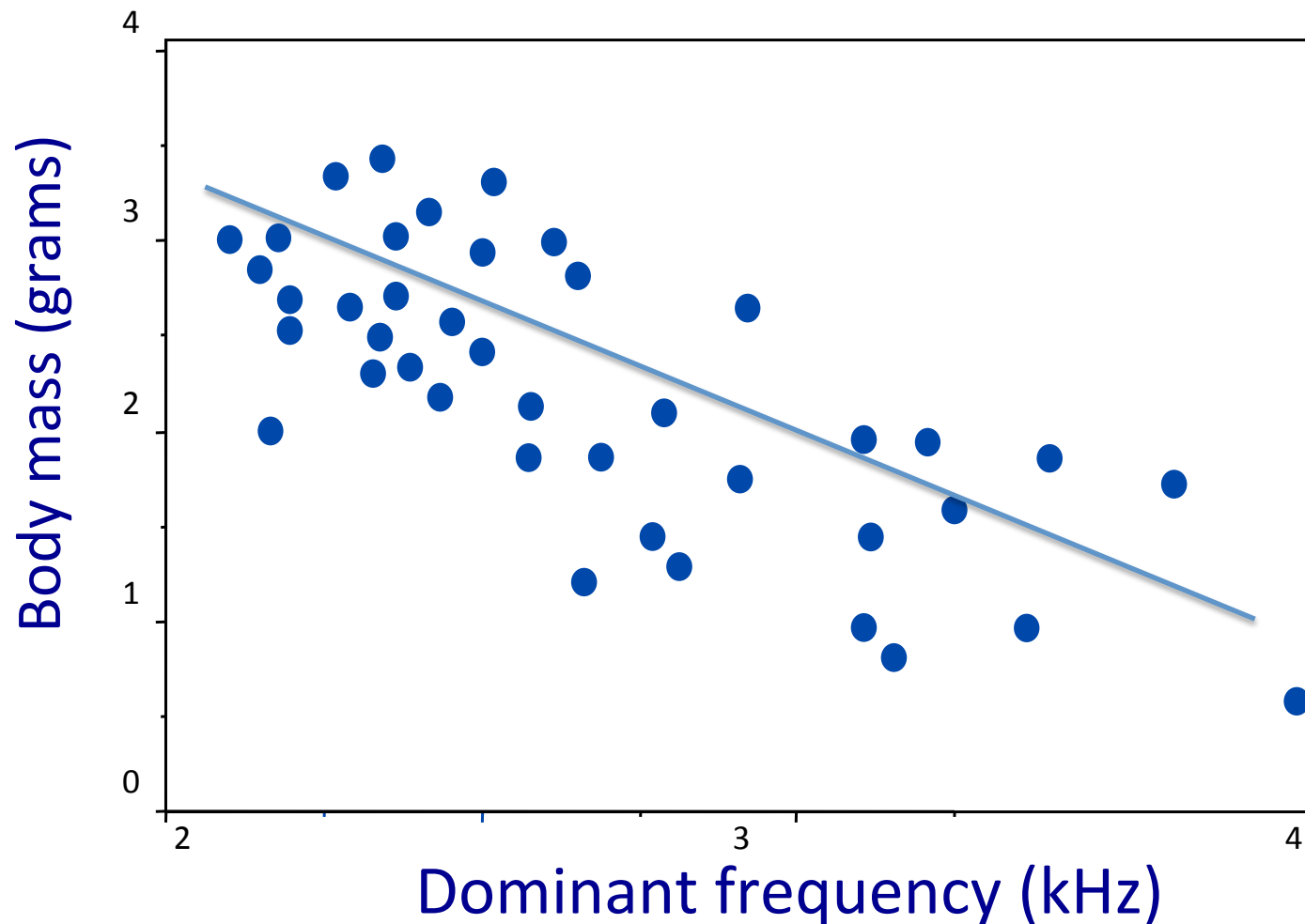
Mike Webster, G. Budney, E. Scholes, M. Madley– Cornell
Travis LaDuc – Univ. Texas (Ryan and Blair sound libraries)
G. Zug and R. Heyer – USNM (Smithsonian collection)

Sexual Selection in Tungara frogs:

Females prefer lower frequency calls, an indication of larger body size.

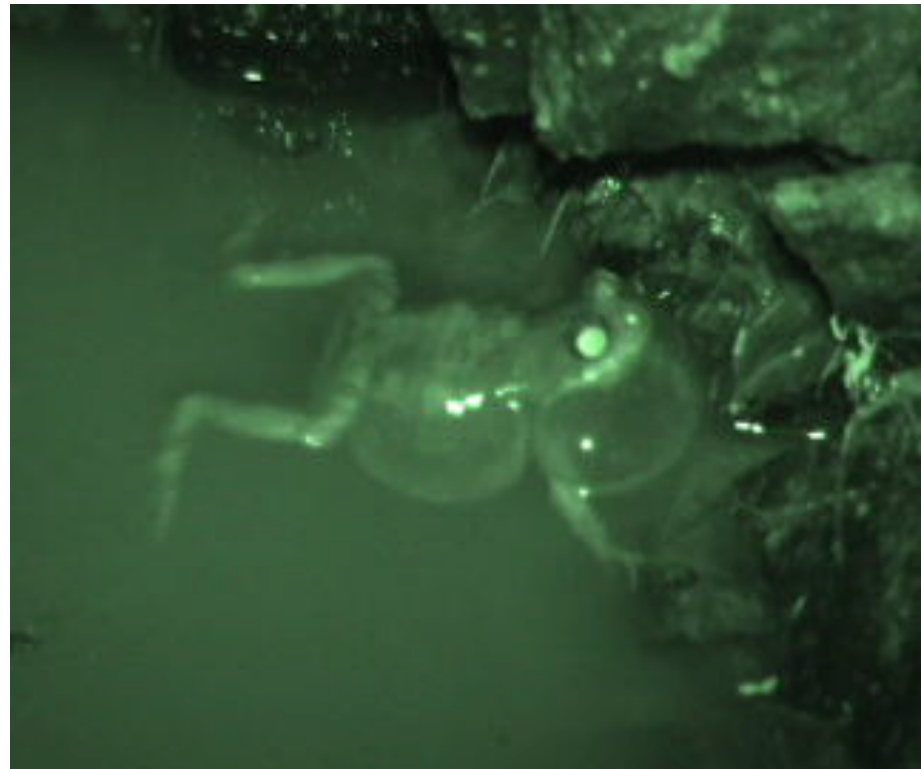
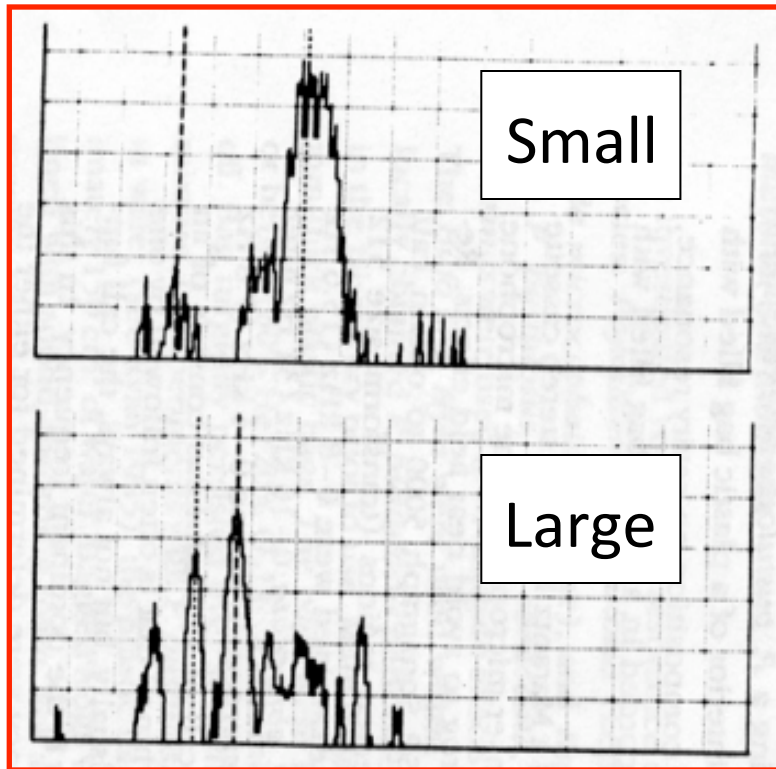


Sexual Selection in Tungara frogs: fundamental relationships between male size (quality?), call frequency, and female choice



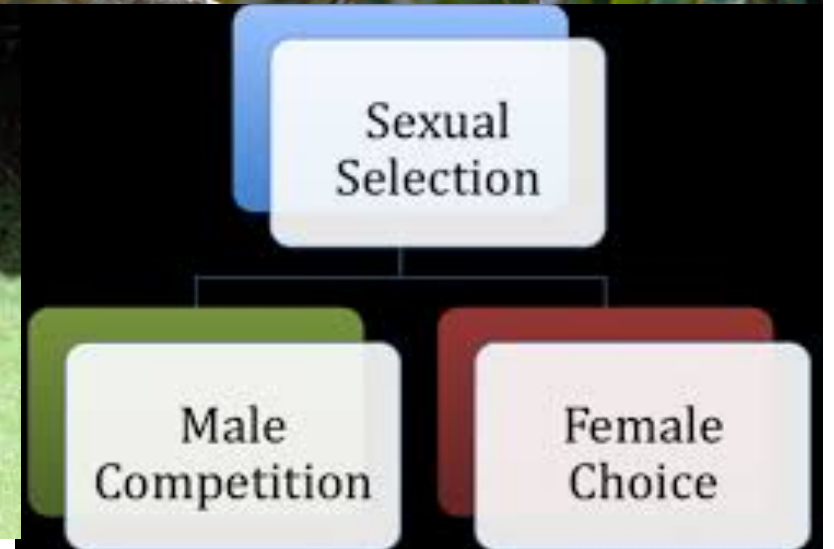
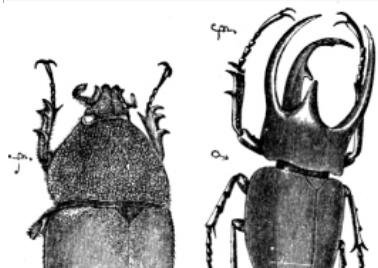
Sexual Selection in Tungara frogs:

- 1) media specimens (video, audio),
- 2) physical specimens,
- 3) Linked data derived from both types...



Dominant Call Frequency

1) Linked data derived from both types...



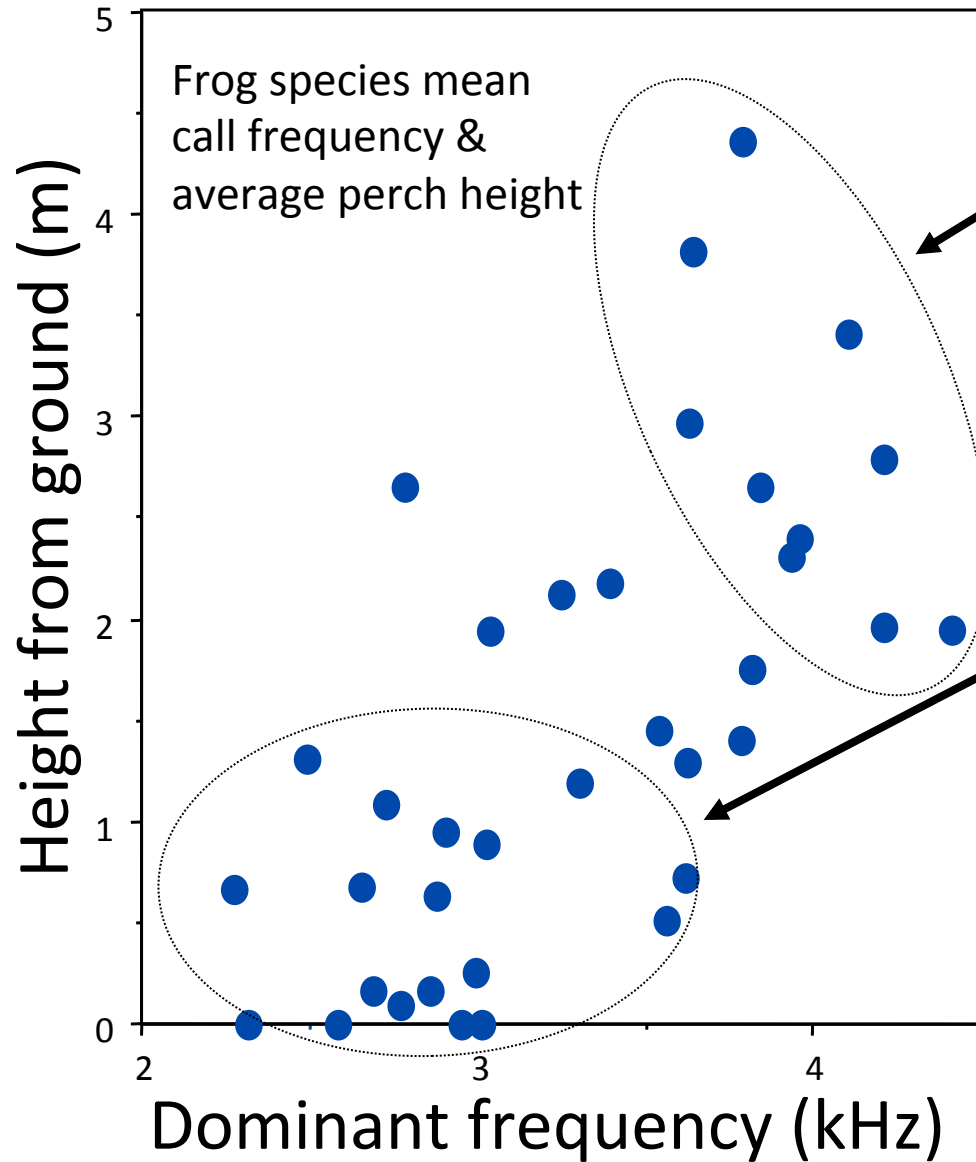
Acoustic Adaptation Hypothesis (AAH) - Morton, 1975

- Physical characteristics of the environment can differentially degrade acoustic signals, thus exerting *environmental* selection on calls of birds and frogs
- Species may evolve calls that allow for maximal habitat specific transmission efficiency

Acoustic Adaptation Hypothesis (AAH) - Morton, 1975

- Physical characteristics of the environment can differentially degrade acoustic signals, thus exerting *environmental* selection on calls of birds and frogs
- Species may evolve calls that allow for maximal habitat specific transmission efficiency
- High frequency calls differentially attenuated (boundary layer interference) when transmitted on the ground
- **Prediction:** species with low frequency calls can transmit signals at ground level; those with higher frequencies and/or a wider range of frequencies should utilize high perches

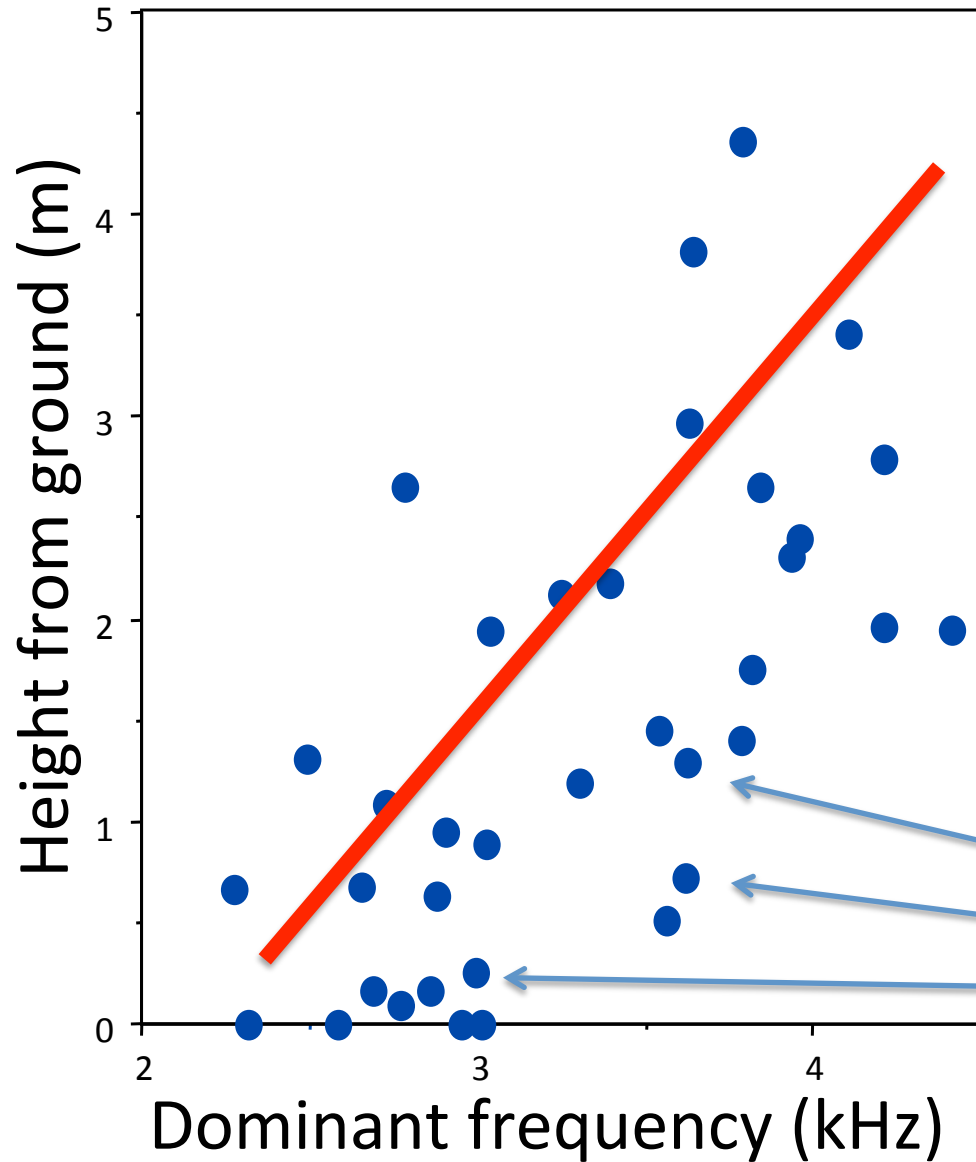
Raw Habitat and Frequency Data



- Species calling from elevated perches generally call with higher frequencies

- Species that perch close to the ground restrict calls to relatively lower frequencies

Raw Habitat and Frequency Data



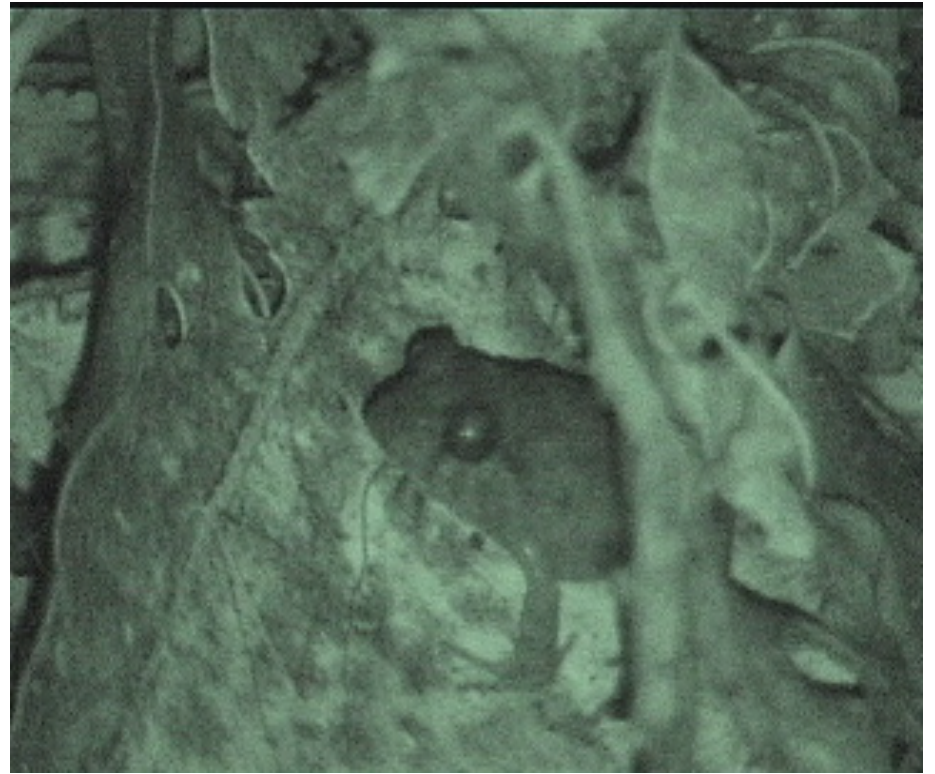
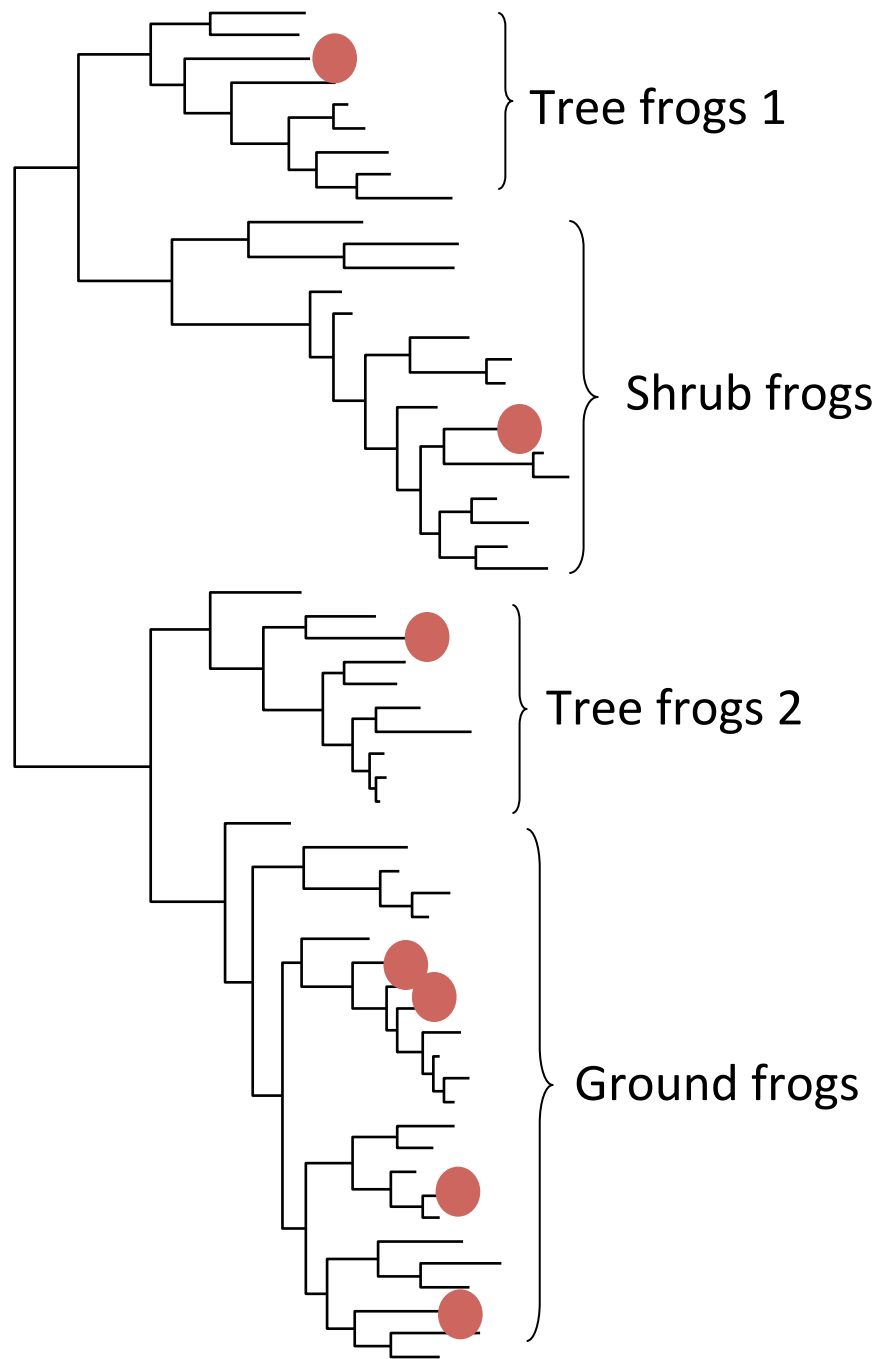
Relationship?

Assumptions & requirements

1) Statistical independence?
(incorporate phylogeny)

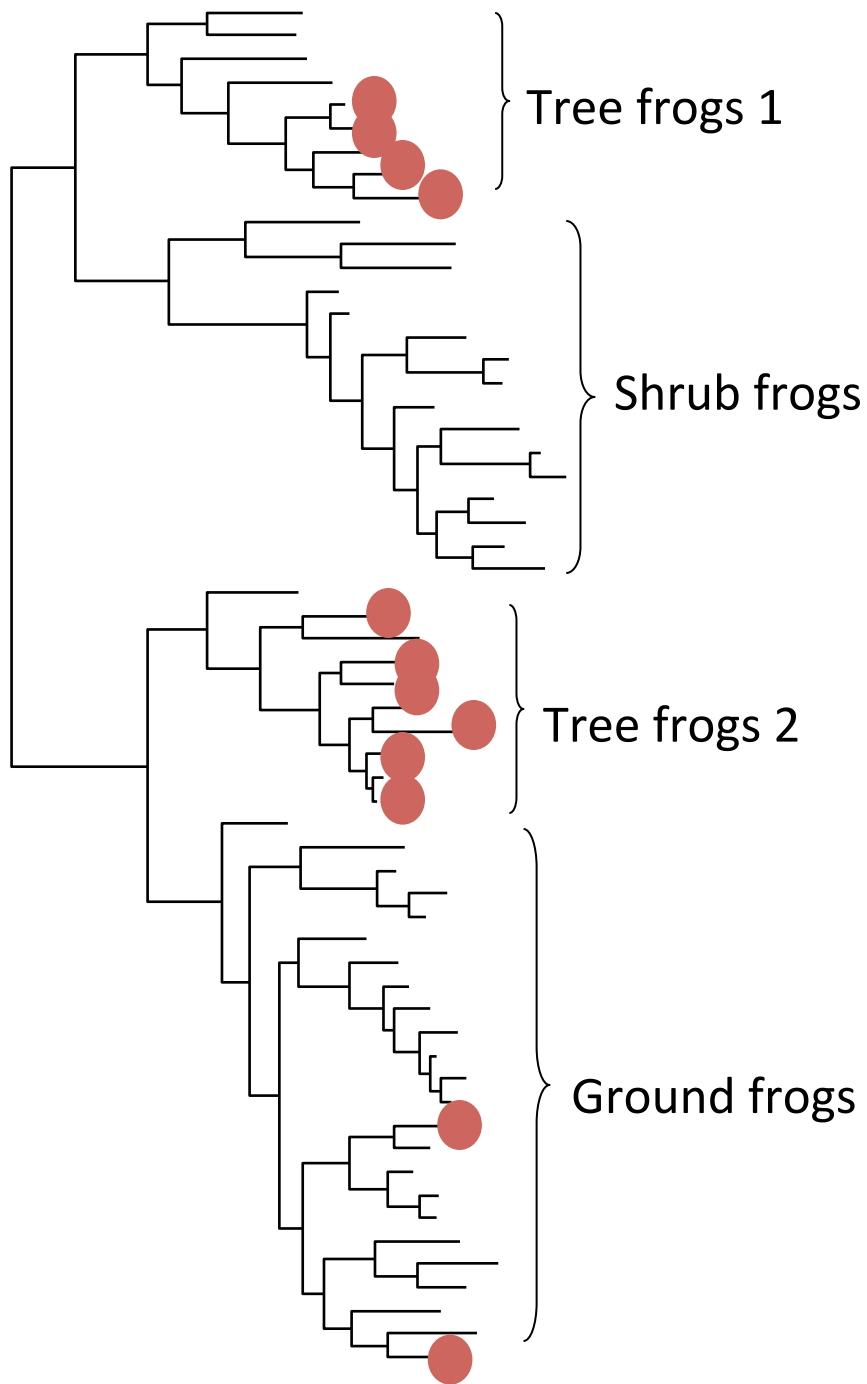
1) Size-corrected data for
interspecific comparisons

Need body size data!
(mass or specimen
Snout-vent length)

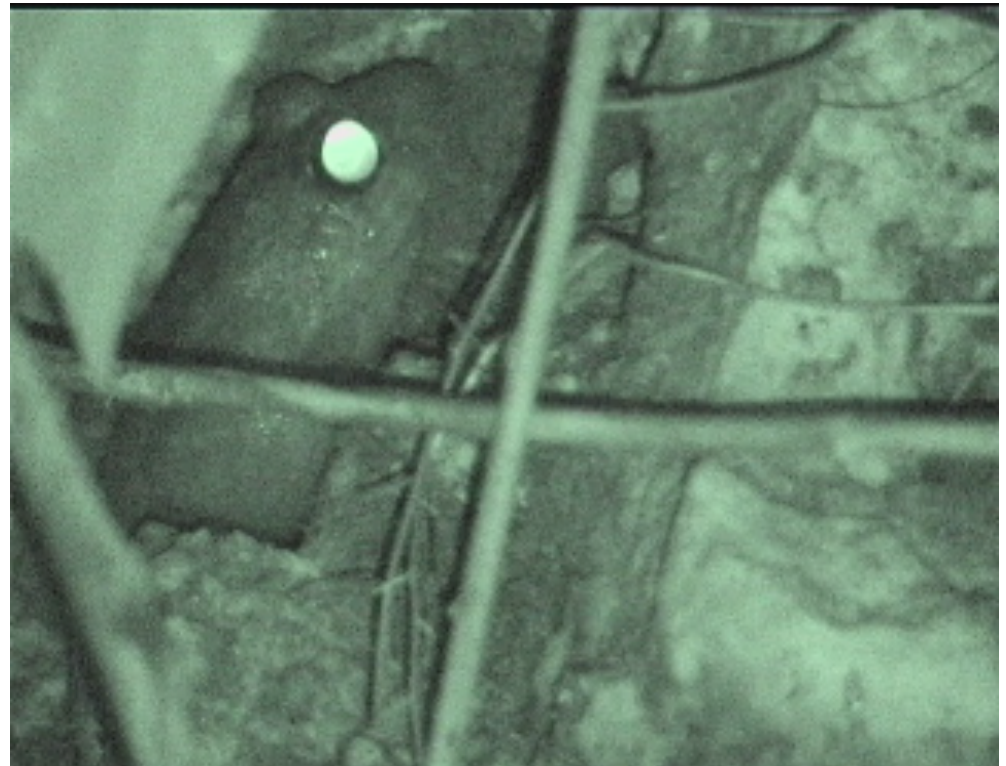
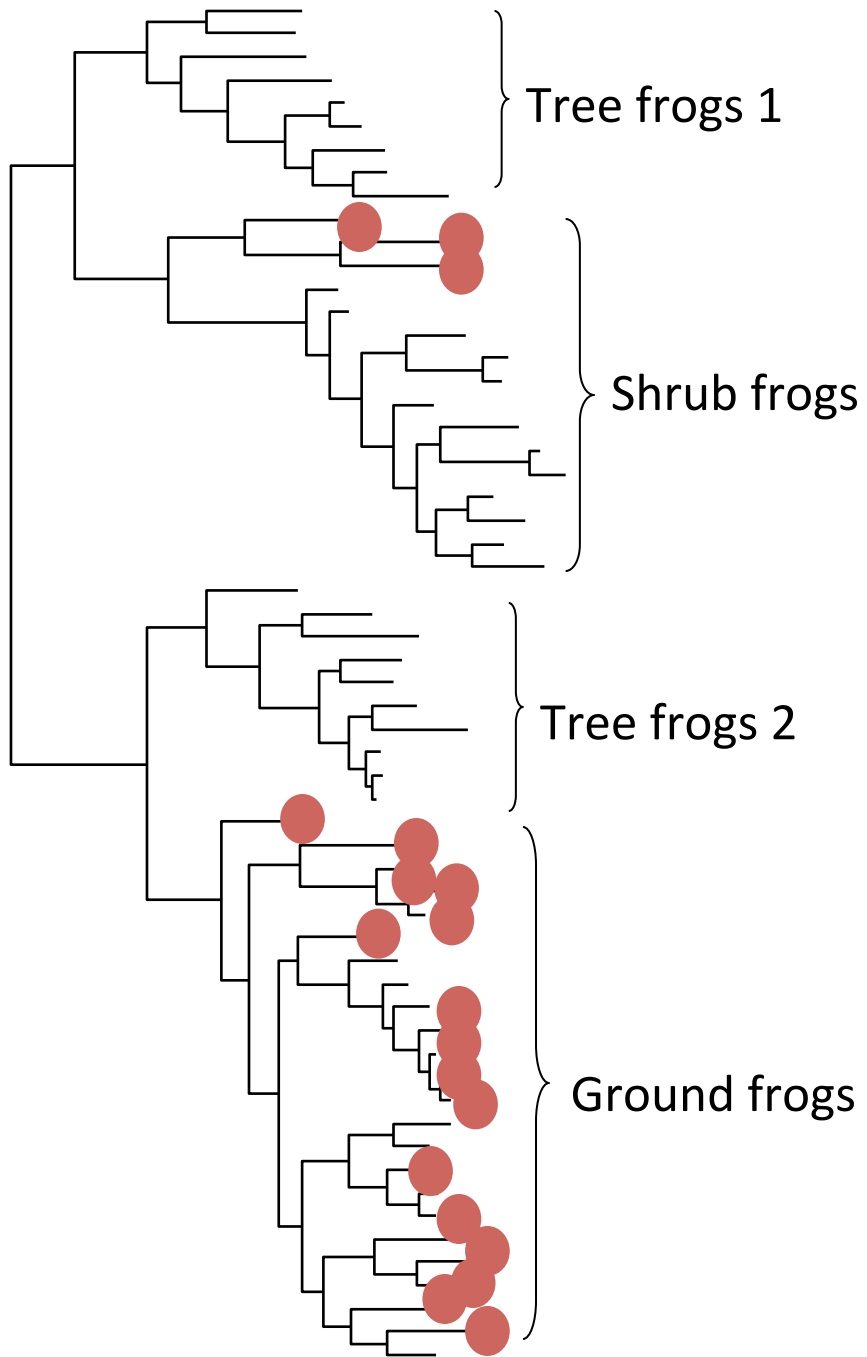


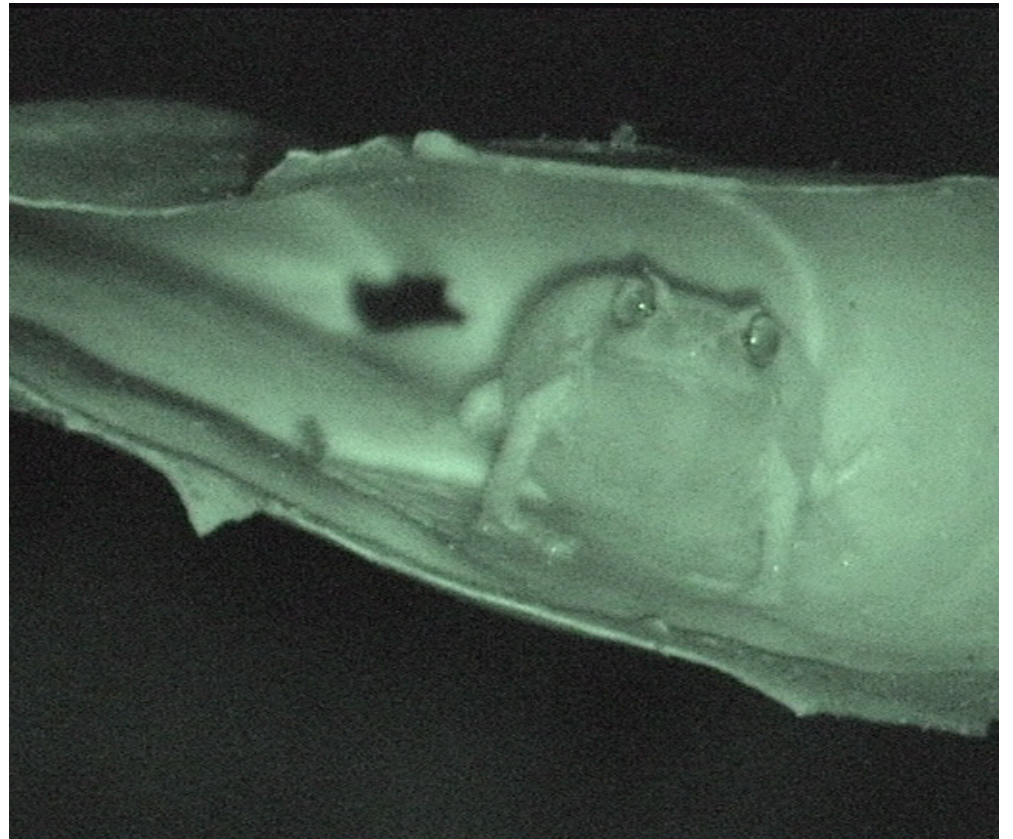
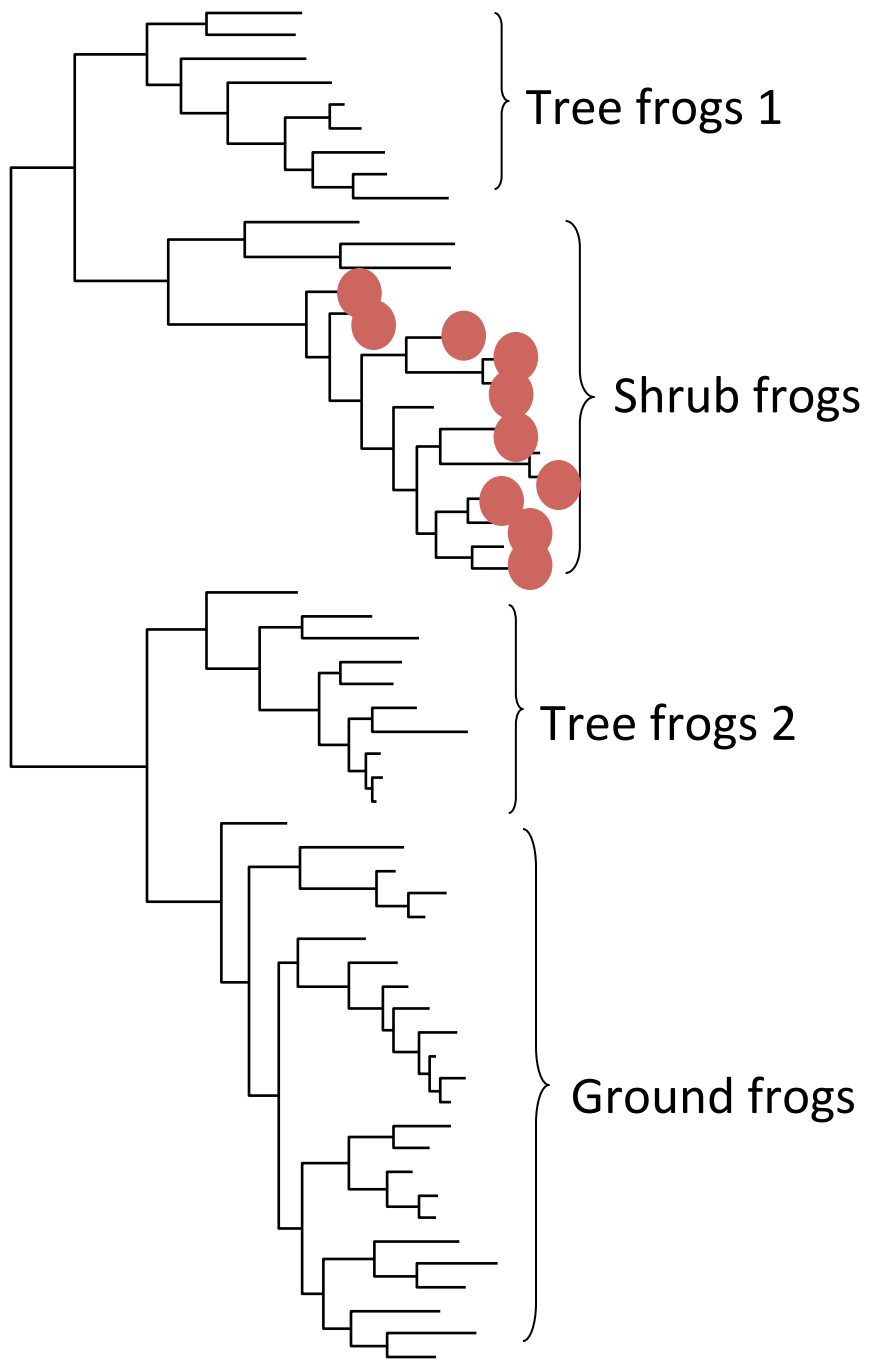
Six origins of
frequency sweep
calls

4 origins of pulsed calls



Two origins of complex calls





Pure tone calls
arose once



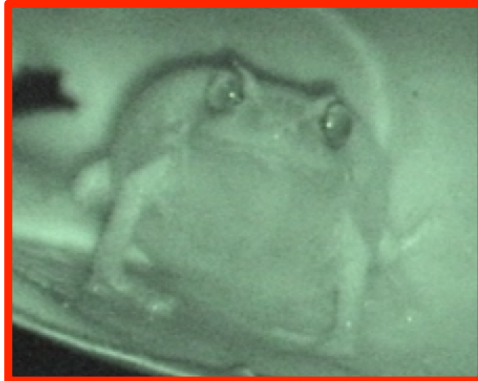
Multilocus phylogeny, derived from sequencing genomic resources in KU's Cryofacility (LN2)

Phylogeny



+

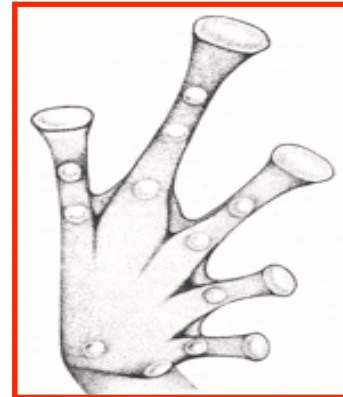
Media specimen



Acoustic analysis:

Frequency,
Call rate,
Etc.

Physical specimen

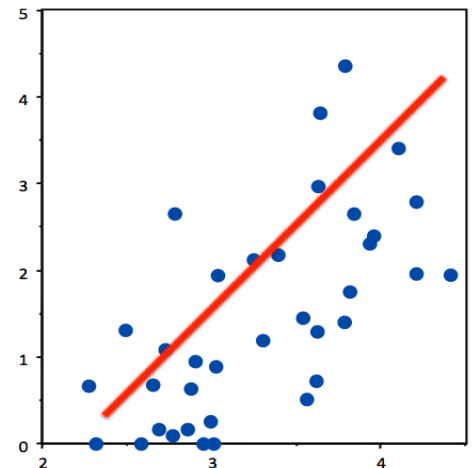


Morphology:

Body size,
Ecotype,
Etc.

=

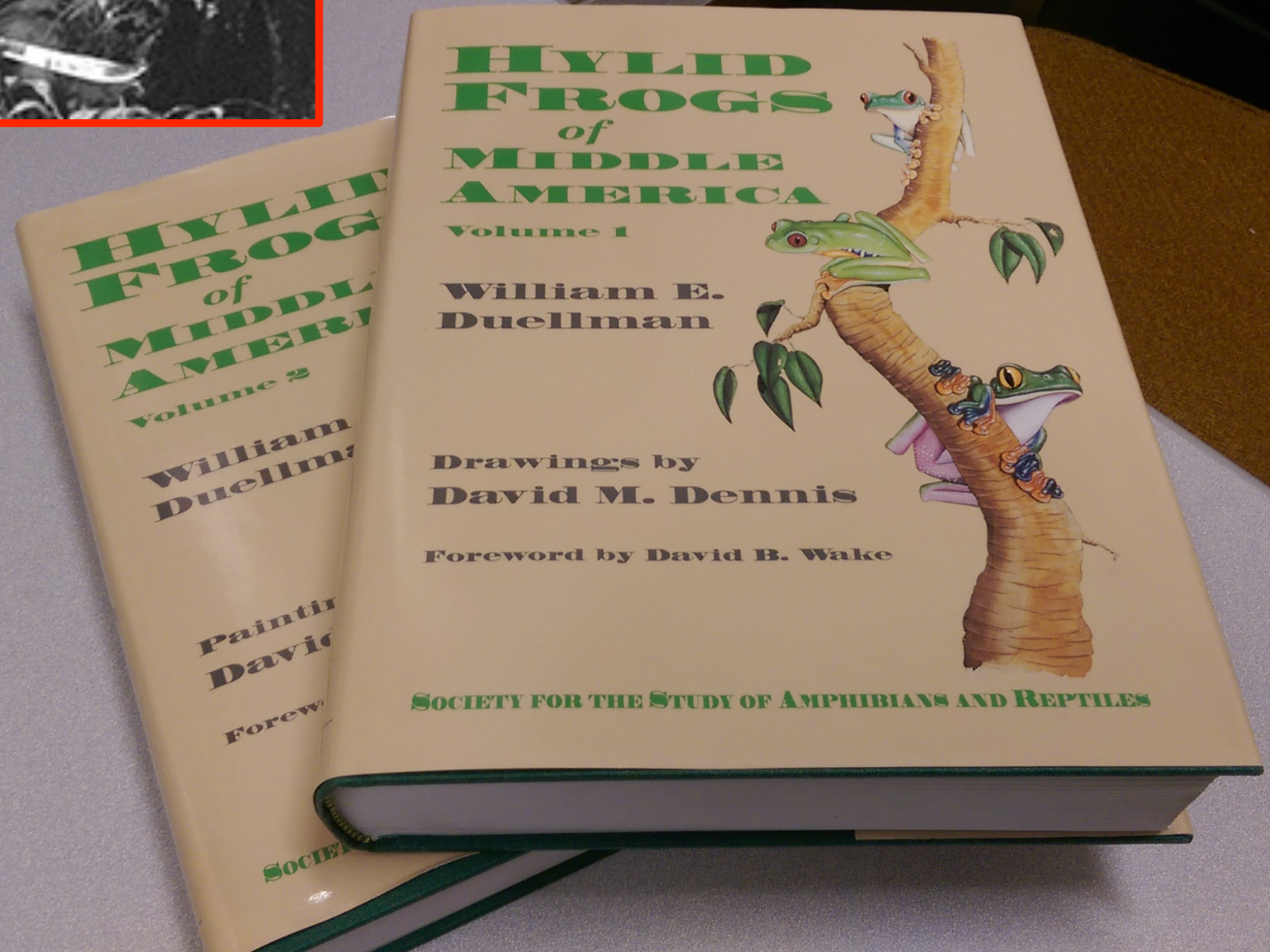
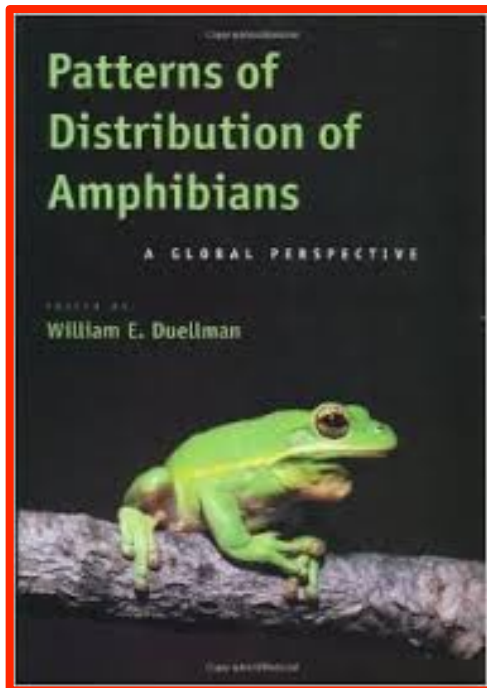
Evolutionary question



Integrative, multidisciplinary evolutionary biology

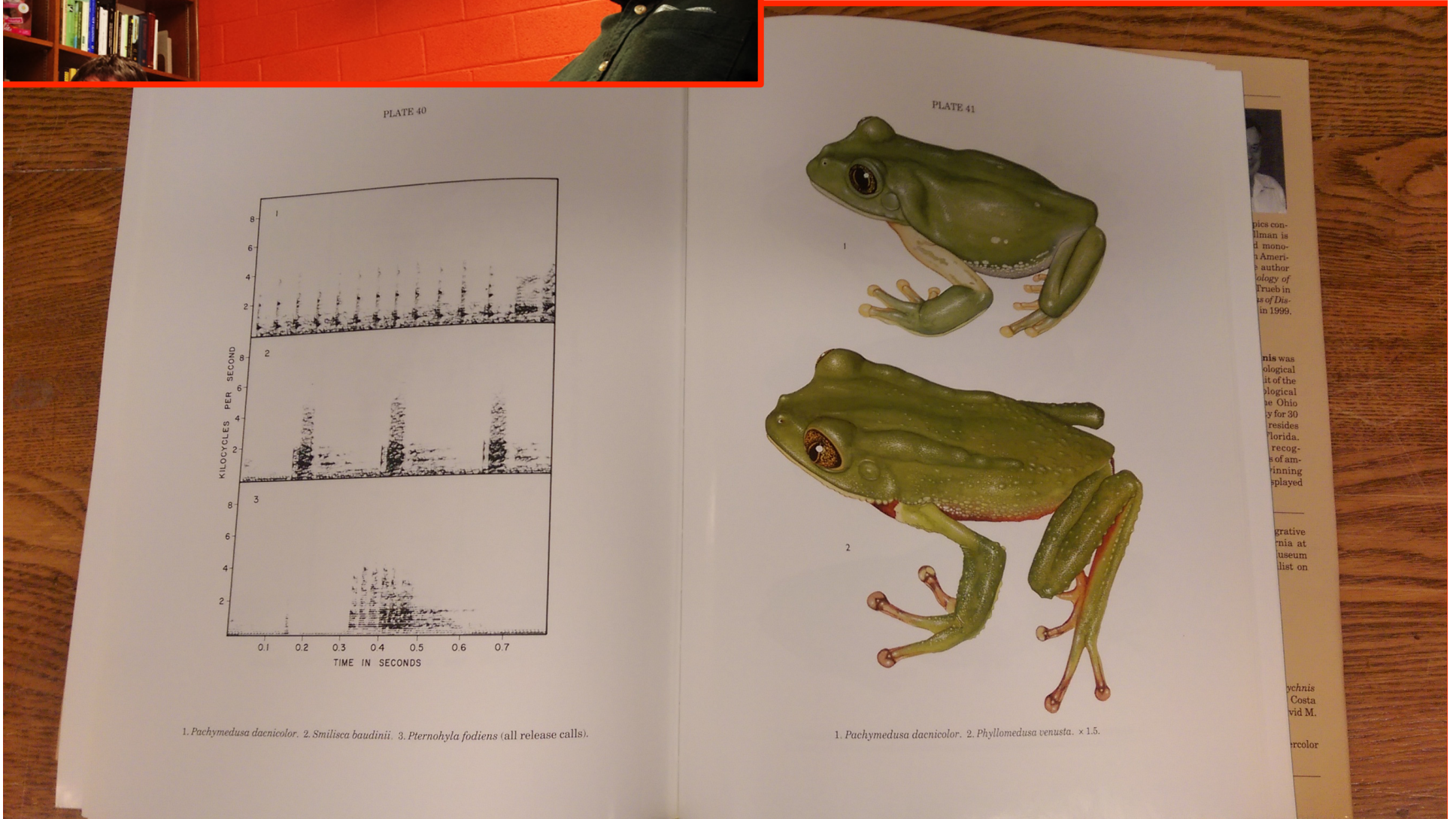
- **Specimens of numerous preparation types:** formerly curated separately, and by different institutions, individuals, etc.
- **Variable data streams:** linked, along with preparations (tissues, records, photos, media), via a centralized archival system.

W. Duellman & C. Myers
(Panama, 1954)





Bill Duellman (Kansas, 2015)

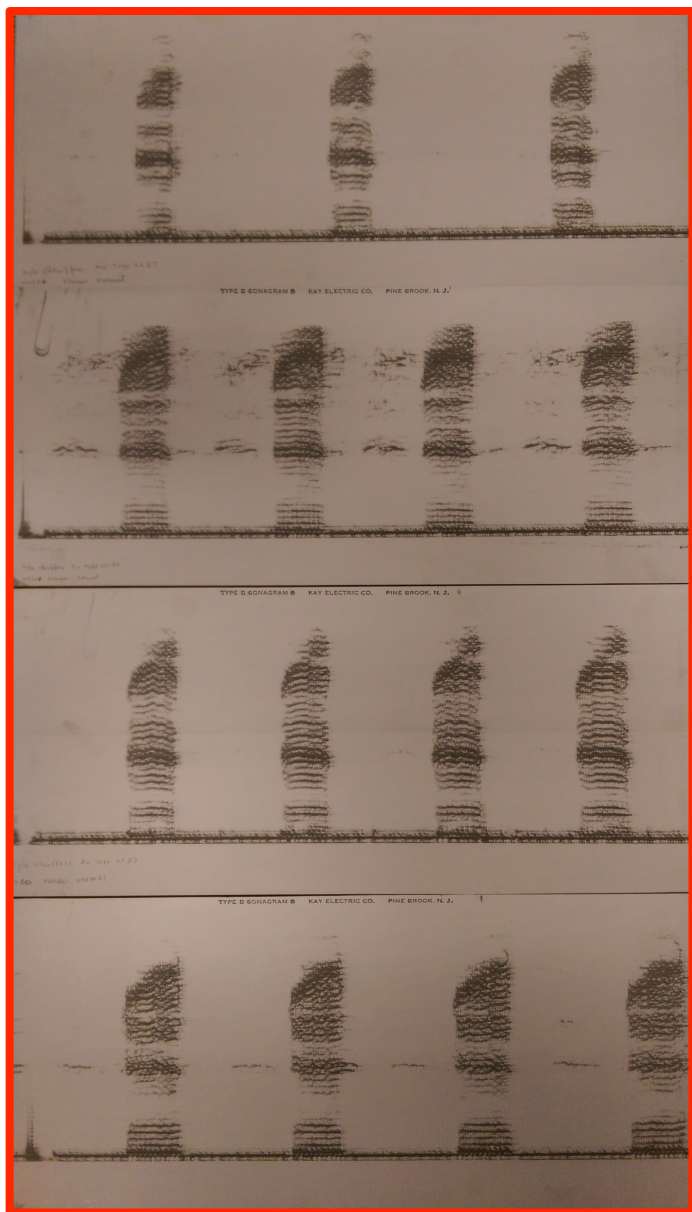




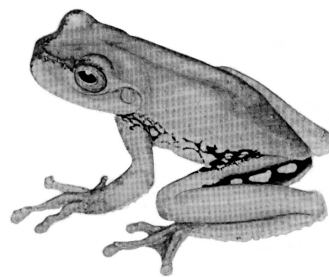
Duellman's original equipment (no longer in use)



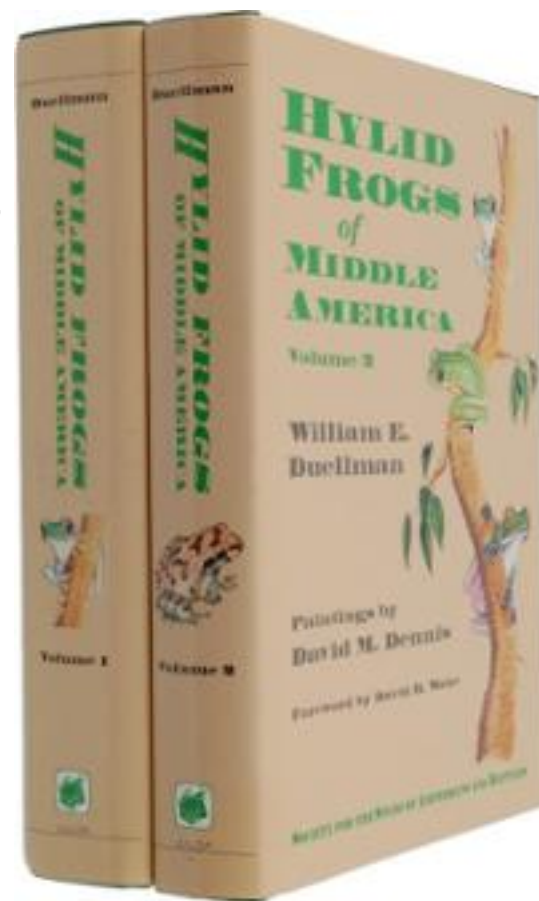
Matt Madler: archival standards at Macaulay sound Lab



Digitized original
audiospectrograms



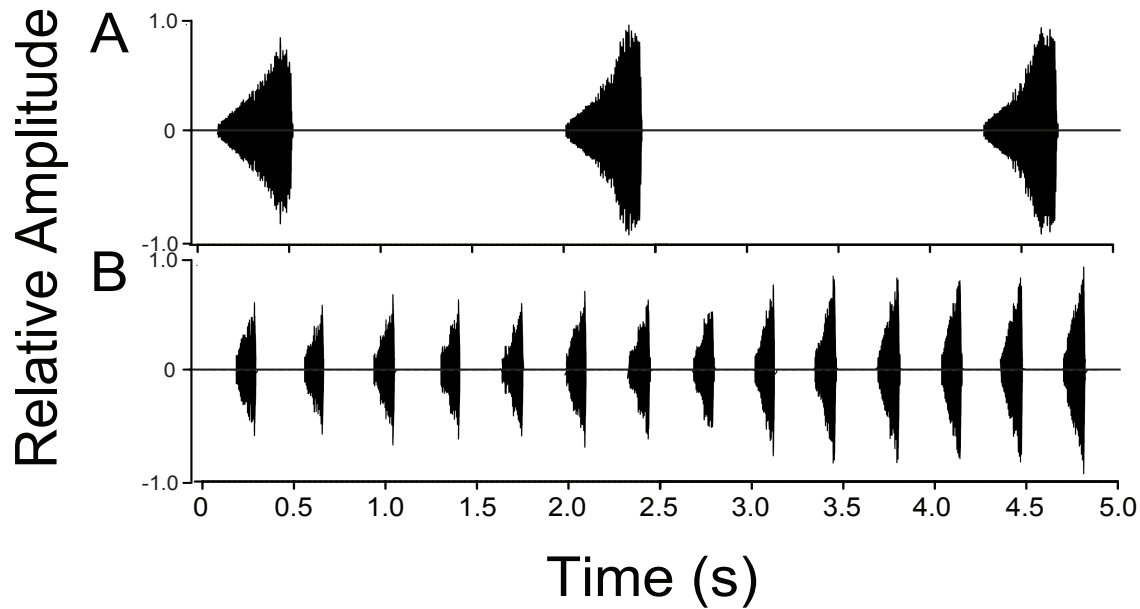
Digitized original
illustrations



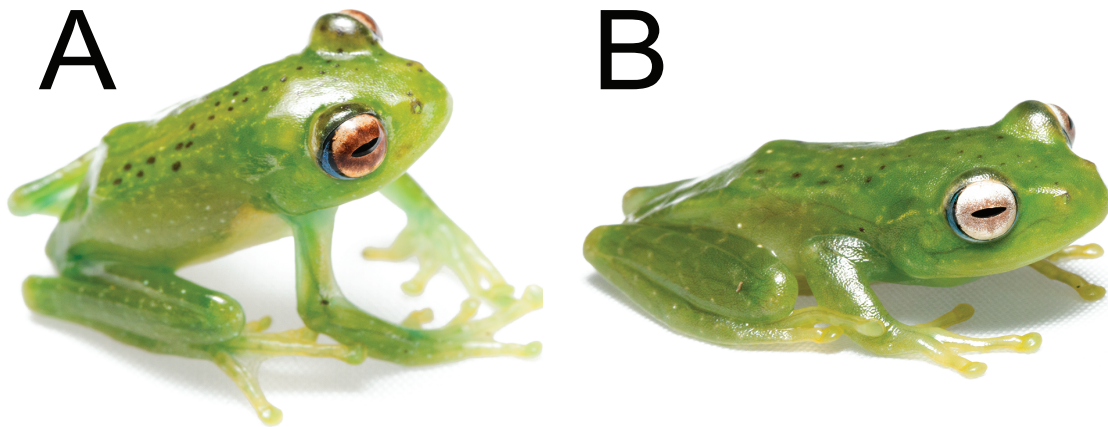
Verification of data
from publications...



Digitization and data capture from Duellman field notes



Species delimitation
in a conservation
hotspot:
morphology, calls,
and DNA sequences



Carl Hutter's acoustic comparisons of cryptic species of
frogs from Madagascar



Imaging Duellman's hylid frog holotypes



A



B

10 mm



5 mm

C



D



E

5 mm

**Robin
Abraham's**
standards for
imaging bush
frogs of the
Western
Ghats



Hard copy records triage:

Digitization of some portions of records....

Geographical card catalog

Slide collection catalog

Type card catalog

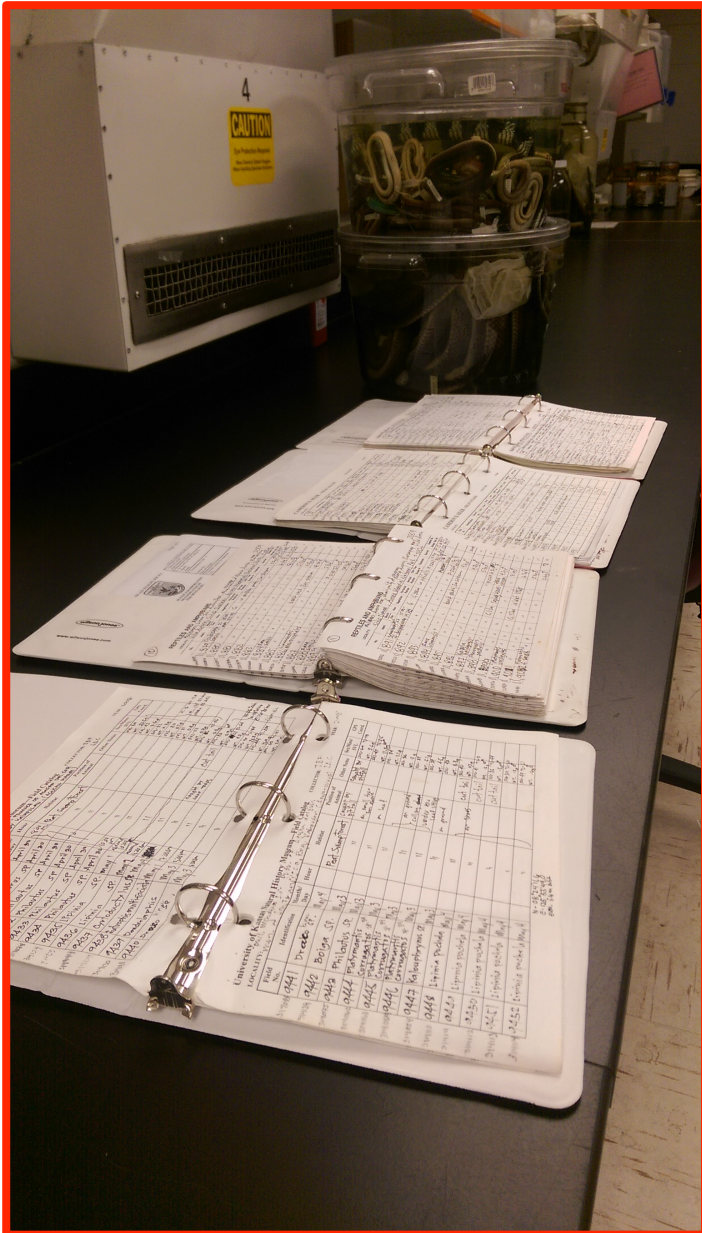
Accession records catalog



Habitat data from
related notes



Digitizing transparencies:
animal images, habitat, etc



Melanesian forest frogs: morphology, calls, DNA sequences



Photography today...



Female... (non-callers)





Males (vocalizing individual), juveniles, color polymorphism....



Individual variation...



Individual variation...

Identification	Taxonomy	Location	Year	Map	Media
MVZ Amphibian and reptile specimens 112333	Amphibia: Plectrohyla hazelae	Mexico, Oaxaca: 22 km N of Guelatao by Mexico Hwy. 175	1974		
UCM Amphibian and reptile specimens 48311	Amphibia: Plectrohyla hazelae	Mexico, Oaxaca: 11.4 mi. N. Vista Hermosa	1965		
USNM Amphibians & Reptiles 114576.6086218	Amphibia: Plectrohyla hazelae	Mexico, Oaxaca: Cerro San Felipe	1940		
USNM Amphibians & Reptiles 114577.6086219	Amphibia: Plectrohyla hazelae	Mexico, Oaxaca: Cerro San Felipe	1940		
USNM Amphibians & Reptiles 224499.6343625	Amphibia: Plectrohyla hazelae	Mexico, Oaxaca: La Cumbre, 4.6 mi W of, on road to Cerro San Felipe	1975		
AMNH Herpetology A-175116	Amphibia: Plectrohyla hazelae	Mexico, Oaxaca			
AMNH Herpetology A-175117	Amphibia: Plectrohyla hazelae	Mexico, Oaxaca			

VertNet / GBIF records...

Macaulay Library

Search recordings by catalog number or species:

All Media

- Find
- Order
- Guides
- About
- Sign in

Results by Collection: Archive: **Audio** 12 **Video** 0



You searched for: Plectrohyla [\(Clear\)](#)

Audio Archive Recordings 1-4 of 12

	<u>Catalog</u>	<u>Species</u>	<u>Sound Type</u>			<u>Location</u>	<u>Recordist</u>	<u>Date</u>	<u>Length</u>	<u>Quality</u> ▼
			<u>C</u>	<u>S</u>	<u>M</u>					
1.	193986 ▶ ⏮	Plectrohyla hazelae	Call			Mexico Oaxaca	Duellman, William E.	8 Aug 1966	:56	★★★
2.	193982 ▶ ⏮	Plectrohyla thorectes	Call			Mexico Oaxaca	Duellman, William E.	2 Aug 1966	1:09	★★★

Linked to Macaulay Library specimens...

Nucleotide

Nucleotide

plectrohyla

Save search Advanced

Species

Animals (82)

Customize ...

Molecule types

genomic DNA/RNA (82)

Customize ...

Source databases

GenBank (82)

Customize ...

Genetic compartments

Mitochondrion (29)

Display Settings: Summary, 20 per page, Sorted by Default order

Results: 1 to 20 of 82

<< First < Prev Page 1 of 5

[Plectrohyla matudai seventh in absentia gene, partial cds](#)

1. 397 bp linear DNA

Accession: AY844925.1 GI: 62530824

[GenBank](#) [FASTA](#) [Graphics](#) [PopSet](#)

[Plectrohyla guatemalensis seventh in absentia gene, partial cds](#)

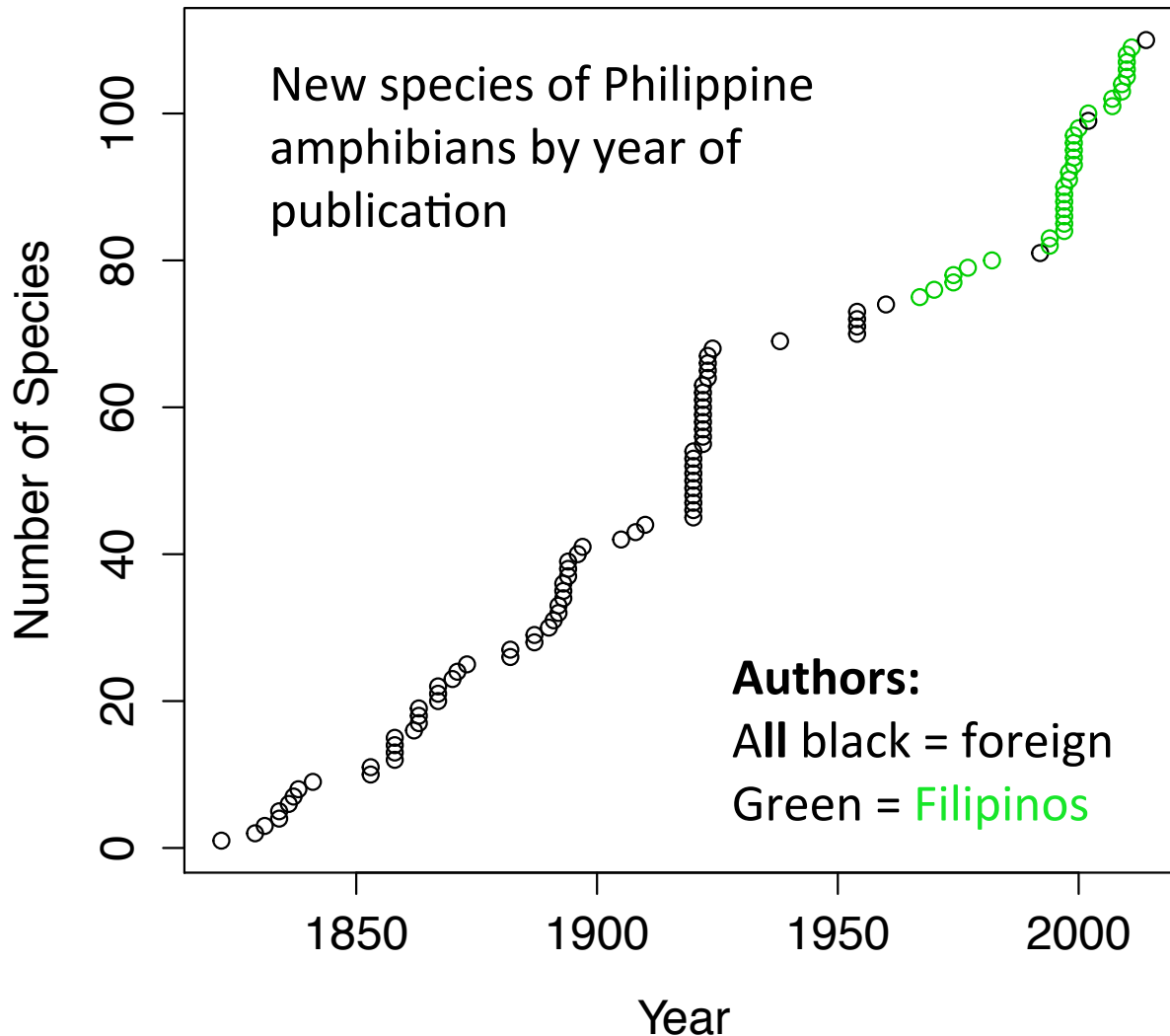
2. 397 bp linear DNA

Accession: AY844924.1 GI: 62530822

[GenBank](#) [FASTA](#) [Graphics](#) [PopSet](#)

GenBank records...

Authorship trends in systematic publications



c.o.: D. Blackburn, AmphibiaWeb

Increasingly, international systematic research led by non-U.S. scientists.

Specimens, physical vouchers or otherwise, often repatriated

Data sharing necessarily an increasingly global enterprise

IT-enabling and digitization part of the curatorial process





Acknowledgements



- **Funding (NSF):**

- NSF TCN

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- T. LaDuc
- D. Cannatella
- M. Ryan
- S. Rand
- R. Heyer
- G. Zug