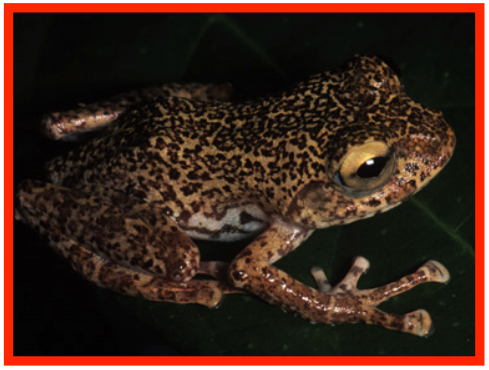
Collection of Physical and Media Specimens: Why Bother?

Rafe M. Brown

KU Biodiversity Institute



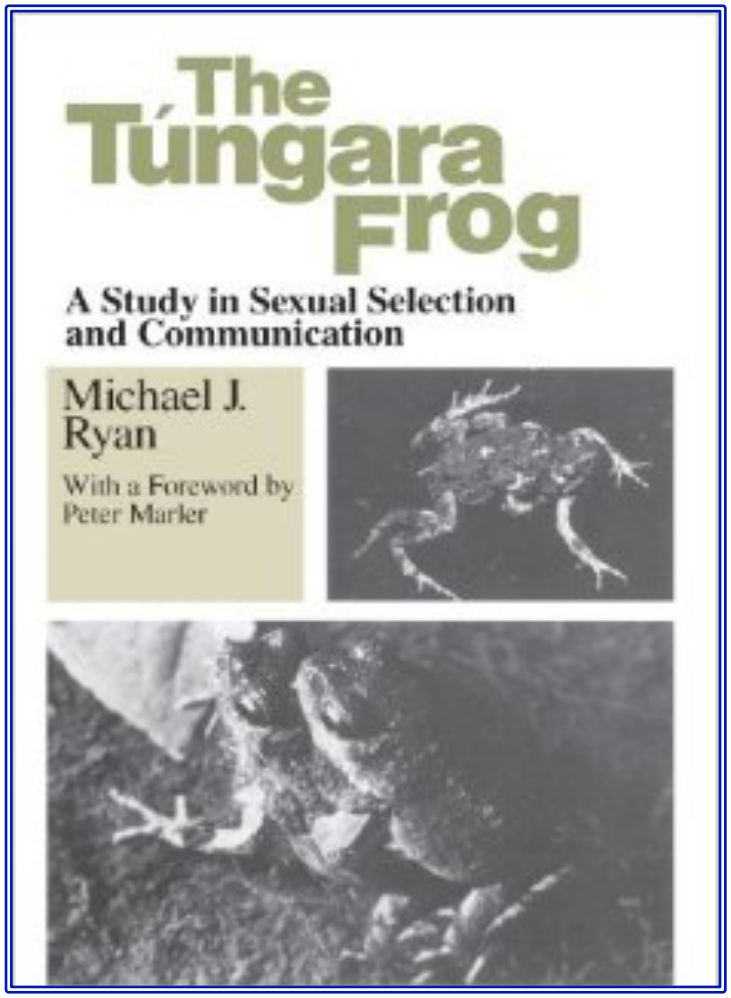


KU BIODIVERSITY INSTITUTE
The University of Kansas

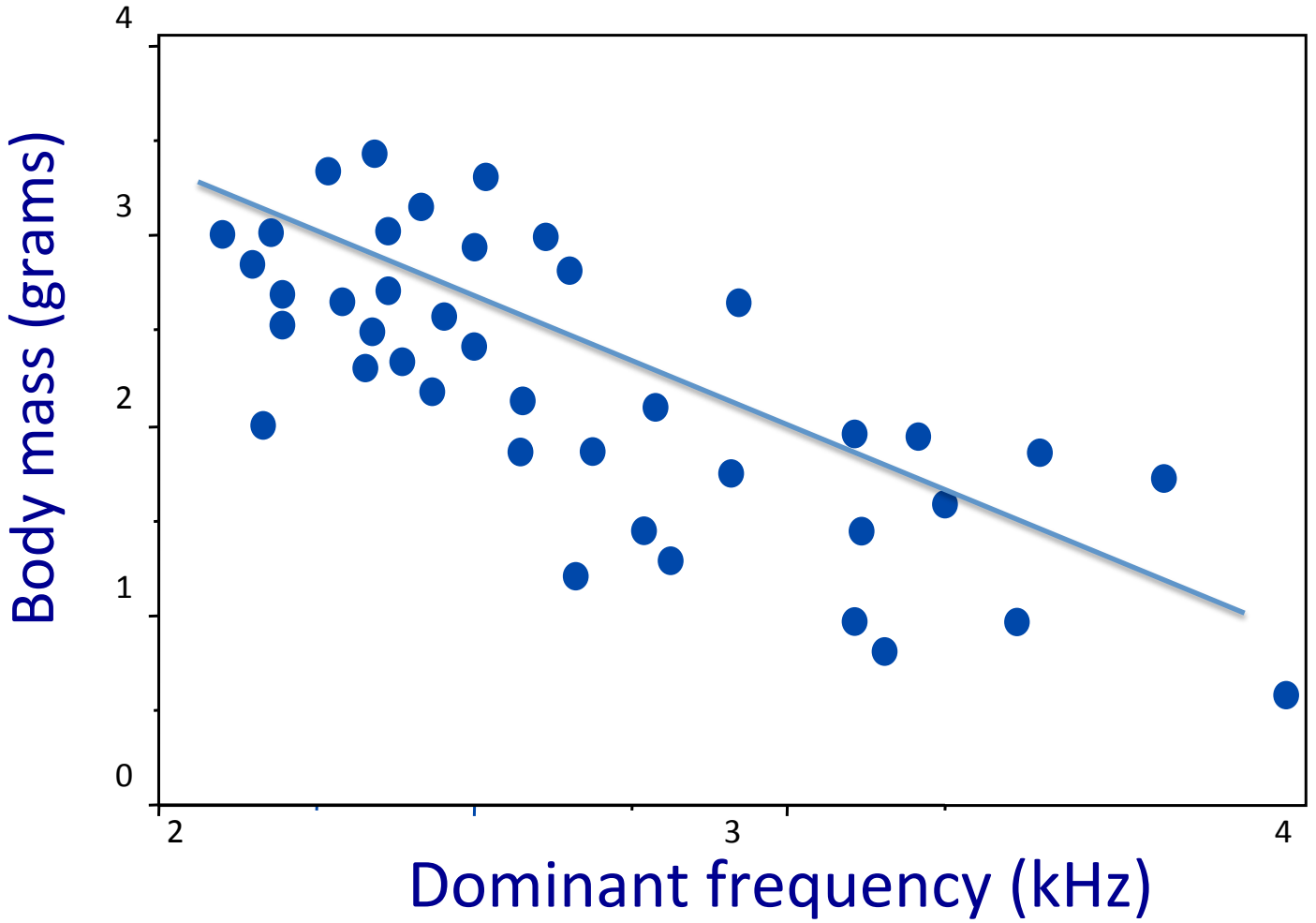
Mike Webster, G. Budney, E. Scholes, M. Madley– Cornell
Travis LaDuc – Univ. Texas (Ryan and Blair sound libraries)
G. Zug and R. Heyer – USNM (Smithsonian collection)

Sexual Selection in Tungara frogs:

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

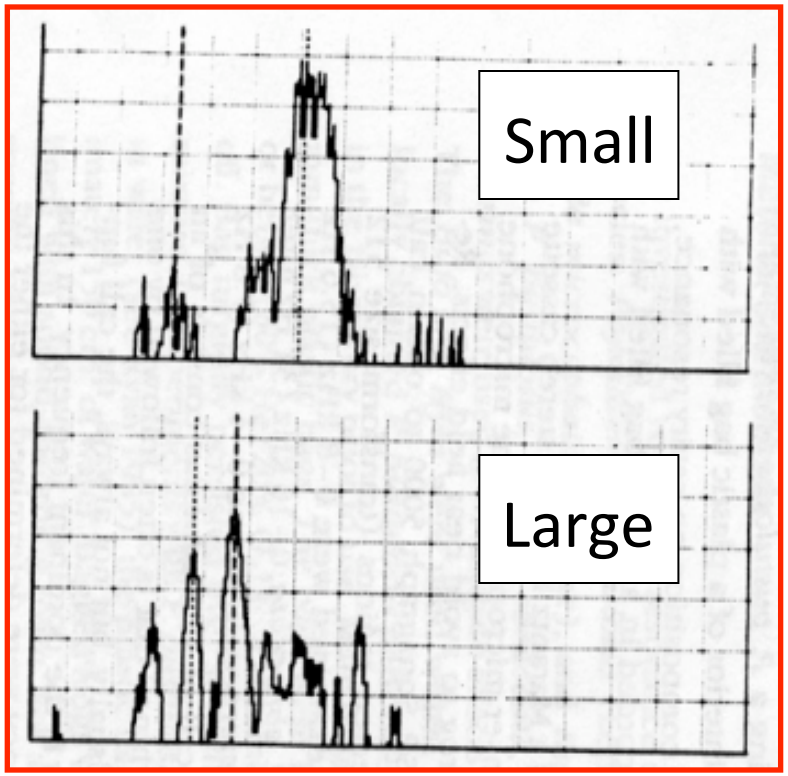


Sexual Selection in Tungara frogs: fundamental relationships between male size (quality?), call frequency, and female choice

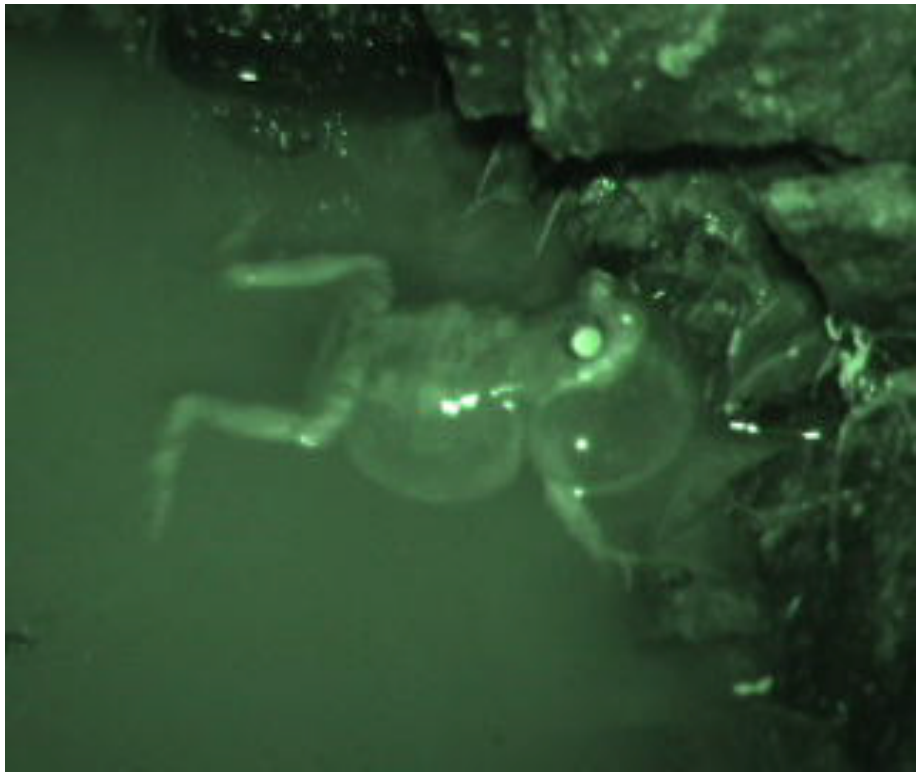


Sexual Selection in Tungara frogs:

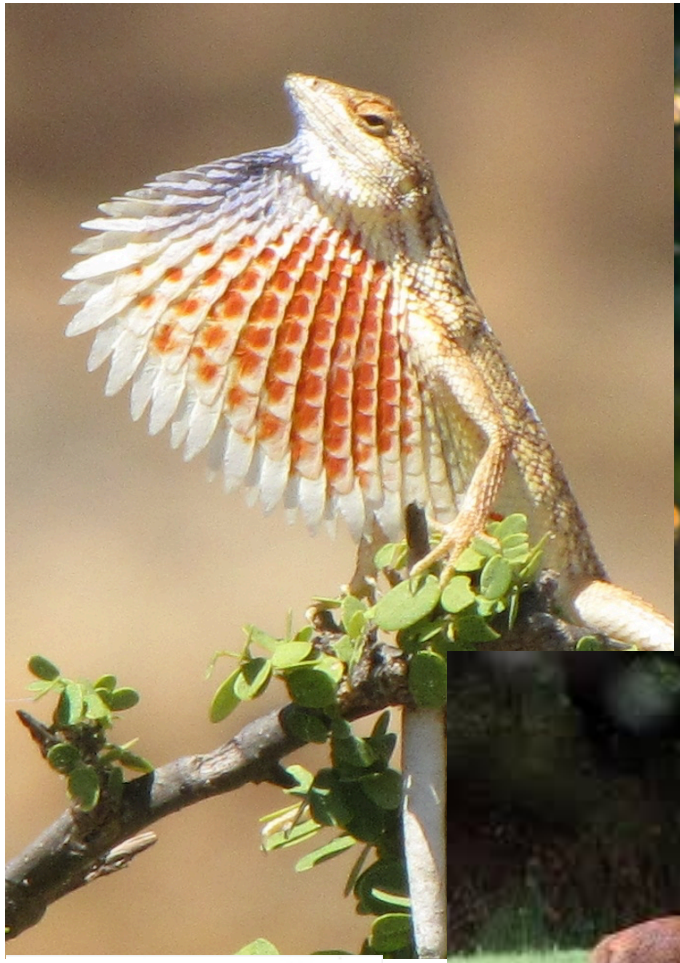
1) media specimens (video, audio),
2) physical specimens,
3) Linked data derived from both types…

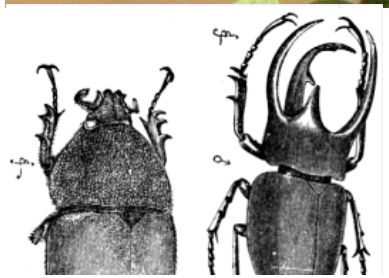


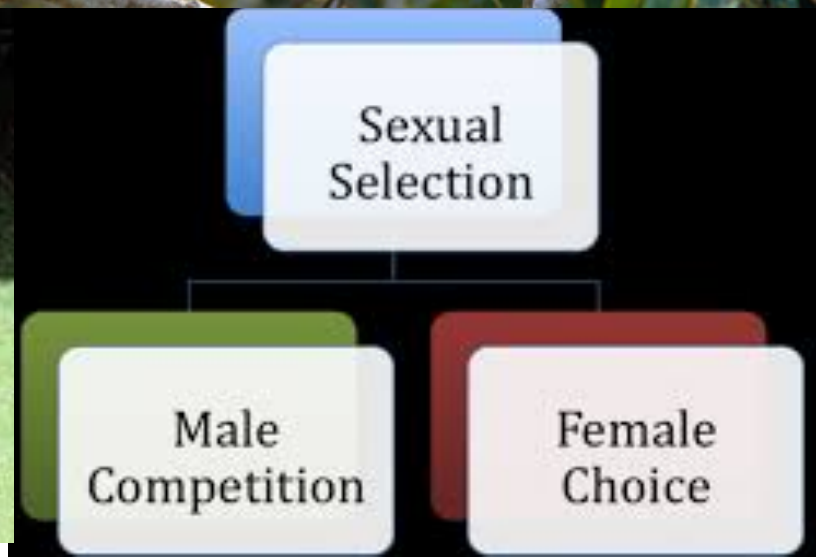
Dominant Call Frequency



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

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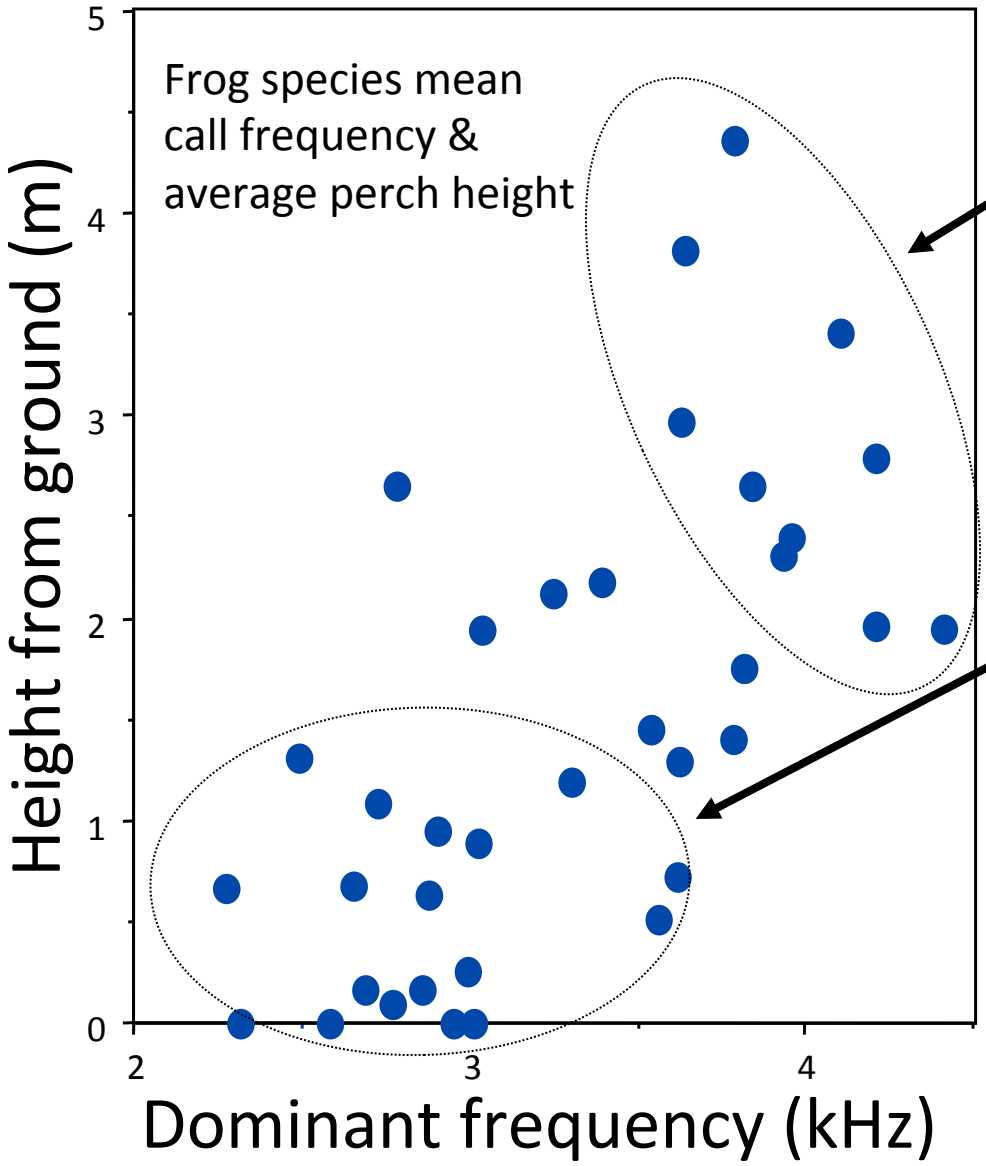
- Species may evolve calls that allow for maximal habitat specific transmission efficiency

- High frequency calls differentially attenuated (boundary layer interference) when transmitted on the ground

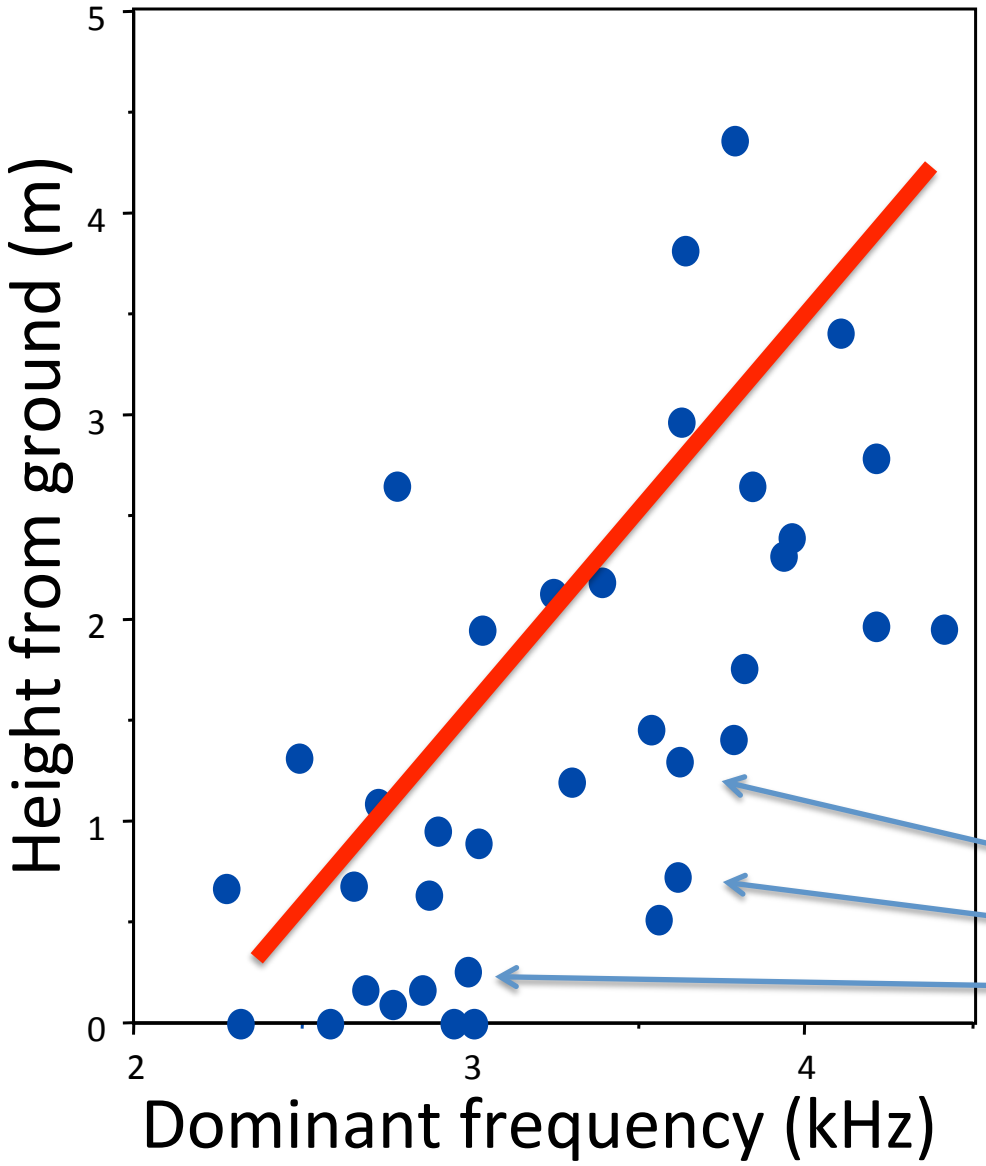
- **Prediction**: species with low frequency calls can transmit signals at ground level; those with higher frequencies and/or a wider range of frequencies should utilize high perches

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



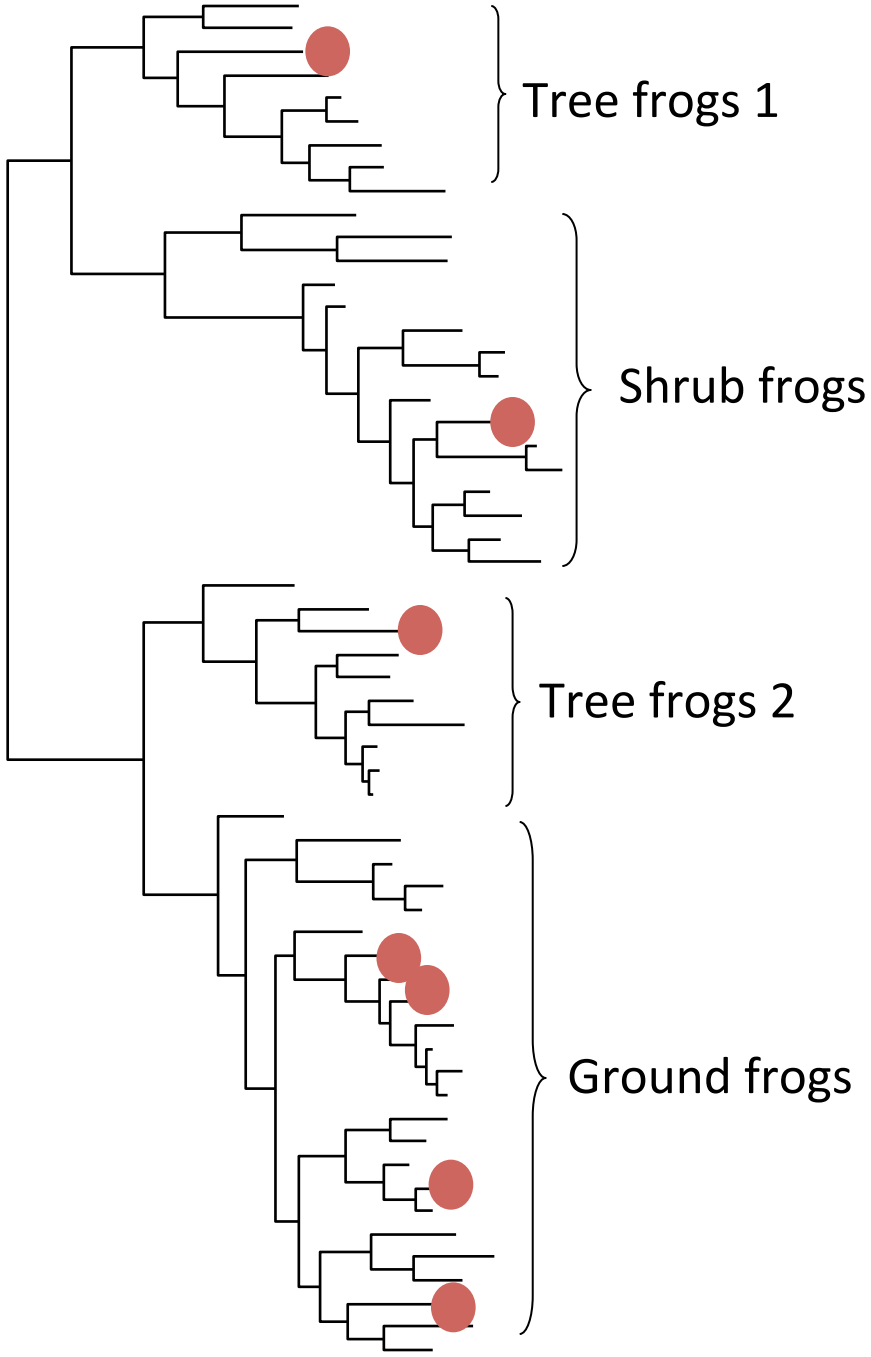
Relationship?

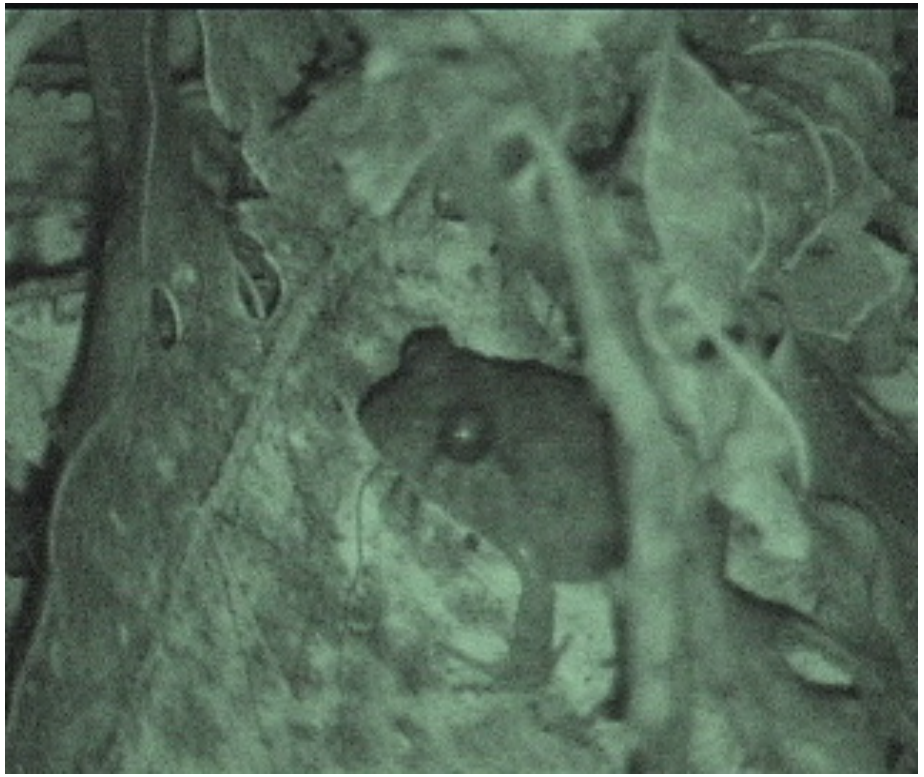
Assumptions & requirements

1) Statistical independence? (incorporate phylogeny)

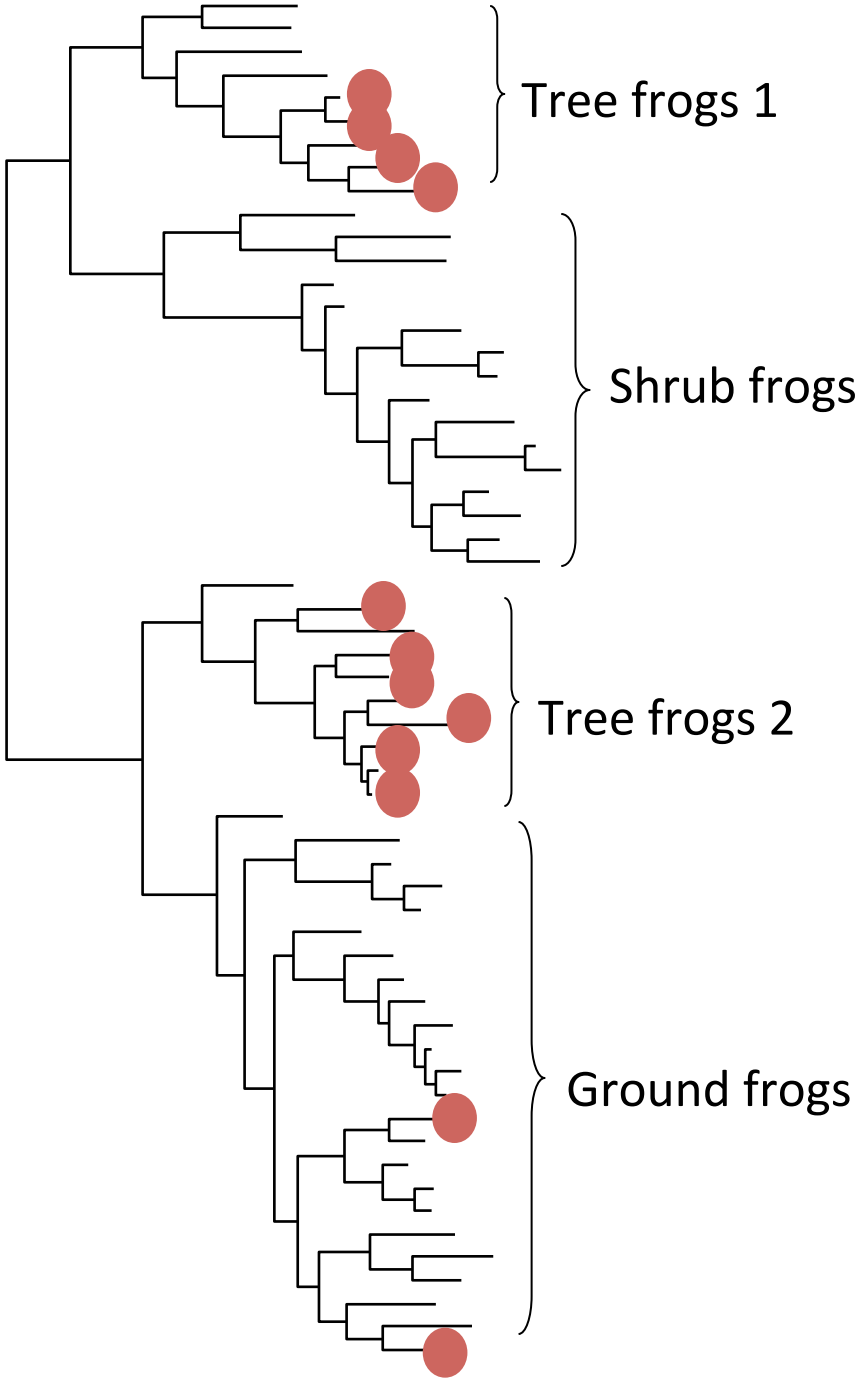
1) Size-corrected data for interspecific comparisons

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

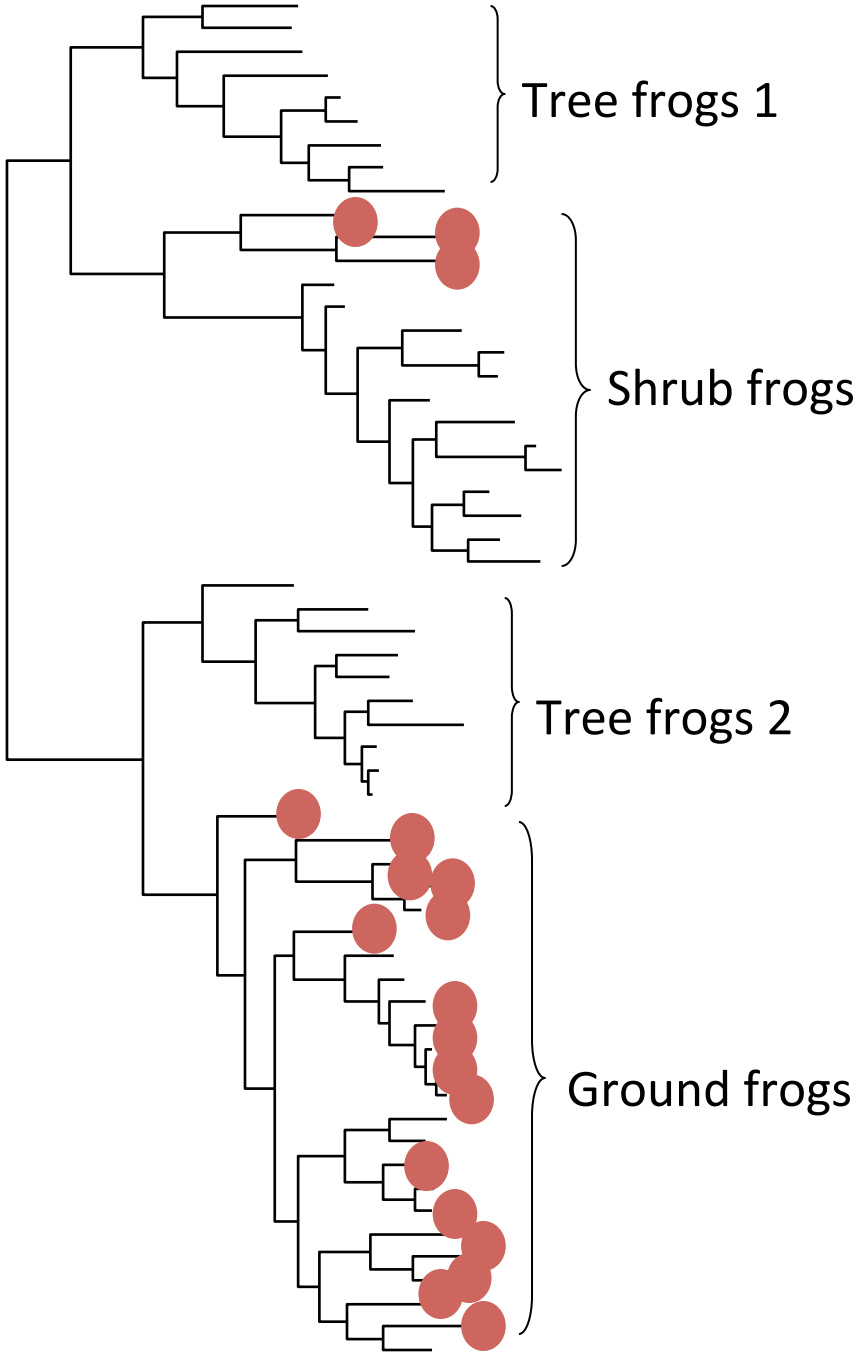




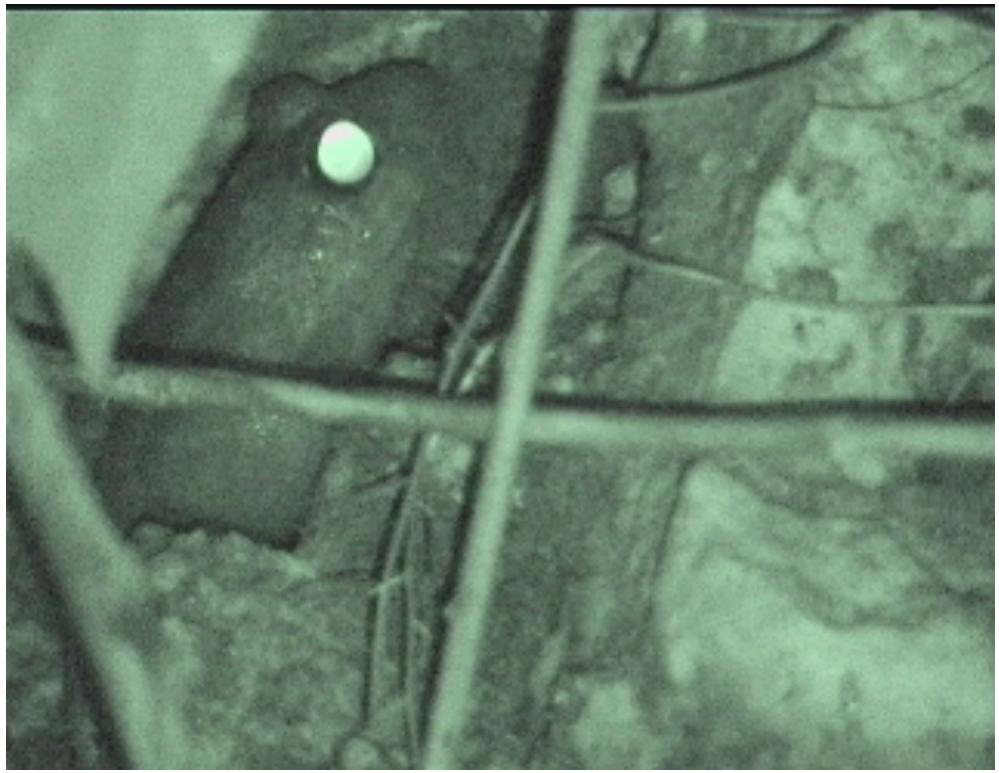
Six origins of frequency sweep calls

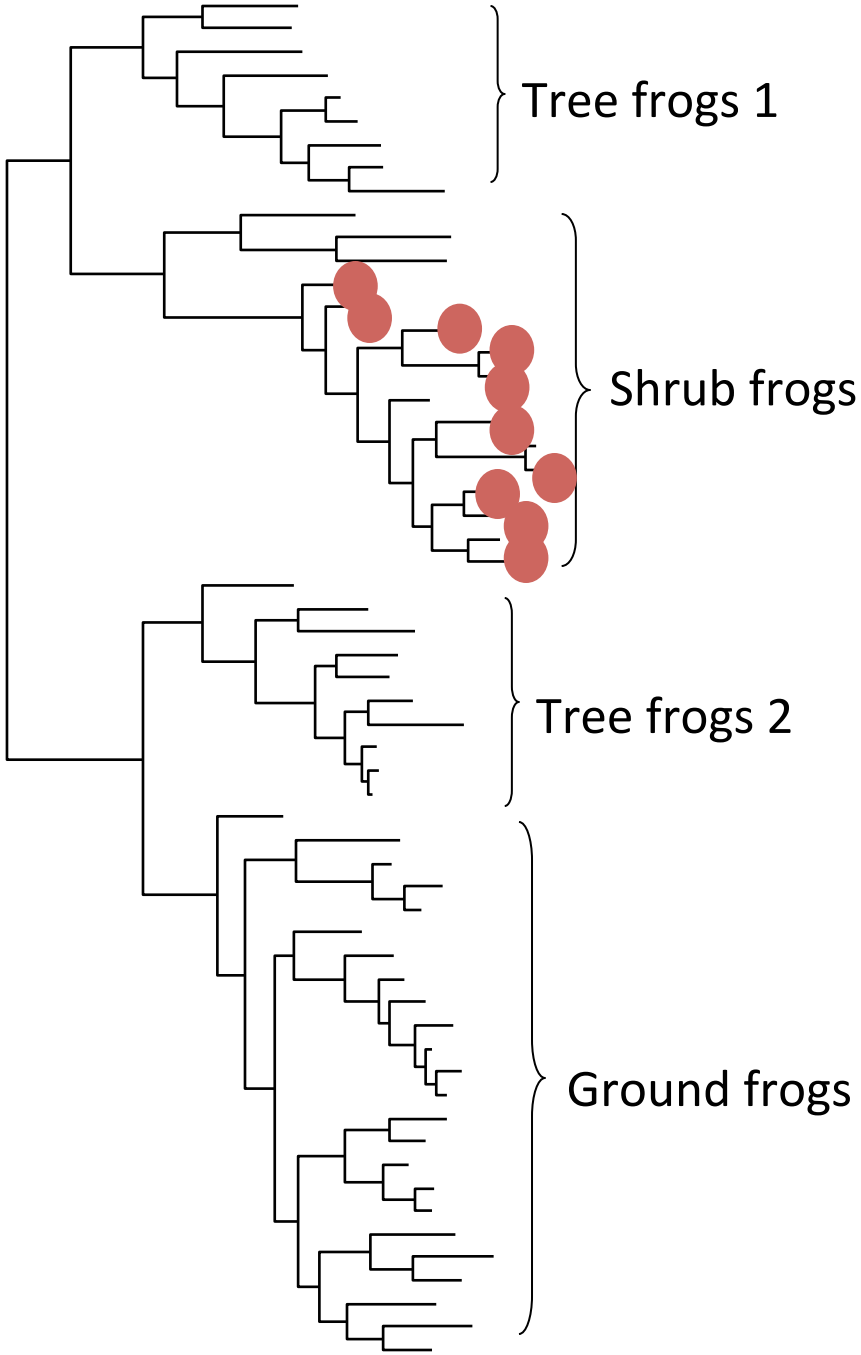


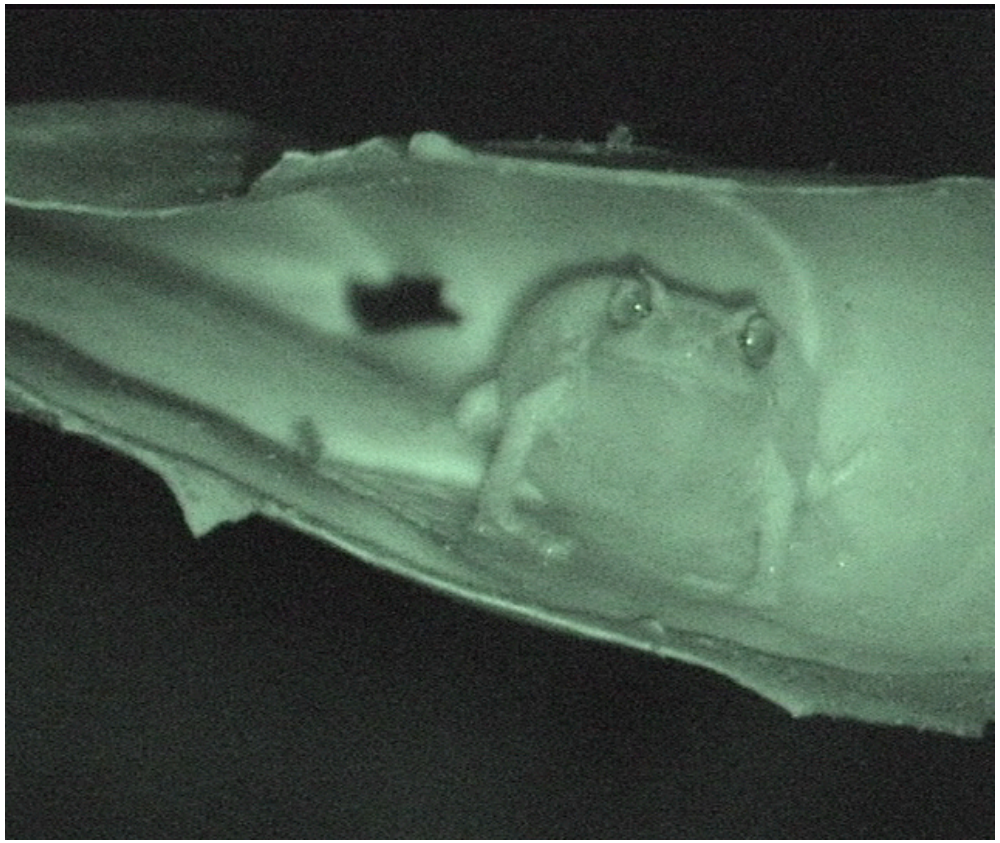
4 origins of pulsed calls



Two origins of complex calls







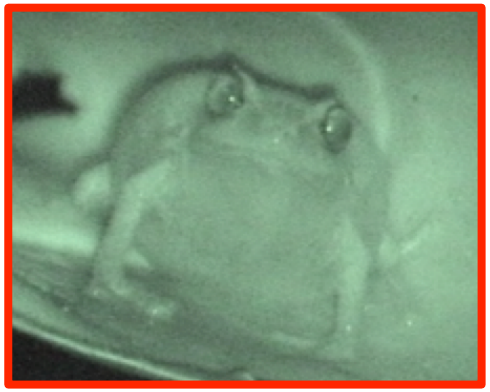
Pure tone calls arose once

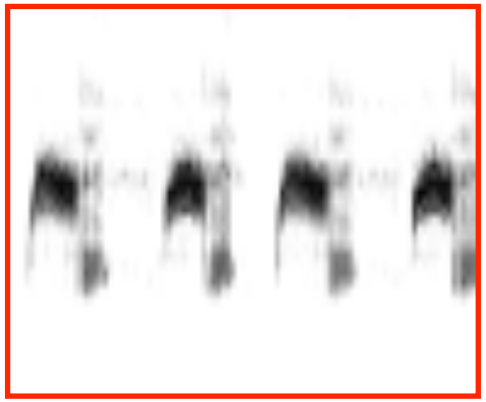
Multilocus phylogeny, derived from sequencing genomic resources in KU's Cryofacility (LN2)

Phylogeny

+

Media specimen





Physical specimen

Acoustic analysis:

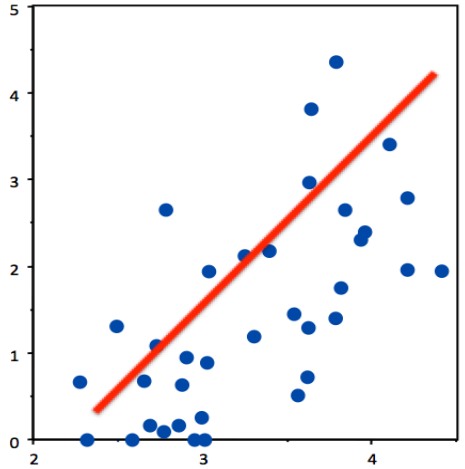
Frequency,
Call rate,
Etc.

Morphology:

Body size,
Ecotype,
Etc.

=

Evolutionary question

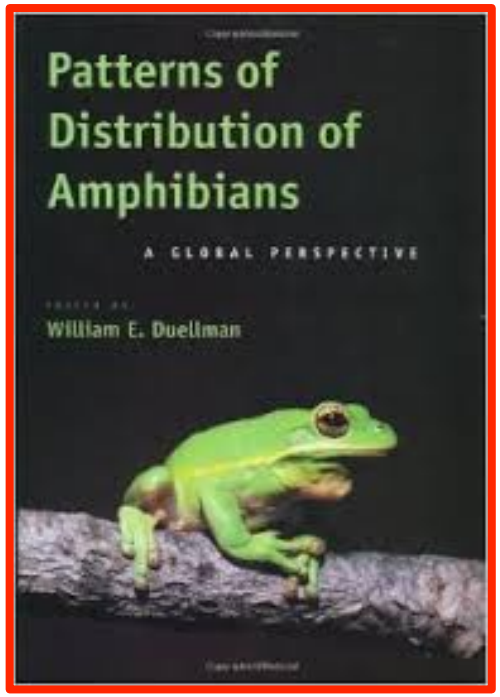


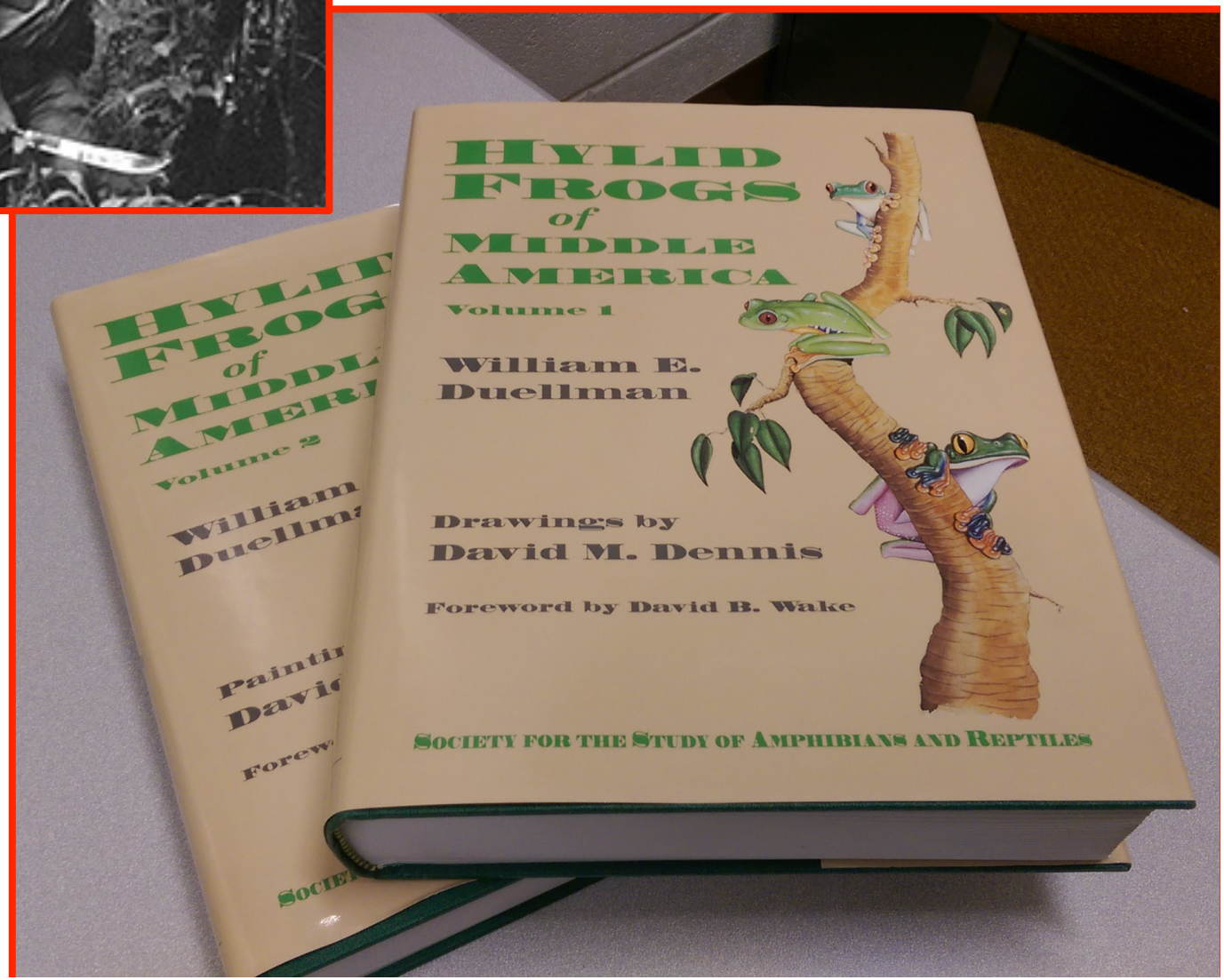
Integrative, multidisciplinary evolutionary biology

- **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.

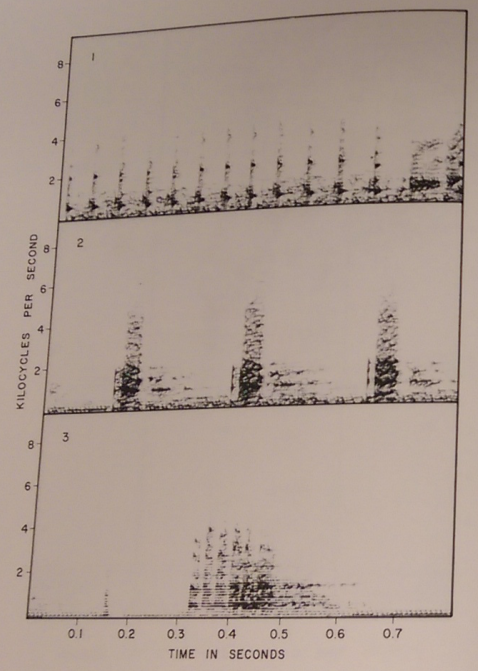
W. Duellman & C. Myers
(Panama, 1954)





Bill Duellman (Kansas, 2015)

PLATE 40



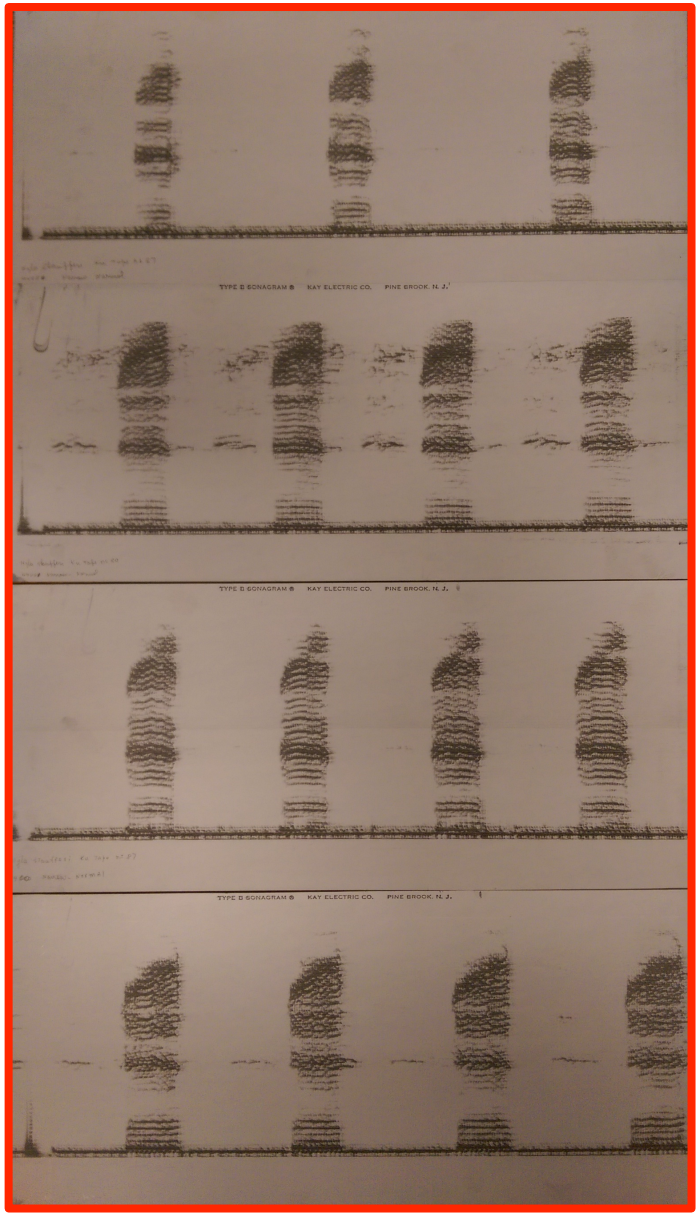
1. *Pachymedusa dacnicolor*. 2. *Smilisca baudinii*. 3. *Pternohyla fodiens* (all release calls).

PLATE 41

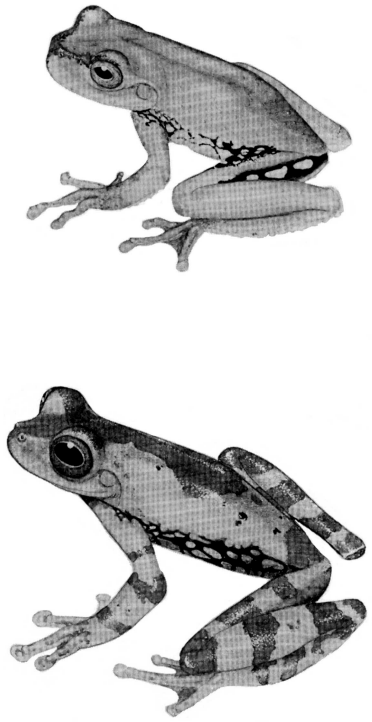
1. *Pachymedusa dacnicolor*. 2. *Phyllomedusa venusta*. × 1.5.

Duellman's original equipment (no longer in use)

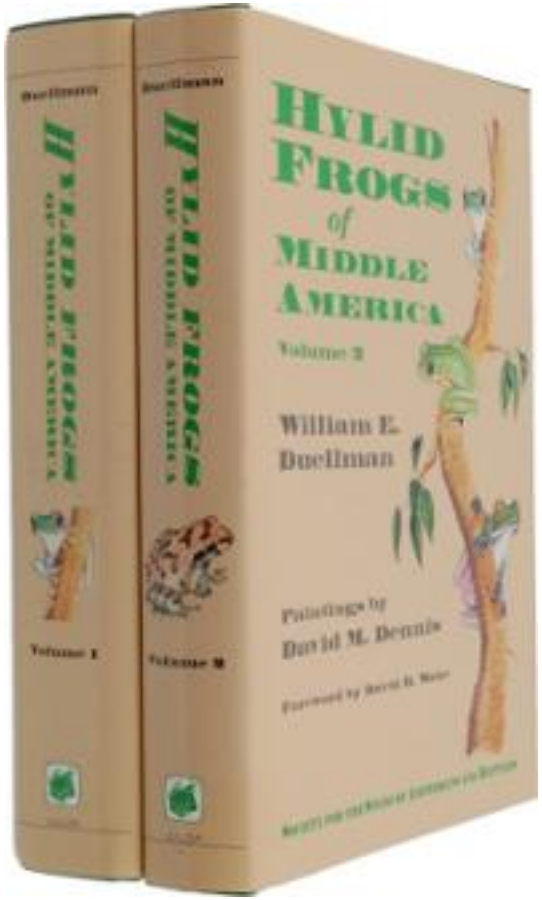
Matt Madler: archival standards at Macaulay sound Lab



Digitized original audiospectrograms

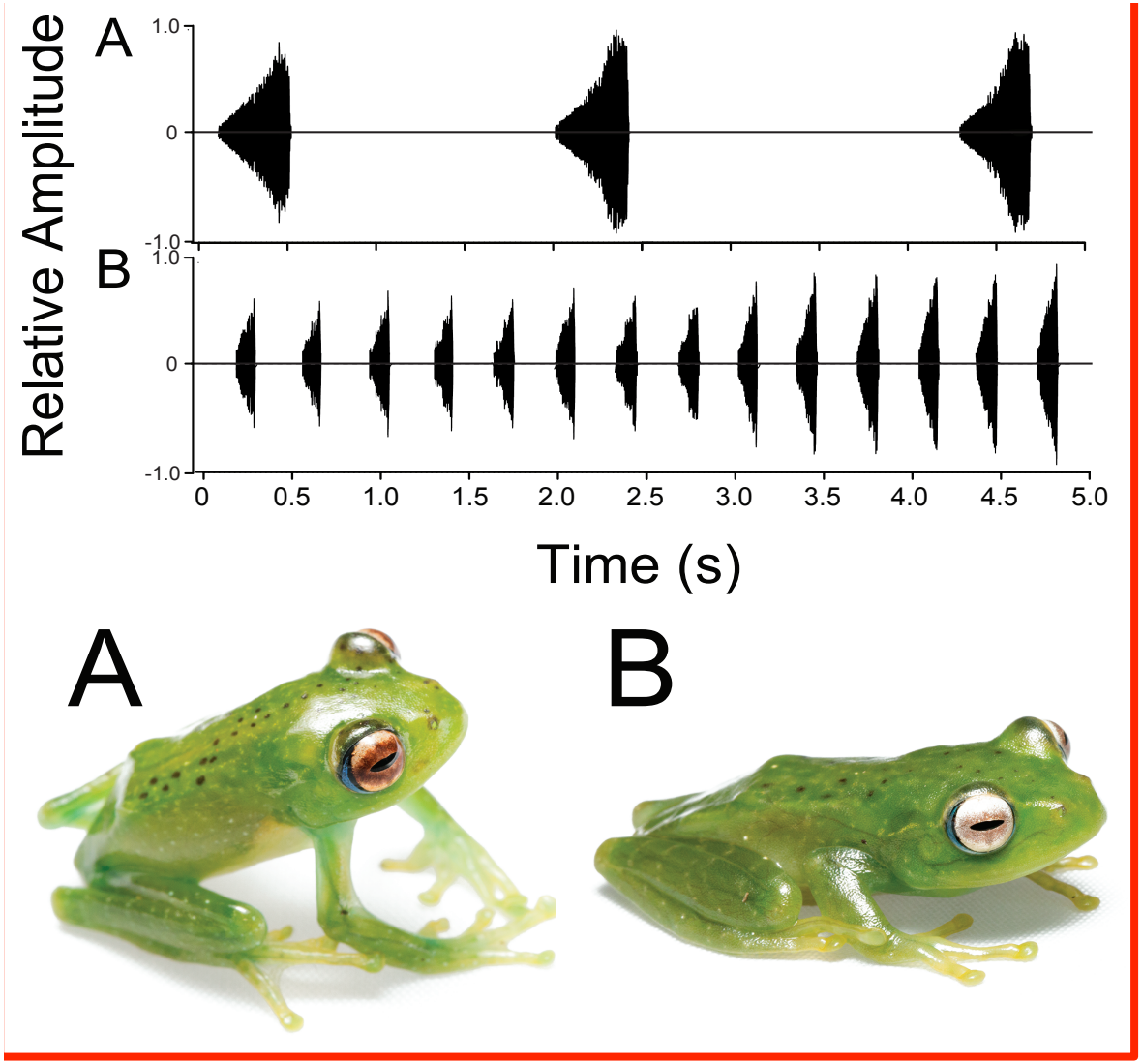


Digitized original illustrations



Verification of data from publications…

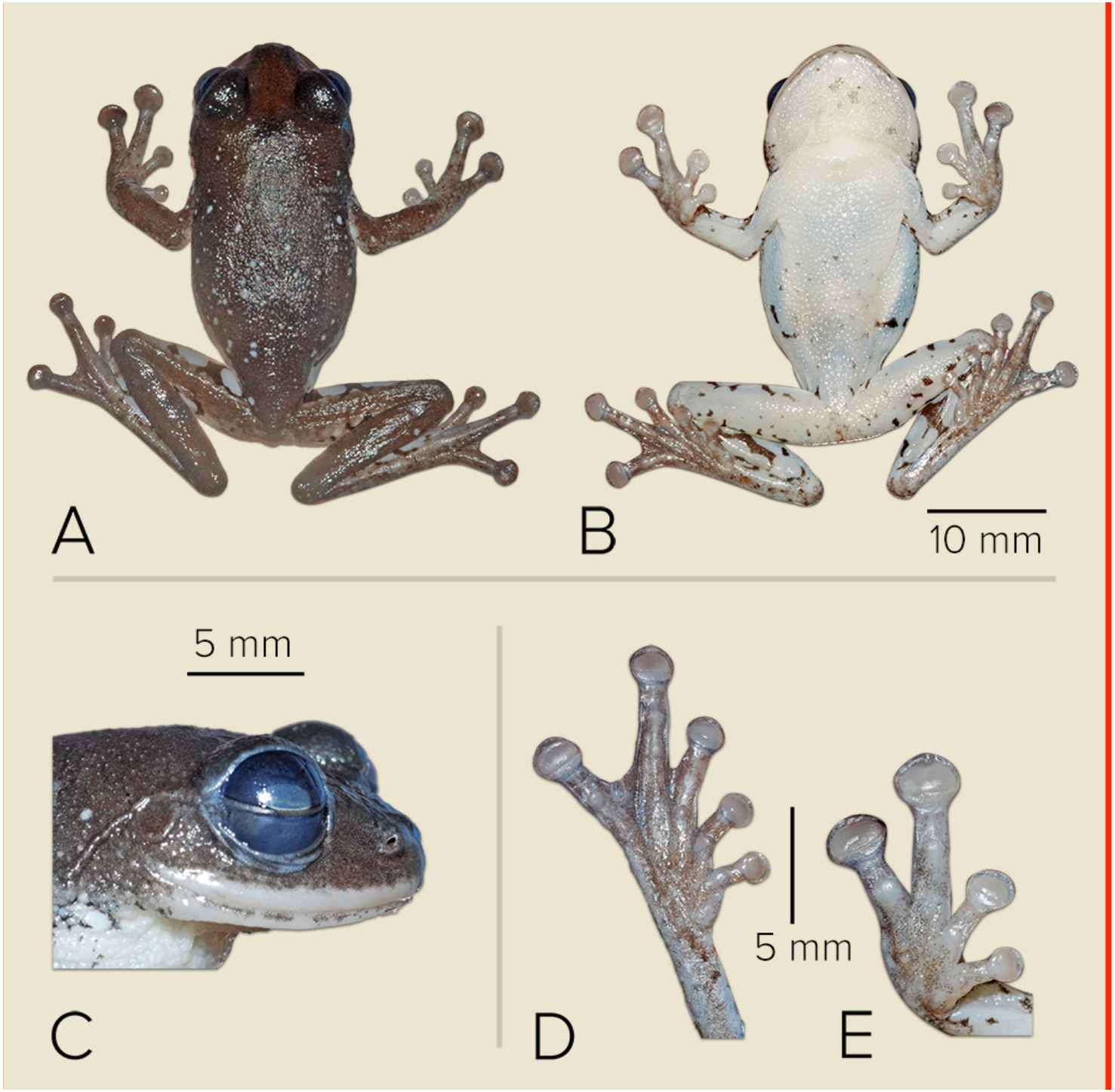
Digitization and data capture from Duellman field notes



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



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

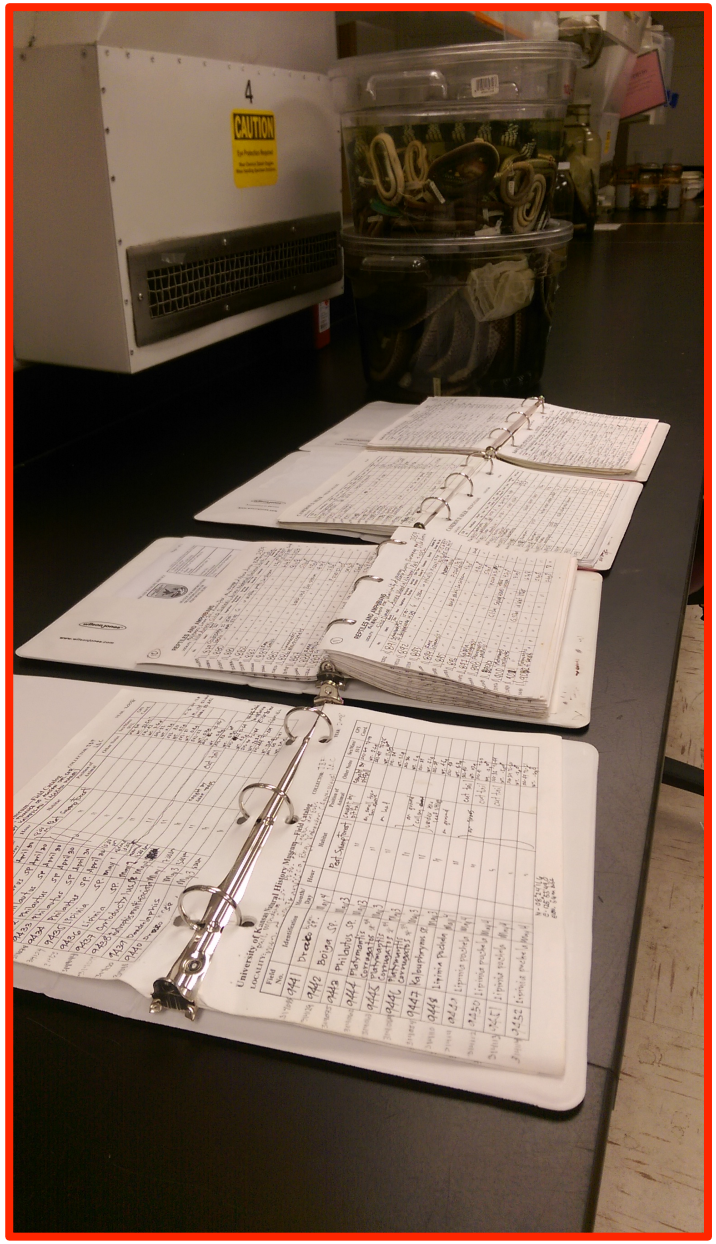
Slide collection catalog

Type card catalog

Accession records catalog

Habitat data from related notes

Digitizing transparencies: animal images, habitat, etc



Melanesian forest frogs: morphology, calls, DNA sequences

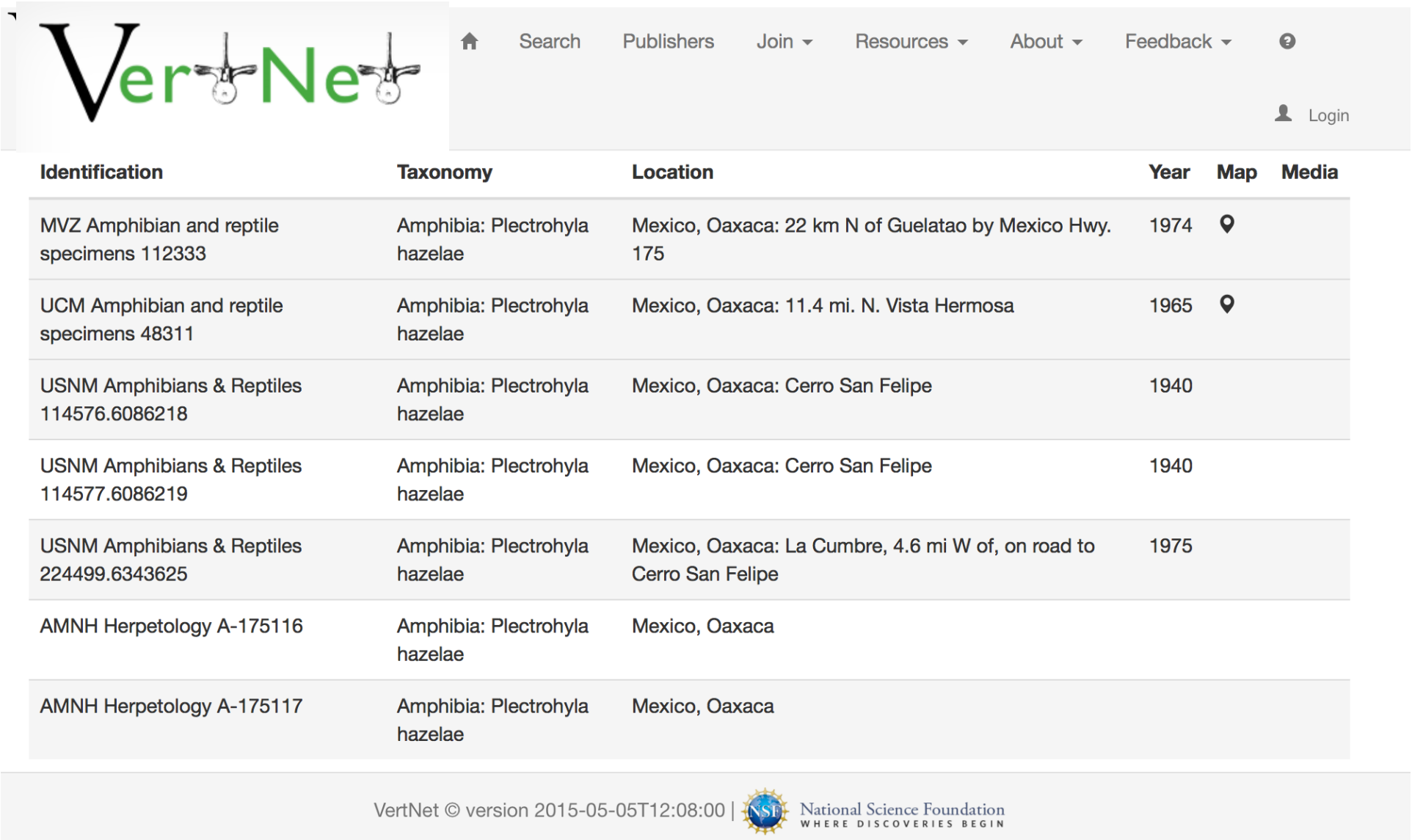
Photography today…

Female… (non-callers)

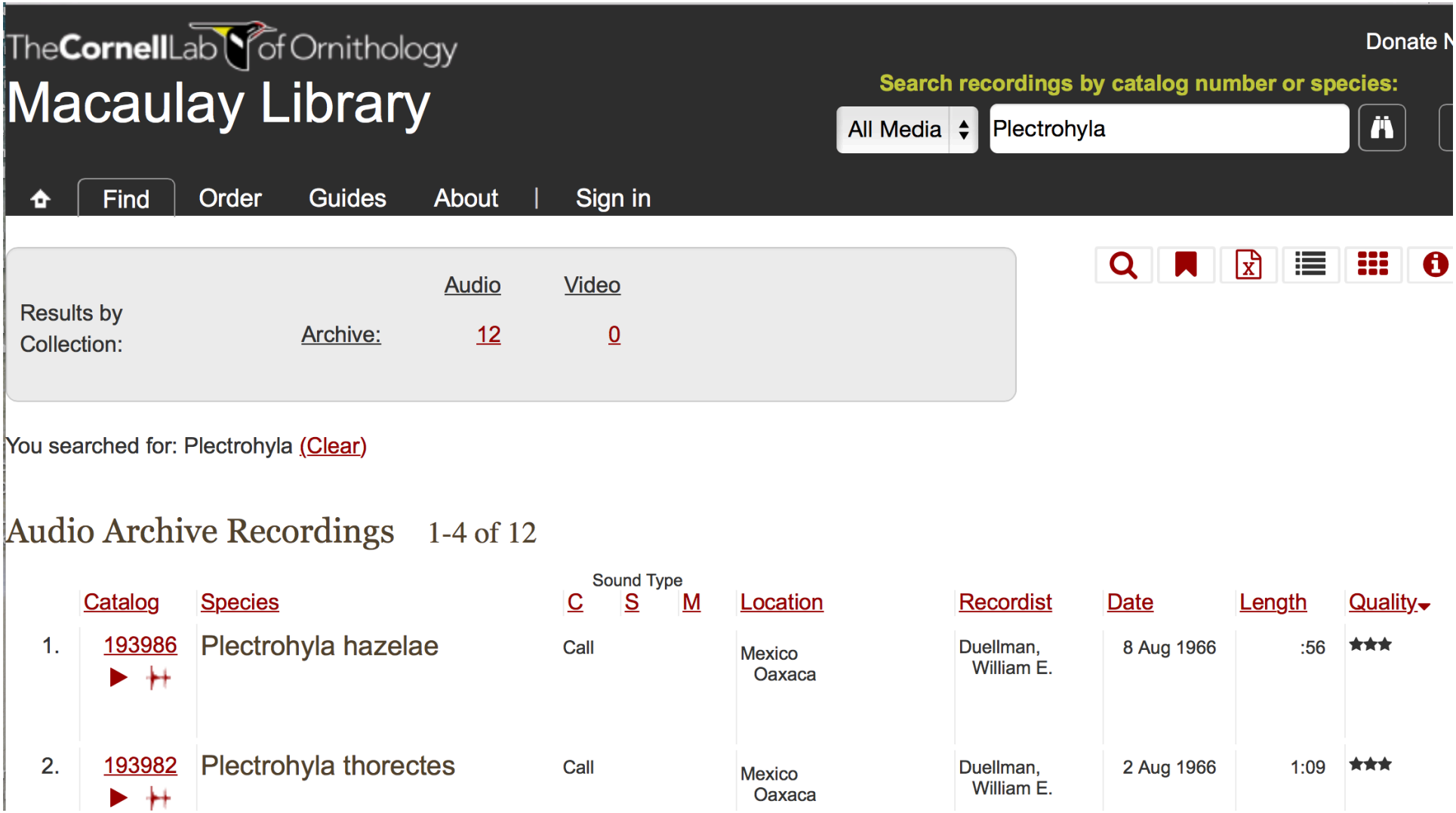
Males (vocalizing individual), juveniles, color polymorphism….

Individual variation…

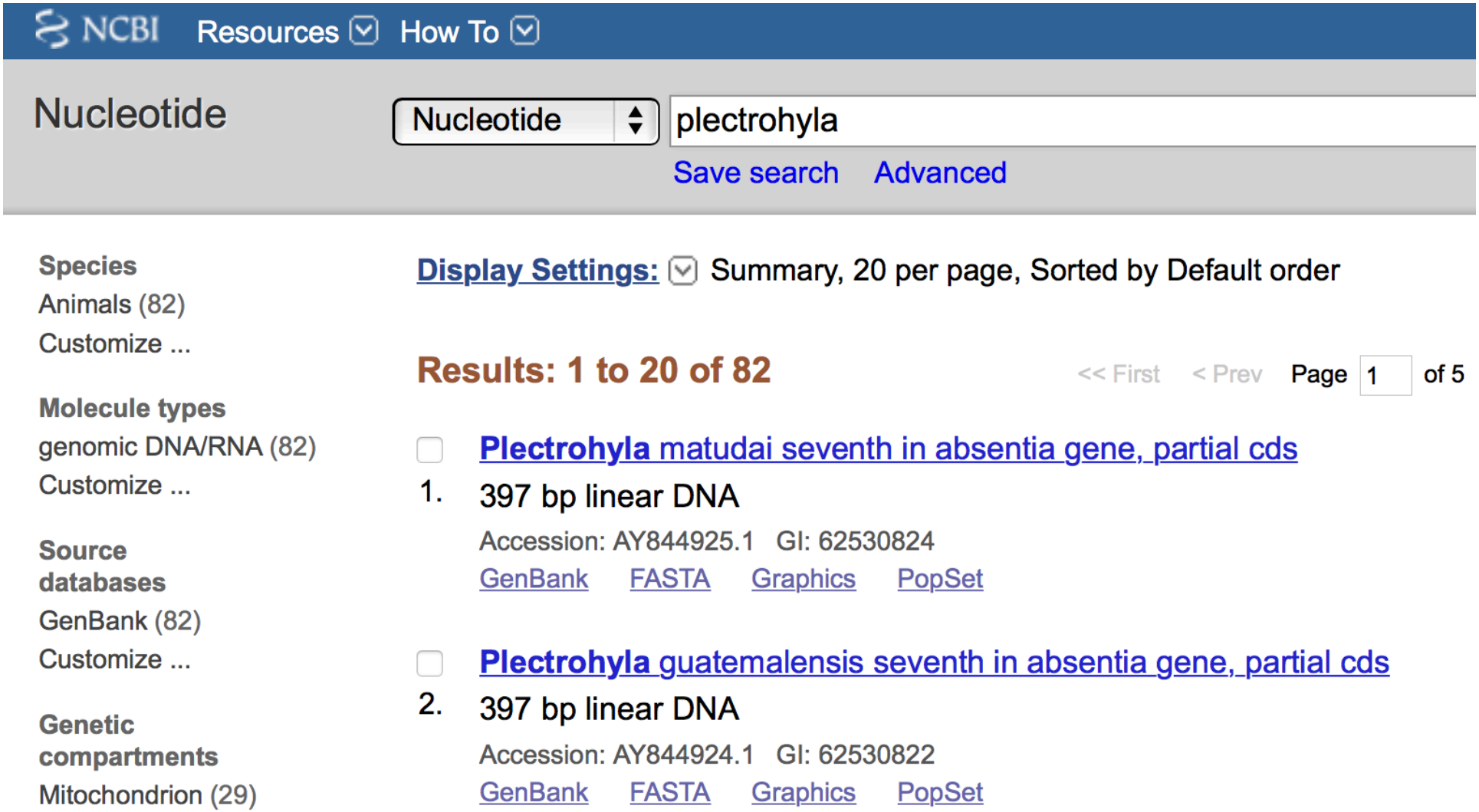
Individual variation…



VertNet / GBIF records…

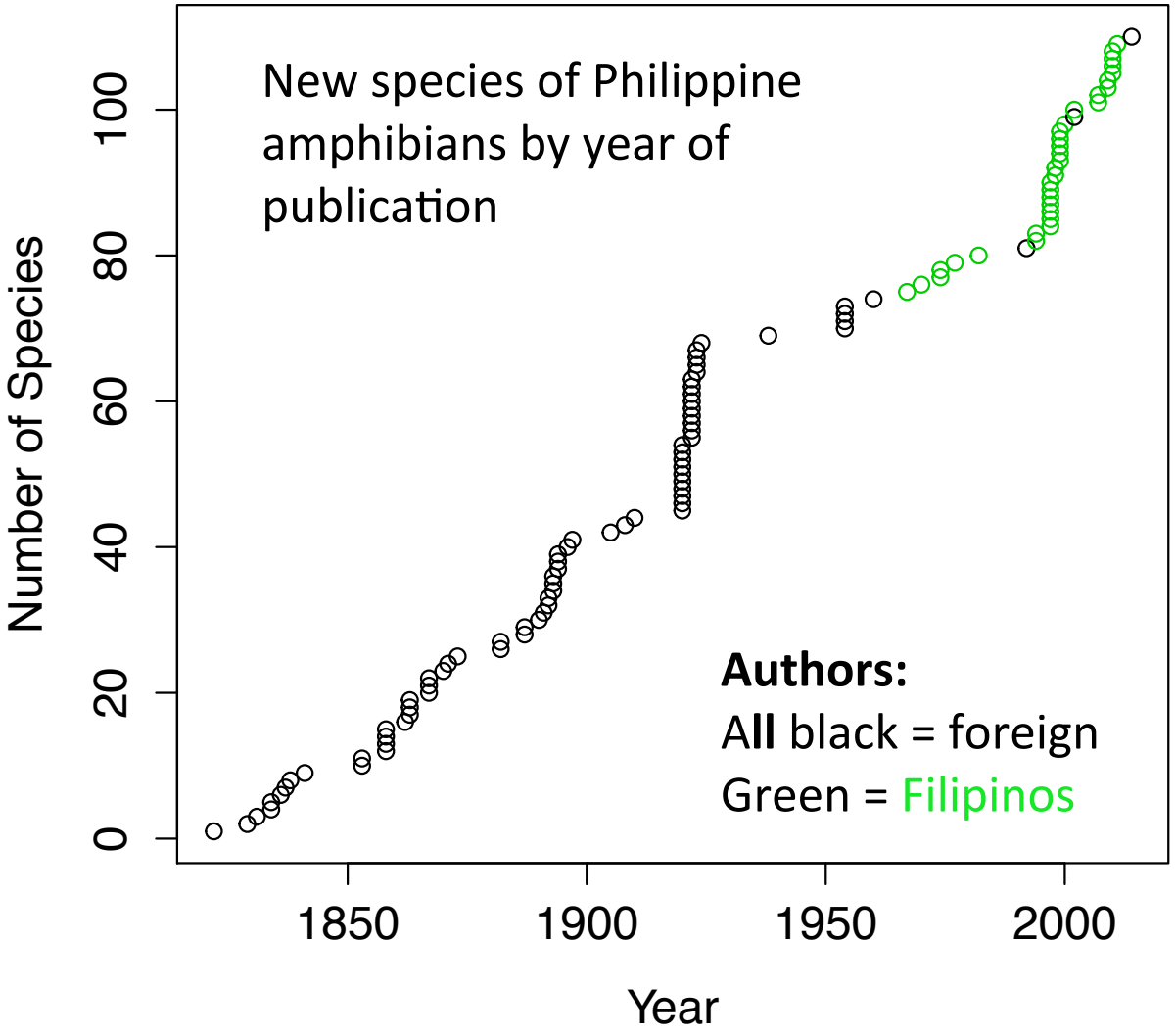


Linked to Macaulay Library specimens…



GenBank records…

Authorship trends in systematic publications



c.o.: D. Blackbun, 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


Pls... Observe Cleanliness!
got frogs?
KAPLAG
Mt. Balatukan Natural Park
BATCH
80
LOVE
ClimbHigh

Acknowledgements

- **Funding (NSF):**
  - —NSF TCN
- **Individuals:**
  - —B. Duellman
  - —T. LaDuc
  - —D. Cannatella
  - —M. Ryan
  - —S. Rand
  - —R. Heyer
  - —G. Zug