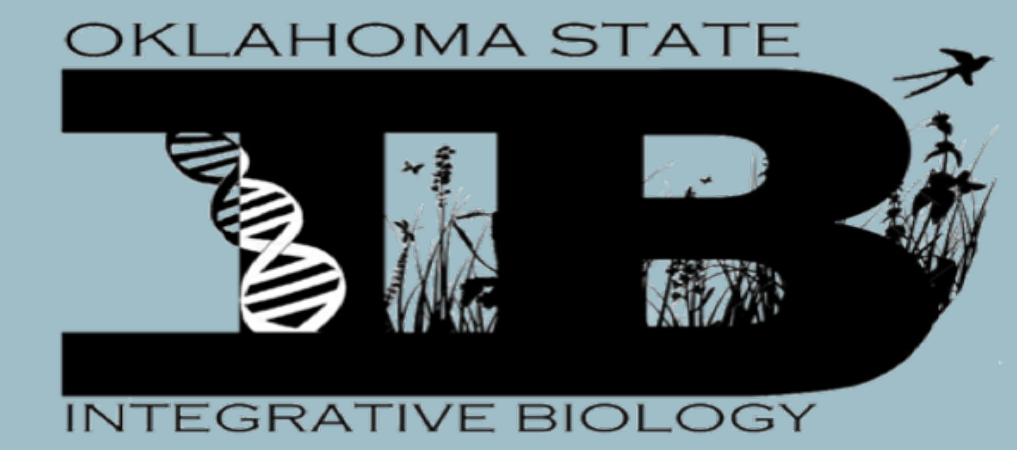


A technique for non-invasive identification of wild frogs using photographs



Jacinda Berokoff and Dr. Michael Reichert

Oklahoma State University – Department of Integrative Biology



Introduction

- A standard method to identify amphibians is Visual Implant Elastomers (VIE). However, VIEs can move, causing misidentification, and may cause infections.
- Photographic mark-recapture is an alternative method that uses the species' natural patterns as a fingerprint for identification.
- This study's goal was to see if the natural pattern on Cope's grey tree frog (*Hyla chrysoscelis*) could be used to identify individuals using photo ID software.



Fig 1. Examples of frog leg spots. The left picture is the same frog as the middle picture. The right picture is from a different frog, showing variation in pattern.

Methods

- I tested if photo ID software could correctly identify frogs previously marked with VIE, using the unique pattern on the inner hindlimb.
- Photos were taken during the 2019 and 2020 summers. Photos were edited to frame focus area.
- We tested whether photo identification accuracy decreased over time and with increasing sample size using these comparisons:
- **Within Nights** : Sample included 2 photos for each frog taken on the same night
- **Across Nights** : Sample includes 1 photo for each frog on every night it was captured
- **Across Years** : Sample includes 1 photo of each frog per year
- **Sample Size** : We randomly sampled 10%, 50% or 100% of photos taken in 2019 (2 photos taken on same night); 8 replicates per percentage
- **Wild.ID**: Photo ID software, which generate a match score for the best match among entered photos
- Match score shows the similarity between photos and can range from 0.00 (low similarity) to 1.0 (high similarity)

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Results

Analysis	Correct Non-match	Correct Match	Incorrect	Percent Correct
Within Nights	348	363	18	97.5
Among Nights	382	196	42	93.2
Across Years	364	17	26	93.6

Table 1. Success rate for the different comparisons.

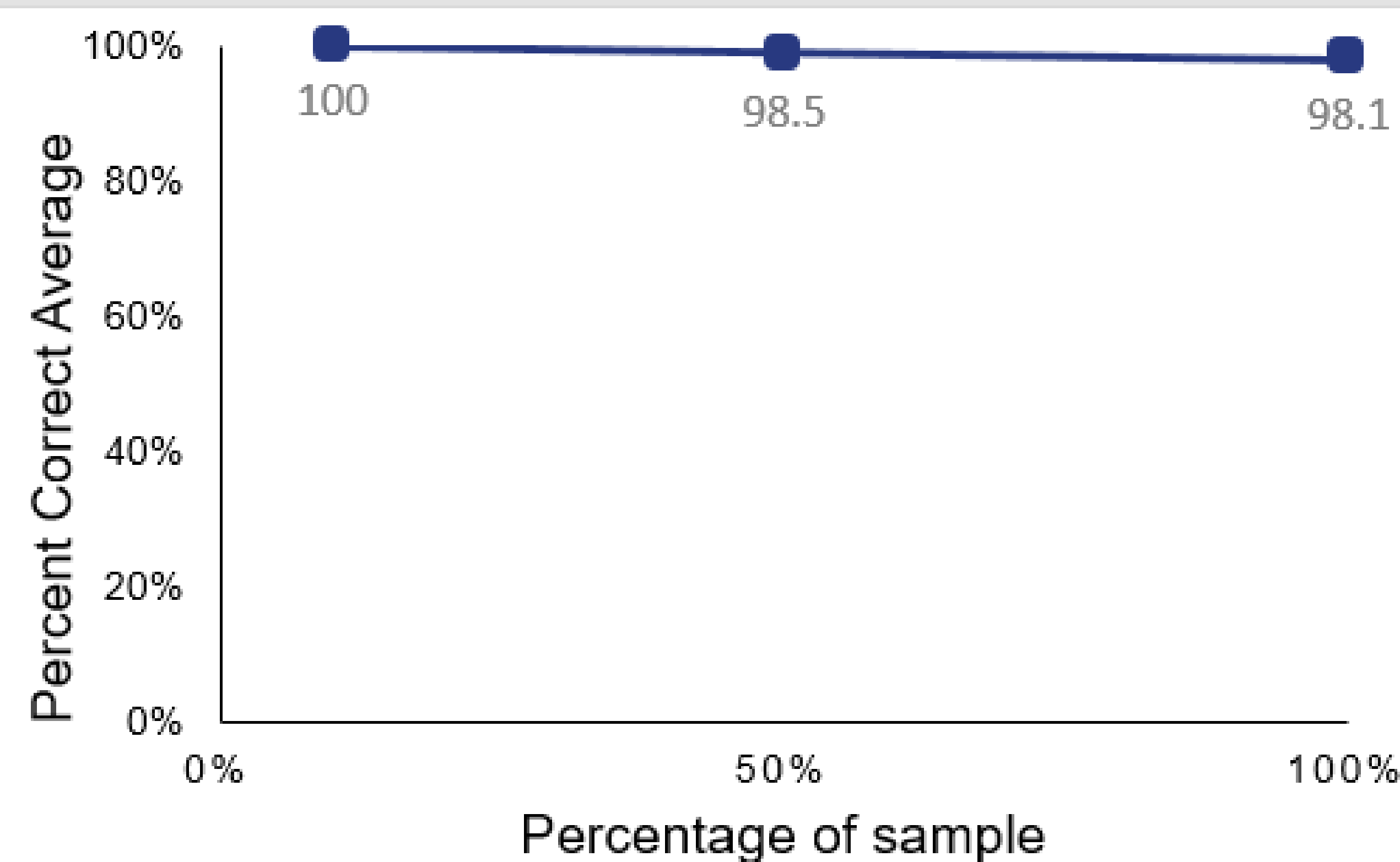


Fig 2. This graph shows the effect of sample size on success rate. Points show mean success rate (percentage correct over total sample; n = 8 replications per percentage).

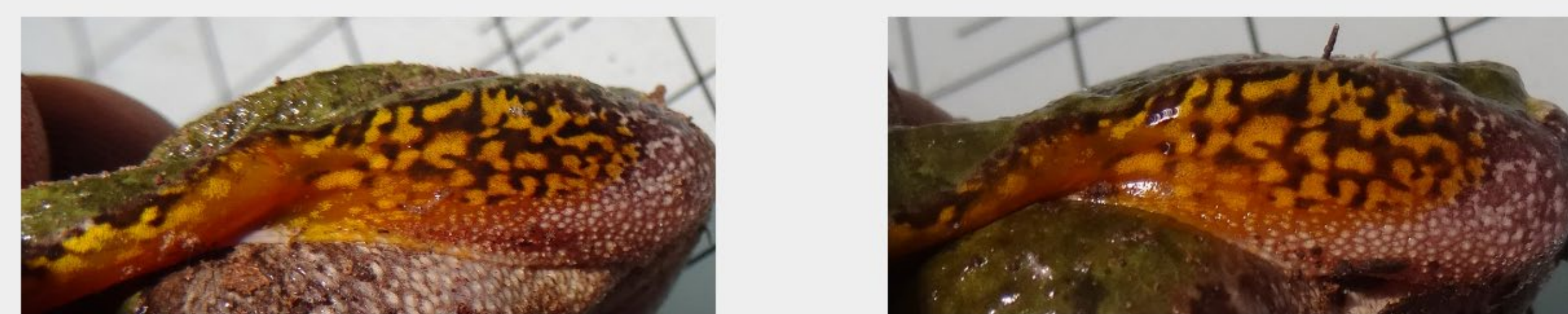


Fig 3. A correct match as it appears in Wild.ID software with a match score of 0.1259.

Discussion

- Overall, Wild.ID produced high percent correct values across all sample groups.
- These results provide evidence that individuals can be identified from photographs on the same night, across multiple nights and even across years.
- As expected, larger sample sizes caused the success rate to decrease. However, it did not decrease drastically and even the full sample still high success rates.
- Some matches identified by photo ID software did not have matching VIE codes. However, in many cases VIE codes were similar. These were likely the same frog, suggesting photo ID is more accurate than human reading of VIE code.
- Ex: VIE code 1O2O3G_X4GO matched with photo of 1O2O3BG4GO with a match score of 0.149 (high similarity). The similar codes indicates these are probably the same frog.
- Therefore, the actual success rate of photo ID is probably even higher than the rates shown in Table 1.

Conclusion

- Photo mark-recapture could reduce invasive procedures, and may be more accurate.
- This technique could improve researchers' ability to estimate population sizes, measure growth rates, and monitor behavior.
- Benefits of using photo IDs: less invasive, inexpensive, takes less time, and requires less experience
- Disadvantages of using photo IDs: Difficult to identify individuals immediately in the field, requires additional processing in the lab
- There is the potential to judge matches on score alone which would decrease the amount of time spent processing photos.

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