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Innovative tools for wildlife monitoring and recovery on military installations

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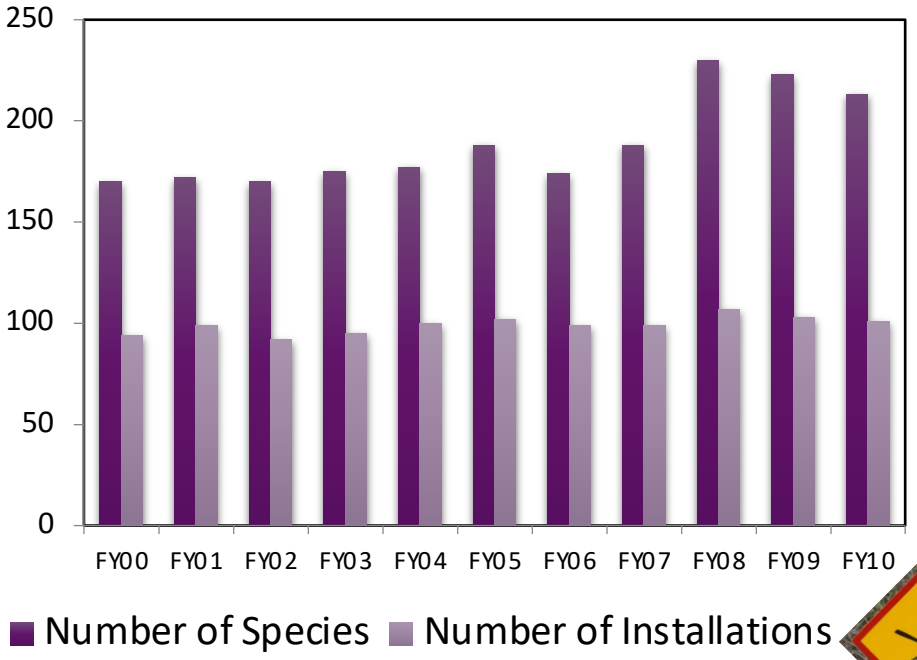
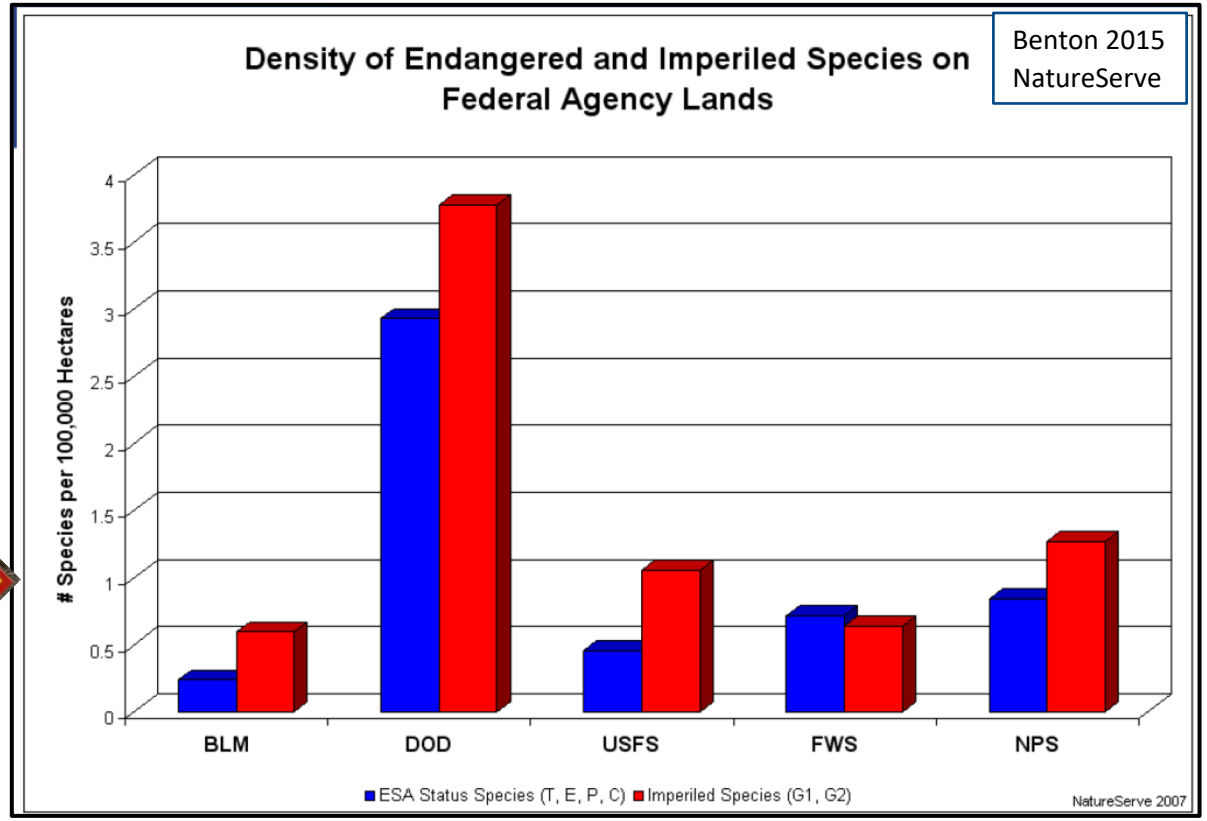
SYMPOSIUM
2018 | Enhancing DoD's Mission Effectiveness

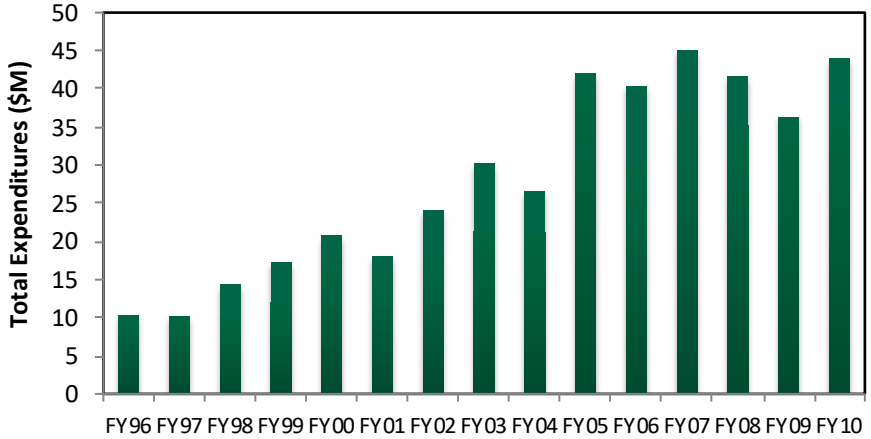
Outline

- Threatened and endangered species (TES) on military lands
- A non-traditional method of surveying for cryptic frog species
- A method of estimating density when mark-recapture is not feasible
- Refining captive-rearing techniques to improve recovery
- Conspecific attraction as a management tool
- Conclusions and acknowledgments

TES on Military Lands







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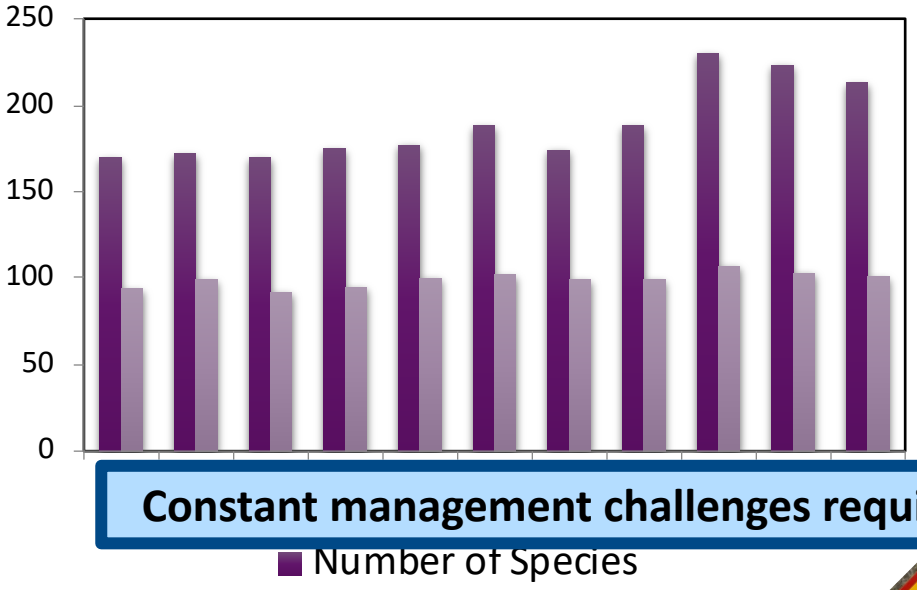
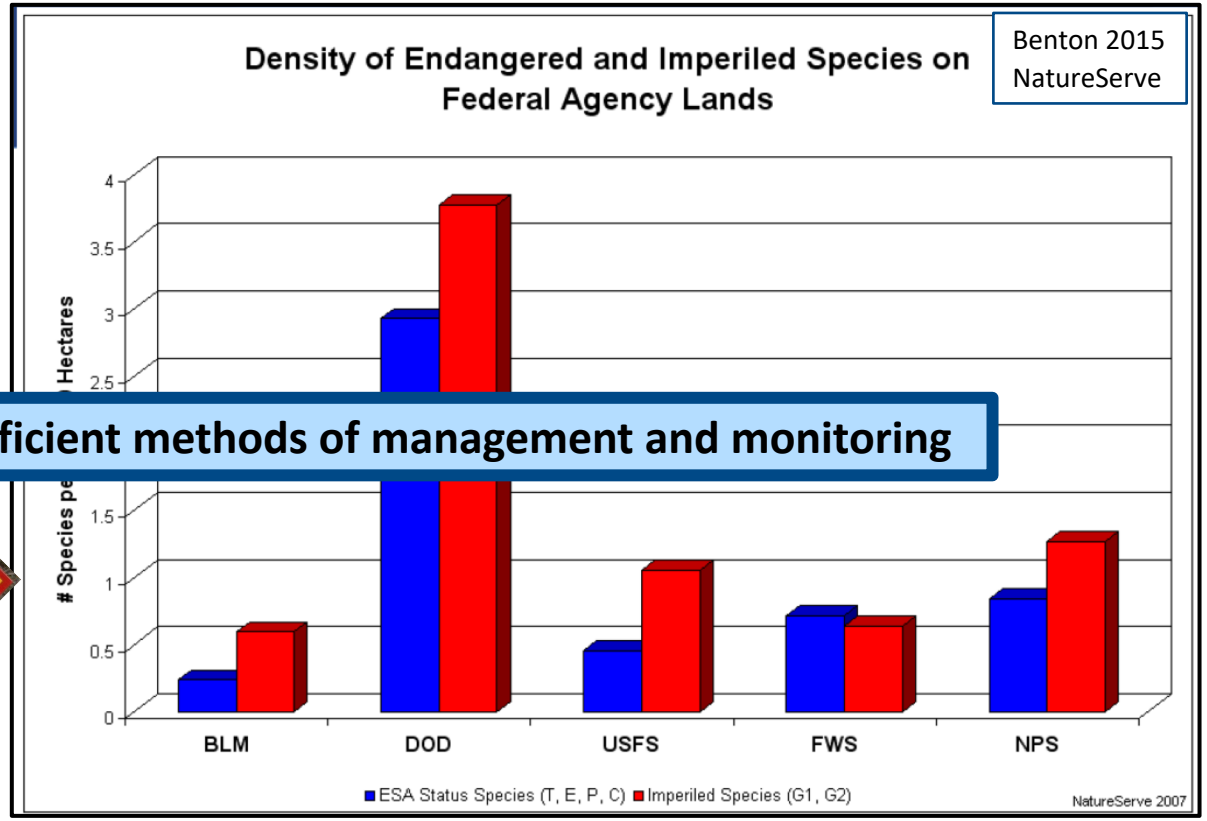
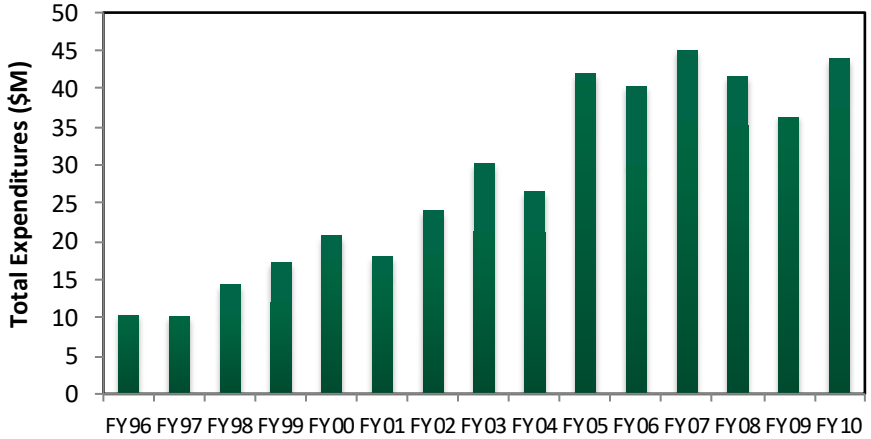
TES on Military Lands





Constant management challenges require innovative and efficient methods of management and monitoring



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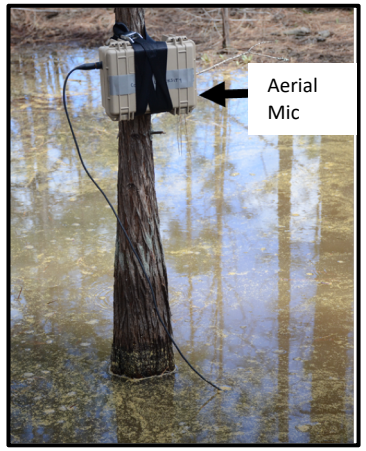
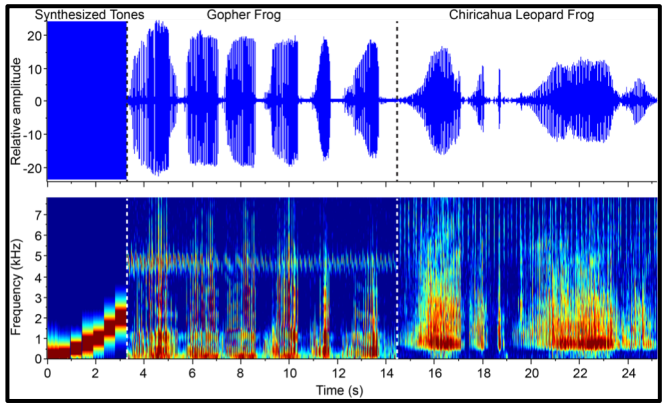
Acoustic Monitoring of Amphibians: Benefits



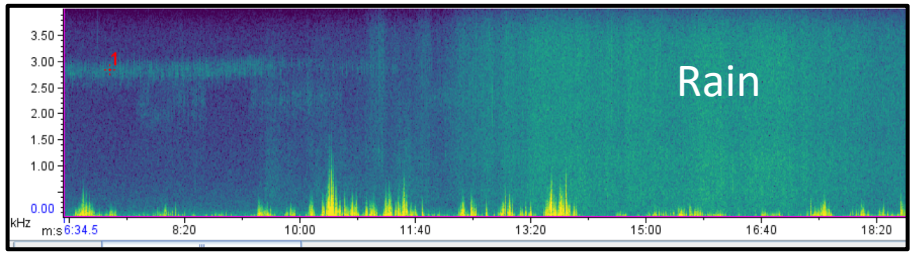
Automated Recording Devices

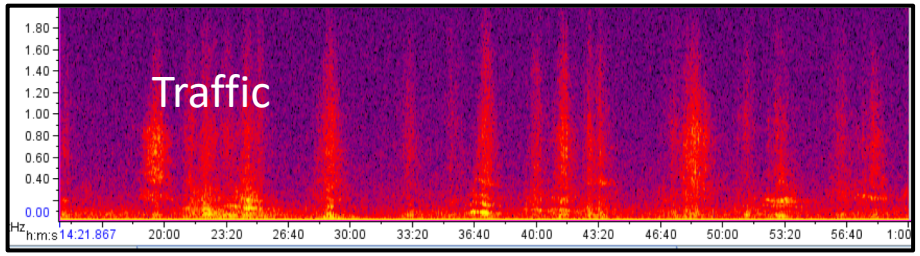


- Commercially available equipment
  - Easy to use and deploy
- Continuous record of vocalizing animals
- Passive monitoring
- Automated approaches to analysis

Software to Detect and Classify Frogs

Acoustic Monitoring of Amphibians: Limitations





- Generates massive amounts of data
- Environmental interference
  - Wind, rain, traffic, military training
- Automation can be difficult
- Some frogs call underwater

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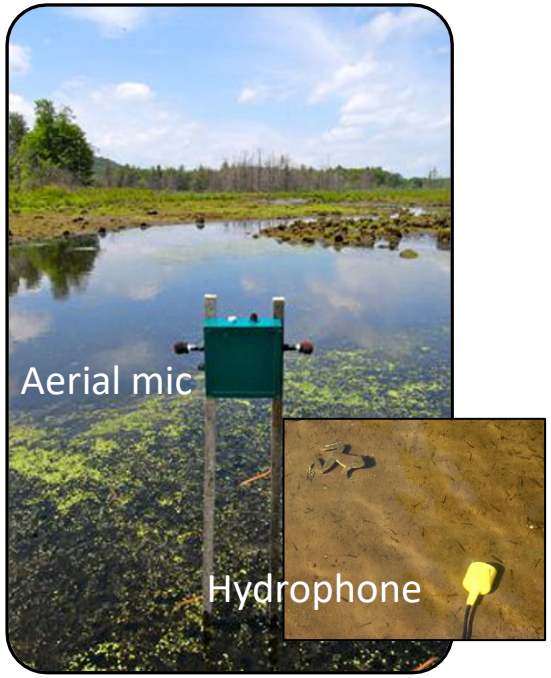
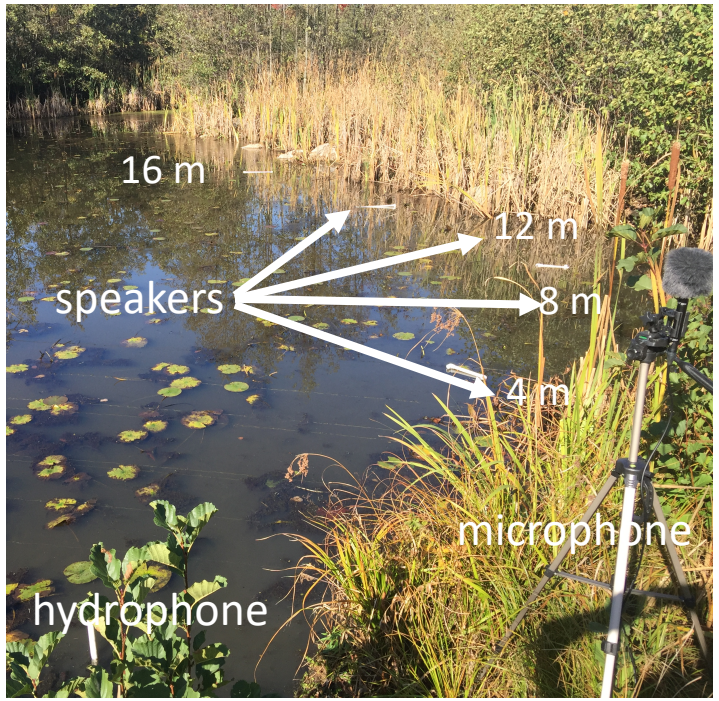
Underwater Calling Frogs

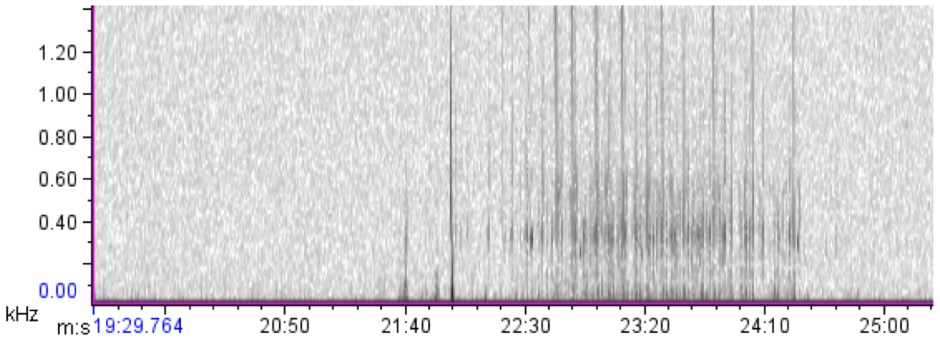
Some frogs call exclusively or regularly from underwater

- Yellow-legged Frog (top left), Gopher Frog (bottom left) Columbia Spotted Frog (top right), Chiricahua Leopard Frog (bottom right). Others?
- Only detected if observer ≤ 10m (Jensen et al. 1995).

Adopt Hydrophone Technology From Marine Systems







Chiricahua leopard frogs via hydrophone
Sept 2018

- Hydrophone was 30X more likely to detect underwater calls than microphone ($t=-9.92$, $df = 559$, $P = 0.001$, $\beta = -3.42$)
- Hydrophone was 8.5X more likely than human observers ($t=-6.92$, $df = 559$, $P = 0.001$, $\beta = -2.14$)

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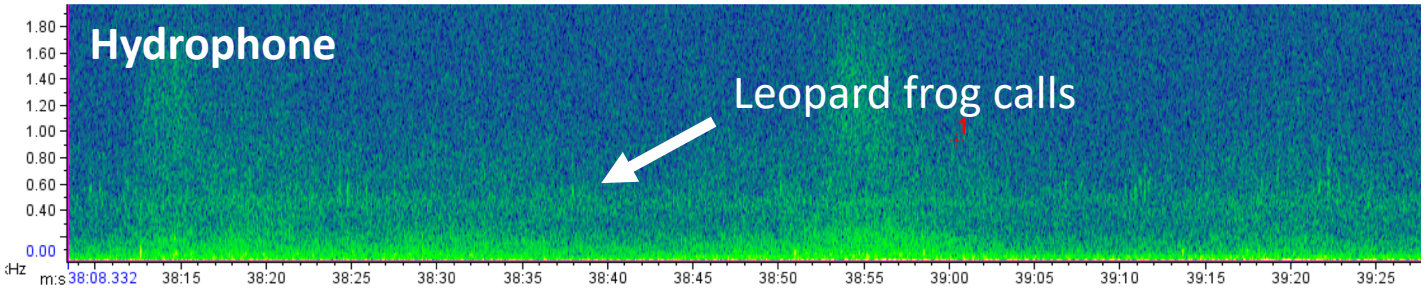
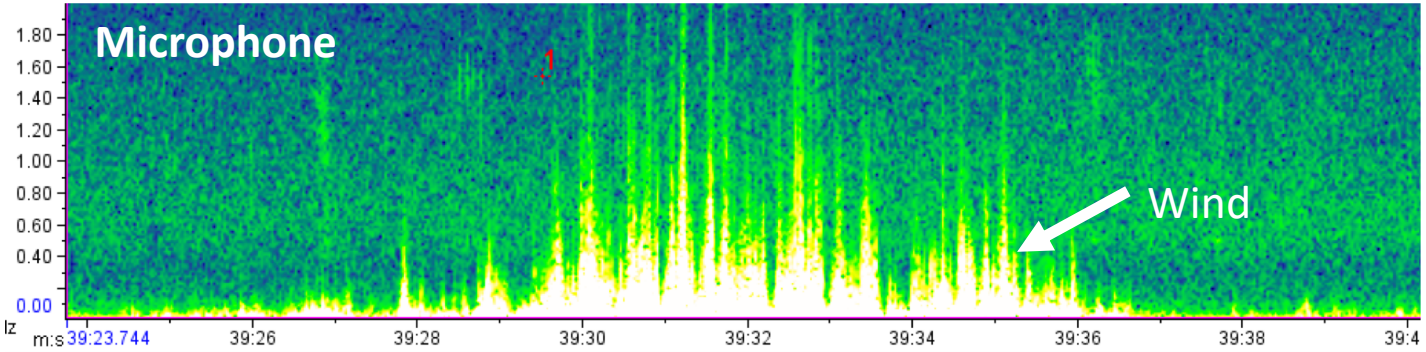
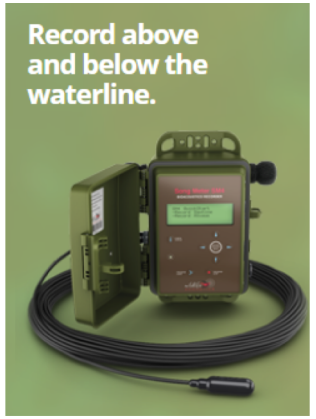
Hydrophone Success



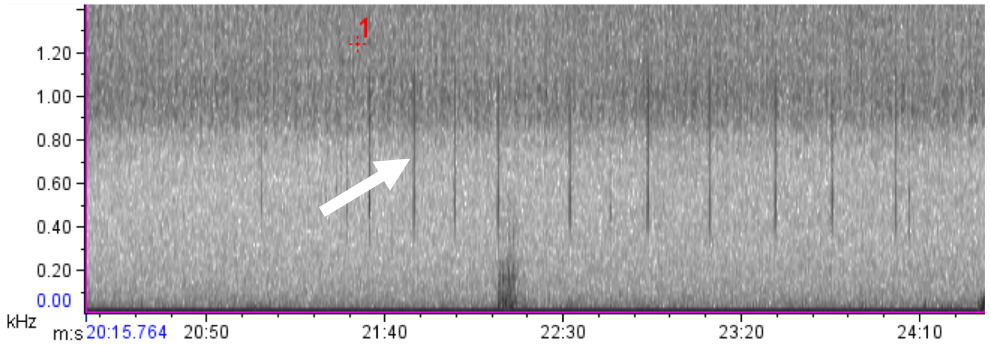


Hydrophones are resilient to environmental interference (wind, rain, traffic, helicopters, gunfire)



- Commercially available
- Easy to deploy
- Analyzed in same manner as microphones

Effective for recording underwater-calling frogs



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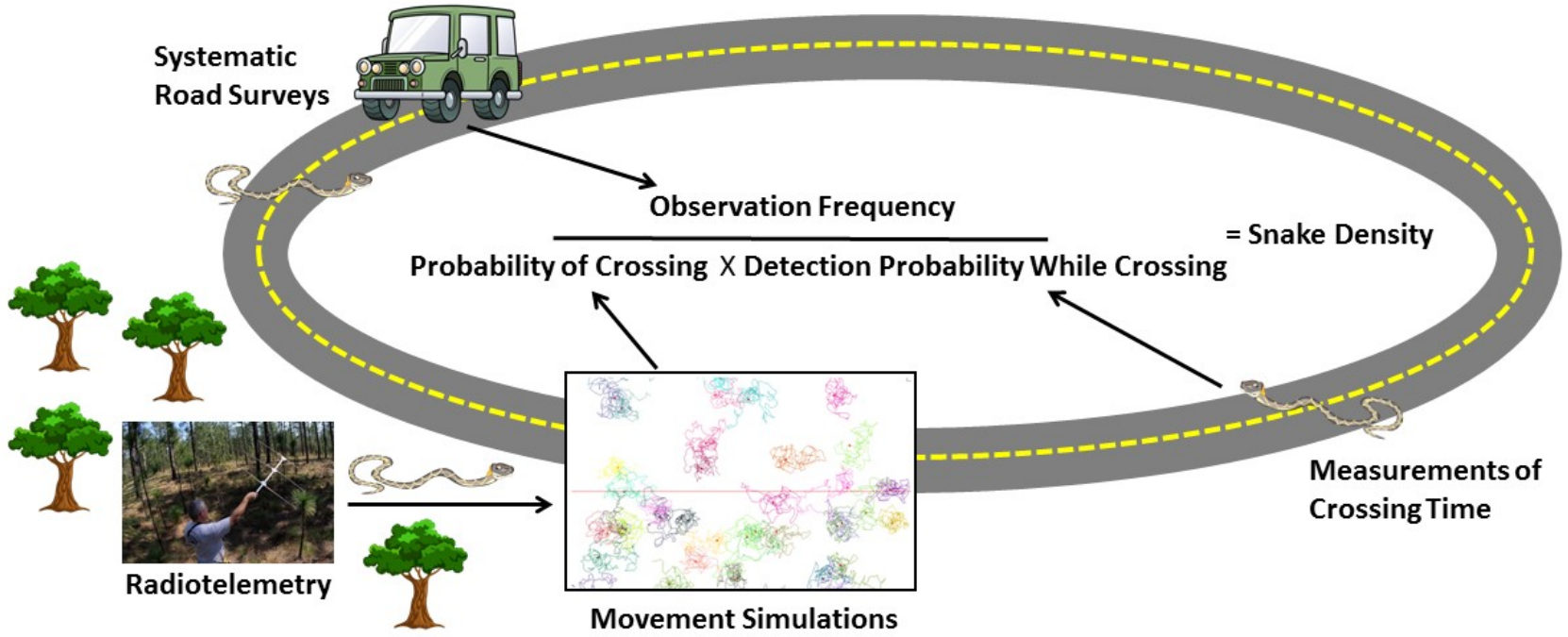
How do you estimate the population density when capture – mark – recapture is not an option?

- Although many snakes can be encountered and captured, recaptures can be extremely difficult or impossible to obtain
- Without reliable estimates of density, recovery and management goals are hindered

Translate observation rates of snakes during road surveys to overall snake density



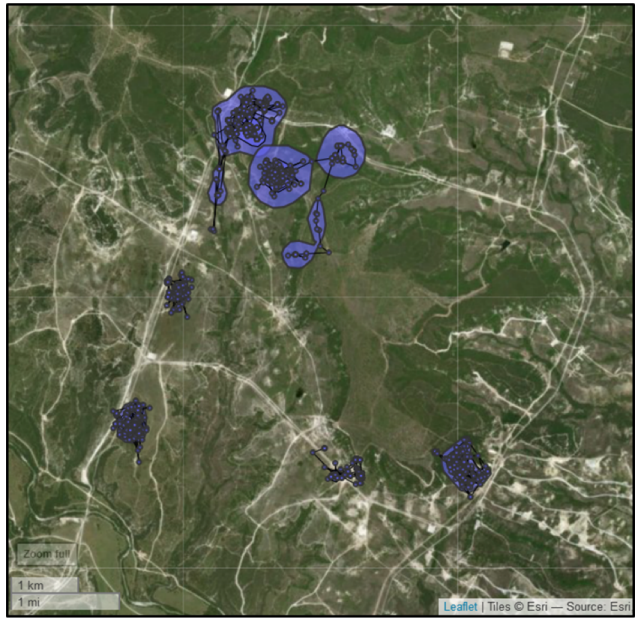
Willson et al. 2018. A novel approach for estimating densities of secretive species from road-survey and spatial-movement data. Wildlife Research.

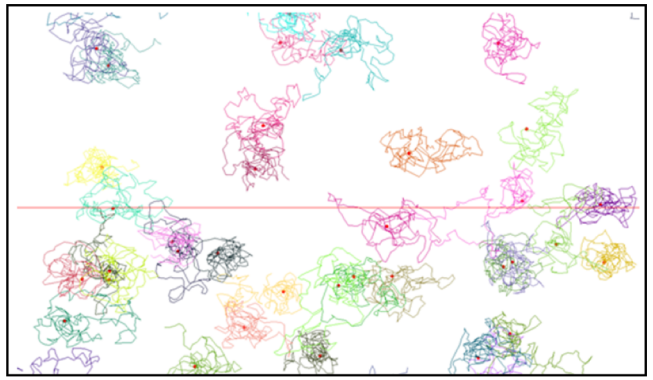
- Use movement simulations based on radiotelemetry data to estimate frequency of road crossings by snakes
- Snake crossing speed and vehicle speed are used to correct for imperfect detection during surveys
- Results in a relationship between encounter frequency and estimated density

Application of Methodology: Novel Data and Validation

Currently, collecting data on Fort Stewart, GA to estimate density of Eastern Diamondbacks and Southern Hognose Snakes.

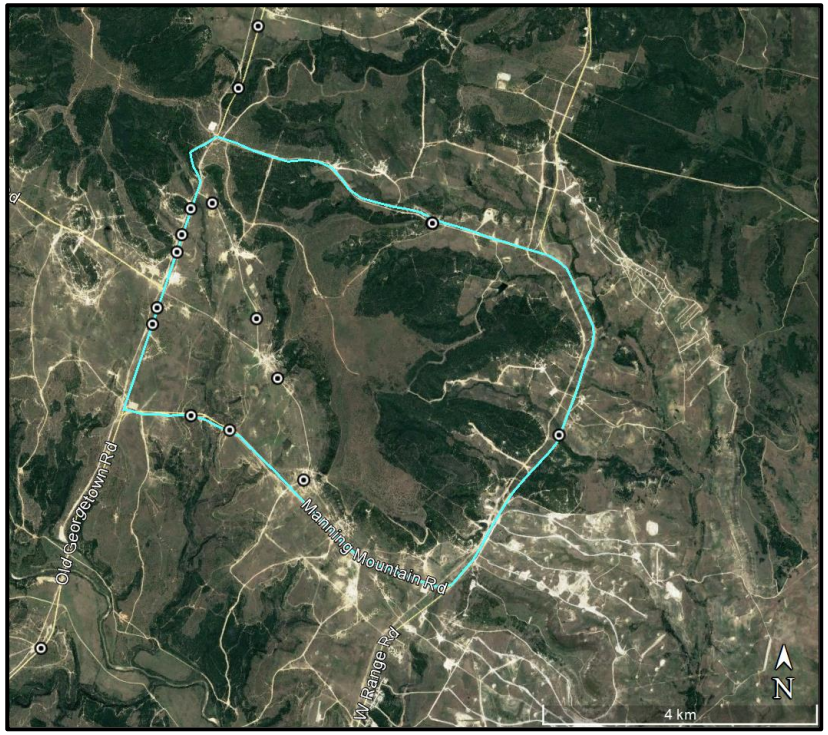
Compare results to Mark-Recapture Plots.

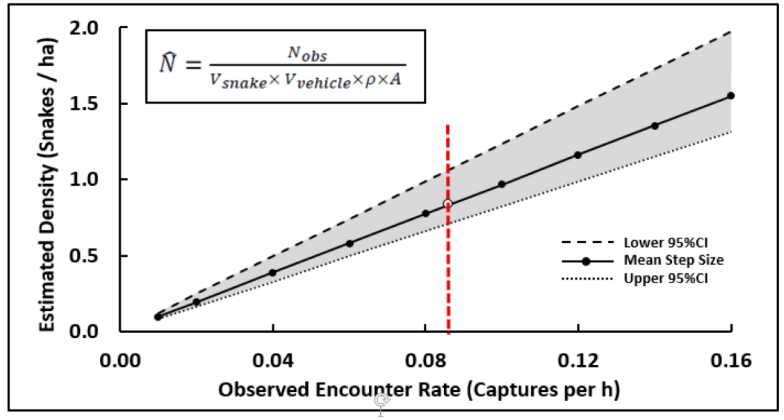




Application of Methodology: Existing Data

Retroactively applied this approach to existing data collected on Fort Hood, TX for ratsnakes studied in 2004 - 2005





Generated density estimate of 0.9 snakes per ha.

Comparable to reports from long-term CMR studies

Mark-recapture failed to converge with 0 recaptures despite years of effort and multiple capture methods

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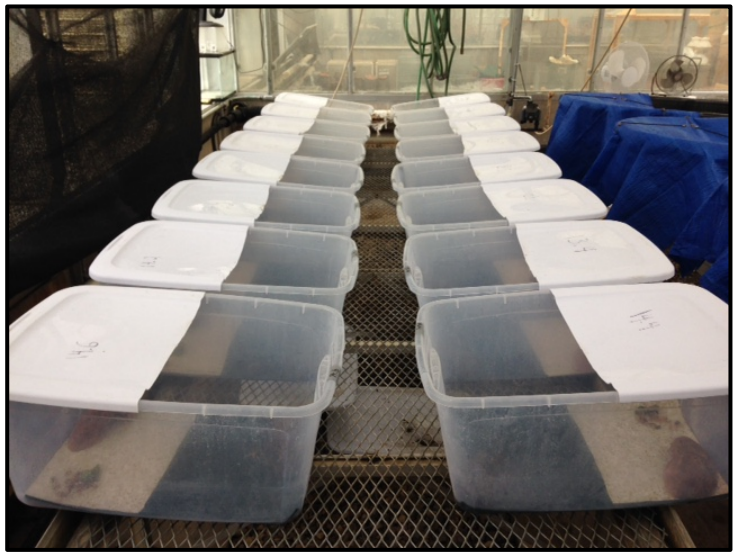
Translocation and Captive-rearing

- Release of animals reared in captivity is a frequently used recovery and mitigation tool on DoD lands and elsewhere.
- This approach has a dubious track record of success.
- Often, animals are at a disadvantage when released.
  - Captive-reared animals are often naïve and poorly equipped for survival.

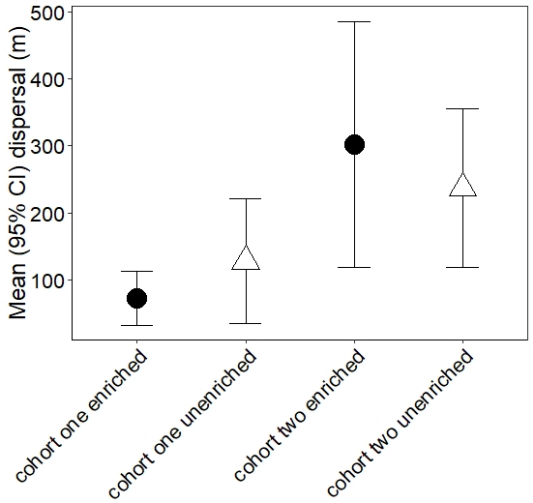
Environmental Enrichment as a Tool to Better Prepare Captive-reared Animals for Survival

- **Environmental Enrichment:** Providing captive animals with complex enclosures that stimulate particular brain functions and behaviors to better prepare individuals for survival upon release into the wild



Movement, Growth, and Survival

No difference in movement between enriched and unenriched turtles.



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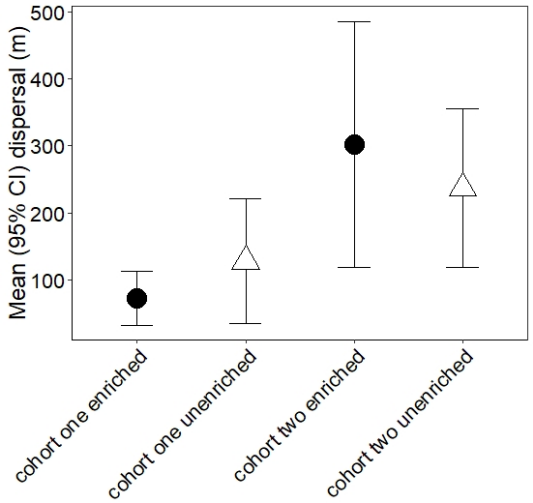
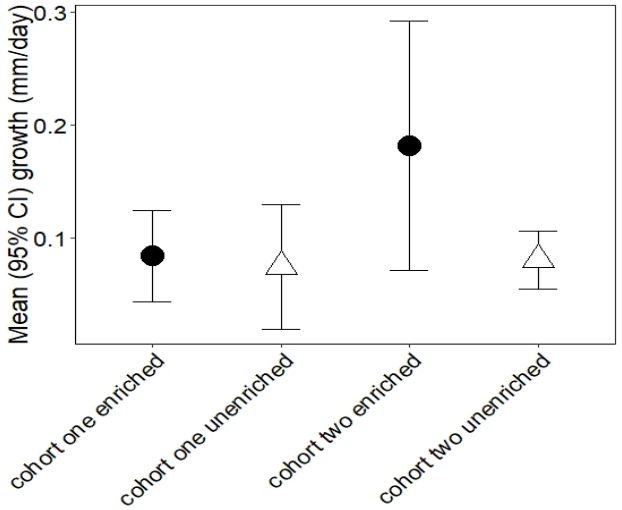


Enriched turtles grow faster post-release (yr 2). More effective foragers.



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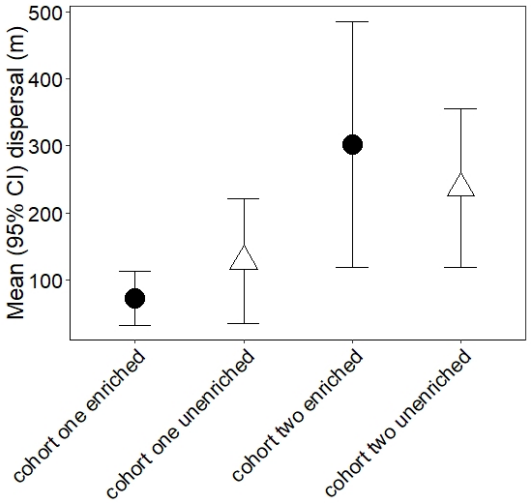

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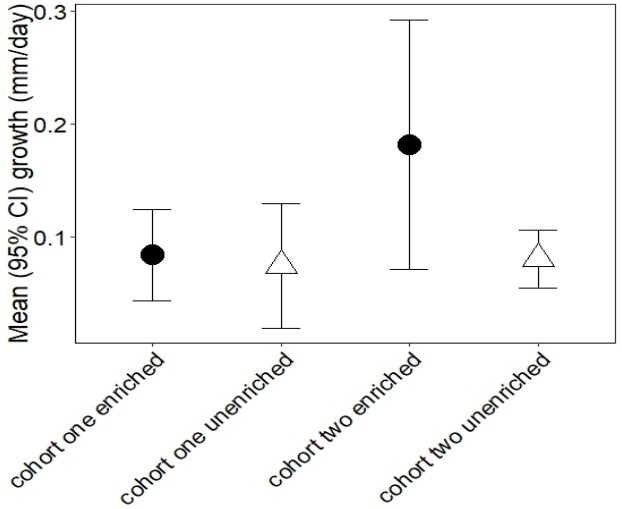

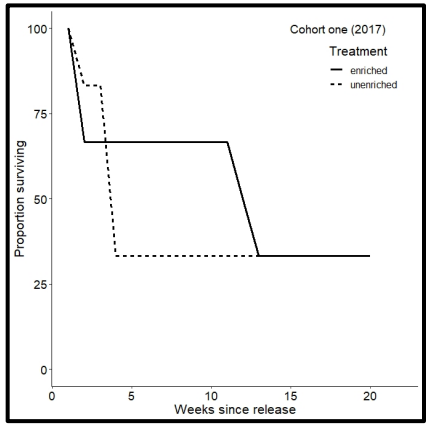

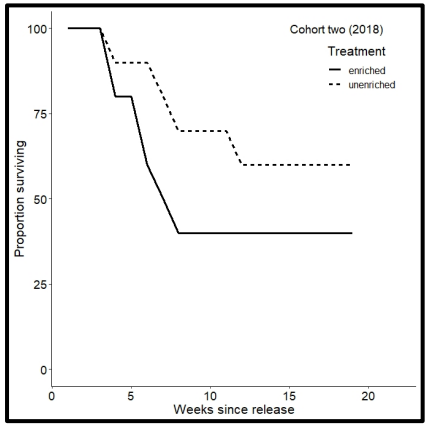

Rapid mortality then level off in both years.
Enriched turtles had higher survival in yr 1 but not yr 2.
Size was best predictor of survival.
Higher survival than similarly aged resident turtles

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Facilitating Use of Restored Habitats

- How do we get species to use suitable but unoccupied or underutilized habitats?
  - “Build it and they will come” – ineffective, long delays
  - Translocation – expensive, mixed results

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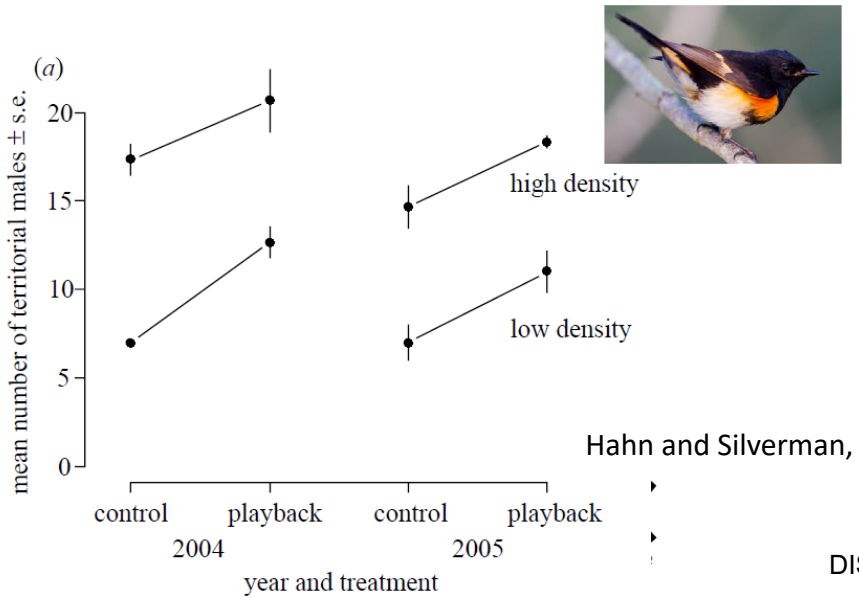
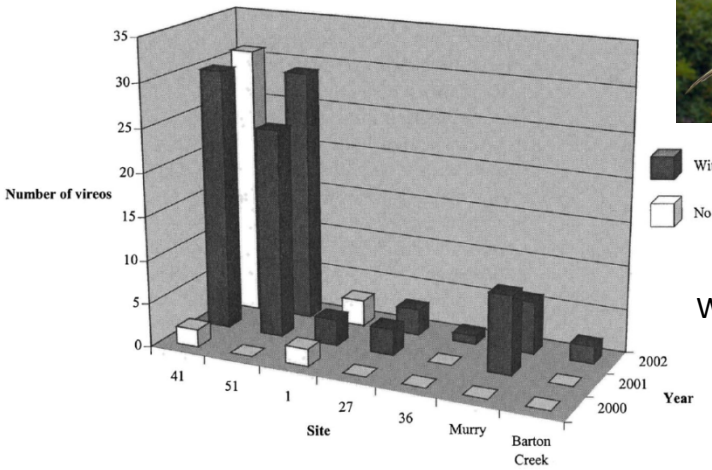
Facilitating Use of Restored Habitats

- Conspecific attraction = tendency for individuals to settle near others of their own species
- Conspecific attraction as a management tool
  - Artificially create social cues to manipulate species behavior
  - Prerecorded vocalizations of target species are broadcast within target area to encourage individuals to settle near playback



Hahn and Silverman, 2006



Ward and Schlossberg, 2004

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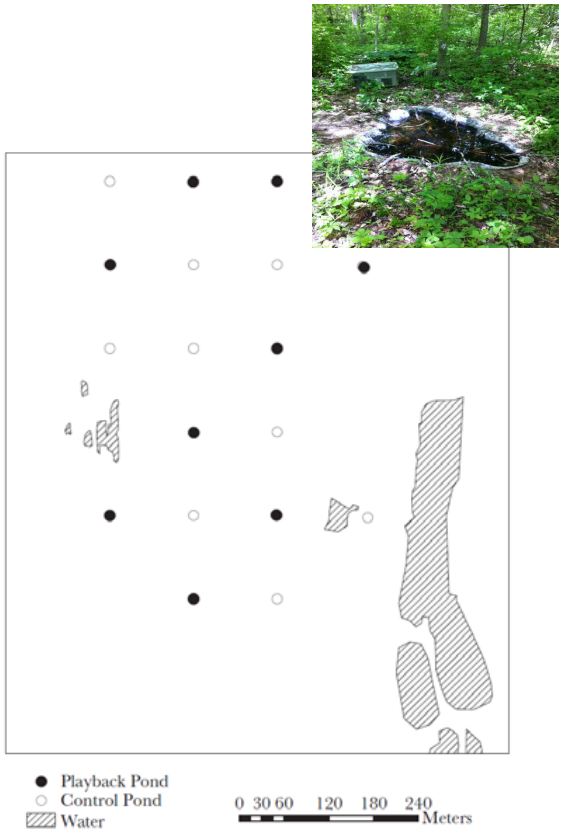
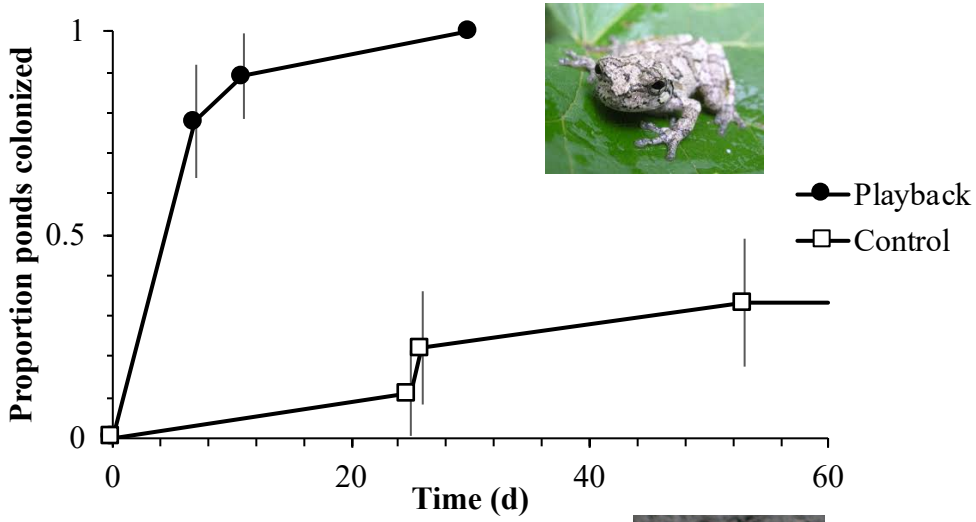
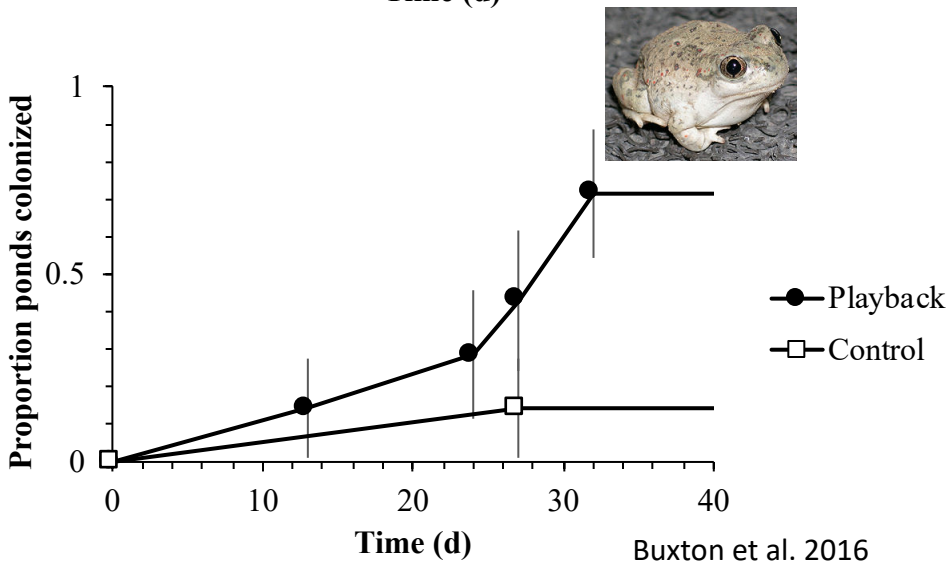
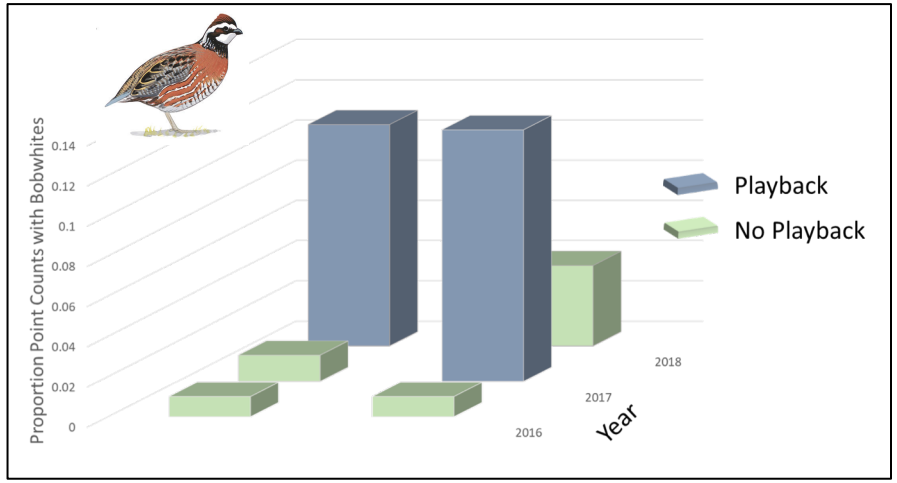
Conspecific Attraction as a Management Tool

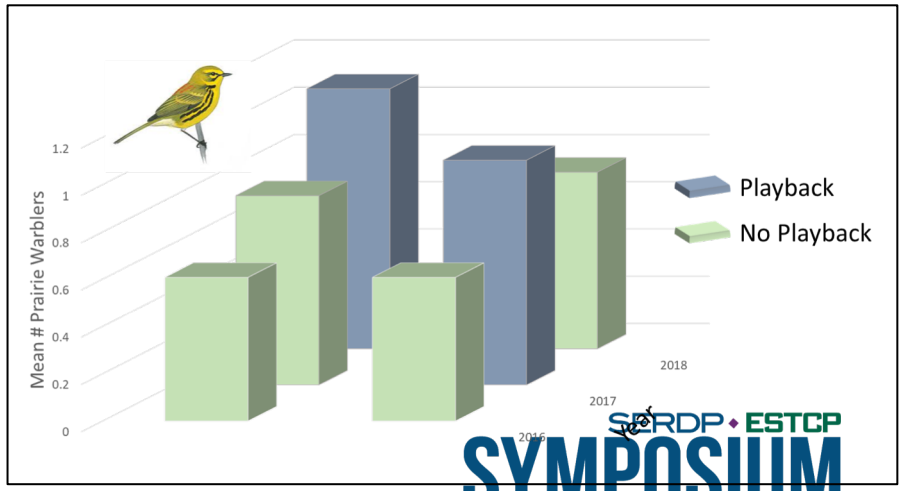






Buxton et al. 2016





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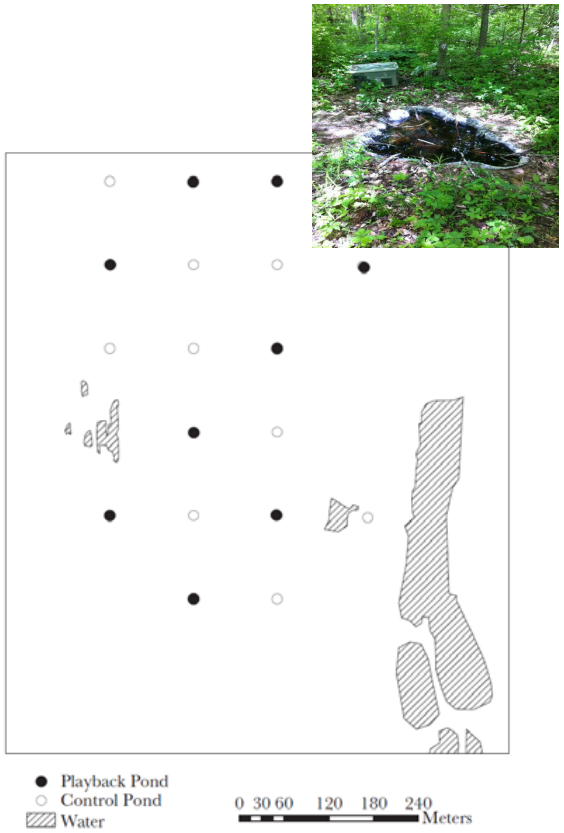
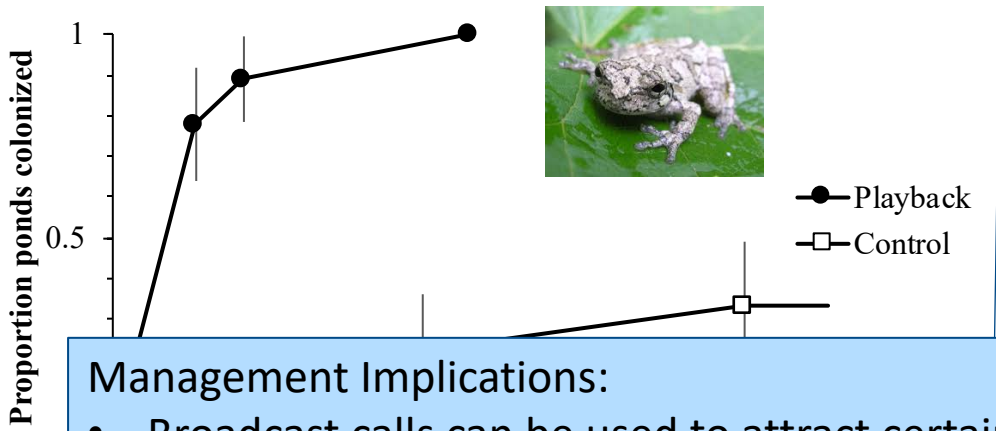
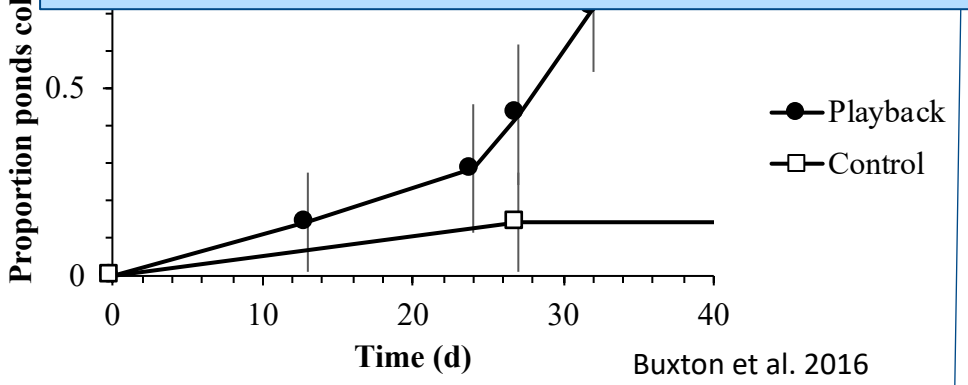


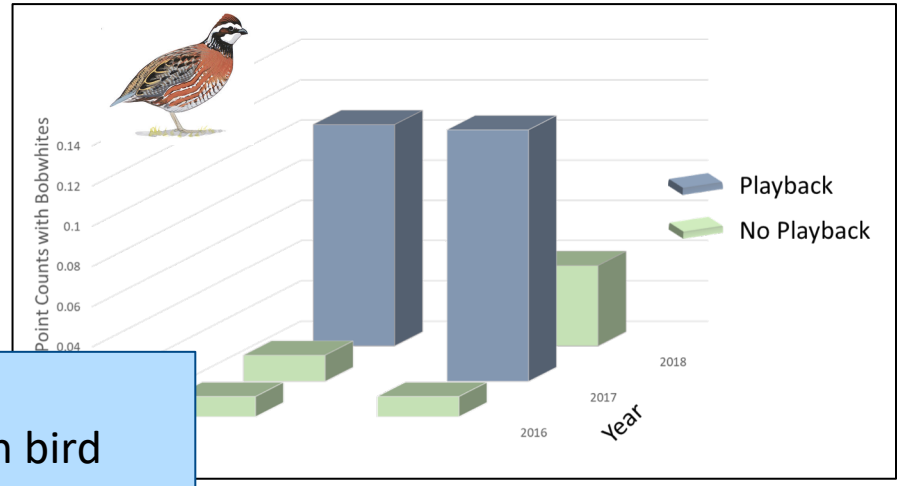


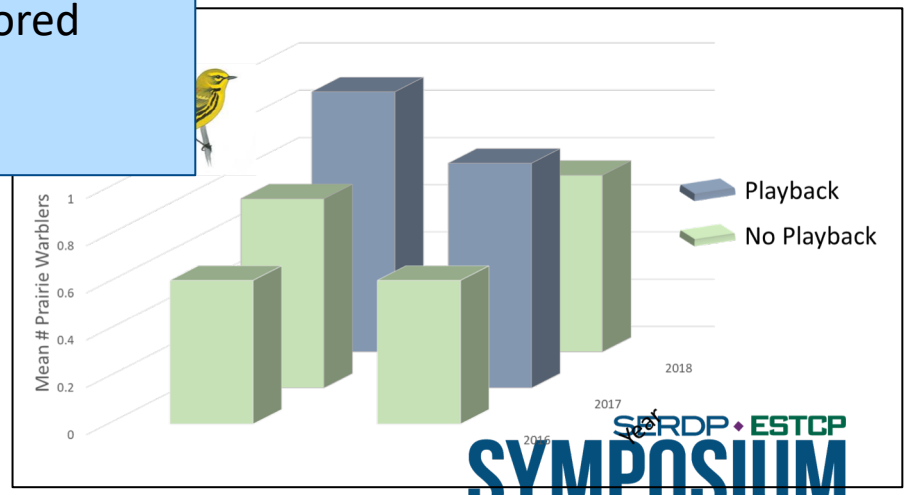


Buxton et al. 2016

Management Implications:

- Broadcast calls can be used to attract certain bird and frog species to target areas
- Can decrease latency to colonization of restored habitats





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Acknowledgements

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